

**[6003]-301**

**T.E. (Automobile) (Semester - I)**  
**Numerical & Optimization Methods**  
**(2019 Pattern) (316481)**

**Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates:**

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1) a)** Using Taylor series find  $y_{(0.2)}$  correct to four decimal places for given  $y' = x - y^2$ ,  $y_{(0)} = 1$  **[9]**

- b) Solve the boundary value problem  $\frac{d^2 y}{dx^2} - 64y + 10 = 0$  Initial condition,  $y(0) = 1$ ,  $y(1) = 1$  take step size,  $h = 1/3$  compute  $y(1/3)$  and  $y(2/3)$ . **[8]**

OR

**Q2) a)** The relationship between  $x$  and  $y$  is given by  $\frac{dy}{dx} + xy = 2$  Estimate  $y$  at  $x = 5.1$  using 4<sup>th</sup> order Runge - Kutta method Assume  $y = 2$  at  $x = 5.0$  take step size of 0.05. **[9]**

- b) Solve  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  for the following condition. At  $x = 0$  and  $x = 0.5$ ,  $u = 1$  for all values of  $t$ . At  $t = 0$ ,  $u = 2x + 1$  for  $0 < x < 0.5$ . Take increment in  $x$  as 0.1 and increment in  $t$  as 0.01. Find all values of  $u$  for  $t = 0$  to  $t = 0.03$ . **[8]**

**Q3) a)** Evaluate the integral  $\int_0^\pi (5 + 3\sin x) dx$  using Simpsons 3/8<sup>th</sup> rule. Take 6 equal subintervals. Calculate percentage error. **[9]**

**P.T.O.**

- b) Find double integration of  $f(x,y) = 2x + y + 1$  for  $x = 0$  to  $2$  and  $y = 0$  to  $2$ . use Simpsons  $1/3^{\text{rd}}$  rule [9]

OR

- Q4)** a) Use Simpsons  $1/3^{\text{rd}}$  method to evaluate the integration  $\int_1^2 \frac{e^x}{x} dx$ . [9]

- b) Find double integration of  $f(x, y) = x + y + 5$  for  $x = 0$  to  $2$  and  $y = 0$  to  $2$  and taking increment in both  $x$  and  $y$  as  $0.5$ . use trapezoidal rule.[9]

- Q5)** a) Explain classification of optimization problem. [5]

- b) Explain Golden-section search method. [5]

- c) Using Newton's method calculates the minimum value of the equation  $7x - \ln(x)$ . take initial guess  $0.1$  and do  $4$  iterations [7]

OR

- Q6)** a) What is optimization and explain Engineering applications of optimizations. [4]

- b) Explain Single variable unconstrained optimization [4]

- c) Using golden section search method determine the maximum value of  $f(x) = 2 \sin x - 0.1 x^2$  in the interval  $[0,4]$  [9]

- Q7)** a) Explain Simulated annealing and also write its advantages, disadvantages and applications. [9]

- b) Explain Ant Colony optimization and also write its advantages, disadvantages and applications. [9]

OR

- Q8)** a) Explain Genetic algorithms and also write advantages, disadvantages and applications. [9]

- b) Explain Particle swarm optimization and also write its advantages, disadvantages and applications. [9]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 4

**P227**

**[6003]-302**

**T.E. (Automobile)**

**HEAT TRANSFER**

**(2019 Pattern) (Semester-I) (316482)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q. 2, Q.3 or Q. 4, Q.5 or Q. 6, Q.7 or Q. 8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain the significance of thermal boundary layer. [6]
- b) Explain the significance of following dimensionless numbers. [6]
- i) Prandtl number
  - ii) Reynold Number
  - iii) Nusselt Number
- c) Calculate appropriate Reynolds numbers and state if the flow is laminar or turbulent for the followings. [5]
- i) The roof of coach 6 m long, travelling at 100 km/hr in air ( $\rho = 1.2 \text{ kg/m}^3$ ,  $\mu = 1.8 \times 10^{-5} \text{ kg/ms}$ )
  - ii) 0.05 kg/s of carbon dioxide gas at 400 K flowing in a 20 mm diameter pipe ( $\mu = 1.97 \times 10^{-5} \text{ kg/ms}$ )

**OR**

- Q2)** a) Explain Local and Average heat transfer coefficient. [6]
- b) Define the forced convection and give three practical examples of forced convection. [5]
- c) Air at 20°C is flowing along a heated plate at 134°C with a velocity of 3 m/s. The plate is 2m long. Heat transferred from first 40cm from the leading edge is 1.45 KW. Determine the width of the plate. [6]
- Properties of air at 77°C :  $\rho = 0.998 \text{ kg/m}^3$ ;  
 $C_p = 1.009 \text{ KJ/KgK}$ ;  $\nu = 20.76 \times 10^{-6} \text{ m}^2/\text{s}$ ;  $k = 0.03 \text{ W/mK}$   
Use the following correlation  
 $Nu_x = 0.332 Re^{0.5} Pr^{0.33}$ .

**P.T.O.**

**Q3) a)** Write the characteristics dimension for following cases in natural convection. [4]

- i) Vertical cylinder
- ii) Horizontal cylinder
- iii) Horizontal plate
- iv) Sphere

b) Explain Mechanism of natural convection with example. [4]

c) A sheet metal air duct carries air-conditioned air at an average temperature of 10°C. The duct size is 320 mm × 200 mm and length of the duct exposed to the surrounding air at 30°C is 15 m long. Find the heat gain by the air in the duct. Assume 200 mm side is vertical surface and top surface of the duct is insulated. Use the following properties: [10]

$Nu = 0.6 (GrPr)^{0.25}$  for vertical surface.

$Nu = 0.27 (GrPr)^{0.25}$  for horizontal surface.

Take the properties of the air at mean temperature of 20°C

$\rho = 1.204 \text{ kg/m}^3$ ;  $\mu = 18.2 \times 10^{-6} \text{ Ns/m}^2$ ;  $\nu = 15.1 \times 10^{-6} \text{ m}^2/\text{s}$ ;

$k = 0.0256 \text{ W/mK}$  and  $Pr = 0.71$ .

OR

**Q4) a)** Differentiate between filmwise and drop wise condensation. Which type of condensation is desirable and which type of condensation occurs in actual? State. [8]

b) A nuclear reactor with its core constructed of parallel vertical plates 2.2 m high and 1.4 m wide has been designed on free convection heating of liquid bismuth. The maximum temperature of the plate surface is limited to 960°C while the lowest allowable temperature of bismuth is 340°C. Calculate the maximum possible heat dissipation from both sides of each plate. For the convection coefficient, the approximate co relation is,

$Nu = 0.13 (Gr \cdot Pr)^{0.333}$

Where, different parameters are evaluated at the means film temperature with Standard notification.  $\rho = 10000 \text{ kg/m}^3$ ,  $\mu = 0.866 \times 10^{-3} \text{ kg/ms}$ ,

$C_p = 150.7 \text{ J/kgK}$ ,  $K = 13.02 \text{ W/mK}$ . [10]



- Q5) a)** Draw labeled temperature profiles of the following types of heat exchangers
- Parallel flow heat exchanger.
  - Counter flow heat exchanger. [4]
- b) What do you mean by fouling in heat exchangers? State the causes of fouling. [5]
- c) Consider the following parallel flow heat exchanger [8]
- cold flow enters at 40°C:  $C_c = 20,000 \text{ W/K}$
- hot flow enters at 150°C:  $C_h = 10,000 \text{ W/K}$
- $A = 30\text{m}^2$ ,  $U = 500 \text{ W/m}^2\text{K}$ .
- Determine the heat transfer rate and exit temperature.

OR

- Q6) a)** What is LMTD for a heat exchanger? Derive an expression for LMTD of parallel flow heat exchanger. [10]
- b) Explain working of a Heat pipe with Application. [7]
- Q7) a)** Explain [6]
- Planck's Law
  - Wien's Displacement law
  - Kirchhoff's Law
- b) Define Irradiation with their characteristics. [4]
- c) Determine the heat lost by radiation per meter length of a 100 mm diameter pipe at 300°C if it is. [8]
- Located in a large room of brick wall whose temperature is 20°C.
  - Located in a 200 mm diameter brick conduit at a temperature of 20°C.
- $\epsilon_{\text{Pipe}} = 0.797$ ,  $\epsilon_{\text{brick}} = 0.93$
- (Assume length of pipe = 1 m)

OR

- Q8)** a) Define following surface Emission Properties. [6]
- i) Emissive power ( $E$ )
  - ii) Emissivity ( $\epsilon$ )
  - iii) Monochromatic emissive power ( $e_\lambda$ )
- b) Write a note on: radiation shape factor. [4]
- c) Two parallel planes with emissivity 0.6 are at 900 K and 300 K. A radiation shield with side polished and having emissivity of 0.05, while emissivity of other side is 0.4 is proposed to be used. Which side of the shield to face the hotter plane, If the temperature of the shield kept to be minimum? Justify your answer. [8]



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SEAT No. :

**P228**

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**[6003]-303**

**T.E. (Automobile Engineering)**

**DESIGN OF MACHINE COMPONENTS**

**(2019 Pattern) (Semester - I) (316483)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Four questions from the following.*
- 2) *Figure to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** A square threaded power screw has a nominal diameter of 30 mm and pitch of 6 mm with double threads. The load on the screw is 6 KN and the mean diameter of thrust collar is 40mm. The coefficient of friction for the screw is 0.1 and for the collar is 0.9. Determine the torque required to raise the load and torque required to lower the load. **[12]**

b) Derive an expression for torque required to lower the load in power screws. **[6]**

OR

**Q2) a)** Explain the types of fastenings. **[6]**

b) A double riveted lap joint is made between 15 mm thick plates. If the ultimate stresses are 400 Mpa in tension, 620 Mpa in crushing and 330 Mpa in shear. Take the factor of safety 4. Design the joint. **[12]**

**Q3) a)** Write a short note on S-N diagram. **[7]**

b) Derive soderberg equation. **[10]**

OR

**Q4) a)** What are the causes of stress concentration and the methods to improve the same? **[10]**

b) A mass of 500Kg is being lowered by means of steel wire rope having cross sectional area 250mm<sup>2</sup>. The velocity of weight is 0.5m/sec. When the length of extended rope is 20m, the sheave gets stuck up. Determine the stress induced in the rope due to sudden stoppage of sheave. Take  $E = 0.8 \times 10^6$  Mpa. **[7]**

**P.T.O.**

- Q5) a)** Explain about herringbone gears with sketch. [6]  
**b)** Design a pair of helical gears are to transmit 15KW at 10,000rpm of the pinion with PCD 80mm. The transmission ratio is 3:1. Assume  $\alpha = 20^\circ$  FDI,  $\beta = 45^\circ$ .  $\sigma_d = 193.2$  Mpa, BHN=250 for pinion and gear. Check only tangential tooth load.

$$Y = \pi (0.154 - 0.912/Z_e), C_v = 5.55/5.55 + V^{0.5} \quad [12]$$

OR

- Q6) a)** Explain about spur gear nomenclature. [6]  
**b)** A spur gear set to transmit 20 KW at 900rpm of pinion. The transmission ratio is 7/3:1. Take  $20^\circ$  FDI,  $Z_1 = 18$ ,  $\sigma_d = 140$  Mpa for pinion and  $\sigma_d = 55$  Mpa for gear. The diameter of the pinion is 105 mm, Design number of teeth, module and face width for strength only.

$$Y = \pi (0.154 - 0.912/Z), C_v = 3.05/3.05 + V. \quad [12]$$

- Q7)** Worm & worm wheel is to transmit 10 KW with transmission ratio 20:1 and worm shaft rotates at 1440 rpm. Design the gear set. Assume single start square thread. Take  $\sigma_d = 207$  Mpa, for worm and  $\sigma_d = 82.4$  Mpa, for worm wheel. Form factor  $Y = \pi (0.154 - 0.912/Z)$ . [17]

OR

- Q8)** A pair of bevel gears are connected by  $20^\circ$  full depth involute teeth. The velocity ratio is 3:1. The pinion transmits 37.5 KW at 750 rpm. Assume number of teeth on pinion is 20. Design the gear set. Take  $\sigma_d = 233.4$  Mpa, BHN=200 for pinion and  $\sigma_d = 172.6$  Mpa, BHN=150 for gear. Form factor  $Y = \pi (0.154 - 0.912/Z_e)$ ,  $C_v = 6.1/6.1 + V$ . [17]



Total No. of Questions : 8]

SEAT No. :

P229

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[6003]-304

T.E. (Semester - I)

**AUTOMOBILE ELECTRICAL AND ELECTRONICS**

**(316484) (2019 Pattern)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Explain the electronic ignition system with a sketch. [6]
- b) Describe the construction and working of oil pressure gauge and fuel gauge. [6]
- c) What are the different types of spark plugs? Explain any one. [6]

OR

- Q2)** a) Describe the working of battery coil ignition system in detail. [8]
- b) Explain working of Fuel gauge. [10]
- Q3)** a) What is use of Voltage regulator? [5]
- b) Enlist the different types of battery ratings. [5]
- c) Explain the working of Wind shield wiper with neat sketch. [7]

OR

- Q4)** a) What are the different types of sensors? Explain any one. [5]
- b) Explain with neat sketch Solenoid Actuators. [5]
- c) Write short note on cold and warm start system. [7]

**P.T.O.**

- Q5)** a) What are the different types of actuators? Explain any one. [5]  
b) Explain with neat sketch MAP Sensor. [5]  
c) Write down the difference between Group and sequential injection system. [7]

OR

- Q6)** a) Explain CRDI system with neat sketch. [5]  
b) Write short note on Traction control. [5]  
c) Compare PFI and TBI system. [7]

- Q7)** a) Write down the difference between cold start and warm start system. [6]  
b) Write short note on Vehicle tracking system. [6]  
c) Explain Radar warning system with layout. [6]

OR

- Q8)** a) Explain ABS System with layout. [6]  
b) Explain Global Positioning Systems (GPS). [6]  
c) What is Adaptive Cruise Control? Explain in brief. [6]

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Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

**P230**

**[6003]-307**

**T.E. (Automobile)**

**AUTOMOTIVE REFRIGERATION & AIR CONDITIONING**  
**(2019 Pattern) (Semester-II) (316485)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams should be drawn whenever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of steam table & Psychrometric chart is allowed.
- 5) Assume suitable data necessary.

- Q1)** a) Explain Air filters with its types. [6]  
b) Explain air management and heater systems. [6]  
c) Explain Defrost and Demist system. [6]

OR

- Q2)** a) What are the factors affecting human comfort? Explain comfort chart.[6]  
b) Explain manual and automatic temperature control system. [6]  
c) State function & types of fans. Explain blower Fans in detail. [6]

- Q3)** a) Define [8]  
i) Absolute Humidity  
ii) Relative Humidity  
iii) DBT  
iv) DPT  
b) The humidity ratio of atmospheric air at 28 °C dry bulb temperature and 760 mm of mercury is 0.016 kg/kg of dry air. Determine: [9]  
i) Partial pressure of water vapour  
ii) Relative humidity  
iii) Dew point temperature  
iv) Specific enthalpy  
v) Vapour density

OR

*P.T.O.*

- Q4)** a) Explain methods of obtaining humidification & dehumidification with neat sketch. [7]
- b) The atmospheric air at 30 °C dry bulb temperature 75% relative humidity enters a cooling coil at the rate of 200 m<sup>3</sup> min. The coil dew point temperature is 14 °C & the bypass factor of the coil is 0.1, Determine
- The temperature air leaving the coil dry bulb temperature,
  - The capacity of cooling coil in tonnes of refrigeration & in Kilo,watt.
  - The amount of water vapour removed per minute 4. the sensible heat factor for the process. [10]

**Q5)** A restaurant with a capacity of 100 persons is to be air conditioned with the following conditions: [18]

Outside conditions = 30°C DBT and 70% RH

Desired inside conditions = 23 °DBT and 55% RH

Quantity of air supplied = 0.5 m<sup>3</sup>/ min/person

The desired conditions are achieved by cooling dehumidifying and then heating. Determine

- Cooling of coil in tonnes of refrigeration
- Capacity of heating coil
- Amount of water removed by dehumidifier
- Bypass factor of the heating coil if its surface temperature is 35 °C

OR

**Q6)** A hall is to be maintained at 24°C dry bulb temperature and 60% relative humidity under the following conditions : [18]

Outdoor conditions = 38 °C DBT and 28 °C WBT

Sensible heat load in the room = 46.4 kW

Latent heat load in the room = 11.6 kW

Total Infiltration air = 1200 m<sup>3</sup>/hr

Apparatus dew point temperature = 10 °C

Quantity of recirculated air from the hall = 60%

If the quantity of recirculated air is mixed with the conditioned air after the cooling coil, Find the following:



- a) The condition of air leaving the conditioner coil & before mixing with the recirculated air
- b) The condition of air before entering the hall
- c) The mass of air entering the cooler
- d) The mass of total air passing through the hall
- e) The bypass factor of the cooling coil
- f) The refrigeration load on the cooling coil in tonnes of refrigeration.

- Q7)** a) What is the significance of Initial vehicle inspection? Why it is required?[6]
- b) 'Why temperature measurement is required in automotive AC? Explain what are the different temperatures measured in AC? How it is measured? [6]
- c) Explain refrigerant recycle and charging. [5]

OR

- Q8)** a) State leak detection methods and Explain odor removal in automotive AC. [6]
- b) Write note on automotive AC components removing and replacing. [6]
- c) Write short note on Compressor servicing. [5]



Total No. of Questions : 8]

SEAT No. :

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**P231**

**[6003]-308**

**T.E. (Automobile Engineering)**

**AUTOMOTIVE CHASSIS AND TRANSMISSION**

**(2019 Pattern) (Semester-II) (316486)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer any four questions from the following.*
- 2) Figure to the right indicate full marks.*
- 3) Draw the neat sketches wherever required.*

**Q1) a)** Explain the wheel balancing procedure. **[10]**

b) What are the merits of Tubeless over Tubed tyres? **[8]**

OR

**Q2) a)** Explain the construction and working of Hydraulic brake system with neat sketch. **[10]**

b) What are the functions and requirements of braking system? **[8]**

**Q3) a)** Explain the construction and working of Electromagnetic clutch with neat sketch. **[10]**

b) Discuss about the clutch plate lining materials. **[7]**

OR

**Q4) a)** Explain the working of synchromesh gearbox with neat sketch. **[10]**

b) Discuss about gear selector mechanism. **[7]**

**Q5) a)** Explain the real axle with types of load acting on rear axle. **[10]**

b) Explain torque tube drive with neat sketch. **[8]**

OR

**P.T.O.**

- Q6)** a) Explain the constructional details of differential with sketch. [10]  
b) Explain the features of propeller Shaft with types. [8]

- Q7)** a) Discuss the construction and working of torque convertor with sketch.[10]  
b) Explain the construction & working of simple epicyclic gear train. [7]

OR

- Q8)** a) Explain continuous variable transmission with advantages & disadvantages. [10]  
b) Discuss about fully automatic transmission. [7]



Total No. of Questions : 8]

SEAT No. :

**P232**

[Total No. of Pages : 4

**[6003] - 309**

**T.E. (Automobile )**

**DESIGN OF ENGINE COMPONENTS**

**(2019 Pattern) (Semester - II) (316487)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Explain the design of an I.C. engine valve. **[6]**

b) Explain the design procedure of push rod in a valve mechanism. **[6]**

c) Design an exhaust valve for a horizontal diesel engine using the following data : Cylinder bore = 150 mm, length of stroke = 275 mm, Engine speed = 500 rpm, Maximum gas pressure = 4 Mpa, seat angle = 50°  
Calculate : **[6]**

- i) diameter of the valve port,
- ii) diameter of the valve head,
- iii) diameter of the valve stem,
- iv) thickness of the valve head,
- v) maximum lift of the valve. Assume allowable mean velocity of the gas 50m/s Also, the allowable bending stress of valve material as 50N/mm<sup>2</sup>.

OR

**P.T.O.**

**Q2) a)** Explain the design of engine cooling system with neat diagram. [8]

b) Design the fulcrum pin of a rocker arm for the exhaust valve of a four stroke engine using the following data: Effective length of each arm = 180mm, Angle between two arms =  $135^\circ$  Diameter of valve head = 75 mm, Lift of valve = 25 mm, mass of valve = 0.5kg, Engine speed = 600 rpm, Back pressure when exhaust valve opens = 0.4 Mpa, maximum suction pressure = 0.02 Mpa below atmosphere. The valve opens  $33^\circ$  before the outer dead centre and close  $1^\circ$  after inner dead centre. The motion of the valve is SHM without dwell in the fully opened condition. Assume the bearing pressure at fulcrum pin as  $5 \text{ N/mm}^2$  and allowable direct shear in fulcrum pin as  $42 \text{ N/mm}^2$ . [10]

**Q3) a)** Differentiate between Flywheel and Governor. [5]

b) Explain Torque Analysis of flywheel with an example. [5]

c) The turning moment diagram for petrol engine is drawn to following scales: Turning moment,  $1 \text{ mm} = 5 \text{ N-m}$ , Crank angle,  $1 \text{ mm} = 1^\circ$  The turning moment diagram repeats itself half revolution of the engine and the area above and below the mean turning moment line, taken in order are 295, 685, 40, 340, 960, 270  $\text{mm}^2$ . Determine the mass of 300 mm diameter flywheel rim when the coefficient of fluctuation of speed is 0.3% and the engine runs at 1800 rpm. Also determine the cross section of rim when the width of the rim is twice of thickness. Assume density of rim material as  $250 \text{ Kg/m}^3$ . [7]

OR

**Q4) a)** Explain the design of solid disk and rimmed flywheel. [7]

- b) A single cylinder, single acting, four stroke oil engine develops 20 kw at 300 rpm. The work done by the gases during the expansion stroke is 2.3 time the work done on the gases during the compression and work done during the suction and exhaust strokes is negligible. The speed is to be maintained within + - (1%). Determine the mass moment of inertia of the flywheel. [10]

Q5) a) Explain Sommerfeld's number. [5]

- b) Explain hydrodynamic lubrication. [5]

- c) The following data is given for a 360° hydrodynamic bearing: radial load = 3.2 kN, journal speed = 1490 rpm, journal diameter = 50mm. bearing length = 50 mm, radial clearance = 0.05 mm, viscosity of lubricant = 25cP Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate: [7]

- i) coefficient of friction;

$\left(\frac{l}{d}\right)$	$\epsilon$	$\left(\frac{h_o}{c}\right)$	$S$	$\phi$	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcm^3}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{f}{\mu_{max}}\right)$
$\infty$	0	1.0	$\infty$	(70.92)	$\infty$	$\pi$	0	-
	0.1	0.9	0.240	69.10	4.80	3.03	0	0.826
	0.2	0.8	0.123	67.26	2.57	2.83	0	0.814
	0.4	0.6	0.0626	61.94	1.52	2.26	0	0.764
	0.6	0.4	0.0389	54.31	1.20	1.56	0	0.667
	0.8	0.2	0.021	42.22	0.961	0.760	0	0.495
	0.9	0.1	0.0115	31.62	0.756	0.411	0	0.358
	0.97	0.03	-	-	-	-	0	-
	1.0	0	0	0	0	0	0	0
	0	1.0	$\infty$	(85)	$\infty$	$\pi$	0	-
1	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.520
	0.4	0.6	0.264	63.10	5.79	3.96	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.686	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.132
	1.0	0	0	0	0	0	1.0	0

OR

**Q6)** a) Explain the types of Rolling - contact Bearing. [5]

b) Explain the selection of bearing life. [5]

c) Write a short note on static and dynamic load carrying capacities. [7]

**Q7)** a) Write a short note on selection of engine type on the basis of stroke and Bore. [6]

b) Write a short note on Cylinder arrangement. [6]

c) Write a short note on considerations of combustion chamber. [6]

OR

**Q8)** a) Write a short note on Osilloscope engine analyzers and Distributor dwell - angle. [6]

b) Write a short note on Exhaust gas CO and HC analyzer. [6]

c) Write a short note on Mechanical fuel pump testing. [6]

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Total No. of Questions: 8]

SEAT No. :

**P233**

**[6003]-310**

[Total No. of Pages : 2

**T.E. (Automobile Engineering)**

**AUTOMOTIVE AERODYNAMICS AND BODY ENGINEERING**

**(2019 Pattern) (Semester-II) (Elective-II) (316488-A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

**Q1) a)** Write down the Fundamentals of wind tunnel technique. **[9]**

b) Explain in details about Small -scale wind tunnels. **[9]**

OR

**Q2) a)** Explain in details Mechanism of generation and transmission of Wind noise. **[9]**

b) Write a Note on CFD methodology — Application to vehicle aerodynamics. **[9]**

**Q3) a)** What are the different car body layout ? Explain Any one in Detail. **[8]**

b) Write down the Methods of improving visibility. **[9]**

OR

**Q4) a)** Describe Sheet metal as auto body material with its advantages and disadvantages. **[8]**

b) Suggest the methods to reduce aerodynamic drag in car body. **[9]**

**P.T.O.**



- Q5)** a) Explain in details about tipper body. [8]  
b) Describe the dimensions of driver seat in relation to control. [9]

OR

- Q6)** a) Write a note on design of chassis frame. [8]  
b) Describe the dimensions of driver cabin design. [9]

- Q7)** a) What are the Types of safety belts? Explain any one in Detail. [9]  
b) Describe the symmetric & asymmetric vertical loads in car. [9]

OR

- Q8)** a) What is the use of energy absorbing system in automobiles? Explain in detail. [9]  
b) Write a Note on Ergonomics and anthropometry. [9]



Total No. of Questions: 8]

SEAT No. :

**P234**

**[6003]-311**

[Total No. of Pages : 2

**T.E. (Automobile Engineering)**

**AUTOMOTIVE MATERIALS**

**(2019 Pattern) (Semester-II) (316488 B) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*

**Q1) a)** Explain the Resin transfer moulding. **[9]**

b) Compare Injection moulding with Compression moulding. **[8]**

OR

**Q2) a)** Explain the Reinforcement of fibres in composites. **[9]**

b) Describe the Hand lay-up process. **[8]**

**Q3) a)** Explain the properties and composition of glass. **[9]**

b) Describe the scratch resistant paints. **[9]**

OR

**Q4) a)** Explain the various approaches in tempering of glass for improved toughness. **[9]**

b) Discuss the different methods of nano coatings for corrosion resistance. **[9]**

**Q5) a)** Explain the new trends in engines. **[9]**

b) Discuss the use of MR fluids in automobiles. **[8]**

OR

**P.T.O.**

- Q6)** a) Describe the smart materials used in the automobile industry. [9]  
b) Explain the powder metallurgy process for making disc brake pads. [8]

- Q7)** a) Explain the criteria for selection of materials for different systems in automobiles. [9]  
b) Describe the materials developments by Land Rover. [9]

OR

- Q8)** a) Explain the developments in materials by Ferrari. [9]  
b) Discuss the Ashby charts. [9]



Total No. of Questions : 8]

SEAT No. :

P-235

[Total No. of Pages : 2

[6003]-312

T.E. (Chemical) (Semester - I)

Mass Transfer - I

(2019 Pattern) (309341)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1) a)** Explain mechanism of Gas Absorption & Desorption? Explain absorption in wetted wall column? [8]

- b) 5,000 kg/hr of a SO<sub>2</sub> - air mixture containing 5% by volume SO<sub>2</sub> is to be scrubbed with 2,00,000 kg/hr. of water in a packed tower. The exit concentration of SO<sub>2</sub> is reduced to 0.15%. The tower operates at 1 atm. The equilibrium relationship is given by  $Y = 30X$  Where,  $Y = \text{Mole SO}_2/\text{Mole air}$  &  $X = \text{Mole SO}_2/\text{Mole water}$ . If the packed height of the tower is 420 cm, estimate the height of transfer unit (HTU)? [9]

OR

**Q2) a)** What is Absorption & Stripping factor? Explain minimum L/G ratio? [8]

- b) A packed tower is designed to recover 98% CO<sub>2</sub> from a gas mixture containing 10% CO<sub>2</sub> & 90% air using water. The equilibrium relation is given as  $Y = 14X$ .

Where  $Y = \text{KgCO}_2/\text{Kg dry air}$  &  $X = \text{Kg CO}_2/\text{Kg water}$  The water to gas rate is kept 30% more than the minimum value. Calculate the height of tower if (HTU) OG = 1 m. [9]

**Q3) a)** Explain Adiabatic Saturation temperature in Humidification operation? [8]

P.T.O.

- b) The air in a room is at  $26.7^{\circ}\text{C}$  & a pressure of  $101.325\text{KPa}$  & contains water vapor with a partial pressure  $2.76\text{ KPa}$ . Calculate i) Absolute Humidity ii) Saturation humidity. iii) Percentage humidity iv) Percentage Relative humidity v) Relative humidity vi) Humid Heat vii) Humid Volume.

**Data:** Vapour pressure of water at  $26.7^{\circ}\text{C}$  is  $3.5\text{ KPa}$  [9]

OR

- Q4)** a) Explain design of cooling tower-HTU, NTU concept? [8]  
 b) A gas (B) - Benzene (A) mixture is saturated at  $1\text{ std.atm}$   $50^{\circ}\text{C}$ . Calculate the absolute humidity if B is i) Nitrogen and ii) Carbon dioxide. (Data:  $P_A = 0.362\text{ std.atm.}$ ) [9]

- Q5)** a) What are the various equipment's used for gas-liquid contact. With neat sketch explain Venturi Scrubber & Spray Towers? [9]  
 b) What are the different types of Column? Explain? [9]

OR

- Q6)** a) Explain mechanically agitated vessels with different types of impellers? [9]  
 b) What is Tray efficiency? Explain types of Tray efficiencies? [9]

- Q7)** a) Explain how to plot the Rate of drying curve? [8]  
 b) A porous dry solid was dried under constant drying conditions in a batch dryer. It took 6 hrs. to reduce the moisture from 50% to 10%. All the moisture content on dry basis. How long will it take to dry a sample of the above solid to dry from 66% to 6% under the same drying conditions? [10]

OR

- Q8)** a) Explain time required for Drying? Derive the equation to calculate total time for Drying? [8]  
 b) A batch of solid for which the following table of data applies is to be dried from 25% to 6% (wet basis) moisture under conditions identical to those for which the data were tabulated. The initial weight of the wet solid is  $300\text{ kg}$  & the drying surface is  $1\text{ m}^2/8\text{ kg dry weight}$ . Determine the time for drying? [10]

X Kgmoisture / Kg dry solid	0.35	0.25	0.2	0.18	0.16	0.14	0.12	0.10	0.09	0.08	0.064
R Kgmoisture/ hr. $\text{m}^2$	0.3	0.3	0.3	0.266	0.239	0.208	0.18	0.15	0.097	0.07	0.025



Total No. of Questions : 8]

SEAT No. :

**P236**

[Total No. of Pages : 2

**[6003]-313**

**T.E. (Chemical)**

**CHEMICAL TECHNOLOGY-II**

**(2019 Pattern) (Semester-I) (309342)**

*Time : 2½ Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagram must be drawn wherever necessary.*
- 2) *Assume suitable data, if necessary.*
- 3) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*

**Q1) a)** Explain production of coke in detail. Give its major engineering problems. **[9]**

b) Describe the process of manufacturing of Portland cement. Write the metaloxides composition necessary in the Portland cement. **[9]**

OR

**Q2) a)** Describe various steps involved in pyrolysis of coal. **[9]**

b) Explain types of steel in detail with their applications. **[9]**

**Q3) a)** Describe different types of solvents used in paint manufacture? **[9]**

b) Discuss production of water gas with its major engineering problems. **[8]**

OR

**Q4) a)** Explain the preparation of paint with a typical formulation, mention the function of each ingredient. **[9]**

b) Give the classification of dyes based on various parameters. **[8]**

**Q5) a)** Explain manufacturing of penicillin with major engineering problems. **[9]**

b) Discuss different types of agrochemicals and explain manufacturing process of pesticides. **[9]**

OR

**Q6) a)** Describe in detail about plant growth regulators and yield stimulators. **[9]**

b) What are different Antibiotics? explain their properties and applications. **[9]**

**P.T.O.**

**Q7)** a) Describe the importance and production of ethylene dichloride (EDC) with suitable example. [9]

b) Explain in detail about Halogenated Hydrocarbons. [8]

OR

**Q8)** Draw a neat flow diagram and explain in brief (any 2) [17]

a) Production of acetone

b) Production of Phenol

c) Production of vinyl chloride



Total No. of Questions : 8]

SEAT No. :

**P237**

[Total No. of Pages : 2

[6003]-314

**T.E. (Chemical Engineering)**  
**CHEMICAL ENGINEERING MATHEMATICS**  
**(2019 Pattern) (Semester - I) (309343)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2 Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures of the right indicate full Marks.
- 4) Assume suitable data wherever necessary.

**Q1)** Numerically integrate following equation  $f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x$  from  $x_1 = 0$  and  $x_2 = 0.8$  using Trapezoidal rule, Simpson's 1/3<sup>rd</sup> rule, Simpson's 3/8<sup>th</sup> rule. [18]

OR

**Q2) a)** Use Multiple linear regression to fit the following data. [9]

$X_1$	0	2	2.5	1	4	7
$X_2$	0	1	2	3	6	2
Y	5	10	9	0	3	27

**b)** Use a least square regression to fit a straight line to. [9]

X	0	2	4	6	9	11	12	15	17	19
Y	5	6	7	6	9	8	7	10	12	12

**Q3) a)** Find  $y(0.2)$  for  $y' = (x-y)/2$ ,  $y(0) = 1$ , with step length 0.1 using Eulers method. [8]

**b)** Find  $y(0.2)$  for  $y' = (x-y)/2$ ,  $y(0) = 1$ , with step length 0.1 using Second order Runge Kutta method. [9]

OR

**Q4)** Solve the following set of differential equations using RK 4 method Assuming that at  $x = 0$ ,  $y_1 = 4$ ,  $y_2 = 6$  Integrate to  $x = 1$  with step size of 0.5  $dy_1/dx = -0.5 y_1$ ,  $dy_2/dx = 4 - 0.3 y_2 - 0.1 y_1$ . [17]

**Q5) a)** What is second order partial differential equation? Explain with suitable example. Give classification of second order PDEs with suitable examples and equations. [9]

**b)** Explain Crank Nicolson method (Finite difference method) used solve parabolic Partial differential equations in detail. [8]

OR

P.T.O.



**Q6)** Use Explicit method to solve for the temperature distribution of a long thin rod with a length of 10cm and following values  $k' = 0.49 \text{ cal/s (s.cm. } ^\circ\text{C)}$ ,  $\Delta x = 2 \text{ cm}$  and  $\Delta t = 0.1 \text{ s}$ . At  $t = 0$ , the temperature of the rod is zero and boundary conditions are fixed for all times at  $T(0) = 100 ^\circ\text{C}$  and  $T(10) = 50 \text{ deg C}$ . Note that the rod is of aluminium with  $C = 0.2174 \text{ cal/ (g. } ^\circ\text{C)}$  and density of rod  $= 2.7 \text{ gms/cm}^3$ . Therefore  $k = 0.835 \text{ cm}^2/\text{s}$  and  $\Lambda = 0.020875$ . [17]

**Q7) a)** Employ golden section search method to find the maximum of  $f(x) = 4x - 1.8x^2 + 1.2x^3 - 0.3x^4$ , use  $x_1 = -2$  and  $X_u = 4$ . [12]

b) Enlist and explain any two Chemical engineering applications of optimization. [6]

OR

**Q8) a)** What is Simplex method? Explain the method in detail. [8]

b) Use Simplex method to find the optimal solution of following LPP. [10]

$$\text{Max. } Z = 3X_1 + 5 X_2$$

Subject to

$$3X_1 + 2 X_2 \leq 18$$

$$X_1 \leq 4$$

$$X_2 \leq 6$$

$$X_1, X_2 \geq 0$$



[6003]-315

T.E. (Chemical) (Semester - I)

**CHEMICAL ENGINEERING THERMODYNAMICS**

(309344) (2019 Pattern)

Time : 2½ Hours]

[Max. Marks : 70]

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1)** Assuming Raoult's law to be valid, prepare a P-x-y diagram for a temp of 363.15 K and T-x-y diagram for a pressure of 90 kPa for benzene (1) and ethyl benzene (2) system. [18]

The Antoine equation and parameters are given below:

$$\ln P^{sat} / \text{KPa} = A - \frac{B}{T + C} \quad (T \text{ in K})$$

Component	A	B	C
Benzene	13.8594	2773.78	-53.08
Ethyl benzene	14.0045	3279.47	-59.95

OR

**Q2) a)** A liquid mixture of cyclohexane (1)/phenol (2) for which  $x_1 = 0.6$  is in equilibrium with its vapour at 417 K. Determine the equilibrium pressure P and vapour composition  $y_1$  from the following information. [10]

$\ln \gamma_1 = A x_2^2$ ,  $\ln \gamma_2 = A x_1^2$ , At 417K  $P_1^{(sat)} = 75.20 \text{ KPa}$ ,  $P_2^{(sat)} = 31.66 \text{ KPa}$ .  
The system forms an azeotrope at 417K for which  $x_1^{az} = y_1^{az} = 0.294$ .

b) Explain the Gibbs - Duhem equation and its various forms. [8]

**P.T.O.**

**Q3) a)** Show that at constant T and P, the condition for a single phase binary system is given as  $d \ln \gamma_1 / dx_1 > -1/x_1$ . **[10]**

b) Explain in brief the three types of constant pressure liquid/liquid solubility diagrams. **[7]**

OR

**Q4) a)** Explain following consistency tests for VLE data: **[10]**

i) Slope of  $\ln \gamma_1$  curves.

ii) Redlich Kister method.

b) Explain triple point and eutectic temperature with neat diagram. **[7]**

**Q5) a)** The equilibrium constant at 420K for the vapour phase hydration of ethylene to ethanol according to the reaction  $C_2H_4 + H_2O \rightarrow C_2H_5OH$  is  $6.8 \times 10^{-2}$  and standard heat of reaction at 298K is  $-45.95 \times 10^3$  J. The specific heat data are as follows. **[14]**

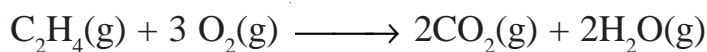
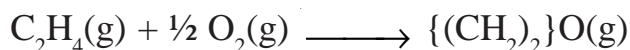
Component	$\alpha$	$\beta$	$\gamma$
Ethylene	11.886	$120.12 \times 10^{-3}$	-
Water	30.475	$9.652 \times 10^{-3}$	$1.189 \times 10^{-6}$
Ethanol	29.358	$166.9 \times 10^{-3}$	$-50.09 \times 10^{-6}$

Formulate general relationship for estimating the equilibrium constant and standard free energy change as functions of temperature.

b) Write a note on feasibility of a chemical reaction. **[4]**

OR

- Q6) a)** A system initially containing 2 mol  $C_2H_4$  and 3 mol  $O_2$  undergoes the reactions : **[10]**

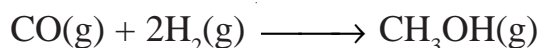


Develop expressions for the mole fractions of the reacting species as functions of the reaction co-ordinates for the two reactions.

- b) Derive the following expression.  $-RT \ln K = \sum v_i G_i^0$  **[8]**

- Q7) a)** A stoichiometric mixture of  $N_2(g)$  and  $H_2(g)$  at 100 bar and 800K enter a catalytic reactor for the synthesis of ammonia . Assuming that the gas phase is ideal, estimate the degree of conversion and the equilibrium composition. At 800 K,  $K_a = 1.122 \times 10^{-5}$ . **[8]**

- b) Methanol can be produced according to the reaction. **[9]**



Estimate the degree of conversion of  $CO(g)$  into methanol at 500K and 5 bar if

- i) an equimolar mixture of  $CO$  and  $H_2$  is fed to a reactor
- ii) a stoichiometric mixture of  $CO$  and  $H_2$  is fed
- iii)  $CO$  and  $H_2$  in the ratio 1 : 4 enter the reactor.

OR

- Q8) a)** For the cracking reaction  $C_3H_8(g) \longrightarrow C_2H_4(g) + CH_4(g)$  the equilibrium conversion is negligible at 300K but becomes appreciable at temperatures above 500K . For a pressure of 1 bar, determine **[12]**

- i) Fractional conversion at 600K
  - ii) The temperature at which the fractional conversion is 80%.
- b) Explain phase rule for reacting systems. **[5]**

**x x x**

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P239**

**[6003] - 316**

**T.E. (Chemical)**

**CHEMICAL INDUSTRY MANAGEMENT**

**(2019 Pattern) (Semester - I) (Elective - I) (Theory) (309345 A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** Explain various functions of store keeper. **[8]**

b) What do you mean by Inventory? Explain the Term LIFO and FIFO in detail. **[8]**

OR

**Q2) a)** What are tenders Explain the types of tenders. **[8]**

b) Explain various functions of purchase department. **[8]**

**Q3) a)** What is sales promotion? Explain sales promotion techniques. **[8]**

b) Differentiate between marketing and selling. **[10]**

OR

**Q4) a)** Explain in detail pricing strategies in detail. **[10]**

b) Write an explanatory note on advertising. **[8]**

**P.T.O.**

- Q5) a) Write notes on :** [10]
- i) Antidumping Duty.
  - ii) MODVAT.
- b) Write a explanatory note on International trade. [8]

OR

- Q6) a) Write a detailed note on Quality Management with it's importance.** [10]
- b) Explain in detail business cycle with neat diagram. [8]

- Q7) a) Write short notes on :** [10]
- i) MRTP.
  - ii) Flow Chart and Flow Diagram.
- b) Define work measurement. Explain the objectives and procedures of work measurement. [8]

OR

- Q8) a) Write a brief note on concept of guarantee and warranty.** [10]
- b) Explain the classification of types of contracts. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P240**

**[6003] - 317**

**T.E. (Chemical)**

**FOOD TECHNOLOGY**

**(2019 Pattern) (Semester - I) (Elective - I) (309345 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** Discuss about various types of storage of fruits and vegetables. **[8]**

**b)** Write short notes on preservation of fruits and vegetables by. **[8]**

i) Fermentation.

ii) Drying.

OR

**Q2) a)** Explain aseptic canning technology for canning of fruits and vegetables. **[8]**

**b)** Write Short note on preparation of syrups. **[8]**

**Q3) a)** Explain theory of size reduction equipment's and effect of size reduction on foods. **[10]**

**b)** Explain applications and effect on food materials for drying and freeze concentration. **[8]**

OR

**Q4) Write Short Notes on :** **[18]**

a) Hot oil frying theory and equipment's.

b) Baking theory and equipment's

c) Roasting theory and equipment's.

**P.T.O.**

**Q5)** Describe following. [18]

- a) Various methods to extend shelf-life of foodstuff.
- b) Food packaging materials and their properties.

OR

**Q6)** a) Write short notes on : [10]

- i) Plywood and wire bound boxes.
- ii) Corrugated and fibre board boxes.

b) Explain flexible packaging materials and their properties. [8]

**Q7)** a) Describe Objectives, importance, & Functions of quality control of food. [9]

b) Explain quality assessment of food materials in cereals and dairy products. [9]

OR

**Q8)** a) Explain concept of Codex Alimentarius / HACCP in food quality assurance. [9]

b) Explain food adulteration and food safety, basis, trends and composition of India's foreign trade. [9]





Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P241**

**[6003] - 318**

**T.E. (Chemical)**

**POLYMER ENGINEERING**

**(2019 Pattern) (Semester - I) (Elective - I) (309345 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Neat diagrams must be drawn whenever necessary.
- 4) Assume suitable data if necessary.

**Q1)** Write detailed notes on along with their method of determination: **[18]**

- Mn.
- Mw.
- Mv.

OR

**Q2)** Explain the method of Molecular-Weight Averages calculation. A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions:

1 g 10,000 molecular weight

2 g 50,000 molecular weight

2 g 100,000 molecular weight

Using this information, calculate the number-average molecular weight, weight average molecular weight, and PDI of the mixture. **[18]**

**Q3)** Explain in detail the kinetics of Coordination polymerization with example. **[17]**

OR

**Q4) a)** Explain the role of the Chain transfer agents in detail. List down the examples. **[8]**

b) What do you mean by Co-Polymers? How do they occur? Give examples. **[9]**

**P.T.O.**

**Q5)** Explain in detail the requirement of additives, lubricants and antioxidants in polymer industry along with proper examples. **[18]**

OR

**Q6)** What are the various moulding methods of polymers? Explain any two in detail. **[18]**

**Q7)** With a neat and labeled flowsheet, explain the process of manufacturing of Neoprene polymer. Also list down its properties and applications **17]**

OR

**Q8)** With a neat and labeled flowsheet, explain the process of manufacturing of Poly Ester polymer. Also list down its properties and applications. **[17]**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P242**

**[6003] - 319**

**T.E. (Chemical)**

**DOWNSTREAM PROCESSING**

**(2019 Pattern) (Semester - I) (Elective - I) (309345 D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

**Q1) a)** Explain the downstream processes in refinery industry. **[9]**

b) Explain desulfurization in detail. **[9]**

OR

**Q2) a)** Write short notes on: **[18]**

i) Petrochemical off gases.

ii) Gas recovery-olefin.

**Q3) a)** Explain extractive distillation in detail. **[9]**

b) Explain pressure swing distillation. **[9]**

OR

**Q4) a)** Explain azeotropic distillation. **[9]**

b) Explain column sequences in detail. **[9]**

**P.T.O.**

- Q5)** a) Explain molecular sieves. [9]  
b) Explain hydrogel process. [9]

OR

- Q6)** a) Explain zeolites structure and its industrial applications. [9]  
b) Explain energy conservation in industry. [9]
- Q7)** a) Explain separation process synthesis for non azeotropic mixtures. [8]  
b) Explain ion exchange in detail. [8]

OR

- Q8)** a) Explain separation synthesis algorithm. [8]  
b) Explain regeneration, applications and catalysis use of ion exchange. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P243**

[6003]-320

**T.E. (Chemical)**

**CHEMICAL REACTION ENGINEERING-I**

**(2019 Pattern) (Semester-II) (309348)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagram should be drawn whenever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Derive performance equation for Plug flow reactor. **[12]**

- b) Find the conversion of A in a 50%A-50% inert feed ( $v_0=180$  liter/min,  $C_{A0}=300$  mol/liter) to a  $1\text{ m}^3$  mixed flow reactor. Gaseous reactant A decomposes as follows :  $A \rightarrow 3R$   $r_A = (0.6\text{ min}^{-1}).C_A$  **[6]**

OR

**Q2) a)** Explain the terms space time and space velocity and state their units.**[6]**

- b) Derive performance equation for Batch reactor and represent the graphs of Batch reactor for general case and constant density system. **[12]**

**Q3) a)** Explain series, parallel, and independent reactions with suitable examples. **[12]**

- b) Derive the relationship for  $C_{Rf}$  in terms of  $\psi$  for plug flow reactor in case of parallel reaction. **[5]**

OR

**Q4)** Explain quantitative treatment of mixed flow reactor for a first order reaction in series. **[17]**

*P.T.O.*

- Q5) a)** Between 0 °C and 100 °C determine the equilibrium conversion for the elementary aqueous reaction

$$A \leftrightarrow B \quad \Delta G_{298}^{\circ} = -14130 \text{ J / mol}$$

$$\Delta H_{298}^{\circ} = -75300 \text{ J/ mol}$$

$$C_{PA} = C_{PR} = \text{Constant}$$

Present the results in the form of temperature versus conversion. What restriction should be placed on the reactor operating isothermally if we are to obtain a conversion of 75% or higher? [12]

- b) Explain the concept of chemical equilibrium with characteristics. [6]

OR

- Q6) a)** Explain heat of reaction from thermodynamics. [12]

- b) Explain optimum temperature progression for exothermic reversible reaction. [6]

- Q7) a)** Explain early and late mixing of fluids. [9]

- b) Explain the concept of residence time distribution in detail. [8]

OR

- Q8) a)** Explain relationship between E, F and C curves. [9]

- b) Explain tank in series model. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

**P244**

**[6003]-321**

**T.E. (Chemical)**

**MASS TRANSFER-II**

**(2019 Pattern) (Semester-II) (309349)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Differentiate between the Solvent Extraction and Distillation for separation of liquid mixtures. **[5]**

b) Discuss on the minimum solvent requirement for counter-current Solvent Extraction in case of immiscible solvents. **[5]**

c) A solution containing 5% acetaldehyde and 95% Toluene is to be extracted with water in five stage crosscurrent extraction to extract Acetaldehyde. Toluene and water are essentially immiscible. 25kg of water is used per 100 kg of feed each time. Calculate the amount of Acetaldehyde extracted and the final concentration of the exit solution. The equilibrium is  $Y = 2.20 X$

Where  $Y$  = kg of Acetaldehyde/kg of water

$X$  = kg of nicotine/kg of Toluene **[8]**

OR

**Q2) a)** Solution of Nicotine in water containing 1% nicotine is to be extracted with kerosene as a solvent at 293K. Water and kerosene are practically immiscible (Essentially insoluble). **[10]**

Assume the equilibrium relationship to be  $Y = 0.9 X$

Where  $Y$  = kg of nicotine / kg of kerosene

$X$  = kg of nicotine / kg of water

Determine % extraction of nicotine;

i) If 100 kg of the feed solution is extracted with 150 kg of solvent in single stage.

ii) If three theoretical Extractions using 50 kg solvent in each stage.

**P.T.O.**

- b) Define the following terms in solvent Extraction with their significance;[8]
- Selectivity and Distribution coefficient
  - Plait point and Tie lines

- Q3)** a) Discuss on the graphical representation of equilibrium characteristics of Leaching operation with diagram and proper notations. [7]
- b) Explain the constant and variable underflow in leaching operation. [4]
- c) Write the material balance for the single stage leaching operation assuming variable underflow and no insoluble in the overflow. [6]

OR

- Q4)** a) Explain the construction and mechanism of Bollman (Basket) Extractor for leaching operation with neat diagram. [7]
- b) Oil is be extracted from meal by means of benzene using continuous counter-current leaching unit. The unit treats 1000 kg of meal (on completely exhausted solids basis) per hour. The untreated meal contains 365 kg of oil and 30kg of benzene. The solvent used contains 14 kg of oil and 590 kg of benzene, The exhausted solids contain 55 kg of oil and 451 kg of benzene. Find the number of stages required. The entrainment [10]

data is:

Kg of oil/kg of solution	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Kg of Solution/kg of Solid	0.5	0.505	0.515	0.53	0.55	0.517	0.595	0.62

- Q5)** a) Describe the Freundlich and Langmuir adsorption Isotherms in adsorption operation. [10]
- b) Discuss on the principle, equilibria and rate of Ion Exchange process in details. [8]

OR

- Q6)** a) A solution of washed raw cane sugar is coloured by the presence of small amounts of impurities. The solution is to be decolourised by treatment with an adsorptive carbon in contact filtration plant. The original solution has a colour concentration of 9.6 measured on an arbitrary scale and it is desired to reduce the colour of 0.96 Calculate the necessary



dosage of fresh carbon per 1000 kg solution for two stage crosscurrent process. [10]

The data for an equilibrium isotherm is as follows;

Kg Carbon/kg solution	0	0.001	0.004	0.008	0.02	0.04
Equilibrium Colour	9.6	8.6	6.3	4.3	1.7	0.7

- b) Which parameters should affect the shape of Breakthrough curve in adsorption? [8]

**Q7)** a) Classify the crystallizers and give the significance of vacuum Crystallizer.[7]

- b) Crystallizer is charged with 7500 kg of an aqueous solution at 377K. Anhydrous sodium sulphate is 29.6% by weight in the feed. The solution is cooled in the cooling stage, and 5% of water is lost by evaporation. As a result, crystals of  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  crystallize out. Calculate the yield of the crystals and the quantity of mother liquor is found to contain 18.3% by weight anhydrous  $\text{Na}_2\text{SO}_4$ .

Data: Molecular weight of  $\text{Na}_2\text{SO}_4 = 142$  [10]

OR

**Q8)** a) Give classification of membrane processes. What are different membrane modules? Explain the principle and application of Reverse Osmosis[10]

- b) Write the material and energy balance of crystallizer. [7]



Total No. of Questions : 8]

SEAT No. :

**P245**

**[6003] - 322**

**[Total No. of Pages : 3**

**T.E. (Chemical Engineering)  
TRANSPORT PHENOMENA**

**(2019 Pattern) (Semester - II) (309350)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Derive the expression of molar flux, concentration profile and average concentration for diffusion with homogeneous chemical reaction. **[12]**

b) What is rate of evaporation of chloropicrin into air at 298 K? **[6]**

Total pressure = 770 mm Hg, diffusivity =  $0.088 \text{ cm}^2/\text{sec}$ , vapor pressure = 23.81 mm Hg,  $Z_2 - Z_1 = 11.14 \text{ cm}$ , density of chloropicrin =  $1.65 \text{ g/cm}^3$ ,  $S = 2.29 \text{ cm}^2$ .

OR

**Q2) a)** The solute HCl is diffusing through a thin film of water 2.0mm. The concentration of HCl at point 1 is 12.0 wt% (density =  $1061 \text{ kg/m}^3$ ), and at point 2 is 6.0 wt% (density =  $1030 \text{ kg/m}^3$ ).

Diffusivity of HCl in water is  $2.5 \times 10^{-9} \text{ m}^2/\text{s}$ . Calculate the flux of HCl in  $\text{kg-mole/m}^2.\text{s}$  **[6]**

b) Consider a natural gas mixture contained in a pyrex tube with radius as  $R_1$  and  $R_2$ . Obtain an expression for the rate at which helium will leak through the tube. **[12]**

**P.T.O.**

**Q3) a)** Use Navier Stoke's equation of motion to derive Hagen Poiseuille Equation. [12]

b) Give significance of different types of derivatives. [5]

OR

**Q4) a)** Derive Newton's second law of motion. [12]

b) Derive dimensionless form of equation of change. [5]

**Q5) a)** Derive Blake Kozeny equation for laminar flow of fluid through packed bed. [12]

b) Derive expression for friction factor and Reynold number for laminar flow through fluid through pipe. [6]

OR

**Q6) a)** Derive Burke Plummer equation for turbulent flow of fluid through packed bed. [12]

b) Explain macroscopic mass balance equation. [6]

**Q7) a)** Explain Martinnelli's analogy. [9]

b) Explain Reynold analogy. [8]

OR

**Q8) a)** Explain co-relation of binary mass transfer coefficient in one phase at low mass transfer rates. [9]

b) A spherical water droplet, 0.05 cm in diameter is falling at velocity of 215 cm/sec through dry, still air at 1 atm pressure. Estimate instantaneous rate of evaporation from the drop if drop surface is at 21° C and air at 60° C. Vapor pressure of water at 21° C is 0.0247 atm. Assume pseudo steady state condition and  $k_{xm} = 1.35 \times 10^{-3} \text{ mol s}^{-1} \text{ cm}^{-2}$ . [8]

\* \* \*

Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 2

**P246**

**[6003]-323**

**T.E. (Chemical)**

**ENERGY CONSERVATION IN CHEMICAL PROCESS  
INDUSTRIES**

**(2019 Pattern) (Semester-II) (Elective-II) (309351 A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 Q.4, or Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Explain in detail new energy technologies. **[18]**

OR

**Q2)** Explain in detail about motivation of implementing conservation measures and evaluating costs and benefits of conservation measures. **[18]**

**Q3)** Explain in detail human aspect of energy conservation and involvement tree. **[17]**

OR

**Q4)** Explain in detail about plant level organization, division level organization, corporate level organization. **[17]**

**Q5) a)** Draw the sketch of evaporators and explain its principle and working. **[9]**

b) Explain waste minimization and resource conservation. **[9]**

OR

**Q6) a)** How and where the energy losses can be minimized in heat exchangers. **[9]**

b) Enlist the checklist for energy conservation in lighting system. **[9]**

**P.T.O.**

**Q7)** What are the energy consuming units in sugar and give the important conservation steps? **[17]**

OR

**Q8)** Explain waste minimization and its classification, housekeeping, process change, recycling, product modification, waste minimization methodology steps, benefits of waste minimization in cement industry. **[17]**



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 2

**P247**

**[6003]-324**

**T.E. (Chemical)**

**PROCESS INSTRUMENTATION AND CONTROL**

**(2019 Pattern) (Semester-II) (Elective-II) (309351 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Figures to the right indicate full marks.*
- 2) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1) a)** Explain classification of pressure measuring instruments. **[8]**

b) Explain with diagram, construction and working LVDT as pressure measuring device. **[8]**

OR

**Q2) a)** Explain with diagram, construction and working of Diaphragms. **[8]**

b) What are different types of manometers? With neat sketch explain inclined leg manometer. **[8]**

**Q3) a)** Explain with diagram, construction, working and flow equation of orifice meter plate. **[10]**

b) Explain classification of flow measuring instruments. **[8]**

OR

**Q4) a)** Explain classification of level measuring instruments. **[8]**

b) Explain with diagram, construction and working of air purge level measurement method. **[10]**

**P.T.O.**

**Q5)** Describe with neat diagram the following techniques of composition analysis. **[18]**

- i) Gas chromatography
- ii) Mass Spectroscopy

OR

**Q6)** a) Write short notes on: **[10]**

- i) pH meter
  - ii) HPLC
- b) Explain principle with diagram, construction, working of liquid chromatography. **[8]**

**Q7)** a) Describe the heat exchanger automatic control system with block diagram. **[9]**

- b) Explain modes of control action. **[9]**

OR

**Q8)** a) Derive the dynamic response equation of first order system for step change. **[9]**

- b) State difference between first order and second order system. **[9]**





Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 2

**P248**

**[6003]-325**

**T.E. (Chemical)**

**CORROSION ENGINEERING**

**(2019 Pattern) (Semester-II) (309351 C) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain in Detail about uniform attack. **[5]**

b) Explain in Detail about fretting corrosion in Steel and its Remedial Measure. **[8]**

c) What is stress corrosion cracking? Explain in Detail. **[5]**

OR

**Q2) a)** What is intergranular Corrosion? Explain in Detail. **[5]**

b) Explain in Detail about dezincification. **[5]**

c) Discuss Remedial Measure for cavitation, erosion. **[8]**

**Q3) a)** Write a short note on **[15]**

i) Mechanisms of Oxidation

ii) Corrosion of iron and steel

iii) High temperature oxidation

b) What is Corrosion? **[2]**

OR

**P.T.O.**

- Q4)** a) Explain different theories of corrosion with suitable example. [7]  
b) Explain in Detail about the Effect of temperature and composition on Media. [8]  
c) Define Pilling Bedworth ratio. [2]

- Q5)** a) Define and Explain in Brief about Erosion and Cavitation. [6]  
b) What is High temperature oxidation? Explain with Example. [6]  
c) Write a short note on surface treatment coatings. [6]

OR

- Q6)** a) Explain the method to Prevent Galvanic Corrosion. [6]  
b) Explain Prevention techniques for different types of Corrosion. [12]
- Q7)** a) Explain in Detail about Modification technique for material, also suggest required heat treatment to avoid corrosion. Justify your answer with proper example. [12]  
b) What is Non Metallic Lining? Explain in Detail. [5]

OR

- Q8)** a) With proper example justify the role of alloying to prevent corrosion. [7]  
b) Write a Short Note on [10]  
i) cathodic protection  
ii) anodic protection



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 2

**P249**

**[6003]-326**

**T.E. (Chemial)**

**ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**(2019 Pattern) (Semester-II) (Elective II) (309351D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Explain in detail Fuzzy logic and genetic algorithms. **[18]**

OR

**Q2)** Explain knowledge based process control in detail with suitable example. **[18]**

**Q3)** Define expert system and explain in detail characteristics, limitations, advantages, disadvantages and application of expert system. **[17]**

OR

**Q4)** Discuss expert system design and development in detail with suitable examples. **[17]**

**Q5)** Explain resolution in propositional and first order logic with resolution graph. **[18]**

OR

**Q6) a)** Discuss the role of reasoning in knowledge-based systems. **[9]**

b) Explain logic and inference in detail. **[9]**

**P.T.O.**

- Q7)** a) Explain the concept of problem decomposition with help of goal trees. [9]
- b) Discuss rule based expert systems with example. [8]

OR

- Q8)** Explain in detail the difference between state space planning and goal stack planning. [17]



Total No. of Questions : 8]

SEAT No. :

P-250

[Total No. of Pages : 2

[6003]-327

T.E. (Civil) (Semester - I)

**Hydrology & Water Resources Engineering**  
**(2019 Pattern) (301001)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Q. No 1 or Q. No 2, Q. No 3 or Q. No 4, Q. No 5 or Q. No 6, Q. No 7 or Q. No 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain hydrological design of culverts and bridges. **[10]**

- b) An urban catchment has area of 85 ha, The slope of catchment is 0.006 and the maximum length of water travel is 950 m. The maximum depth of rainfall with return period of is as below

Duration (mm)	5	10	20	30	40	60
Depth of rainfall (mm)	17	26	40	50	57	62

If a culvert for drainage at the outlet of this area is to be designed for a return period of 25 years estimate the required peak flow rate, by assuming runoff coefficient as 0.3 **[8]**

OR

**Q2) a)** State and explain step by step procedure to delineate watershed on a topo sheet with neat sketches. **[10]**

- b) Explain step by step software procedure to generate contour map of a catchment area where dam is to be constructed. **[8]**

**Q3) a)** State and explain importance of various investigations to be carried out before construction of multipurpose dam project. **[10]**

- b) What are reservoir losses and suggest method to control leakages from reservoir. **[7]**

OR

**P.T.O.**

- Q4)** a) Explain how you will fix the capacity of reservoir using elevation capacity curve and dependable yield. Explain neat sketch. [10]  
b) State measures to control reservoir sedimentation. [7]

- Q5)** a) Derive the formula to calculate discharge of a well in a confined aquifer and unconfined aquifer. [10]  
b) What is water logging? Explain tile drain method and also state formula for spacing of tile drains. [8]

OR

- Q6)** a) Explain participatory irrigation management and also explain water distribution societies in detail. [10]  
b) State various types of tube wells and explain construction of any type. [8]

- Q7)** a) Explain Piped Distribution Network (PDN) and state its advantages. [10]  
b) What is micro irrigation and what are its advantages compared to other methods of irrigation. [7]

OR

- Q8)** a) State various methods of canal revenue collection and explain any two in detail. [10]  
b) Differentiate between surface irrigation and subsurface irrigation and explain drip irrigation in detail. [7]



Total No. of Questions : 8]

SEAT No. :

**P251**

[Total No. of Pages : 2

**[6003]-328**

**T.E. (Civil Engineering)**

**WATER SUPPLY ENGINEERING**  
**(2019 Pattern) (Semester-I) (301002)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain in detail: Rapid Mixer and flocculator. [6]  
b) A clariflocculator is to be designed for an average flow of 50 MLD. Assuming, inlet velocity as 1.2 m/s, and detention time in flocculator and clarifier as 30 min and 120 mins, respectively, surface overflow rate in clarifier as  $40\text{m}^3/\text{m}^2/\text{d}$ ,  $G$  in flocculator  $40_{\text{s}^{-1}}$ , and depth of flocculator basin as 2.5m, determine diameter of inlet pipe, flocculator and clarifier. [6]  
c) Discuss in details various mechanisms involved in the filtration process. [6]

**OR**

- Q2)** a) What is Flocculation? State factors affecting the flocculation. [6]  
b) A filter unit is of size  $4\text{m} \times 8\text{m}$ . After filtering  $8000\text{ m}^3/\text{day}$  in 24 hr period, the filter is back washed for 30 minutes at the rate of  $10\text{ lit}/\text{m}^2/\text{sec}$  for 10 minutes. Compute the average filtration rate, quantity and percentage of treated water used in washing and the rate of wash water flow in each trough. The unit has 4 collecting troughs. [6]  
c) Explain in detail: operational problems of RSG filter. (Min 03 to be explained) [6]
- Q3)** a) Enlist various methods of disinfection. Explain any two methods in detail. [6]  
b) What is Residual Chlorine? Find the dose of chlorine and chlorine demand for water quantity of  $40,000\text{ m}^3/\text{day}$ . Chlorine used is 15 kg per day and residual chlorine after 10 minutes of contact time is  $0.2\text{ mg}/\text{lit}$ . [6]  
c) Write with a neat sketch a detailed note on Reverse Osmosis. [2+3=5]

**OR**

**P.T.O.**

- Q4)** a) Explain in detail: fluoridation & defluoridation of water. [6]  
 b) Explain in detail: Super chlorination, Dechlorination, Prechlorination. [6]  
 c) Write with a neat sketch: a detailed note on Electrodialysis. [2+3=5]

- Q5)** a) Write in detail: any 02 methods of water distribution. Support your answer with a suitable sketch. [8]  
 b) Designed demand of a town is 3 MLD. It is pumped into an elevated service reservoir at a uniform rate from 5 am to 9am and 5pm to 9pm. The variation in demand of water is given below. [10]

Period	5 am to 9 am	9 am to 5 pm	5 pm to 9 pm	9 pm to 12 am	12 am to 5 am
demand	40%	15%	30%	10%	05%

Determine the balancing Capacity of the reservoir.

OR

- Q6)** a) Write difference between continuous and intermittent system. (Min 06 point of comparison are expected) [6]  
 b) Calculate the storage capacity and dimensions of the tank to store rain water for the given data:  
 Terrace area= 200 m<sup>2</sup>, average annual rainfall=720 mm  
 Runoff coefficient= 0.8 Assume L:B=2, D=2m [6]  
 c) Write a detailed note on detection and prevention of leakage. [6]

- Q7)** a) Write a note on: [6]  
 i) Gate valve,  
 ii) Pressure relief valve  
 b) Explain in detail Packaged WTP. [5]  
 c) Explain with neat sketch: one pipe system partially ventilated [6]

OR

- Q8)** a) Write a note on: [6]  
 i) Reflux valve,  
 ii) Air relief valve  
 b) Explain in detail with neat sketch: two pipe system. [5]  
 c) Enlist initiatives taken by Government in water infrastructure. Explain one of them in detail. [6]





Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

**P252**

[6003]-329

T.E. (Civil)

**DESIGN OF STEEL STRUCTURES  
(2019 Pattern) (Semester - I) (301003)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat sketches must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Take  $f_y = 250$  and  $f_c = 410$  grade of steel.*
- 5) *Take ultimate stress in bolt,  $f_{ub} = 400$  N/mm<sup>2</sup>.*
- 6) *Assume suitable data, if necessary.*
- 7) *Use of electronic pocket calculator, IS : 800-2007 and steel table are allowed.*
- 8) *Use of cell phone is prohibited in the examination hall.*

- Q1)** a) State and explain in brief type of column bases. [3]
- b) Check the adequacy of ISHB 450 @ 87.2 kg/m to carry a factored axial load of 850 kN at an eccentricity of 250 mm about major axis. The effective length of column is 3 m. Consider only section strength. [14]

OR

- Q2)** a) Differentiate between slab base and gusseted base. [3]
- b) A column having effective length of 4 m is subjected to factored axial load of 500 kN and factored moment of 75 kNm. Design the column section. Check for section strength only. [14]

- Q3)** a) Explain in brief web buckling and web crippling with suitable sketches. [4]
- b) A simply supported steel joist of 5 m effective span carries a working uniformly distributed load 50 kN/m on entire span and a point load of 70 kN at mid span. The section is laterally supported throughout the span. Design an appropriate section. Apply usual checks for strength along with check for deflection. [14]

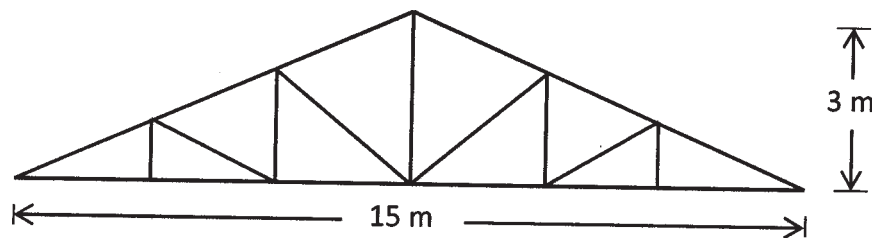
OR

- Q4)** a) Classify the section ISLB500@75.0 kg/m and ISA 100 × 75 × 8 mm @ 10.5 kg/m used as a beam. [4]

*P.T.O.*

- b) A simply supported beam carries a uniformly distributed load of magnitude  $W$  kN/m on entire span of 5 m. The compression flange is laterally unsupported throughout the span. Find the intensity of uniformly distributed load the section ISMB 500@ 86.9 kg/m can carry for the beam safely. Both ends of beam are fully restrained against torsion. [14]

**Q5)** Determine panel point dead load, imposed load and wind load for a truss as shown in Figure 1. Assume design wind pressure as  $1170 \text{ N/m}^2$ , use G.I. Sheet and the centre to centre spacing of truss as 3.5 m. Assume self weight of purlin as  $20 \text{ N/m}^2$  on plan area. [17]



**Fig. 1**

OR

**Q6)** Design a gantry girder supporting an electronically operated crane for following data : [17]

- Capacity of crane = 120 kN.
- Span between crane rails = 20 m.
- Self-weight crane girder = 100 kN.
- Weight of crab, electric motor, hook etc. = 15 kN.
- Minimum hook approach = 1.2 m.
- Wheelbase = 2 m.
- Span of Gantry 5.5 m.
- Weight of rails = 0.3 kN/m.

- Q7)** a) Explain in brief IS provisions for length and spacing of intermittent weld. [4]
- b) Design the cross-section of a simply supported welded plate girder with an effective span of 20 m. The girder is subjected to a working uniformly distributed load of 43 kN/m throughout the span, including self-weight. Assume that the compression flange is laterally supported throughout the span. Apply checks for bending and shear. [14]

OR

- Q8)** a) Explain in brief flange curtailment of plate girder. [4]
- b) A simply supported welded plate girder is designed for the span of 24 m. It is subjected to a shear force of 2300 kN and bending moment of 20700 kNm. A section used for plate girder to carry above load is as given below - [14]

Flanges - 780 mm wide and 50 mm thick.

Web - 16 mm thick and 2600 mm deep.

Design intermittent welded connection between flange and web. Also design end bearing stiffener. Assume stiff bearing length as 300 mm near support.



Total No. of Questions : 8]

SEAT No. :

P253

[Total No. of Pages : 3

[6003]-330

T.E. (Civil) (Semester - I)

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

(301004) (2019 Pattern)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

- Q1) a) Elaborate the importance of financial management in construction. [6]  
b) Explain “Why is construction financial management is different?” and enlist the various stakeholders involve in construction financial management. [6]  
c) What is a contract account? Draw the typical format of contract account.[5]

OR

- Q2) a) The following were the expenses on a contract which commenced on 1st January 2015. [6]

Particular	Amount (Rs.)
Material Purchased	1,10,000
Materials at the end	1,250
Direct Wages	15,000
Plant issued	5,000
Direct Expanses	8,000

The contract price was Rs. 1,50,000. It was duly received when the contract was completed on 31-3-2015. Charge indirect expenses at 15% on wages and provide Rs. 1,000 for depreciation on plant; Prepare the contract account.

- b) Explain in detail procedure for costing of contract. [6]  
c) What is contract and explain any two types of contract. [5]

P.T.O.

- Q3)** a) Explain in detail: Purposes of Budget. [6]
- b) Write a note on “Net Present Value Method” of capital budgeting with its advantages and disadvantages. [6]
- c) The initial investment in project A and B is Rs. 3000 lakh each. Rank the as per Profitability Index if the present value of cash inflow for both the projects mentioned in the following table: [5]

Sr. No.	Present value of cash inflow for project A (in lakh Rs.)	Present value of cash inflow for project B (in lakh Rs.)
1	1181.70	818.10
2	908.60	743.40
3	675.90	675.90
4	437.12	614.70
5	397.44	558.90

OR

- Q4)** a) Explain the process of capital budgeting. [6]
- b) Write down a detailed note on “Operating Budget”. [5]
- c) A concrete mixer was purchased at Rs. 8,00,000. Assuming Scrap Value to be Rs. 5,50,000 after 10 years. Calculate the depreciation at the end of 5 years by [6]
- i) Straight Line Method
- ii) Constant Percentage Method

- Q5)** a) Write down the significance of working capital in construction company. Enlist any four factors considered for determination of working capital. [6]  
b) Explain in details various Financing Resources of Working Capital. [6]  
c) What is safety stock? Which types of costs are associated with it? Explain its importance. [6]

OR

- Q6)** a) Write a note on “Types of working capital”. [6]  
b) A construction company purchases 10000 bags of cement annually. Each bag cement cost Rs. 500 and cost incurred in procuring each lot is Rs. 150. The cost of carrying is 25%. What are the most EOQ and number of orders? If lead time is 5 days, calculate order point. [6]  
c) Explain the various phases of operating cycle. [6]

- Q7)** a) What is direct tax and indirect tax? Explain any one type of direct tax and any one type of indirect tax. [6]  
b) Calculate the tax to be paid on property in Delhi, from following data: [6]  
Covered area = 900 sq. ft.  
Unit area value for one month = 6.0 per sq.ft.  
Age factor = 1.0  
Use factor = 1.2  
Structure factor = 1.0  
Occupancy factor = 1.0  
Taxrate = 11%  
c) Explain any six functions of Reserve Bank of India (RBI). [6]

OR

- Q8)** a) Write a note on Goods and Services Tax (GST). Also write down the impact of GST on construction industry. [7]  
b) Explain “Capital Value System” for the calculation of property tax. [5]  
c) Write down the roles and functions of following financial regulatory bodies: [6]  
i) ICRA (Information and Credit Rating Agency)  
ii) SEBI (Security and Exchange Board of India)

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P254**

[Total No. of Pages : 2

**[6003]-331**

**T.E. (Civil)**

**ADVANCED FLUID MECHANICS & HYDRAULIC MACHINES**

**(2019 Pattern) (Semester - I) (Elective - I) (301005a)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to right indicate full marks.
- 3) Assume suitable data if necessary.

- Q1)** a) A jet of water issuing from an orifice 25 mm diameter under a constant head of 1.7 m falls 0.98 m vertically before it strikes the ground at a distance of 2.30 m measured horizontally from the vena-contracta. The discharge was found to be 110 lit/min. determine Cd, Cv, and Cc for the orifice. [8]
- b) Explain function, location and types of surge tank. [6]
- c) Define unsteady flow? Give two examples of unsteady flow. [4]

OR

- Q2)** a) A 2 m diameter, 1500 m long steel penstock having a wall thickness of 15 mm carries water at the rate of 6.5 m<sup>3</sup>/s. Find the rise of pressure due to water hammer, if the valve at the end of penstock is closed in 4 seconds. Take modulus of elasticity of steel as  $2.06 \times 10^{11}$  N/m<sup>2</sup> and bulk modulus of elasticity of water as  $2.01 \times 10^9$  N/m<sup>2</sup>. Neglect loss of energy due to friction. [10]
- b) Explain one complete cycle of water hammer. [8]
- Q3)** a) A tank having constant cross-sectional area was emptied through a sharp-edged orifice situated at the bottom of the tank. It took 120 seconds to empty the upper third of the tank. How long will it to empty the middle third? [8]
- b) Derive an expression for force exerted by jet on a series of flat plate striking at its centre. Also determine the maximum efficiency developed. [9]

OR

**P.T.O.**

- Q4) a)** Show that the maximum efficiency of is 100%, when a jet strikes on series of frictionless semicircular moving curved vane fixed around the circumference of a wheel. [8]
- b)** A jet of water moving at 20 m/s impinges on a symmetrical curved vane shaped to deflect the jet such that is the vane angles at inlet and exit are each equal to  $25^\circ$ . If the vane is moving at 5 m/s, find the angle of the jet so that there is no shock at inlet. Also determine the absolute velocity of exit in magnitude and direction, and the work done. [9]

- Q5) a)** A Pelton wheel develops 9,000 kw, under a head of 300 m with an overall efficiency of 85% when revolving under a speed of 300 rpm. Find the unit discharge, unit power, and unit speed. If the head on same turbine falls to 250 m, find discharge, power and speed for this head. [10]
- b)** Draw a neat labelled sketch of Francis turbine. Explain working of each component. Also explain its working. [8]

OR

- Q6) a)** Derive expression for unit quantities. Also explain the importance of these quantities. [10]
- b)** A Pelton wheel develops 4100 kW under a net head of 130 m at a speed of 205 rpm. Assume  $C_v = 0.98$ , speed ratio = 0.46, efficiency = 80% and the jet diameter ratio =  $1/9$ . Determine (i) the flow required, (ii) the diameter of the wheel, (iii) the diameter and number of jets required. [8]

- Q7) a)** A centrifugal pump running at 1500 rpm discharges 120 lit/s against a head of 28 m. If the diameter of the impeller is 250 mm and its width is 50 mm, find the vane angle at the outer periphery. The manometric efficiency of the pump is 75%. [9]
- b)** Describe - troubles and remedies of centrifugal pump. [8]

OR

- Q8) a)** The outer diameter and outlet width of a centrifugal pump is 55 cm and 6 cm respectively. The pump develops total head of 28 m, when running under 1090 rpm. If the vane angle at outlet is  $40^\circ$  and manometric efficiency is 80%, find [8]
- velocity of flow a outlet
  - velocity of water leaving the vane
  - angle made by absolute velocity at outlet discharge
- b)** Explain 'characteristics curves' of centrifugal pump. [9]





Total No. of Questions : 8]

SEAT No. :

**P255**

[Total No. of Pages : 2

[6003]-332

**T.E. (Civil Engineering)**

**RESEARCH METHODOLOGY AND IPR**

**(2019 Pattern) (Semester-I) (301005b) (Elective-I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagram be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*

**Q1)** a) Write a brief note on different types of analysis of data also state the significance of each. **[9]**

b) Indicate the basis for selecting a statistical technique in analysing data for educational research. **[8]**

OR

**Q2)** a) Explain the phrase 'Analysis of Data' or 'Treatment of Data'. Indicate the need and importance of data analysis. **[9]**

b) Describe the role of statistics and parameters in analysing the data. Illustrate your answer with suitable example. **[8]**

**Q3)** a) Describe the precautions that the researcher should take while interpreting his findings. **[9]**

b) What do you understand by research report or thesis? Indicate its need and importance in the research work. **[9]**

OR

**Q4)** a) Explain the following terms used in a research. **[9]**

- i) Research proposal or synopsis or outline of a research project.
- ii) Research report, or thesis or dissertation.
- iii) Research summary, and
- iv) Research abstracts.

b) What are the methods of constructing regression equation? Explain in details. **[9]**

**P.T.O.**

- Q5)** a) Describe how monopoly nature of owner is controlled by Patent Trademark Organization. [8]  
b) What are the functions of international intellectual property organizations? [9]

OR

- Q6)** a) Explain different types of intellectual property in detail. [8]  
b) Define trademark and service mark. [9]

- Q7)** a) Distinguish between Trademark and Trade secrets. [9]  
b) Write the procedure for “use of mark” owned by Third parties. [9]

OR

- Q8)** a) Explain how the ownership rights and transfers are taken place. [9]  
b) Describe the advantages of law of patent. [9]



Total No. of Questions : 8]

SEAT No. :

**P256**

[Total No. of Pages : 2

**[6003] - 333**

**T.E. (Civil Engg.)**

**CONSTRUCTION MANAGEMENT**

**(2019 Pattern) (Semester - I) (Elective-I)(301005 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*

- Q1)** a) Write short note on child labor act. [6]
- b) What is the use of project balance sheet and what is its significance. [6]
- c) What are the advantages of labor laws in the field of civil engineering? [6]

OR

- Q2)** a) Explain workmen's compensation act and building and other construction worker act 1996. [6]
- b) What are the requirements of working capital? [6]
- c) Write note on profit loss statement. [6]
- Q3)** a) What are the steps in risk management? [6]
- b) Explain the role of insurance in risk management. [6]
- c) Explain decision tree analysis. [5]

OR

- Q4)** a) Explain sensitivity analysis. [6]
- b) Write short note on energy cost escalation. [6]
- c) State the applications of value engineering. [5]

**P.T.O.**

- Q5)** a) What are the objectives of material management? [6]  
b) What is the use of ERP in material management? [6]  
c) Explain the role of material management in construction management. [6]

OR

- Q6)** a) What are the inventory control methods? [6]  
b) Explain the various phases of material flow. [6]  
c) Explain the concept of EOQ in detail. [6]

- Q7)** a) Write short note on fuzzy logic. [6]  
b) Write short note on recruitment and selection process. [6]  
c) Write short note on staffing policy and pattern. [5]

OR

- Q8)** a) Explain the importance of human resource in construction sector. [6]  
b) What is the application of Artificial intelligence in Civil Engineering? [6]  
c) Explain genetic algorithm in detail. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P257**

**[6003] - 334**

**T.E. (Civil)**

**ADVANCED CONCRETE TECHNOLOGY**  
**(2019 Pattern) (Semester - I) (Elective-I)(301005 d)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Figures to the right indicate full marks.

- Q1)** a) List any six applications of chemical admixtures. [6]
- b) With a neat diagram explain the functioning of plasticizers. [6]
- c) Explain the classifications of superplasticizers. [6]

OR

- Q2)** a) With a neat diagram, explain the functioning of air-entraining admixtures. [6]
- b) Explain lignosulfonate based admixures. [6]
- c) What are the functions of viscosity modifying admixtures. [6]
- Q3)** a) What are the functions of the fibers added to concrete? [5]
- b) Explain the effect of steel fibers on the properties of concrete. [6]
- c) Explain the classification of glass fibers. [6]

OR

- Q4)** a) List any five advantages of glass fibers. [5]
- b) Write a note on synthetic fibers. [6]
- c) What are aramid fibers? Explain its characteristics. [6]

**P.T.O.**

- Q5)** a) What is durability of concrete? What factors affect it? [6]  
b) Explain plastic shrinkage of concrete. [6]  
c) What is autogenous shrinkage? Explain the factors affecting it. [6]

OR

- Q6)** a) What are the transport properties of concrete? Explain any one property. [6]  
b) Explain diffusion with a neat schematic. [6]  
c) Explain the external causes of chloride penetration in concrete. [6]
- Q7)** a) Explain the principle and at least five applications of ultrasonic pulse velocity method. [8]  
b) What is half-cell potential measurement? Explain with a neat diagram. [9]

OR

- Q8)** a) Explain why the core test for concrete is required. [8]  
b) Explain the permeability test of concrete. [9]



[6003]-335

T.E. (Civil)

## MATRIX METHODS OF STRUCTURAL ANALYSIS (2019 Pattern) (Semester - I) (Elective - I) (301005-e)

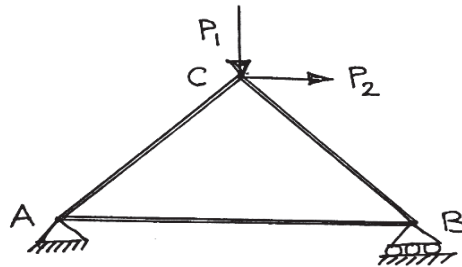
Time : 2½ Hours]

[Max. Marks : 70]

*Instructions to the candidates:*

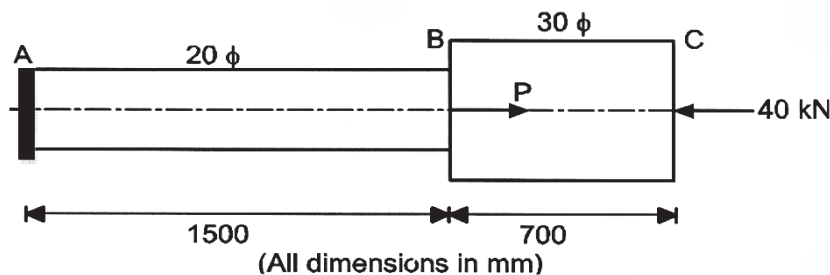
- 1) Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6; Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable electronic calculator is allowed.
- 5) Assume suitable data, if necessary.
- 6) Assessment will be based on complete solution and not on final answer.

**Q1)** Using stiffness member approach, determine the horizontal and vertical displacement at C and horizontal displacement at B for the pin jointed equilateral angle truss as shown in the figure. Find the axial forces in all the members. AE = constant, Consider  $P_1 = 50$  kN and  $P_2 = 100$  kN. Take  $AB = 4$  m. [18]



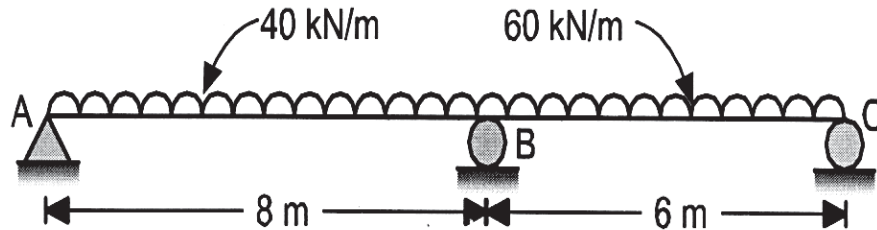
OR

- Q2)** a) Derive the member stiffness matrix for a bar element. [4]
- b) For the given bar with varying diameter, subjected to axial forces, determine the displacements at B, and C. Consider end A as fixed. Also find the corresponding strains and stresses. Take  $P = 50$  kN and  $E = 200$  GPa. AB portion has diameter = 20 mm and BC portion has diameter of 30 mm. [14]



P.T.O.

- Q3)** Analyze the continuous beam shown in the figure using member stiffness matrix method. Find the rotational displacement at A, B and C. Find the reactions and draw the shear force and bending moment diagram. EI is constant for both spans. [17]



OR

- Q4)** a) Derive the stiffness matrix for plane frame member. [8]  
 b) A propped cantilever beam of length 6m is subjected to a uniformly distributed load of 30 kN/m. Determine the slope at propped end using member stiffness method. [9]

- Q5)** a) Signify the importance of transformation matrix. Derive the transformation matrix for grid member. [9]  
 b) Derive the stiffness matrix for grid member. [8]

OR

- Q6)** A grid consisting of two perpendicular members AB and BC is fixed at A and rigidly connected at B. The grid is subjected to point load of 80 kN at C. Length of both members is 3 m. Consider EI and GJ as constant and using structure approach, analyse the grid and find the displacements. [17]

- Q7)** a) Derive the stiffness matrix for a space frame member by drawing neat sketches. [9]  
 b) Derive the stiffness matrix for space truss element for local axis. Write the global stiffness matrix for space truss element. Show the direction cosines with a neat sketch. [9]

OR

- Q8)** a) Write flowchart for solution of plane truss problem. [9]  
 b) Write flowchart for solution of space frame problem. [9]





[6003]-336

T.E. (Civil)

**ADVANCED MECHANICS OF STRUCTURES**  
**(2019 Pattern) (Semester-I) (Elective-I) (301005f)**

Time : 2½ Hours]

[Max. Marks : 70]

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of electronic pocket calculator is allowed.

- Q1) a)** A simply Supported beam of span 8m loaded as shown in fig.1. Find the shear force & bending moment at a section 4m from left end. Draw ILD for support reactions, shear force & Bending Moment. [9]

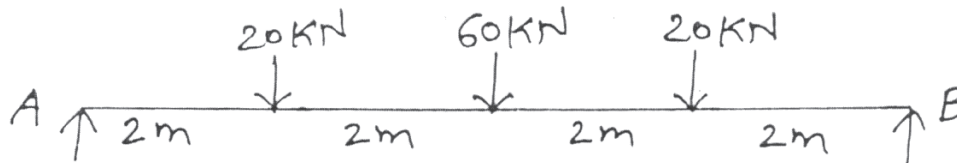


Fig. 1

- b)** Draw the influence line diagrams for forces in the member  $U_2L_3$ ,  $U_2U_3$  and  $L_2L_3$  of the through type bridge truss as shown in fig.2. [8]

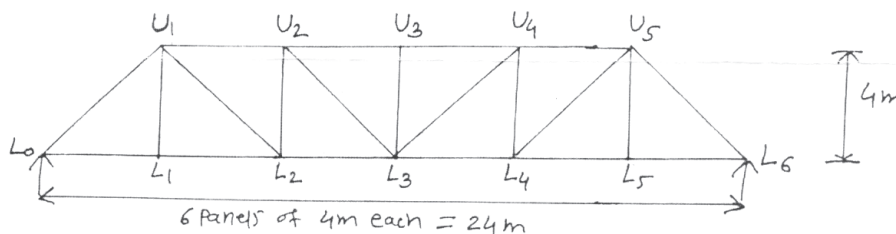


Fig. 2

OR

P.T.O.

- Q2) a)** A simply Supported beam of span 10m loaded as shown in fig.3. Find the Support Reactions, shear force at point D & bending moment at Point F. Draw ILD for support reactions, shear force & Bending Moment. [9]

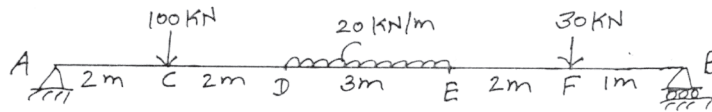
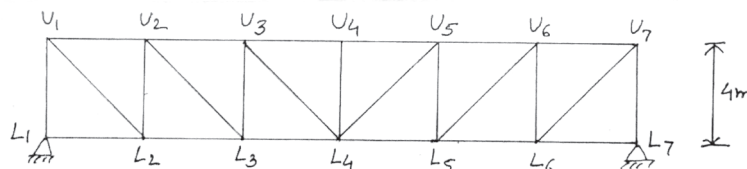


Fig. 3

- b) Draw the influence line diagrams for forces in the member  $U_2U_3$ ,  $U_2L_2$  and  $L_2L_3$  of the truss as shown in fig.4. [8]



6 Panels @ 4m each

Fig. 4

- Q3) a)** A simply supported beam of 20 m span is carrying a rolling UDL of intensity 40 kN/m with length larger than the span. Determine [12]
- Maximum Reactions
  - Maximum negative & positive shear force & Maximum Bending Moment at a section 8m from left support
  - Absolute Maximum Bending Moment anywhere in the span.
- b) An uniformly distributed load of span 8m having intensity has 25 kN/m moving on simply supported beam of span 6m. Draw Influence line diagram for shear force and bending moment at distance 2.5m from left support. [6]

OR

- Q4) a)** A simply supported beam of 10 m span is carrying a rolling UDL of 4m length with intensity of 20 kN/m moving from left to right. Determine [12]
- Maximum Reactions
  - Maximum negative & positive shear force & Maximum Bending Moment at a section 4m from left support
  - Absolute Maximum Bending Moment anywhere in the span.

- b) Two wheel loads 50 kN & 150 kN spaced at 2m move on a girder of 12m long. Find the maximum positive and negative shear force at a section 3m from left end. Any wheel load can lead the other. [6]

**Q5)** Derive an expression for semi-circular beam simply supported on three supported equally spaced support. [17]

OR

**Q6)** Derive an expression for circular beam loaded with uniformly and supported on symmetrically placed column. [17]

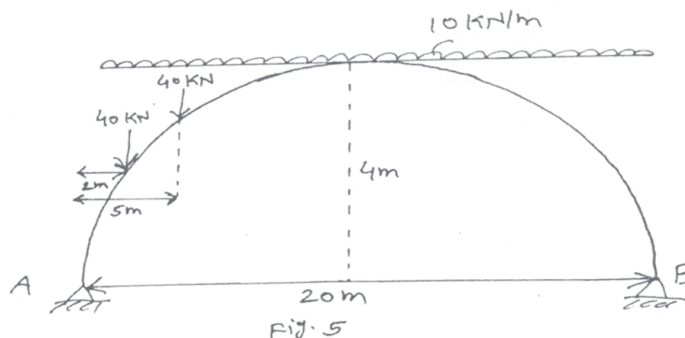
**Q7) a)** A three hinged parabolic arch of 20 m span & carries rise of 5m carries a point load of 20 kN at 6m from the left hand hinge. Find reactions at support, Maximum positive & negative bending moment and draw BMD. [12]

- b) Derive the expression for horizontal thrust when entire span of two hinged parabolic arch is loaded with udl of intensity 'w' kN/m [6]

OR

**Q8) a)** A Parabolic arch is hinged at the springing, which are at the same level. The span is 48m with a central rise of 6m. It carries a point load of 160 kN at the crown. If  $I=10\text{Sec } \theta$ . Calculate the normal thrust, radial shear and bending moment at the left and quarter span. [12]

- b) A symmetrical 3 hinged parabolic arch as shown in fig.5 has a span of 20m. It carries UDL of intensity 10 kN/m over the entire span & two point loads of 40 kN each at 2m & 5m from left support. Compute the reactions, Horizontal Thrust & Normal Thrust at a section 4m from left end take central rise as 4m [6]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

**P260**

**[6003]-337**

**T.E. (Civil)**

**WASTE WATER ENGINEERING**  
**(2019 Pattern) (Semester-II) (301012)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of scientific calculators is allowed*

**Q1) a)** Explain the importance of secondary treatment and principle of biological treatment. **[6]**

b) An average operating data for conventional activated sludge treatment plant is as follows. **[6]**

Sewage flow-30000 m<sup>3</sup>/d, volume of aeration tank-10500m<sup>3</sup>, influent BOD-200mg/L, effluent BOD-20 mg/L, mixed liquor suspended solids-3000 mg/l, effluent suspended solids-30 mg/L, Waste sludge suspended solids-9500mg/L, quantity of waste sludge-200m<sup>3</sup>/d. Determine

- i) Food to microorganism ratio
  - ii) Sludge age
  - iii) Percentage of efficiency of BOD removal
- c) Describe symptoms, causes and remedial measures of sludge bulking in activated sludge process. **[6]**

OR

**Q2) a)** Explain the term Volumetric BOD loading, F/M Ratio, Sludge age in detail.**[6]**

b) The mixed liquor suspended solids. Concentration in aeration tank is 3000 mg/l and sludge volume after 30 minutes of settling in a 1000 ml graduated cylinder is 135 ml. Determine. **[6]**

**P.T.O.**

- i) SVI
- ii) Required return sludge ratio
- iii) Suspended solids concentration in recirculated sludge
- c) Describe symptoms, causes and remedial measures of foaming in activated sludge process. [6]

- Q3)** a) Summarize the principle components and factors affecting oxidation pond design. [5]
- b) Design an oxidation pond for the following data. Raw sewage flow-10 MLD, raw sewage  $BOD_5$ -200mg/L, desired  $BOD_5$  of treated effluent-20mg/L, BOD removal rate constant-0.1/d, BOD loading rate for the given latitude of the place-250kg/Ha/d, elevation of the place-550 m above MSL. Determine. [6]

- i) Area of oxidation pond
- ii) Detention time required
- iii) Dimension of the pond
- c) Enumerate principle, advantages and disadvantages of aerated lagoon.[6]

OR

- Q4)** a) Explain with a neat sketch the principle of trickling filter. [5]
- b) A single stage trickling filter is designed for an organic loading of 10000 kg of BOD in raw sewage per hectare meter per day with a recirculation ratio of 1.1. This trickling filter treats 1.95 MLD of raw sewage with a BOD of 180mg/L. Use NRC formula and determine the strength of the effluent. [6]
- c) Describe the operational problems and its control in trickling filter. [6]

- Q5)** a) Compare the aerobic and anaerobic treatment of wastewater. [6]
- b) Design a septic tank for 300 users. Water allowance is 120 L per head per day. Assume suitable data if required. [6]
- c) Describe with a neat sketch working of up-flow anaerobic sludge blanket reactor. [6]

OR

- Q6)** a) Summarize the features and applications of up-flow anaerobic sludge blanket. [6]
- b) Design the dimensions of septic tank for small colony of 160 persons provided with an assured water supply from municipal head works at the rate of 120 L per person per day. Assume suitable data if required. [6]
- c) Explain the merits of sequential batch reactor over conventional activated sludge process. [6]
- Q7)** a) Describe the governing factors in anaerobic digesters. [5]
- b) Sedimentation tank is treating the flow of 5 MLD containing 275 ppm of suspended solids. Tank removes around 50% of suspended solids. Calculate the quantity of sludge produce per day in bulk and weight if [6]
- i) Moisture content of the sludge is 98%
- ii) Moisture content of the sludge is 96%
- c) Explain the stages of digestion in anaerobic digesters. [6]

OR

- Q8)** a) Indicate the major challenges in sludge management. [5]
- b) The moisture content of a sludge is reduced from 95% to 80%. Find the decrease in the volume of the sludge. Explain why dewatering of sludge is necessary. [6]
- c) Discuss the reuse opportunities of wastewater in industrial sector. [6]



[6003]-338

T.E. (Civil)

## DESIGN OF REINFORCED CONCRETE STRUCTURES (2019 Pattern) (Semester - II) (301013)

Time : 2½ Hours]

[Max. Marks : 70]

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures in bold to the right indicate full marks.
- 3) Neat diagrams should be drawn where ever necessary.
- 4) IS: 456 is permitted in the examination.
- 5) Additional data if needed, may be suitably considered and clearly mentioned.

**Q1) a)** A stair hall of a building measures  $3.0 \text{ m} \times 5.5 \text{ m}$ . The floor to floor height is 3.4 m. Design a dog-legged stair case resting on beams of size 230 mm. The design load on the stairs may be considered as  $4 \text{ kN/m}^2$ . Adopt M-25 grade of concrete and Fe-500 grade of steel. Sketch the details of reinforcement. **[14]**

b) What are flanged sections? Explain how the flanged width is calculated. **[3]**

OR

**Q2) a)** Figure 1 shows the floor plan of a building. The beams are of size 230 mm  $\times$  450 mm. Beam  $B_1$  is reinforced with 4-16# bars in tension and 2-10# in compression. The load on the slab is  $6 \text{ kN/m}^2$ . Design the beam for shear. Adopt M-25 grade of concrete and Fe-500 grade of steel. Sketch the details of reinforcement. **[14]**

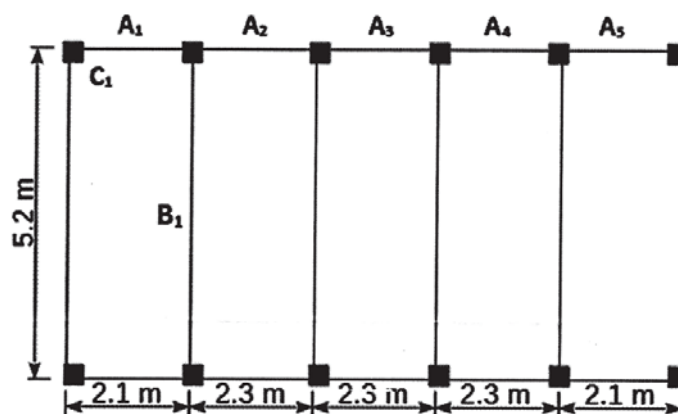


Fig. 1

b) What is torsion? List any three practical situations where concrete beam is subjected to torsion. **[3]**

P.T.O.

- Q3) a)** For the floor plan shown in Fig. 1, design the continuous beam  $A_1-A_2-A_3-A_4-A_5$ . The total load on the slab is  $5.5 \text{ kN/m}^2$ . Design the beam using M-20 grade concrete and Fe-500 grade of steel. Sketch the details of reinforcement. [15]
- b)** Explain the assumptions made in the IS code method of analysis of continuous beams. [3]

OR

- Q4)** Design the beam A-B-C shown in Fig. 2. The load on the beam may be considered as  $12 \text{ kN/m}$ . Design the beam using M-20 grade concrete and Fe-500 grade of steel. Sketch the details of reinforcement. [18]



Fig. 2

- Q5) a)** How are reinforced concrete columns classified? Explain the modes of failure. [3]
- b)** For the floor plan shown in Fig. 1, design column  $C_1$ . Show how the column is oriented, The column is subjected to working load of  $700 \text{ kN}$ , working moment of  $90 \text{ kN-m}$  about major axis bisecting the depth of column. The unsupported length of column is  $4.0 \text{ m}$ . The column is fixed at both the ends. Show detailed design calculations and reinforcement details. Use M-30 grade concrete and Fe-500 grade of steel. [14]

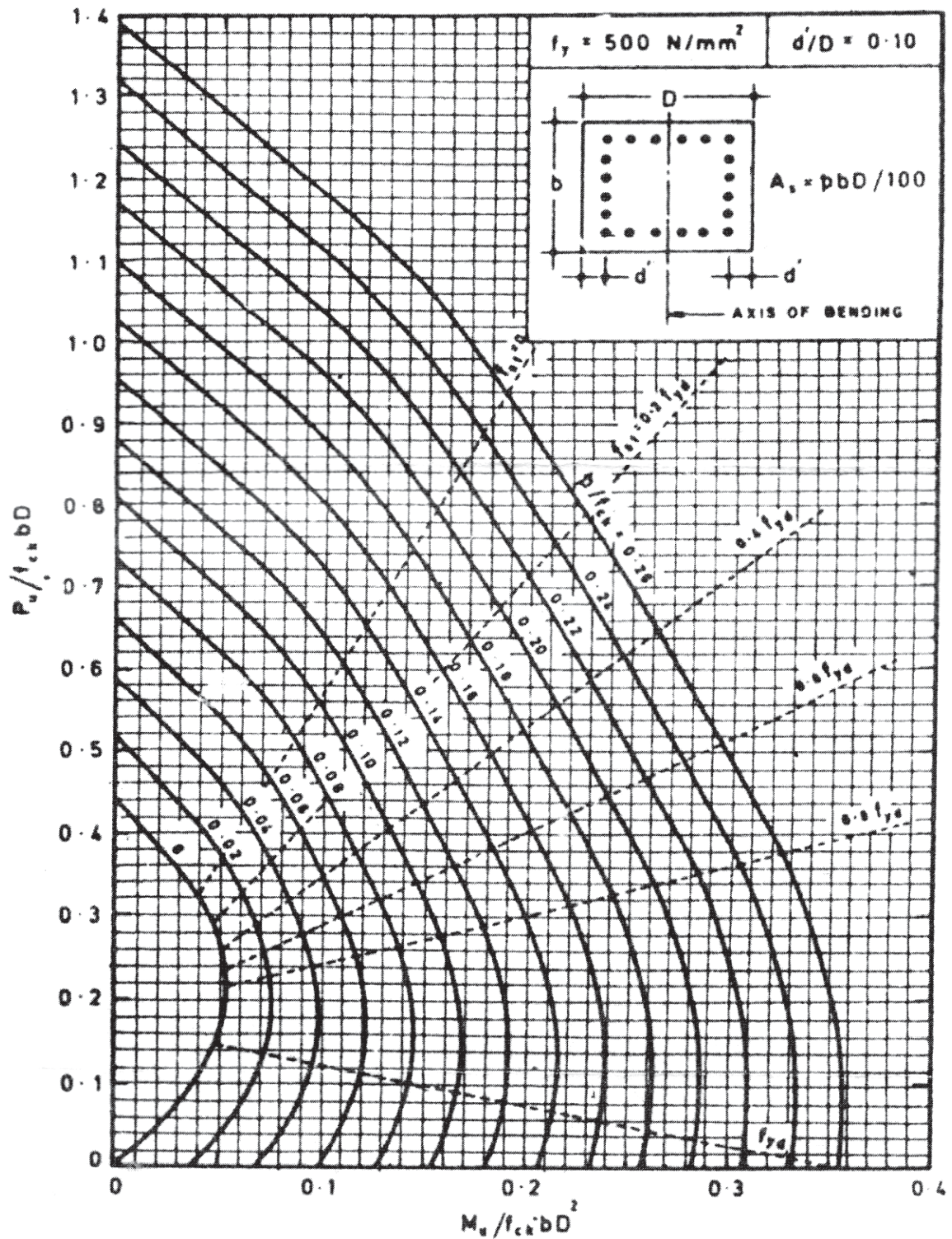
OR

- Q6) a)** What are interaction curves? Explain the characteristic of a typical interaction curve. [5]
- b)** Explain the design procedure for axial-loaded, uni-axial loaded, and bi-axial loaded columns. [12]
- Q7) a)** State and explain types of combined footing for two adjoining columns. How do you decide size and projections of combined footing? [9]
- b)** Explain one-way and two-way shear. Also, describe how are they calculated? [9]

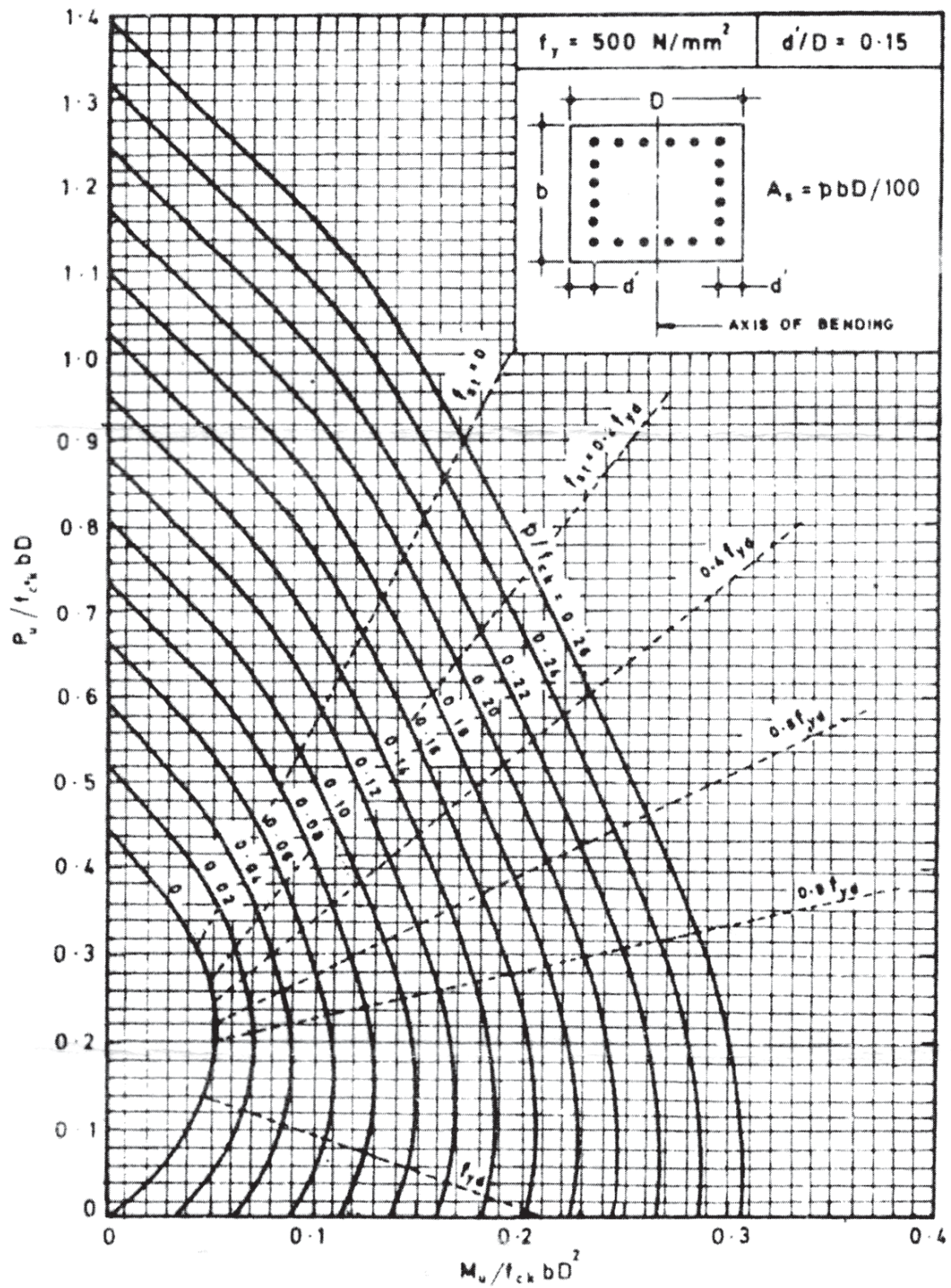
OR

- Q8)** A column of size  $350 \times 600 \text{ mm}$  is reinforced with 8-20#. The column supports a dead load of  $700 \text{ kN}$  and imposed load of  $450 \text{ kN}$ . The safe bearing capacity of the soil is  $200 \text{ kN/m}^2$ . Design the footing using M-30 grade concrete and Fe-500 grade of steel. Also, sketch the details of the reinforcement. [18]



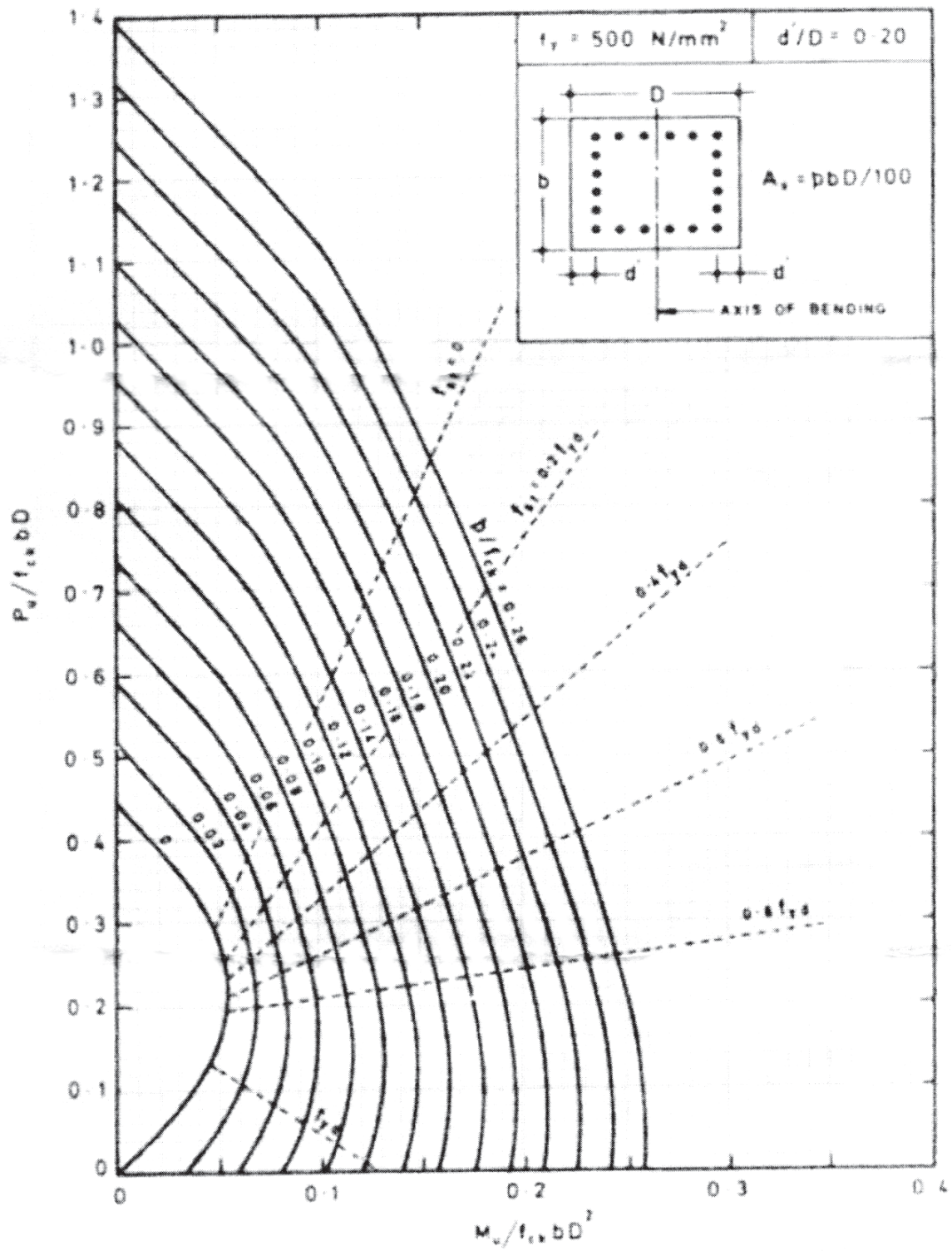


**Chart No 1: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on all sides**



**Chart No 2: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on all sides**





**Chart No 3: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on all sides**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P261**

**[6003]-339**

**T.E. (Civil)**

**REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM  
(2019 Pattern) (Semester - II) (301014)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 Q.7 or Q.8.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) Use of electronic pocket calculator is allowed in the examination.*
- 5) Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Give a brief account of Origin of Global positioning system. [6]
- b) Write a note on applications of GNSS in surveying. [6]
- c) Describe Global Navigation satellite system in detail. [6]

OR

- Q2)** a) Describe sources of error in GPS. [6]
- b) Define DGPS. Write sources of errors of DGPS. [6]
- c) Write a note on types of GPS tracking. [6]

- Q3)** a) What is image acquisition in Digital image processing? [6]
- b) Differentiate between Visual and Digital image interpretation. [6]
- c) Define Triangular Irregular Network Model (TIN) and its applications.[5]

OR

- Q4)** a) What is Digital Image Processing? What are the most common image processing functions. [6]
- b) What is image registration? [6]
- c) State the application of DEM. [5]

**P.T.O.**

- Q5)** a) Write in detail about various components of GIS. [6]  
b) Illustrate Cloud computing with types and applications. [6]  
c) Write a note on essential elements of GIS hardware. [6]

OR

- Q6)** a) Write a note on fundamentals of Cartography and map creation in GIS.[6]  
b) Discuss the difference between drafting software's and GIS. [6]  
c) Illustrate the advantages of data storage in GIS. [6]

- Q7)** a) Define Raster and Vector Data types. Explain with neat diagram. [6]  
b) Discuss applications of GIS in civil engineering. [6]  
c) Write a note on application in land measurement work. [5]

OR

- Q8)** a) Enumerate different Attribute Data models and explain any one of them.[6]  
b) Write a note on essential elements of GIS hardware. [6]  
c) Discuss the applications in irrigation planning. [5]



Total No. of Questions: 8]

SEAT No. :

**P262**

**[6003]-340**

[Total No. of Pages : 3

**T.E. (Civil)**

**ADVANCED ENGINEERING GEOLOGY WITH ROCK  
MECHANICS**

**(2019 Pattern) (Semester-II) (301015 a) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4 Q.5 or Q.6, Q.7 or Q.8.
- 2) Figure to the right indicates full marks.
- 3) Neat diagram must be drawn wherever necessary.

- Q1)** a) Write a note on Compact basalt as construction material. [6]  
b) Differentiate between active faults and dead faults. [6]  
c) Write in detail on treatments given to fracture/fracture zone. [6]

**OR**

- Q2)** a) What are favorable conditions/characteristics of the rock for the purpose of construction material? [6]  
b) What is R.I.S.? Explain R.I.S. with case study, in Deccan Trap area. [6]  
c) Will dam building activity cause a major earthquake? Explain. [6]
- Q3)** a) What are various physical properties of rocks. [6]  
b) Calculate RQD recovery and Core recovery from following table. [6]

Run in m	Piece No.	Length in cm	Nature of fracture
3-6 m	1	15	J
	2	12	J
	3	80	M
	4	46	M
	5	50	M
	6	09	J
	7	50	J
	8	6	J
	9	8	J
6-9 m	10	110	M
	11	80	M
	12	90	M
	13	09	M

**P.T.O.**

- c) Calculate apparent resistivity values of different depth zones. [6]

Sr. No	R	A	$2\pi a R$
1	1.81	1	?
2	1.76	2	?
3	1.57	3	?
4	1.42	4	?
5	1.29	5	?
6	1.10	10	?

OR

- Q4)** a) Explain in detail Bieniawski's Geomechanical classification. [6]  
b) Explain in detail R.Q.D. System of classification. [6]  
c) Importance of orientation of joints and joint frequency index in rock mechanics. [6]

- Q5)** a) Write a note on Engineering significance of Tachylytic Basalt. [6]  
b) Explain treatment to be given to a Fracture crossing dam alignment. [6]  
c) What are the reasons of tail channel erosion in Deccan Trap area? [5]

OR

- Q6)** a) Explain in detail case histories of Varasgaon and Mula Dam sites, where economy has been achieved. [6]  
b) Discuss the strength and water tightness characters of DTB from foundation point of view. [6]  
c) Discuss relationship between local Geology and location of Spillway in Deccan Trap. [5]

- Q7)** a) Discuss with suitable examples suitability of amygdaloidal basalts from tunneling point of view. [6]  
b) Write note on Standup time of rock during tunneling. [6]  
c) Explain in brief safe bearing capacity during bridge construction. [5]

OR

- Q8)** a) Can we locate a pier of bridge partly on weathered rock and on dyke? [6]  
b) Explain in detail engineering geological investigations for bridge foundation. [6]  
c) Explain favorable and unfavorable conditions for tunneling. [5]





Total No. of Questions: 8]

SEAT No. :

**P263**

**[6003]-341**

[Total No. of Pages : 3

**T.E. (Civil)**

**SOFT COMPUTING TECHNIQUES**

**(2019 Pattern) (Elective-II) (301015 b) (Semester-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Your answers will be valued as a whole*
- 3) *Assume suitable, data if necessary.*

**Q1) a)** Discuss Overfitting of ANN in brief with its cause and effect. How to avoid overfitting. Discuss data preprocessing. **[9]**

- b) Determine the functional value of the 3 x 2 x 1 neural network in forward pass with the following data. Inputs [6,4,11], First layer weights (input to hidden): [0.4 -0.5 0.6; -0.3 0.8 -0.7], First layer bias: [3;-3.7], Second layer weights (hidden layer to output layer): [0.35 0.55], second layer bias: [2]. Use sigmoidal transfer function between the first layer and hidden layer and hyperbolic tangent function between the hidden layer and output layer. **[9]**

**OR**

**Q2) a)** For feed forward back propagation neural network, how to fix number of Input neurons, Output neurons, Hidden layers, hidden neurons? Discuss data preprocessing. **[9]**

- b) Determine the functional value of the 3x2x1 neural network in forward pass with the following data. Inputs [6,6,8], First layer weights (input to hidden): [0.4 -0.5 0.6; -0.3 0.8 -0.7], First layer bias: [3;-3.7], Second layer weights (hidden layer to output layer): [0.35 0.55], Second layer bias: [2]. Use sigmoidal transfer function between the first layer and hidden layer and hyperbolic tangent function between the hidden layer and output layer. **[9]**

**P.T.O.**

- Q3)** a) Distinguish between Radial basis function networks and Generalized regression neural networks. Give suitable example for each. [8]
- b) The power developed by a water turbine (P) depends upon the rotational speed N, Operating head (H), Gravitational acceleration(g), diameter(D) and breadth(B) of the runner, density ( $\rho$ ) and viscosity( $\mu$ ) of water. Design a 3 layered neural network using the above parameters and give the following details: [9]
- Input and output parameters
  - Architecture with figure
  - Size of weight and Bias matrix
  - Activation function/s between the layers
  - Performance function

OR

- Q4)** a) Discuss working of self-organized feature maps with suitable examples. [8]
- b) 28-day Compressive strength of concrete (in MPa) depends on the quantity (in kg/m<sup>3</sup>) of Cement, Fine aggregate, coarse aggregate and water. Design a 3 layered neural network using the above parameters and give the following details: [9]
- Input and output parameters
  - Architecture with figure
  - Size of weight and Bias matrix
  - Activation function/s between layers
  - performance functions/s

- Q5)** a) Discuss in detail an application of Genetic Algorithm in Civil Engineering. [9]
- b) What is a kernel in SVM? Why do we use kernels in SVM? Discuss any one kernel in detail. [9]

OR

- Q6)** a) Discuss the Genetic operators in Genetic Algorithm in detail. [9]
- b) Discuss the basic principle of Support Vector Regression. What do you mean by generalization error in terms of the SVM? [9]

- Q7) a)** Discuss working of Random Forest regression. Explain M5 Algorithm in Model Tree. [8]
- b)** The power developed by a water turbine (P) depends upon the rotational speed N, Operating head(H), Gravitational acceleration(g), diameter(D) and breath(B) of the runner, density( $\rho$ ) and viscosity ( $\mu$ ) of water. Design a Model using Random Forest using the above parameters and give the following details: [9]
- i) Input and output parameters
  - ii) No. of trees
  - iii) Data division
  - iv) Out of bag estimates
  - v) Performance function/s

OR

- Q8) a)** Discuss working of Model Tree with M5 Algorithm. Explain Feature importance in a Random Forest [8]
- b)** 28-day Compressive strength of concrete (in MPa) depends on the quantity (in  $\text{kg/m}^3$ ) of Cement, Fine aggregate, coarse aggregate and water. Design a model using Model Tree, using the above parameters and give the following details: [9]
- i) Input and output parameters
  - ii) No. of rules
  - iii) Splitting criteria
  - iv) Standardization of data
  - v) Performance function/s



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 2

**P264**

**[6003]-342**

**T.E. (Civil)**

**ADVANCED SURVEYING**

**(2019 Pattern) (Semester-II) (Elective-II) (301015 c)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No. 1 or Q.No.2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q. No. 6, Q.No. 7 or Q.No. 8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Determine the azimuth and altitude of a star from the following data:  
Declination of star =  $20^{\circ}30'N$  Hour angle of star =  $42^{\circ}6'$  Latitude of observer =  $50^{\circ}N$ . [6]
- b) Explain the method for measurement of soundings. [4]
- c) Explain the analytical method of determining the position of boat in hydrographic surveying. [8]

OR

- Q2)** a) Mention the properties of spherical triangle. [6]
- b) What are tides? Explain the weight gauge. [4]
- c) In order to locate the position of boat, observations were made with a sextant to three points A, B and C on Shore. The angles AOB and BOC were found to be  $50^{\circ}56'$  and  $27^{\circ}23'$  respectively. From the map, AB was scaled as 394 m and BC as 198 m while the angle ABC measured  $163^{\circ}18'$ . What were the distances of O from A, B & C respectively? [8]
- Q3)** a) Define ground relief. Derive an expression for the same. [6]
- b) Define vertical photograph, tilted photograph and oblique photograph. [5]
- c) The scale of an aerial photograph is  $1\text{cm}=160\text{ m}$  & the size of the photograph is  $20\text{ cm} \times 20\text{ cm}$ . If the longitudinal overlap is 65% and side overlap is 35%, determine the number of photographs required to cover an area of 232 sq. Km. [6]

OR

*P.T.O.*

**Q4) a)** What are the applications of photogrammetry? Explain any one of them in detail. [6]

b) A camera having focal length of 20 cm is used to take a vertical photograph to a terrain having an average elevation of 1500 m. What is the height above sea level at which an aircraft must fly in order to get the scale of 1:8000. [5]

c) Determine the minimum number of aerial photographs required to cover an area of 40 km × 30 km, with the following details: [6]

Size of an aerial photograph = 23 cm × 23 cm

Scale of aerial photograph: 1 cm = 150 m

Longitudinal overlap = 60%

Side overlap = 30%

**Q5) a)** Explain the components of ideal remote sensing system. [5]

b) Describe the components of Electronic total station. [8]

c) Enlist and explain the advantages of LIDAR technology. [5]

OR

**Q6) a)** Define and explain the concept of remote sensing. [5]

b) Explain the salient features of Electronic total station. [8]

c) Explain the interaction of electromagnetic energy with the earth's surface. [5]

**Q7) a)** Explain the working principle of GPS. What are the differences between hand held GPS and differential GPS. [9]

b) Enlist the advantages and applications of GPS survey. [8]

OR

**Q8) a)** Explain the basic principle of GPS and its applications in Civil Engineering. [9]

b) Explain digital terrain modelling. [8]



Total No. of Questions: 8]

SEAT No. :

**P265**

**[6003]-343**

[Total No. of Pages : 3

**T.E. (Civil)**

**ADVANCED GEOTECHNICAL ENGINEERING  
(2019 Pattern) (Semester-II) (301015 d) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 Q.No.7 or Q.No.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to right indicate full marks.
- 4) Assume suitable data if necessary.

- Q1)** a) Differentiate between unconsolidated undrained test, consolidated undrained test and consolidated drained test for determination of shear strength of soil. [6]
- b) Explain stress-strain and volume change relationship for shear strength of sand. [6]
- c) Explain in detail: Factors affecting pore water pressure of cohesive and cohesionless soils. [6]

OR

- Q2)** a) Explain the following: [6]
- i) Mohr-coulomb strength envelope
  - ii) Sketch the stress-strain relationship for dense and loose sand.
- b) Write short note on shear strength characteristics of clays. [6]
- c) In a drained triaxial compression test, a saturated sample of cohesionless sand fails under a deviator stress of 500 kN/m<sup>2</sup> when the cell pressure is 120 kN/m<sup>2</sup>. Find the effective angle of shearing resistance of sand and the approximate inclination of the failure plane to the horizontal. [6]

- Q3)** a) Drained triaxial compression test results are given below plot the stress path in  $t-s, s'$ . [6]

$\sigma_1$ (kPa)	$\sigma_3$ (kPa)	$q$ (kPa)
300	300	100
400		
500		
565		
590		

**P.T.O.**

- b) Draw and explain the stress path (t-s,s') for stress produced below foundation due to undrained loading. [6]
- c) State and explain the variants of cambridge plot. [5]

OR

- Q4)** a) Undrained triaxial compression test results are given below plot the stress path in t-s,s'. [6]

$\sigma_1$ (kPa)	$\sigma_3$ (kPa)	4(kPa)
300	300	100
350		165
380		200
396		224
398		232

- b) Draw and explain the stress path (t-s,s') for gradual built up of overburden pressure due to sedimentation and its removal. [6]
- c) State and explain the variants of MIT plot. [5]
- Q5)** a) Why soils are to be stabilized? Discuss the principles of soil-fly ash stabilization and associated benefits. [6]
- b) What are different admixtures that are used in expansive clay soil stabilization? Discuss any one. [6]
- c) Explain in detail physico-chemical reactions in stabilization of clay with lime. [6]

OR

- Q6)** a) What are the different factors affecting the mechanical stability of a mixed soil? [6]
- b) Explain the design principles and additives of Bitumen-soil stabilization. [6]
- c) Discuss plasticity, swelling and strength characteristics of fly ash treated black cotton soil. [6]

- Q7)** a) State different methods of grouting. Explain ground improvement by stone column. [6]  
b) Explain the steps for vibrofloatation with inserting reinforcement with neat sketch. [6]  
c) Explain the steps for design of sand drains in Isotropic case. [5]

OR

- Q8)** a) Explain ground improvement by excavating and replacing of soil. [6]  
b) Write a note on in-situ ground improvement by compaction piles. [6]  
c) Explain the steps for design of sand drains in Anisotropic case. [5]





Total No. of Questions: 8]

SEAT No. :

**P266**

**[6003]-344**

[Total No. of Pages : 2

**T.E. (Civil)**

**ARCHITECTURE AND TOWN PLANNING  
(2019 Pattern) (Semester-II) (Elective - II) (301015 e)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

**Q1) a)** What is mean by new town? Which parameters involved in design of new town? Explain any two. **[9]**

b) What is DP? Elaborate Mechanism of preparation of DP according to MRTP Act 1966. **[9]**

OR

**Q2) a)** Explain in detail how TPS and NHP are controlling haphazard growth of town. **[9]**

b) Enlist and explain objectives of town planning and state benefits of town planning. **[9]**

**Q3) a)** What is the importance of Civic Surveys for D.P.? How these are carried out for housing and land use structure for new town? **[9]**

b) Explain the objectives and functions of CIDCO and its role of developing New Mumbai **[8]**

OR

**Q4) a)** Elaborate hierarchy of roads and Traffic Management system. **[9]**

b) Elaborate objectives, functions of any one planning agency and the organizational details. **[8]**

**P.T.O.**

- Q5) a)** Write a note on URDPFI guidelines and its contents for infrastructure. [9]
- b) How AMRUT guidelines helpful to overall development of city? [9]

OR

- Q6) a)** Explain in detail features of Land Acquisition, Rehabilitation and Resettlement Act 2013. [9]
- b) Explain in detail concept of “MAHA-RERA”. [9]
- Q7) a)** Explain in detail planning strategy for special township project. [9]
- b) Write a note on SEZ and CRZ. [8]

OR

- Q8) a)** What is the contribution of rural planning in overall development? [8]
- b) Explain in detail application of GIS, GPS, remote sensing in Town planning. [9]



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 3

**P267**

**[6003]-345**

**T.E. (Civil)**

**SOLID WASTE MANAGEMENT**

**(2019 Pattern) (Semester-II) (Elective -II) (301015 F)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of scientific calculator is allowed.*

**Q1) a)** Explain mechanical volume reduction method of processing technique. **[6]**

b) Explain manual component separation method of processing technique. **[6]**

c) State the terms related to solid waste management- **[6]**

i) Segregation

ii) Recovery

iii) Recycling

iv) Reuse

**OR**

**Q2) a)** Define recycling of solid waste. State the purposes of recycling of municipal solid waste. **[6]**

b) What is the importance of 3R principle in solid waste management? **[6]**

c) What are the factors to be considered in the design of aerobic composting system. **[6]**

**P.T.O.**

- Q3)** a) Suggest the relevant situations for the disposal of solid waste through incineration. [6]
- b) Describe the incineration technologies and air emissions and its control in detail. Explain the following: [6]
- i) Pyrolysis
  - ii) Refuse derived fuel
  - iii) Bio gasification
- c) List the products of incineration process and state its utility value. [5]

OR

- Q4)** a) Write short note on energy content of MSW. [6]
- b) Write difference between pyrolysis and plasma gasification. [6]
- c) What are the different stages of anaerobic digestion? [5]

- Q5)** a) Explain area method of landfilling and state the factors to be considered for site selection. [6]
- b) Define waste disposal. Point out the factors to be considered while disposing solid waste. [6]
- c) Describe the design and operation of a sanitary landfill with a neat sketch. [6]

OR

- Q6)** a) Explain the various phases of municipal solid waste decomposition in a closed landfill cell. [6]
- b) Enlist methods of Biomining and explain any one method of it. [6]
- c) Write short notes on legal aspects of solid waste disposal. [6]

- Q7)** a) List the sources of generation of biomedical waste. [6]  
b) Define E-waste and its harmful effects on environment. [6]  
c) Explain the role of Maharashtra Pollution Control Board in Plastic waste management. [5]

OR

- Q8)** a) How waste minimization is done in Industrial solid waste? [6]  
b) Write short note on to life cycle assessment (LCA) in solid waste management. [6]  
c) Write objectives and major provision in plastic waste management rules - 2016. [5]



Total No. of Questions : 8]

SEAT No. :

P-268

[Total No. of Pages : 3

[6003]-346

T.E. (Computer/A.I.D.S.)

DATABASE MANAGEMENT SYSTEM

(2019 Pattern) (Semester - I) (End Sem.) (310241)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** a) What is the impact of insert, update & delete anomaly on overall design of database? How normalization is used to remove these anomalies? [6]

b) Explain different features of good relational database design. [6]

c) Explain following Codd's rules with suitable examples : [6]

- i) Guaranteed Access Rule
- ii) Comprehensive Data Sub-Language Rule
- iii) High-Level Insert, Update, and Delete Rule

OR

**Q2)** a) Explain entity and referential integrity constraints used in SQL. [6]

b) Define 3NF. Explain with example, how to bring the relation in 3NF? [6]

c) Explain following Codd's rules with suitable examples : [6]

- i) Physical Data Independence
- ii) Integrity Independence
- iii) Systematic Treatment of NULL Values

P.T.O.

- Q3)** a) State and explain the ACID Properties. During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain the situations when each state transition occurs. [9]
- b) Check whether following schedule is view serializable or not. Justify your answer. (Note :  $T_1$  &  $T_2$  are transactions). Also explain the concept of view equivalent schedules and conflict equivalent schedule considering the example schedule given below : [8]

$T_1$	$T_2$
read (A)	
$A := A - 50$	
	read (A)
	$temp := A * 0.1$
	$A := A - temp$
	write (A)
	read (B)
write (A)	
read (B)	
$B := B + 50$	
write (B)	
	$B := B + temp$
	write (B)

OR

- Q4)** a) Suppose a transaction  $T_i$  issues a read command on data item Q. How time-stamp based protocol decides whether to allow the operation to be executed or not using time-stamp based protocol of concurrency control. Explain the situations when each state transition occurs. [9]
- b) Write a short note on : [8]
- Log based recovery
  - Shadow Paging

- Q5)** a) BASE Transactions ensures the properties like Basically Available, Soft State, Eventual Consistency. What is soft state of any system, how it is depend on Eventual consistency property? [6]
- b) Enlist the different types of NOSQL databases and explain with suitable examples. [8]
- c) What is structured and unstructured data. Explain with example. [4]

OR

- Q6)** a) Explain the CAP theorem referred during the development of any distributed application. [6]
- b) Analyze the use of NOSQL databases in current social networking environment also explain need of NOSQL databases in social networking environment over RDBMS. [6]
- c) Explain the difference between SQL and NOSQL database. [6]

- Q7)** a) Write a short note on emerging databases : [9]
- i) Active and Deductive Databases
- ii) Main Memory Databases
- b) What is object relational database system. Explain Table inheritance with example. [8]

OR

- Q8)** a) Write a short note on complex data types : [9]
- i) Semi-structured data
- ii) Features of semi-structured data models
- b) Describe spatial data like Geographic data and Geometric data. [8]





[6003]-347

T.E. (Computer Engineering)

THEORY OF COMPUTATION

(2019 Pattern) (Semester-I) (310242)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** Give a Context Free Grammar for the following language. [9]

- i)  $L1 = \{a^i b^j c^k \mid i = j + k\}$  such that  $i, j, k > 0$
- ii)  $L2 = \{a^i b^j c^k \mid j = i + k\}$  such that  $i, j, k > 0$

b) Reduce the following grammar to Greibach Normal form. [9]

$S \rightarrow SS, S \rightarrow 0S1 \ 01$

OR

**Q2) a)** Show that the following grammar is ambiguous. [6]

$S \rightarrow iCtS$

$S \rightarrow iCtSeS$

$S \rightarrow a$

$C \rightarrow b$

b) Convert the following grammar to Chomsky Normal Form (CNF). [6]

$G = (\{S\}, \{a, b\}, P, S)$

$P = \{S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb\}$

c) Consider the following grammar. [6]

$E \rightarrow E + E \mid E - E \mid id$

Derive the string  $id-id*id$  using

- i) Leftmost derivation
- ii) Rightmost derivation

**Q3) a)** Find the transition rules of PDA for accepting a language  $L = \{w \mid w \in \{a, b\}^* \mid w \text{ is of the form } a^n b^n \text{ with } n \geq 1\}$  through both empty stack and final state and demonstrates the stack operation for the string  $aaabbb$ . [9]

P.T.O.

- b) Design a push down automation to recognize the language generated by the following grammar :  
 $S \rightarrow S + S \mid S \square S \mid 4 \mid 2$   
 Show the acceptance of the input string  $2+2*4$  by this PDA. [8]

OR

- Q4)** a) What is NPDA? Construct a NPDA for the set of all strings over  $\{a,b\}$  with odd length palindrome. [9]  
 b) Design a push down automation to recognize the language generated by the following. [8]  
 $S \rightarrow S + S \mid S \square S \mid 4 \mid 2$   
 Show the acceptance of the input string  $2+2*4$  by this PDA.

- Q5)** a) Design a Turing Machine for the following language by considering transition table and diagram. [9]  
 i) TM that erases all non blank symbols on the tape where the sequence of non blank symbols does not contain any blank symbol B in between.  
 ii) TM that find 2's complement of a binary machine.  
 b) What is TM? Design TM to check well formedness of parenthesis. Expand the transition for  $(())()$  [9]

OR

- Q6)** a) How turing machine can be use to compute the functions? Design turing machine for multiplication of two numbers. [9]  
 b) Elaborate the following terms. [9]  
 i) Universal Turing Machine (UTM)  
 ii) Recursively Enumerable Languages  
 iii) Halting problem of Turing Machine

- Q7)** a) Define and Compare Class P and Class NP Problem with suitable diagram. [9]  
 b) What do you mean by polynomial time reduction? Explain with suitable example. [8]

OR

- Q8)** a) Explain Satisfiability Problem and SAT Problem and comment on NP Completeness of the SAT Problem. [9]  
 b) What makes a problem NP-Complete? How do we prove a problem is NP-complete? Are all decision problems NP-complete? [8]



Total No. of Questions: 8]

SEAT No. :

**P270**

**[6003]-348**

[Total No. of Pages : 2

**T.E. (Computer Engineering)**  
**SYSTEM PROGRAMMING & OPERATING SYSTEM**  
**(2019 Pattern) (Semester-I) (310243)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 Q.4, or Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Assume suitable data if necessary.

- Q1)** a) Explain “General loading scheme (using suitable diagram)” with advantages and disadvantages? [9]
- b) Give complete design of Direct Linking Loader? [9]

OR

- Q2)** a) Give complete design of Absolute Loader with suitable example? [9]
- b) What is the need of DLL? Differentiate between Dynamic and static linking? [9]

- Q3)** a) Explain the following types of Schedulers. [9]
- i) Short Term
  - ii) Long Term
  - iii) Medium Term
- b) Explain seven state process model with diagram? Also explain difference between Five state process model & Seven state process model? [8]

OR

**P.T.O.**

- Q4)** a) Draw Gantt chart and calculate Avg. turnaround time, Avg. waiting time for the following process using SJF non preemptive and round robin with time quantum 0.5 Unit [9]

Process	Burst Time	Arrival Time
P1	2	10
P2	1	10
P3	1	11
P4	1	12

- b) What is mean by Threads, Explain Thread lifecycle with diagram in detail? [8]

- Q5)** a) Write a short note on following with example? [9]

i) Semaphore ii) Monitor iii) Mutex

- b) Explain Deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery with example? [9]

OR

- Q6)** a) Explain producer Consumer problem & Dining Philosopher problem with solution? [9]

- b) What is deadlock? State and explain the conditions for deadlock, Explain them with example? [9]

- Q7)** a) Consider page sequence 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2 and discuss working of following page replacement policies Also count page faults. (use no. of Frames = 3) [8]

i) FIFO

ii) LRU

- b) Discuss fixed Partitioning and Dynamic Partitioning in detail. [9]

OR

- Q8)** a) Write a short note on following with diagram [8]

i) VM with Paging

ii) VM with Segmentation

- b) Explain Page Table structure and Inverted page Table? [9]



Total No. of Questions : 8]

SEAT No. :

P271

[Total No. of Pages : 2

[6003]-349

**T.E. (Computer Engineering) (Semester - I)**  
**COMPUTER NETWORKS AND SECURITY**  
**(310244) (2019 Pattern)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn whenever necessary.*
- 2) Figures to the right side indicate full marks.*
- 3) Assume Suitable data if necessary.*
- 4) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

- Q1)** a) Differentiate between Circuit Switching and Packet Switching. [6]  
b) Give short note on RIP. [6]  
c) 192.168.5.71 /26 for given address find out the [6]  
i) subnet mask?  
ii) what is first ip address for given series?  
iii) what is last ip address for given series?

OR

- Q2)** a) Draw and explain Header format of IPV6. [6]  
b) Give short note on BGP [6]  
c) List and explain functions of Network Layer. [6]
- Q3)** a) What is socket? What are different types of socket? Explain socket functions used in connection less services with diagram. [6]  
b) Explain TCP congestion control in transport layer? [6]  
c) What is Quality of Service? Explain any two methods to improve QoS?[6]

OR

**P.T.O.**

- Q4)** a) Explain RTP protocol in detail. [6]  
b) List and explain transport layer services. [6]  
c) 06 32 00 0D 001C E2 17 using this UDP hexadecimal dump find out in decimal numbers [6]  
i) Source port no.  
ii) Destination port no.  
iii) Total length of user datagram.

- Q5)** a) What is HTTP? Explain HTTP request and reply messages. [9]  
b) Write short notes on SMTP and MIME. [8]

OR

- Q6)** a) What is DHCP? Explain DHCP working with client state diagram. [9]  
b) Write short notes on POP3 and Webmail. [8]

- Q7)** a) Differentiate between Symmetric and Asymmetric Key Cryptography. [6]  
b) Explain model for network security. [6]  
c) Give short note on Security Policy and mechanisms. [5]

OR

- Q8)** a) Explain Types of Network Attacks. [6]  
b) Explain IPSec in detail. [6]  
c) Give short note on S/MIME. [5]

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P272**

**[6003]-350**

[Total No. of Pages : 2

**T.E. (Computer)**

**INTERNET OF THINGS AND EMBEDDED SYSTEMS  
(2019 Pattern) (Semester - I) (Elective-I) (310245(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

- Q1)** a) Demonstrate the use of different networking components and devices required for the IoT application design. Consider smart irrigation system as an example for it. [6]
- b) Demonstrate the IoT communication Models. [6]
- c) Illustrate the different pillars of IoT. [6]

OR

- Q2)** a) Illustrate steps of IoT design methodology for smart forest fire detection. [6]
- b) Demonstrate the Web socket API with suitable IoT system. [6]
- c) Categorize requirement of connectivity technologies for IoT system development and explain any one of them in brief. [6]
- Q3)** a) Examine the different issues in standardization of IoT Protocols. [6]
- b) Classify the different IoT Protocols used at Network layer and explain any one of them in brief. [6]
- c) Show the use of LoRa protocol in the smart irrigation system development. [5]

OR

- Q4)** a) Classify between M2M and SCADA Protocol. [6]
- b) Demonstrate the use of IP based protocols in the IoT Applications. [6]
- c) Apply the appropriate IoT protocol to develop smart irrigation system with proper explanation. [5]

**P.T.O.**

**Q5) a)** Examine how Cloud Computing is an IoT enabling technology with the suitable example. [8]

b) Use the knowledge of Cloud Computing to demonstrate.

i) Auto Bahn for IoT

ii) Xively Cloud for IoT

[10]

OR

**Q6) a)** Show that Cloud computing is the fusion of Grid Computing and SOA. [8]

b) Apply the concept of cloud computing to design the smart home system with proper explanation. [10]

**Q7) a)** Predict the possible vulnerabilities in designing smart home intrusion detection system. [8]

b) Apply the key elements of IoT security for securing the forest fire detection system with proper explanation. Enlist possible threats may encountered in designing such applications. [9]

OR

**Q8) a)** Illustrate the challenges in securing IoT applications. [8]

b) Use security concepts to identify different misuse cases (at least 03) in each of the following IoT applications: [9]

i) Smart Home Automation.

ii) Smart Parking System.

iii) Smart Irrigation Sytem.





Total No. of Questions : 8]

SEAT No. :

**P273**

[Total No. of Pages : 2

**[6003] - 351**

**T.E. (Computer)**

**HUMAN COMPUTER INTERFACE**

**(2019 Pattern) (Semester - I) (Elective - I) (310245 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Make suitable assumption whenever necessary.*

**Q1) a)** Explain interaction styles: **[6]**

- i) Command-line and
- ii) Menu Selection.

b) Which are the characteristics of Graphical User Interface? Explain. **[6]**

c) Discuss software life cycle importance used in HCL using appropriate example. **[6]**

OR

**Q2) a)** Explain interaction styles: **[6]**

- i) Form fill-in and
- ii) Direct Manipulation.

b) Elaborate the characteristics of Web using Merging of Graphical Business Systems and Web characteristics of Intranet. **[6]**

c) Write down about Iterative design and Prototyping using suitable example. **[6]**

**Q3) a)** Describe GOMS model. **[6]**

b) Write short note on : **[6]**

- i) Formative evaluation.
- ii) Summative Evaluation.

c) Elaborate Heuristic Evaluation with example. **[5]**

OR

**P.T.O.**

- Q4)** a) Evaluate Evaluation Framework using DECIDE. [6]  
b) Write short note on : [6]  
i) Empirical Methods : Experimental Evaluation.  
ii) Field Studies.  
c) Elaborate Cognitive Walkthrough. [5]

- Q5)** a) Describe paradigms used for Interaction in HCI: [6]  
i) Time Sharing.  
ii) Video Display Unit.  
iii) Programming Toolkits.  
b) What is mean by ubiquitous computing? Which are the applications of it? Explain with suitable Example. [6]  
c) Explain sensor-based and context-based interaction. [6]

OR

- Q6)** a) What is mean by framework in HCI? Explain Five-stage search framework. [6]  
b) Explain “Dynamic queries and faceted search” used in HCI. [6]  
c) What is mean by pattern recognition? Explain phases involved in pattern recognition process with suitable example. [6]

- Q7)** a) Write short note on : [6]  
i) Mobile form factors.  
ii) Handheld format apps.  
b) Discuss Mobile Navigation, Content, and Control Idioms using appropriate example. [6]  
c) Write down about designing for automotive interfaces in HCI. [5]

OR

- Q8)** a) Describe Drawers used in HCL System. Explain Item-level drawers. [6]  
b) Discuss Tap-to-Reveal and direct manipulation in detail. [6]  
c) Write down about designing for mobile devices using HCI. [5]



Total No. of Questions : 8]

SEAT No. :

**P274**

**[6003] - 352**

**[Total No. of Pages : 2**

**T.E. (Computer Engineering)**

**DISTRIBUTED SYSTEMS**

**(2019 Pattern) (Semester - I) (Elective - I) (310245 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Assume suitable data, if necessary.

- Q1)** a) What is clock synchronization? Explain in brief clock synchronization algorithms. [6]
- b) What is mutual exclusion? Compare centralized and decentralized mutual exclusion algorithms. [6]
- c) Explain how logical positioning of nodes is done in Gps location system. [6]

OR

- Q2)** a) Explain in detail lamport's logical clock. [6]
- b) Explain with suitable example how butly election algorithm works. [6]
- c) Explain gossip-based overlay construction of gossip-based contribution. [6]

- Q3)** a) Explain the following naming system of file system. [6]
- i) flat naming.
- ii) structured naming.
- b) Explain file service architecture of distributed file systems. [6]
- c) Explain with suitable example, Andrew file system. [5]

OR

- Q4)** a) What is attributed based naming? Explain. [6]
- b) What are identifiers? Explain. [6]
- c) Explain with suitable example, Suns network file system. [5]

**P.T.O.**

- Q5)** a) Differentiate between data - centric and client - centric consistency models. [6]
- b) Describe architecture of replicated data management. [6]
- c) Explain following terms w.r.t. replica management. [6]
- i) Content replication.
- ii) Content distribution.

OR

- Q6)** a) What is replication? Enlist reasons for replication. [6]
- b) Explain eventual consistency model. [6]
- c) Explain how replicated objects are managed by replica management. [6]
- Q7)** a) What is fault tolerance? Explain in short failure models. [6]
- b) Explain failure masking in distributed system. [6]
- c) Describe checkpointing for recovery. [5]

OR

- Q8)** a) Describe RPC semantics in presence of failures. [6]
- b) Explain failure models in distributed system. [6]
- c) Describe atomic multicast for reliable group communication. [5]



Total No. of Questions : 8]

SEAT No. :

**P275**

[Total No. of Pages : 2

**[6003] - 353**

**T.E. (Computer)**

**SOFTWARE PROJECT MANAGEMENT**

**(2019 Pattern) (Semester - I) (Elective-I)(310245 D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Assume suitable data, if necessary.

- Q1)** a) How many activity relationships are used in software project management? Explain any two relationship in detail. [6]
- b) What is activity table? Explain activity table of forward pass. [6]
- c) Explain different approaches for identifying activities that make up a project. [6]

OR

- Q2)** a) List and Explain in details the objectives of activity planning? [6]
- b) What are forward and backward pass? [6]
- c) What is critical path? What are limitations of critical path? [6]
- Q3)** a) List and explain different types of project status report. [6]
- b) List and explain different tools and methods used for monitoring and regulating project operations? [6]
- c) Explain in detail earned value analysis. [5]

OR

- Q4)** a) List and explain different methods used in visualizing process. [6]
- b) What is cost monitoring? List and Explain different approaches for cost monitoring. [6]
- c) Explain the different stages in contract placement. [5]

**P.T.O.**

- Q5)** a) What is difference between agile and traditional project? [6]  
b) What are the different stages of Agile? Explain each one in brief. [6]  
c) How to schedule project using agile methods? [6]

OR

- Q6)** a) What are the responsibilities of agile project? [6]  
b) Explain agile team roles. [6]  
c) What is Scrum? [6]

- Q7)** a) Explain different types of team organization. [6]  
b) Explain influencing elements of organizational behavior. [6]  
c) Explain all stages of team development. [5]

OR

- Q8)** a) Explain different communication genres used in organization. [6]  
b) Explain decision making process. [6]  
c) Explain challenges in working with virtual team. [5]



Total No. of Questions : 8]

SEAT No. :

P-3153

[Total No. of Pages : 2

[6003]-354

T.E. (Computer Engineering)

Data Science and Big Data Analytics

(2019 Pattern) (Semester - II) (310251)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of Scientific Calculalor is permitted.

**Q1)** a) What is Model Building elaborate this phase of data analytics with the help of suitable example. [9]

b) Explain any three sources of Big Data. Differentiate BI versus Data science. [8]

OR

**Q2)** a) What are the three characteristic of Big Data and what are the main consideration in processing Big Data. [8]

b) Explain Descriptive, Diagnostic, Predictive analytics. [9]

**Q3)** a) Explain why decision tree are used. Draw a sample decision tree and explain its parts. [9]

b) How Apriori Algorithm works, explain with suitable example? [9]

OR

**Q4)** a) What is data preprocessing? Explain in details about handling missing data and transformation of data. [9]

b) Explain Naïve Bayes' classifier and it applications. [9]

P.T.O.

- Q5)** a) What is text processing? Explain TF-IDF with example. [8]  
b) With suitable example ,explain the steps involved in k-means algorithm. [9]

OR

- Q6)** a) Define following terms with respect to confusion matrix : [8]  
i) Accuracy  
ii) Precision  
iii) Recall  
iv) AUC-ROC  
b) Explain k-fold Cross Validation & Random Subsampling. [9]

- Q7)** a) With a suitable example, draw a Histogram, boxplot and explain its usages. [9]  
b) Describe the data visualization tool Tableau. List of data visualization tools. [9]

OR

- Q8)** a) What is Data Visualization? Describe the challenges of data visualization. [9]  
b) Explain architecture of Apache-Pig. [9]





Total No. of Questions : 8]

SEAT No. :

**P276**

[Total No. of Pages : 2

**[6003]-355**

**T.E. (Computer Engg.)**

**WEB TECHNOLOGY**

**(2019 Pattern) (Semester-II) (310252)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) What are strengths of XML technology? Explain the need of XML. [5]  
b) What are DTD's? Explain how do they work? [5]  
c) Explain URL writing and cookies in servlet with example. [8]

OR

- Q2)** a) Explain servlet architecture in detail. [8]  
b) What do you understand by AJAX?. Explain it. [5]  
c) Write a servlet which accepts two numbers using POST method and display the maximum number. [5]

- Q3)** a) List & describe important inceptors provided by strut framework. [5]  
b) Identify & justify the benefits of using Web Services. [5]  
c) Explain JSP life cycle with diagram. [7]

OR

- Q4)** a) What is JSP? Enlist advantages of JSP over servlet? [5]  
b) What is WSDL and SOAP? Explain WSDL in detail. [5]  
c) Draw and explain MVC architecture for developing web application. [7]

- Q5)** a) What is WAP? Explain components of WAP architecture in detail. [8]  
b) What is multidimensional arrays in PHP? Explain it with simple PHP code. [5]  
c) Explain overview of node JS. [5]

OR

**P.T.O.**

- Q6)** a) Explain how cookies and session are used for session management in PHP. [8]  
b) What is WML? Explain WML elements. [5]  
c) Explain in brief overview of ASP. NET. [5]

- Q7)** a) Explain how multiple selection constructs are implemented in Ruby. [7]  
b) Explain Rails with AJAX in detail. [5]  
c) Draw & explain the role of EJB container in Enterprise applications. [5]

OR

- Q8)** a) Explain how to write the methods and call the method in RUBY with example. [7]  
b) What are the difference between java beans and EJB? [5]  
c) What is Ruby programming language? List some features of Ruby. [5]



Total No. of Questions : 8]

SEAT No. :

**P277**

[Total No. of Pages : 2

**[6003]-356**

**T.E. (Computer Engineering)**

**ARTIFICIAL INTELLIGENCE**

**(2019 Pattern) (Semester - II) (310253)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3, or Q.4, Q.5 or Q.6 Q.7, or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Assume suitable data if necessary.

- Q1)** a) List All problem solving strategies. What is backtracking, explain with n queen problem, with Branch and bound or Backtracking. [8]
- b) Explain Monte Carlo Tree Search with all steps and Demonstrate with one Example. [9]

OR

- Q2)** a) i) Explain limitations of game search algorithm, Differentiate between stochastic and partial games AND. [9]
- ii) Explain How use of alpha and beta cut-offs will improve performance of mini max algorithm? [9]
- b) Define is Constraint satisfaction problem, State the types of consistencies Solve the following Crypt Arithmetic Problem. [8]
- SEND  
+MORE  
-----  
MONEY

- Q3)** a) What is an Agent. Name any 5 agents around you Explain Knowledge based agent with Wumpus World. [9]
- List and explain in short the various steps of knowledge engineering process.
- b) Consider the following axioms: [9]
- If a triangle is isosceles, then its two sides AB and AC are equal,  
If AB and AC are equal, then angle B and C are equal  
ABC is an equilateral triangle,  
Represent these facts in predicate' logic.  
Explain Inference in Propositional Logic.

OR

*P.T.O.*

**Q4) a)** Write the following sentences in FOL (any 2) (using types of quantifiers). [9]

- i) Every number is either negative or has a square root .
- ii) Every connected and circuit-free graph is a tree .
- iii) Some people are either religious or pious
- iv) There is a barber who shaves all men in the town who do not shave themselves.

**b)** What is Resolution? Solve the following statement by using resolution algorithm. Draw suitable resolution graph. [9]

- i) Rajesh like all kind of food.
- ii) Apple and vegetables are food.
- iii) Anything anyone eats and is not killed is food.
- iv) Ajay eats peanuts and still alive.

Prove that Rajesh like bananas. .

**Q5) a)** Explain Forward Chaining and Backward Chaining. With its Properties, with one. example. [9]

**b)** Explain Unification Algorithm in FOL. Solve stepwise with proper comments if  $p(x, g(x))$  is equal to or not equal to  $f(\text{prime}, f(\text{prime}))$  [8]

OR

**Q6) a)** Explain FOL inference for following Quantifiers. [8]

- i) Universal Generalization.
- ii) Universal Instantiation.
- iii) Existential Instantiation.
- iv) Existential introduction

**b)** What is Ontological Engineering ,in details with its categories object and Model. [9]

**Q7) a)** Explain with an example State Space Planning. [5]

**b)** Explain with example, how planning is different from problem solving. [5]

**c)** Explain AI components and AI architecture. [8]

OR

**Q8) a)** Explain Planning in non deterministic domain. [5]

**b)** Explain. [8]

- i) Importance of planning
- ii) Algorithm for classical planning

**c)** Explain Limits of AI and Future opportunities with AI. [5]



Total No. of Questions: 8]

SEAT No. :

**P278**

**[6003]-357**

[Total No. of Pages : 2

**T.E. (Computer Engineering)**

**INFORMATION SECURITY**

**(2019 Pattern) (Semester-II) (310254(A)) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Assume suitable data if necessary.

- Q1)** a) What are the different types of attacks possible on RSA? Explain in brief. [6]
- b) Explain the “Man in the middle” attack in Diffie - Hellman Key Exchange algorithm with the help of an example. [6]
- c) Consider a Diffie-Hellman scheme with a common prime  $q = 71$  and a primitive root  $\alpha = 7$  [6]
- i) If user A has private key  $X_A = 5$ , what is A's public key  $Y_A$ ?
  - ii) If user B has private key  $X_B = 12$ , what is B's public key  $Y_B$ ?
  - iii) What is the shared secret key K?

OR

- Q2)** a) Explain Chinese reminder theorem. [6]
- b) Differentiate between Asymmetric key cryptography and symmetric key cryptography. [6]
- c) Perform encryption and decryption using RSA algorithm for the following:  $P=3$ ;  $q=11$ ;  $d=7$ ;  $M=5$  [6]
- Q3)** a) List and describe the contents of the Authentication header in IPSec with diagram. [6]
- b) Explain the working of IPSec. What are the benefits of IPSec? [5]
- c) What is Message Digest? Compare MD-5 with SHA-1. [6]

OR

*P.T.O.*

- Q4)** a) Discuss two modes of IPSec. [6]  
b) Discuss web security issues. [5]  
c) Discuss the basic requirements for a cryptographic hash function. What is the difference between a strong and a weak collision resistance? [6]

- Q5)** a) Explain the needs and challenges of intrusion detection systems. [6]  
b) What is Denial of Service (DoS) attack? How does it affects the network performance? [5]  
c) Discuss Application-level security in detail. [6]

OR

- Q6)** a) Compare Anomaly based and Signature based intrusion detection system. [6]  
b) Explain access control and its types in detail. [5]  
c) Discuss the concept of multilevel security. [6]

- Q7)** Write short note on any three [18]  
a) Botnets  
b) Types of cyber crimes  
c) Information Security Life Cycle  
d) Cyber Stalking

OR

- Q8)** Write short note on any three [18]  
a) Cyber Terrorism  
b) Anonymizers  
c) Types of Cyber stalkers  
d) Aims and objectives of IT act 2000



Total No. of Questions: 8]

SEAT No. :

**P279**

**[6003]-358**

[Total No. of Pages : 2

**T.E. (Computer Engineering)**

**AUGMENTED AND VIRTUAL REALITY**

**(2019 Pattern) (Semester-II) (Elective - II) (310254 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 Q.4, or Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

**Q1) a)** What is rendering system? Describe different methods of aural rendering. [6]

b) Explain geometric based rendering system in detail? [6]

c) Differentiate between aural and haptic representation in Virtual reality.[6]

OR

**Q2) a)** Describe haptic rendering methods in detail. [6]

b) List out different methods for simplifying the amount of information needed to pass between simulation and haptic rendering. Explain any three in detail. [6]

c) How to render complex haptic scenes with force displays? [6]

**Q3) a)** What are the four categories of substance in the virtual world? Explain. [6]

b) What is Wayfinding? Enlist real and virtual-world aids to improve wayfinding in navigation. [6]

c) State side effects of using VR System. [6]

OR

**Q4) a)** State and explain different forms of manipulating a virtual world. [6]

b) What is Direction Selection? Enlist seven ways of selecting direction.[6]

c) What is collaborative interaction? Explain. [6]

*P.T.O.*

- Q5)** a) What is augmented reality? Enlist different ingredients of an augmented reality experience. [6]
- b) Describe Registration and Latency related to AR systems. [6]
- c) How does augmented reality work? Explain in detail [5]

OR

- Q6)** a) What is Depth Cues? Explain Monoscopic and Stereoscopic image depth in detail. [6]
- b) What are different categories of sensors that are used in AR systems? [6]
- c) Explain history of Augmented Reality. [5]

- Q7)** a) Write short note on: [6]
- i) Realistic and Abstract representation
- ii) Physical & Conceptual representation
- b) Describe different software used to create content for the augmented reality application. [6]
- c) Explain software tools used for content creation in AR? [5]

OR

- Q8)** a) Explain the following terms related to interaction in virtual world:: [6]
- i) Manipulation
- ii) Communication
- iii) Navigation
- b) What are marker based and marker-less tracking system in augmented reality? [6]
- c) State advantages and disadvantages of mobile augmented reality. [5]





Total No. of Questions: 8]

SEAT No. :

**P280**

**[6003]-359**

[Total No. of Pages : 2

**T.E. (Computer Engineering/A.I.D.S.)**

**CLOUD COMPUTING**

**(2019 Pattern) (Semester-II) (Elective II) (310254 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** Differentiate between grid computing and cloud computing? **[9]**

b) Define virtualizations? Explain the advantages and disadvantages of Virtualization? **[8]**

OR

**Q2) a)** Describe virtual clustering in cloud computing? **[9]**

b) Explain the importance of hypervisor in cloud computing? Compare Type 1 and Type 2 hypervisor? **[8]**

**Q3) a)** Enlist an applications of cloud computing in differnt Area? Describe any two applications? **[9]**

b) Explain the different components of AWS? **[8]**

OR

**Q4) a)** How the Amazon simple storage service (S3) works? Explain with suitable diagram? **[8]**

b) Enlist the steps for configuring Amazon EC2 VM instance? **[9]**

**Q5) a)** What are the different types of testing in cloud computing? Explain briefly? **[9]**

b) Explain the different types of security risk involved in cloud computing? **[9]**

OR

**P.T.O.**

- Q6)** a) Describe the different Cloud Security Services in detail? [9]  
b) State the use of Content Level Security (CLS)? [9]
- Q7)** a) Describe client-server architecture of docker? [9]  
b) Explain Mobile Cloud in detail? [9]

OR

- Q8)** a) Differentiate between Distributed Cloud Computing Vs Edge Computing? [9]  
b) Explain the concept of DevOps in detail? [9]



Total No. of Questions: 8]

SEAT No. :

**P281**

**[6003]-360**

[Total No. of Pages : 2

**T.E. (Computer Engineering)/(A.I.D.S.)**

**SOFTWARE MODELING AND ARCHITECTURES**

**(2019 Pattern) (Semester-II) (Elective II) (310254 D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) What are the major components of interaction overview diagrams? [6]  
b) What is the types of a state machine diagram? Explain its types in detail. [6]  
c) Explain Fork and Join concept in Activity diagram with a suitable example [6]

OR

- Q2)** a) Explain the significance of timing diagram with a suitable example. [6]  
b) Draw state machine diagram for coffee vending machine. [6]  
c) Explain Communication diagram with example. [6]
- Q3)** a) Explain the real time software architecture with a suitable example. [8]  
b) Explain the importance of Object oriented software architecture and its applicabililty in software development? [9]

OR

- Q4)** a) What is architecture pattern? What is significance of architecting software product? [5]  
b) What is the software architecture? What are the three different views of an architecture? Explain the component of 4+1 architectural view model. [12]

**P.T.O.**

- Q5)** a) Define the importance of architecture structure and views. [6]  
b) Explain the importance of Object oriented software architecture and its applicability in software development. [6]  
c) Explain the broker pattern for design of service oriented architecture.[6]

OR

- Q6)** a) Explain the real time software architecture with a suitable example. [6]  
b) Explain synchronous communication pattern in Client server architecture with example? [6]  
c) Explain Location & Platform transparency in service oriented architecture [6]

- Q7)** a) What is singleton pattern? Explain one example scenario where you will singleton pattern to get applied? [7]  
b) Draw the structure of observer pattern with suitable class diagram including subject and observer. [6]  
c) Explain the broker pattern for design of service oriented architecture [4]

OR

- Q8)** a) What is *Behavioral* Pattern? In which situation you use the *Behavioral* pattern? What is observer *Behavioral* pattern? Explain observer *Behavioral* in detail with the applicability of singleton creational pattern. [9]  
b) What are the different approaches of design patterns in software architecture? [8]



Total No. of Questions : 8]

SEAT No. :

P-282

[Total No. of Pages : 2

[6003]-361

**T.E. (Electrical Engineering)**

**INDUSTRIAL AND TECHNOLOGY MANAGEMENT**

**(2019 Pattern) (Semester - I) (303141)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable additional data, if necessary.*

**Q1) a)** Explain the following : **[9]**

- i) Design
- ii) Trademark
- iii) Copyrights

b) Write a short note on HR planning and Recruitment. **[9]**

OR

**Q2) a)** What is Intellectual Property Rights (IPR)? Explain all its types? **[9]**

b) What is Performance Appraisal? State the objective and Performance Appraisal? **[9]**

**Q3) a)** Explain in brief following : **[8]**

- i) TQM
- ii) SIX SIGMA

b) Explain Quality Management system standard ISO 14001:2004. **[9]**

OR

**Q4) a)** Explain Environmental Management System Standard in details. **[8]**

b) What is meaning of Kaizen. How 5S is used in implementation of Kaizen. **[9]**

**P.T.O.**

- Q5) a)** Explain in detail : [9]  
i) Concept of Monopolistic competition  
ii) Oligopoly  
**b)** What is cost? Explain any four method of costing in detail. [9]

OR

- Q6) a)** Explain in detail : [9]  
i) Online Marketing  
ii) Marketing Research  
**b)** Explain the terms : [9]  
i) Price  
ii) Capital  
iii) Credit and Debit  
iv) Books of Account

- Q7) a)** Enlist the theories of work motivation. Explain Herzberg's Two factor theory in detail. [9]  
**b)** What are the good qualities of good leadership? Explain in details. [8]

OR

- Q8) a)** What is group dynamics? Explain the stages of group dynamics in detail. [8]  
**b)** Explain Government policies and incentives for small business development. [9]



Total No. of Questions : 8]

SEAT No. :

**P283**

[Total No. of Pages : 2

**[6003]-362**

**T.E. (Electrical)**

**POWER ELECTRONICS**

**(2019 Pattern) (Semester-I) (Theory) (303142)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** A single phase half controlled bridge converter feeds a load comprising of a resistance of 10 ohm and a large inductance to provide a constant and ripple free current. Calculate the average value of output voltage and current. Firing angle is  $45^\circ$  and input ac voltage is 120V, 50Hz. **[8]**

b) Describe working of single phase bridge converter with RL load. Draw waveforms of load voltage, load current and derive equation for average load voltage and Current. **[9]**

OR

**Q2) a)** Describe working of circulating current type single phase dual converter with waveforms. **[8]**

b) Draw and explain Single phase semi converter feeding R load with output voltage and current wave forms. Also derive output average and rms voltage equation. **[9]**

**Q3) a)** A three phase half wave controlled converter is fed from 3 phase, 400V, 50Hz source and is connected to a resistive load of 10 ohm per phase. Calculate the average value of load voltage and current for a firing angle of  $30^\circ$  and  $60^\circ$ . **[10]**

b) What is two stage ac voltage regulator? Draw neat diagram and explain its operation with output waveform for RL load. **[8]**

OR

**P.T.O.**

- Q4)** a) Describe working of three phase fully controlled converter & Draw output voltage and current waveforms for R load when  $\alpha = 60^\circ$ . [10]  
 b) Draw and explain three phase semi converter feeding RL load with output voltage wave forms. [8]

- Q5)** a) Explain with circuit diagram and waveforms operation of single phase current source inverter. [8]  
 b) For single pulse width modulation with quasi square wave, show that output voltage can be expressed as

$$V_0 = \sum_{n=1,3,5,\dots}^{\infty} \frac{4V_s}{n\pi} \sin \frac{n\pi}{2} \sin nd \sin n\omega t. \text{ Where } V_s \text{ is source voltage and pulse width is } 2d. \quad [9]$$

OR

- Q6)** a) State different voltage control techniques used in single phase inverter. Elaborate any two methods in detail. [8]  
 b) Explain Sinusoidal pulse width modulation with necessary waveforms. [9]
- Q7)** a) Explain working of three phase six step voltage source inverter in  $180^\circ$  mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. [10]  
 b) List different harmonic elimination techniques used in inverter. Explain any two methods in detail. [8]

OR

- Q8)** a) Explain working of three phase six step voltage source inverter in  $120^\circ$  mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. [10]  
 b) Draw a neat diagram and explain Flying capacitor multilevel converter. [8]





Total No. of Questions : 8]

SEAT No. :

**P284**

[Total No. of Pages : 3

**[6003]-363**

**T.E. Electrical Engineering**

**ELECTRICAL MACHINES-II**

**(2019 Pattern) (Semester-I) (303143)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable additional data, if necessary.
- 5) Use of non-programmable calculator is allowed.

- Q1) a)** Draw the power flow (power stages) diagram of 3 phase synchronous motor. **[4]**
- b) Draw the phasor diagram of 3 phase synchronous motor for leading power factor. & show
- i) Load angle
  - ii) Internal angle
  - iii) Power factor angle on it.
  - (iv) Write the formula for back emf from phasor diagram. **[6]**
- c) A 415 V three phase star connected synchronous motor has armature resistance of 0.2 ohm/ph. and synchronous reactance of 2 ohm/ph. While delivering certain load, it takes 25A from supply. Calculate back EMF induced in the motor if it is working with.
- i) 0.8p.f. lag
  - ii) 0.8 p.f. lead. **[8]**

**OR**

- Q2) a)** Sketch V and inverted V curves of synchronous motor and comments on armature current. **[4]**
- b) State the methods of starting the synchronous motor. Explain the starting by using damper winding. **[6]**

**P.T.O.**

- c) A three phase star connected 50 Hz, synchronous motor is rated 75 kW, 440 V with synchronous reactance 2.5 ohm/phase operates at 0.8 leading power factor. The motor efficiency is 95 %. Calculate.
- armature current
  - back emf and
  - power angle. [8]

- Q3)** a) What is induction generator? Draw the torque - speed characteristics of 3 phase Induction motor and induction generator. [3]
- b) Draw the block diagram & explain the V/f method of speed control of 3phase induction motor. [6]
- c) With the neat construction diagram and explain the working of permanent magnet stepper motor. Show the truth table. how to reverse the direction of rotation. [8]

OR

- Q4)** a) Calculate step angle & resolution of 3-ph stepper motor with 08 stator poles & 06 rotor poles. [3]
- b) What is Energy Efficient Induction Motor? Explain, how to improve the EE? [6]
- c) With the neat diagram describe the construction and working of PM D.C. motor. State its applications & Drawbacks. [8]

- Q5)** a) Draw the torque speed characteristics of AC and DC series motor & explain how unidirectional torque is produced when DC series motor is connected to AC supply? [4]
- b) Compare conductively compensated and inductively compensated series motor. [6]
- c) A series motor having resistance 40  $\Omega$  & inductance 0.3 H When connected to 240 V DC supply draws a current of 1 A and run at 2000 rpm. If it is supplied by 240 V , 50 Hz AC supply with same loading; Calculate
- speed
  - power factor
  - Gross power developed and
  - torque. [8]

OR

- Q6)** a) What are the modifications necessary in construction of DC series motor to operate it on ac supply? [4]
- b) What is universal motor? State its construction types. With neat diagram, explain its working and state its applications. [6]
- c) What are the various methods of improving commutation in series motor? Explain the use of compoles in detail. [8]

- Q7)** a) Sketch the torque-slip characteristics of 1-ph Induction motor based on double field revolving theory. What is the net torque at starting? [3]
- b) Compare single phase motor with 3 phase motor. [6]
- c) 250 W, 230 V, 50 Hz , single phase capacitor start induction motor has following constants.

Main winding:  $Z_m = 4.5 + j 3.7 \Omega$  & Auxiliary winding;  $Z_a = 9.5 + j 3.5 \Omega$ . Determine value of C which will make develop maximum torque.[8]

OR

- Q8)** a) How to reverse the direction of rotation of 1-ph induction motor, explain by connection diagram. [3]
- b) Draw the connection diagram and observation tables to conduct no load and blocked rotor test on single phase induction motor. Also draw the equivalent circuit of motor under these test conditions. [6]
- c) Explain construction and working of capacitor start induction run motor. Draw its torque-speed characteristics. State its two applications. [8]



Total No. of Questions : 8]

SEAT No. :

P-285

[Total No. of Pages : 3

**[6003]-364**

**T.E. (Electrical)**

**ELECTRICAL INSTALLATION, DESIGN AND  
CONDITION BASED MAINTENANCE**

**(2019 Pattern) (Semester - I) (303144)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*

- Q1)** a) Compare Preventive & breakdown maintenance. [4]
- b) State the reasons for the insulation degradation. [6]
- c) Explain Dissolved Gas Analysis. [8]

OR

- Q2)** a) Explain motor current signature analysis (MCSA) with suitable diagrams. [8]
- b) Explain preventive maintenance of induction motor with merits. [6]
- c) Explain use of Thermography in power system. [4]
- Q3)** a) Write short note on Price catalogue. [3]
- b) What are the essentials of estimating and costing? [6]
- c) State the general factors to be considered in estimation of LT lines. [8]

*P.T.O.*

OR

**Q4)** a) What are the qualities of good estimator? [8]

b) Write short notes on the following: [6]

i) Schedule of rates

ii) Labour rates

c) State & explain Guidelines for inviting tenders. [3]

**Q5)** a) Write down all rules for residential wiring work. [4]

b) Write short notes on the following: [6]

i) Current carrying capacity

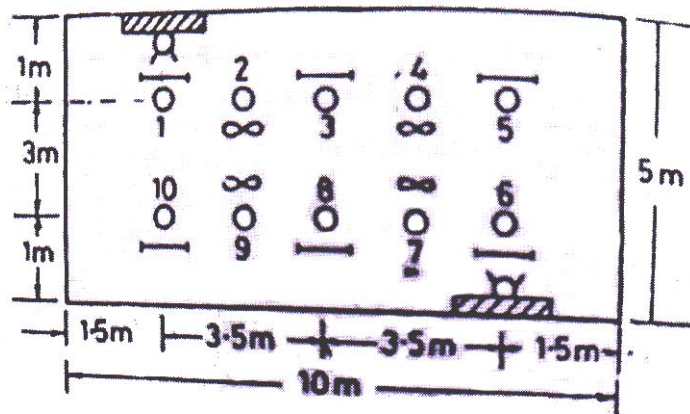
ii) Voltage drop

c) Explain the procedure of installation of underground LT service line. [8]

OR

**Q6)** a) Explain various residential wiring methods with diagrams. [8]

b) A hall of  $10 \times 5$  met is to be provided with 6 light points, 4 fan points & 2 plugs (5A). The plan of hall is as shown in figure:



Draw single line wiring diagram. Estimate the quantity of material required for casing capping wiring. Assume suitable position of switches if required. [10]

**Q7)** a) Enumerate the danger arising out of faulty equipment with appropriate examples. [9]

b) Classify different hazardous areas and its effect on human body. [8]

OR

**Q8)** a) List the different methods for earth testing. Explain any one method in detail with suitable diagram. [9]

b) How electrical accidents can be avoided? [8]



Total No. of Questions : 8]

SEAT No. :

**P286**

[Total No. of Pages : 2

[6003]-365

**T.E. (Electrical)**

**ADVANCED MICROCONTROLLER AND EMBEDDED SYSTEM  
(2019 Pattern) (Semester-I) (303145A) (Elective-I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

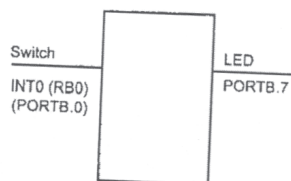
*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams should be drawn whenever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Explain the steps of PWM programming in CCP module. Find the minimum and maximum PWM frequency allowed for XTAL=10MHz. [9]
- b) Find PR2, CCPR1RL, DC1B1: DC1B0 value for the following PWM frequencies with 75% duty cycle. Assume XTAL=10MHz
- a) 2KHz with prescaler=16
  - b) 5KHz with prescaler=4 [8]

OR

- Q2)** a) Draw CCP1CON and list the steps involved in programming PIC18F458 microcontroller in capture mode. [9]
- b) Use PWM mode of CCP module, write a program in C for PIC18F458 to create a 2.5 MHz PWM waveform with 75% duty cycle on CCP1 pin. Assume XTAL=10MHz. [8]
- Q3)** a) Enlist interrupt registers in PIC18F458. Explain any two. [9]
- b) Write a C program for PIC18 toggle the LED connected to pin 7 of the PORT B every time INT0 is activated by a switch connected at INT0(RB0). Assume XTAL=10MHz. [9]



OR

**P.T.O.**

**Q4) a)** State steps the microcontroller does perform upon activation of an interrupt. [9]

b) Write a program in C language using Timer0 to generate square wave form on PORTB.5. Assume PORT C is connected to 8 switches and PORT D to 8 LEDs and same data is being transferred from PORT C to PORT D. [9]

**Q5) a)** Explain how current is measured using PIC 18 microcontroller. Write a program to measure current and display it on PORT D. [8]

b) Explain the programming of PIC 18 ADC using interrupt with suitable example. [9]

OR

**Q6) a)** Explain features of on-board ADC of PIC18F458. Also explain in detail the functions of ADIF and ADFM bits. [8]

b) Draw interfacing diagram of 16x2 LCD with PIC18 microcontroller and explain the functions of various pins of LCD. [9]

**Q7) a)** Explain the interrupt flags bits used in transmission and reception modes of USART. [9]

b) List the steps for programming PIC18 to receive the data serially. [9]

OR

**Q8) a)** Write a note on SPI protocol. Also state its applications. [9]

b) Explain various modes in serial communication. Also enlist various registers associated with transmission and reception modes of USART. [9]





Total No. of Questions : 8]

SEAT No. :

**P287**

[Total No. of Pages : 3

[6003]-366

**T.E. (Electrical)**

**DIGITAL SIGNAL PROCESSING**

**(2019 Pattern) (Semester-I) (Elective-I) (303145B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Neat diagram must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

**Q1) a)** State and prove the time reversal property of DTFT. **[6]**

- b) For the sequence given below find the frequency response, plot magnitude and phase response for  $\omega = -\pi$  to  $\pi$  with step size of  $\frac{\pi}{6}$  **[12]**

$$h(n) = \frac{1}{2} \delta(n-1) - \frac{1}{2} \delta(n+1)$$

OR

**Q2) a)** State and prove the time shifting property of DTFT. **[6]**

- b) For the sequence given below, find the frequency response. **[12]**

i)  $x(n) = \left(\frac{1}{2}\right)^n u(n)$

ii)  $x(n) = \left(\frac{1}{2}\right)^{n-1} u(n-1)$

iii)  $x(n) = \left(\frac{1}{2}\right)^{n+1} u(n+1)$

**P.T.O.**

- Q3)** a) Determine linear convolution of following sequences from circular convolution  $x(n) = \{1, 2, 3, 1\}$  and  $h(n) = \{1, 1, 1\}$ . [6]
- b) State and prove linearity property of DFT. [6]
- c) Find DFT of the sequence: [6]

$$x(n) = \begin{cases} (2)^n & \text{for } 0 \leq n \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

OR

- Q4)** a) Draw the structure of Radix-2 DIT-FFT algorithm for  $N=8$ . [6]
- b) State and prove periodicity property of DFT. [6]
- c) Computer DFT of the sequence  $x(n) = \{1, 2, 1, 2\}$ . Sketch the magnitude and phase spectrum. [6]

- Q5)** a) Compare FIR and IIR filter. [5]
- b) An analog filter has following transfer function. Design a digital filter equivalent to this using impulse invariance method for  $T=0.2$  Sec. [6]

$$H(s) = \frac{10}{s^2 + 7s + 10}$$

- c) Obtain z-transform and direct form-I realization for the system described by difference equation [6]

$$y(n) = 0.5y(n-1) - 0.25y(n-2) + x(n) + 0.4x(n-1)$$

OR

- Q6)** a) Compare analog and digital filter. [5]
- b) Obtain Z-transform following difference equation and realize direct form-I and form-II structure. [12]

$$y(n) = \frac{1}{2}y(n-1) + \frac{1}{4}y(n-3) + x(n) + x(n-1)$$

**Q7) a)** Design a linear phase FIR low pass filter using rectangular window by taking 7 samples of window sequence and with a cutoff frequency  $0.2\pi$  rad/sample. [12]

b) Write short note on measurement of frequency using DSP. [5]

OR

**Q8) a)** What are the different ideal frequency selective filters? Explain each type with equations and graph. [5]

b) Write short note on application of DSP in protective relays. [6]

c) Draw the direct form structure of the FIR System described by the

transfer function.  $H(z) = 1 + \frac{1}{2}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{4}z^{-3} + \frac{1}{2}z^{-4} + \frac{1}{8}z^{-5}$  [6]



[6003]-368

T.E. (Electrical)

POWER SYSTEM-II

(2019 Pattern) (Semester-II) (303148)

Time : 2½ Hours]

[Max. Marks : 70]

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of a calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Give the detailed classification of buses used in load flow analysis. [6]
- b) State the following statements are true or false with justification. [6]
- i) The bus admittance matrix is a sparse matrix
  - ii) In fast decoupled load flow, the resistance of the lines are neglected.
- c) Impedances (in pu) between buses are given in the following Fig. Calculate the Ybus of the system. [6]

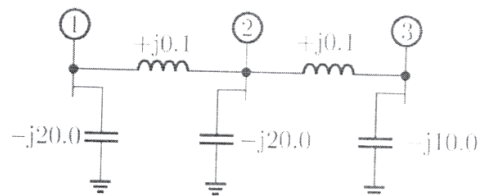


Fig Q1 C)

OR

- Q2)** a) Draw the per-unit impedance diagram of the system shown below. Take the base values as 10MVA, 33kV on the load. [6]

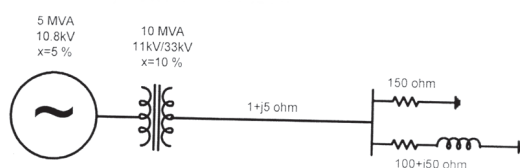


Fig Q2A)

P.T.O.

- b) Explain load flow analysis using the fast decoupled method. [6]
- c) What is per unit system? State the advantages and disadvantages. [6]

**Q3) a)** For the power system shown in the figure below, the specifications of the components are the following: [12]

G1 : 25kV, 100 MVA,  $X=9\%$  G2: 25kV, 100 MVA,  $X=9\%$

T1 : 25kV/220 KV, 90 MVA,  $X=9\%$  T2: 220 kV/25kV, 90MVA,  $X=9\%$

Line 1:  $X=150$  ohms

If the three-phase fault is taken place at bus 1, calculate fault current supplied by each generator. Take generator 1 rating as base values.

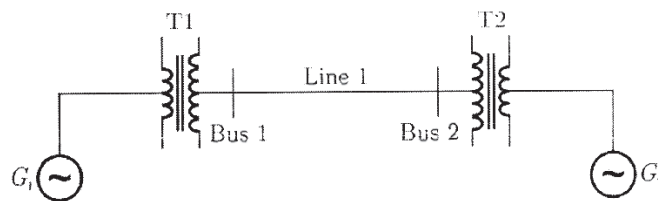


Fig. Q3A)

- b) Draw the nature of fault current, if the symmetrical fault is taken place at the terminal of an unloaded alternator. Clearly mark the sub-transient, transient and steady state period. [6]

OR

**Q4) a)** Find the fault current, if three phase fault is taken place at (i) F1 and (ii) F2. [12]

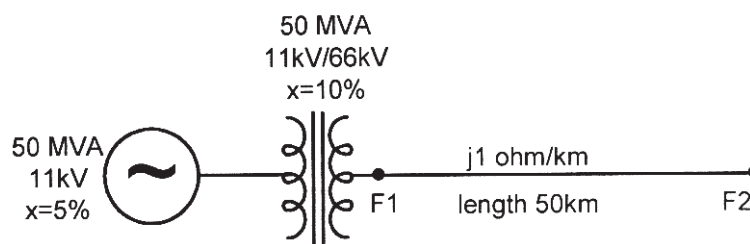


Fig Q4A)

- b) Write a short note on “Feeder reactor”. [6]

**Q5) a)** With usual notation, prove that three-phase apparent power. [6]

$$S_{abc} = 3(V_{a1}I_{a1}^* + V_{a2}I_{a2}^* + V_{a0}I_{a0}^*)$$

**b)** Draw a zero-sequence diagram for the following transformer connection. [6]

i) Delta-star transformer (With isolated neutral)

ii) Delta-star connected transformer with neutral grounded with impedance.

**c)** For a transmission line, positive sequence impedance is  $(1+j10)$  ohm and zero sequence impedance is  $(4+j31)$  ohm. Determine following matrix where  $Z_s$ =Self impedance and  $Z_m$  is mutual impedance of the transmission line. [6]

$$Z_{line} \begin{bmatrix} Z_s & Z_m & Z_m \\ Z_m & Z_s & Z_m \\ Z_m & Z_m & Z_s \end{bmatrix}$$

OR

**Q6) a)** Derive the equation for fault current in LLG fault. [9]

**b)** A 20-MVA, 6.6-kV, 3-Phase alternator is connected to a 3-Phase transmission line. The per unit positive, negative and zero-sequence impedances of the alternator are  $j0.1$ ,  $j0.05$  and  $j0.04$  respectively. The neutral of the alternator is connected to the ground through an inductive reactor of  $j0.05$  p.u. The per unit positive, negative and zero-sequence impedances of the transmission line are  $j0.2$ ,  $j0.2$  and  $j0.3$ , respectively. Per-unit values are based on the machine ratings. A solid ground fault occurs at one phase of the far end of the transmission line. Calculate the fault current. [9]

**Q7) a)** Compare HVDC and EHVAC transmission systems. [6]

**b)** Draw the complete single-line diagram of the HVDC system showing all components. [5]

**c)** Write a short note "Monopolar HVDC station". [5]

OR

**Q8) a)** Explain "Constant Extinction Angle control in HVDC systems" [6]

**b)** Write the functions of the following components in HVDC system: [5]

i) AC side filters.

ii) Converter transformer.

**c)** Write a short note "Chandrapur-Padghe HVDC line". [5]



Total No. of Questions : 8]

SEAT No. :

**P290**

[Total No. of Pages : 2

**[6003]-369**

**T.E. (Electrical)**

**COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES**

**(2019 Pattern) (Semester-II) (303149)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.

- Q1)** a) Explain the mechanical forces developed under short circuit condition in a transformer and the measures to overcome it. (Any two) [6]
- b) Explain the procedure for the calculation of no load current in the three phase transformer. [6]
- c) A 600 KVA, 6600/400 V, 50 Hz, three phase core type transformer has: Width of LV winding = 3CM, Width of HV winding = 3 cm, width of duct between LV and HV = 2 CM, height of HV and LV windings = 40 cm, length of mean turns = 1.5m, HV winding turns = 220,  $\mu_0 = 4\pi \times 10^{-7}$  H/m. Estimate the leakage reactance of the transformer referred to the HV side.[6]

OR

- Q2)** a) State the various assumptions made during the calculation of leakage flux and leakage reactance. [6]
- b) Draw the generalized flow chart of computer aided design of a transformer.[6]
- c) A single phase, 400V, 50 Hz transformer is built from stampings. The length of the flux path is 2.5 m. The net iron area is  $2.25 \times 10^{-3}$  m<sup>2</sup>. The number of primary turns are 800. The iron loss at the working flux density = 2.6 W/Kg, stacking factor = 0.9, weight of iron is  $7.8 \times 10^3$  Kg/m<sup>3</sup>. Total magnetizing mmf is 1989 A. Calculate the no load current of the transformer. [6]
- Q3)** a) Determine the main dimensions of a 250 H.P three phase, 50 Hz, 400 V, 1410 rpm, 4 pole, slip ring induction motor. Assume the following data: efficiency = 0.9, power factor = 0.9 specific magnetic loading = 0.5 wb/m<sup>2</sup>, specific electric loading = 30,000 A/M, Winding factor = 0.955, ratio of core length to core pole pitch = 1.2. The motor is delta connected. Assume the nearest synchronous speed as 1500 rpm. [10]
- b) Explain the types of AC windings. (any two) [7]

OR

**P.T.O.**

- Q4)** a) Derive the output equation of a three phase induction motor and also state the significance of the terms involved. [7]  
 b) Explain the specific electric loading and the various factors responsible for the choice of specific electric loading. [10]

- Q5)** a) Explain the design of rotor slots, rotor bars and end rings for a squirrel cage induction motor. [10]  
 b) For a three phase, 50Hz, 10 KW, 4 pole, 400v star connected induction motor consider the following details: diameter of stator= 15 cm, average flux density=0.45 wb/m<sup>2</sup>. Length of stator core=9 cm, power factor=0.86, number of stator slots=36, efficiency=84%, current density=5 A/ mm<sup>2</sup>, number of rotor slots=30, number of conductors/ slot for stator=12. Design the rotor bar section and end ring by calculating the rotor bar current, area of rotor bar, end ring current and area of end ring. Assume the rotor mmf as 85% of the stator mmf. [8]

OR

- Q6)** a) Derive the relation for the end ring current in terms of the bar current for a squirrel cage induction motor. [10]  
 b) Discuss the various factors which affect the choice of length of air gap for a three phase induction motor. Why generally the air gap should be as small as possible. [8]

- Q7)** a) Draw and explain the generalized flow chart for design of induction motor.[5]  
 b) A 75 KW, 3300 V, 50 Hz, 8 pole, three phase, and star connected induction motor has magnetizing current which is equal to 35% of full load current. Calculate the value of stator turns per phase if the mmf required for flux density at 60° from pole axis 500 A, winding factor= 0.95, efficiency=0.94, power factor=0.86 [7]  
 c) Explain the procedure to find out MMF required for air gap, stator teeth, and stator core, rotor teeth and rotor core of an induction motor. [5]

OR

- Q8)** a) With the help of neat sketches explain the different types of leakage fluxes in an induction motor. (any two) [5]  
 b) Explain the effects of ducts on calculations of magnetizing current. [5]  
 c) Estimate the magnetizing current of an 11 KV, 50 Hz, three phase, star connected, 12 pole induction motor. The stator diameter is 90 cm, length of stator bore is 25 cm, stator has 108 slots with 48 conductors per slot, average flux density is 0.6 wb/m<sup>2</sup>. Ampere turns for iron parts can be assumed to be 45% of that required for air gap, stator winding factor = 0.955, and gap contraction factor = 1.093 and length of air gap is 1 mm. [7]





Total No. of Questions : 8]

SEAT No. :

**P291**

**[6003] - 370**

**[Total No. of Pages : 3**

**T.E. (Electrical Engineering)**  
**CONTROL SYSTEM ENGINEERING**  
**(2019 Pattern) (Semester -II) (303150)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Use of Electronic Calculator is permitted.
- 3) Assume suitable data if necessary.

**Q1) a)** Explain two special cases of routh Hurwitz criterion to determine stability. **[8]**

b) The OLTF of a unity feedback system is given by **[9]**

$$G(s) = \frac{k}{(s+1)(s+3)(s^2+4s+13)}$$

By applying routh criterion determine stability of system. Find value of K which will cause sustained oscillations. Determine frequency of sustained oscillations.

OR

**Q2) a)** Explain any four rules for construction of root locus. **[8]**

b) Sketch the root locus, for unity feedback system determine range of values of K and comment on stability.  $G(s) = \frac{k(s+1)}{s^2(s+3.6)}$  **[9]**

**P.T.O.**

**Q3) a)** Explain different frequency domain specifications. [7]

b) Sketch polar plot for the system given. Also determine GM and PM

$$G(s) = \frac{60}{(s+1)(s+2)(s+5)} \quad [10]$$

OR

**Q4) a)** Explain co relation between frequency domain and time domain [7]

b) Sketch the nyquist plot, for given system and comment on stability

$$G(s) = \frac{20}{(s+2)(s+3)} \quad [10]$$

**Q5) a)** State advantages of Bode plot [6]

b) Draw bode plot for a unity feedback system with G(S) given as. Also find GM, PM and comment on stability of system. [12]

$$G(s) = \frac{160}{s(s+2)(s+20)}$$

OR

**Q6) a)** Explain terms gain cross over frequency, phase cross over frequency, gain margin and phase margin in Bode, plot. [6]

b) Draw bode plot for a unity feedback system with G(S) given as. Also

find GM, PM and comment on stability of system.  $G(s) = \frac{20(s+2)}{s(s+10)}$  • [12]

**Q7) a)** Derive transfer function of armature controlled DC servo motor. [9]

b) Obtain the tuning of PID controller for a unity feedback system with open loop transfer (9) functions as using ziegler Nichols method

$$G(S) = \frac{12}{s(s^2 + 4s + 13)} \quad [9]$$

OR

**Q8) a)** Explain Lag network and derive its transfer function. [9]

b) Explain P,PI, PID controller. [9]

\* \* \*

Total No. of Questions: 8]

SEAT No. :

**P292**

**[6003]-371**

[Total No. of Pages : 2

**T.E. (Electrial)**

**IOT & ITS APPLICATIONS IN ELECTRICAL ENGINEERING  
(2019 Pattern) (Semester-II) (Elective-II ) (303151 A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** 4 LEDs are connected to digital pin No. 2,3,4 and 5 of Arduino UNO. Write a program to glow all the 4 LEDs ONE by One with a delay of 1 sec, continuously. **[9]**

b) Explain with syntax and example, following functions from Arduino IDE. **[9]**

- i) Serial.begin()
- ii) pinMode()
- iii) Serial.println()
- iv) analogRead()

OR

**Q2) a)** List various types of operators used in Python programming and give few examples of each type operators. **[9]**

b) Write a program in Python to accept lower and upper limit of a range of numbers from user and print all the odd numbers in that range. **[9]**

**Q3) a)** Explain in detail LDR sensor. Also, with a neat diagram, show interfacing of LDR sensor with NodeMCU. **[9]**

b) Write a short note on Ultrasonic sensors. **[8]**

OR

*P.T.O.*

**Q4) a)** What is an IR sensor? Explain its working principle and various types. [9]

b) What is a voltage sensor? Explain with a neat diagram, interfacing of voltage sensor with NodeMCU. [8]

**Q5) a)** State and explain salient features of Zigbee communication technology. [9]

b) Write a short note on Z-Wave communication technology. [9]

OR

**Q6) a)** Describe salient features of Bluetooth communication technology. [9]

b) State and explain salient features of IEEE 802.11 standard for Wi-Fi technology. [9]

**Q7) a)** Write a short note on ThingsBoard cloud platform. [9]

b) What is meant by Data Visualization? Explain in short, any 4 techniques of data visualization. [8]

OR

**Q8) a)** With a suitable block diagram, explain simple IoT application of home Automation. [9]

b) State and explain the steps in reading the sensor data and send it to cloud platform. [8]



Total No. of Questions: 8]

SEAT No. :

**P293**

**[6003]-372**

[Total No. of Pages : 2

**T.E. (Electrical)**

**ELECTRICAL MOBILITY**

**(2019 Pattern) (Semester-II) (Elective - II) (303151B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** Explain importance and functions of BMS in Electric Vehicles. **[8]**

b) What is SoC? Explain Coulomb Counting method used in SoC estimation. **[9]**

OR

**Q2) a)** Explain Thermal management system used in EVs. **[8]**

b) Explain importance of cell balancing and write any two cell balancing methods. **[9]**

**Q3) a)** Draw schematic diagram of parallel HEV drive train. Explain its working and mention it's merits. **[10]**

b) What is regenerative braking? Explain its scope with suitable example. **[8]**

OR

**Q4) a)** Draw schematic diagram of series HEV drive train. Explain its working and mention it's merits. **[10]**

b) What is the need of Control System in HEV? State functions of Control System. **[8]**

**P.T.O.**

- Q5)** a) What is CHAdeMO Standard? Write merits and Demerits as compared to SAE J1772. [8]
- b) Draw and explain BLDC drive. What are the advantages of BLDC drive? [9]

OR

- Q6)** a) Write various types of Chargers? Give specifications of Level 1 and Level 2 chargers. [8]
- b) Explain Electric Vehicle Supply Equipment with suitable example. Describe Level 1 Level 2 EVSE equipment. [9]
- Q7)** a) Draw and explain block diagram of interactive operation between EVs and Power grid. [10]
- b) Describe Vehicle to Home (V2H) infrastructure. Explain Case Study of V2H. [8]

OR

- Q8)** a) What is Vehicle to Vehicle? Draw V2V structure and explain its working. [10]
- b) Describe Vehicle to Grid (V2G) infrastructure. What is the role of aggregator for V2G? [8]



Total No. of Questions: 8]

SEAT No. :

**P294**

**[6003]-373**

[Total No. of Pages : 2

**T.E. (Electrical)**

**CYBERNETIC ENGINEERING**

**(2019 Pattern) (Semester-II) (Elective - II) (303151 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer any one questions from each pair of questions: Q.1 & Q.2, Q.3 & Q.4, Q.5 Q.6 Q.7 & Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) Explain the terms transfer function, poles, zero, and pole-zero plot. [6]  
b) Compare optimal control and adaptive control. [6]  
c) What do you mean by a multivariable control system? Give example.[6]

OR

- Q2)** a) Draw the block diagram of the adaptive control system and explain it. [6]  
b) List out differentiating points for linear and nonlinear control system. [6]  
c) What are the different types of nonlinearities in the nonlinear system? Explain them. [6]

- Q3)** a) Describe the components of the electrical system used in mathematical modeling. [6]  
b) Describe how the linearization of the nonlinear system is carried out. [6]  
c) What is the significance of the differential equations of the physical system? [5]

OR

- Q4)** a) Explain the use of software tools in mathematical modeling. [6]  
b) Explain the use of an ODE Solve for getting the solution of an ordinary differential equation. [6]  
c) Obtain the representation of separately excited DC motor using linear ordinary differential equations. [5]

**P.T.O.**



- Q5)** a) Sketch computer architecture and explain it. [8]  
b) What are various analog and digital interfaces? [10]

OR

- Q6)** a) What are the different system components needed for embedded and industrial applications? Explain them. [8]  
b) How data communication is carried out in industrial environment? [10]

- Q7)** a) Define optimization. List out at least five applications of optimization. [7]  
b) Explain the particle swarm optimization method using the example. [10]

OR

- Q8)** a) Write a statement about an optimization problem. [7]  
b) Describe the Genetic Algorithm using examples. [10]



Total No. of Questions: 8]

SEAT No. :

**P295**

**[6003]-374**

[Total No. of Pages : 3

**T.E. (Electrical)**

**ENERGY MANAGEMENT**

**(2019 Pattern) (Semester-II) (303151D) (Elective-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Black figures to the right indicate full marks.*
- 3) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** Discuss implementation of demand side management with suitable flow-graph for industrial consumers. What will be the benefits of it for the society? **[9]**

b) Explain demand management tools suitable to commercial and agricultural consumers. Give appropriate examples. **[9]**

OR

**Q2) a)** Discuss the constraints on Demand Side management. **[9]**

b) What is Supply Side Management? Discuss various alternatives available under supply side management. **[9]**

**Q3) a)** What is preliminary audit? What information is obtained from this audit? Compare preliminary audit with detailed audit. **[9]**

b) In an industry monthly production related energy consumption was 2.34 times the production and non-production related energy consumption was 15500 kWh per month. In the month of June a series of energy conservation measures were implemented. Use CUMSUM technique to develop a table and calculate energy savings for the subsequent 6 months period from the data given below. Also plot CuSum graph. **[8]**

**P.T.O.**

Month	Production (kg)	Actual Energy Consumption (kWh)
Sept	65000	137000
Oct	71000	145000
Nov	78000	150000
Dec	80000	153000
Jan	62000	130000
Feb	73000	142000

OR

- Q4)** a) In context to data analysis explain clustering techniques and pattern mining suitable for energy audit purpose. [9]
- b) Discuss least square method for data analysis. Also explain standard format for energy audit report. [8]

- Q5)** a) The energy manager of company wants to replace 100 HP induction motor with energy efficient motor for energy saving. On the basis on following data calculate payback period for replacement of old motor with energy efficient motor. Take cost of electricity is Rs 7/k Wh. The demad charges Rs. 480/kVA per month. [9]

Description	Old motor	Energy efficiency Motors
Rating of machine	100 HP	100 HP
Loading percentage	80%	80%
Operating hours per annum	6500	6500
Efficiency near full load	89%	93%
Power factor near full load	0.85 lag	0.89 lag
Capital cost	—	Rs. 4,75,000/-
Scrap value	Rs. 50,000/-	—

- b) Discuss energy audit case study for paper and pulp industry. [9]

OR

- Q6)** a) Calculate net present value for an investment of Rs. 5,00,000 for retrofit. The energy savings realised for five years are Rs. 1,20,000, Rs 85,000, Rs. 1,45,000 Rs. 2,00,000 and Rs. 2,50,000/- with discounting factor is 12%. Judge the economic feasibility of the project. [9]
- b) Explain with suitable example break even analysis. How it is different from others? [9]
- Q7)** a) Explain criteria of selection of motors for different applications keeping in mind efficient operation. Also explain ways to increase efficiency during starting of motors. [8]
- b) Energy saving opportunities in boiler and auxiliaries. [9]

OR

- Q8)** a) How fans, blowers and compressors are classified? Enlist energy conservation measures in fans. [8]
- b) Explain different cogeneration Systems? State the advantages of cogeneration systems. [9]



Total No. of Questions : 8]

SEAT No. :

P-296

[Total No. of Pages : 2

[6003]-375

T.E. (Electronics)

**POWER AND INDUSTRIAL ELECTRONICS**

**(2019 Pattern) (Semester - I) (304201)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) Differentiate between SCR based conventional rectifiers and IGBT based rectifiers. [8]
- b) Elaborate Single phase Semi converter for R load with suitable waveforms. [9]

OR

- Q2)** a) Explain Three phase Full converter for R load with suitable waveforms. [8]
- b) What are different Power factor improvement techniques for Controlled Rectifiers? Discuss in details. [9]
- Q3)** a) What is Chopper? Illustrate Step up chopper for R load in details. [9]
- b) Explain different voltage Control strategies used in Chopper with suitable waveforms. [9]

OR

- Q4)** a) Elaborate Single phase AC Voltage Controller for R load. [9]
- b) A d.c. chopper circuit connected to a 100V d.c. source supplies an inductive load having 40mH in series with a resistance of 5 ohm. A freewheeling diode is connected across the load. The load current varies between the limits of 10A and 12A. Determine the time ratio of chopper. [9]

**P.T.O.**

- Q5)** a) Explain performance parameters for Inverters. [8]  
b) Elaborate Voltage control of single phase inverters. [9]

OR

- Q6)** a) Elaborate three phase voltage source inverter 180 degree mode for balanced star R load. [8]  
b) Give an overview of applications of three phase PWM inverters for three phase variable frequency drives (VFDs). [9]

- Q7)** a) Write a short note on Electric Vehicles & Traction applications. [9]  
b) Illustrate Battery Charging Application. [9]

OR

- Q8)** a) Write a short note on HVDC transmission system. [9]  
b) Explain UPS: ON-line and OFF line. [9]



[6003]-376

T.E. (Electronics)

**ELECTROMAGNETIC WAVES AND PROPAGATION THEORY****(2019 Pattern) (Semester-I) (304202)**

Time : 2½ Hours]

[Max. Marks : 70]

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** State Maxwell's equations in point form for time varying field. **[4]**

b) Do the fields  $\vec{E} = E_m \sin x \sin t \hat{a}_y$  and  $\vec{H} = \frac{E_m}{\mu_0} \cos x \cos t \hat{a}_z$  satisfy

Maxwell equations? **[6]**

c) Define displacement current and displacement current density. Prove that  $\nabla \times \vec{H} = \vec{J}_C + \vec{J}_D$  where  $\vec{J}_C$  is conduction current density and  $\vec{J}_D$  is displacement current density. **[8]**

OR

**Q2) a)** State Maxwell's equations in integral form for static field. **[6]**

b) Compare Maxwell's equations for static and time varying fields in point and integral form. **[4]**

c) In a medium,  $\mu = 10^{-5} \text{ H/m}$ ,  $\epsilon = 4 \times 10^{-9} \text{ F/m}$ ,  $\sigma = 0$ . Find K so that each of the following pairs of field satisfies Maxwell's equations. **[8]**

$$\vec{E} = 6\hat{a}_x - 2y\hat{a}_y + 2z\hat{a}_z \text{ nC/m}^2$$

$$\vec{H} = Kx\hat{a}_x - 10y\hat{a}_y - 25z\hat{a}_z \text{ A/m}$$

**Q3) a)** Derive equations of Uniform Plane Wave for free space. **[6]**

b) State and explain Poynting Theorem. Write expression for the Poynting Vector. **[4]**

c) An electric Field in free space is given by  $\vec{E} = 800 \cos(10^8 t - \beta y) \hat{a}_z \text{ V/m}$ .

Find the direction of propagation,  $\beta, \lambda, \vec{H}$  at P (0.1, 1.5, 0.4). **[8]**

OR

**P.T.O.**

- Q4)** a) Derive Wave equations for lossless dielectric medium. [8]
- b) In homogeneous region where  $\epsilon_r = 50$  and  $\mu_r = 1$ , the fields are given as  

$$\vec{E} = 20\pi e^{j(\omega t - \beta z)} \hat{a}_x \text{ V/M and}$$

$$\vec{B} = \mu_0 H_m e^{j(\omega t - \beta z)} \hat{a}_y \text{ T}$$
Find  $\omega$  and  $H_m$  if the wavelength is 1.75m. [8]
- c) Find the velocity of a plane wave in a lossless medium having  $\epsilon_r = 5$  and  $\mu_r = 1$ . [2]
- Q5)** a) Draw equivalent ckt of transmission line and find the expression for characteristic impedance  $Z_0$  of transmission line. [6]
- b) Short ckt and open ckt measurements at a frequency of 5KHz on a line of length 10 Km yield the following results:  $Z_{sc} = 720 \angle 34^\circ \text{ ohm}$  and  $Z_{oc} = 570 \angle -48^\circ \text{ ohm}$ . Find  $Z_0$  and propagation constant of line. [8]
- c) State and explain the primary constants of transmission line. [4]
- OR
- Q6)** a) Explain the term: characteristic impedance. [4]
- b) Derive equation of characteristic impedance for lossless transmission line and distortionless transmission line. [6]
- c) The primary constants of a line working at 1MHz are  $R=83.4 \text{ ohm/Km}$ ,  $L=2.29 \times 10^{-3} \text{ H/Km}$ ,  $C=4.85 \times 10^{-2} \text{ }\mu\text{F/Km}$ ,  $G=0$ . calculate  $Z_0$ ,  $\beta$ ,  $\lambda$  and  $v$ . [8]
- Q7)** a) Compare TE and TM mode in wave guide. [4]
- b) What is waveguide? Explain types, advantages and disadvantages of waveguide. [8]
- c) What is cavity resonator? Explain Reactive cavity resonator in detail. [4]
- OR
- Q8)** a) A rectangular waveguide with dimension  $a=2.5\text{cm}$  and  $b=1\text{cm}$ . how many TE and TM modes the waveguide transmit if the waveguide is filled with medium characterized by  $\sigma = 0$ ,  $\mu = 1$ ,  $\epsilon = 4\epsilon_0$ ? Calculate the cut off frequencies of the modes. Consider frequencies lower than 15.1 GHz. [10]
- b) Compare Transmission lines and waveguides. [6]





Total No. of Questions : 8]

SEAT No. :

**P298**

**[6003]-377**

[Total No. of Pages : 2

**T.E. (Electronics/E&T.C.)**  
**DATABASE MANAGEMENT**  
**(2019 Pattern) (Semester - I) (304183)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 from following questions.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain with example: Aggregate functions, Builtin functions. [6]  
b) Describe role of Primary key, Foreign key, Uruque key. [6]  
c) Explain any two transaction control commands. [6]

OR

- Q2)** a) Explain with example, sub-queries and correlated subqueries. [6]  
b) Explain use of group by, having, order by, join and its types. [6]  
c) How stored procedures, stored functions, database triggers work in SQL, explain with example. [6]

- Q3)** a) What is database transaction management? List properties of transaction. [5]  
b) In database transaction management. What is the role of schedule? Explain serial schedule in details. [6]  
c) In serializability, explain conflict and view with example. [6]

OR

- Q4)** a) Explain with example, recoverable and non recoverable schedules. [6]  
b) What is need of concurrency control in database management? Explain locking methods and deadlock handling. [6]  
c) Explain need and role of Time-Stamp based protocols in database management control. [5]

**P.T.O.**

- Q5)** a) Explain in detail an architecture of a parallel database. [5]  
b) Explain multiuser DBMS architecture. [6]  
c) With schematic diagram, explain the architecture of Oracle Database. [6]

OR

- Q6)** a) What are performance parameters in parallel database. [5]  
b) Explain in detail, types of architectures of parallel databases. [6]  
c) Explain virtualization in multicore processor. [6]

- Q7)** a) What is necessity of distributed database management system? What are advantages of distributed database. [6]  
b) What are types of distributed database? Explain with schematic diagram, architecture of distributed databases. [6]  
c) With suitable example, explain design of distributed database. [6]

OR

- Q8)** a) Explain how data is stored in distributed database. [6]  
b) What is distributed transaction? Explain failure modes of distributed transaction. [6]  
c) Explain in short: Commit protocols and concurrency control in distributed database. [6]



Total No. of Questions : 8]

SEAT No. :

P-299

[Total No. of Pages : 3

**[6003]-378**

**T.E. (Electronics Engineering)**

**MICROCONTROLLERS AND APPLICATIONS**

**(2019 Pattern) (Semester - I) (304204)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

**Q1)** a) A switch is connected to pin P2.7 of 8051 microcontroller. Draw interfacing diagram and write an Embedded C program to monitor the status of SW and perform the following: **[6]**

- i) If SW = 0, the stepper motor moves clockwise.
- ii) If SW = 1, the stepper motor moves counterclockwise.

b) What are advantages of opto-isolators. Draw interfacing diagram of opto-isolator with 8051 microcontroller. **[6]**

c) Draw interfacing diagram and write a C program for the 8051 microcontroller to transfer the letter "A" serially at 4800 baud continuously. Use 8 bit data and 1 stop bit. **[8]**

OR

**Q2)** a) Interface buzzer with 8051 microcontroller. Write an Embedded C program to turn buzzer ON and OFF. **[6]**

b) Draw interfacing diagram of DAC to 8051 microcontroller and write an Embedded C program to generate sine wave form. **[6]**

c) Draw interfacing diagram of Temperature sensor (LM35) with 8051 microcontroller using ADC 0808/0809. Write an Embedded C program for the same. **[8]**

*P.T.O.*

- Q3)** a) List the features of PIC18Fxx microcontroller. Also elaborate the steps for selection of PIC microcontroller depending on application. [8]
- b) Draw and explain the block diagram of Timer 1 of PIC 18Fxx microcontroller in 16 bit mode. [8]

OR

- Q4)** a) With neat diagram explain ROM memory organization of PIC18Fxx microcontroller. [8]
- b) Explain the following terms in PIC18Fxx microcontrollers: [8]
- i) Power down modes
  - ii) BOD

- Q5)** a) Draw the neat block diagram of port structure of PIC18Fxx and explain it in detail. [8]
- b) Write the steps to program the PWM feature of CCP module of PIC18Fxx. Also find the PR2 value for the following PWM frequencies. [8]
- Assume XTAL = 10 MHz. and prescaler = 1.
- i) 10KHz
  - ii) 25KHz

OR

- Q6)** a) Explain the compare mode of CCP module with neat diagram for PIC 18Fxx microcontroller. Also write the algorithm for the same. [8]
- b) Interface internal ADC of PIC18Fxx microcontroller and write an Embedded C program to convert analog to digital signal. [8]
- Q7)** a) Draw the neat block diagram of DAS using 8051 microcontroller and explain it in detail. [6]

- b) Draw the home protection system using PIC18Fxx microcontroller. Also write an Embedded C program for same. [6]
- c) What is need of Digital Multimeter. Draw the block diagram of Digital Multimeter using 8051 microcontroller. [6]

OR

- Q8)**
- a) Design water level monitoring and control system using PIC18Fxx microcontroller and write the algorithm for the same. [6]
  - b) Design frequency counter using 8051 microcontroller and display the result on LCD. [6]
  - c) Design environment Monitoring System using PIC 18Fxx microcontroller. [6]



Total No. of Questions : 8]

SEAT No. :

**P300**

**[6003] - 379**

**[Total No. of Pages : 2**

**T.E. (Electronics Engineering)  
INSTRUMENTATION SYSTEMS**

**(2019 Pattern) (Semester - I) (Elective-I) (304205)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) Explain static, stagnation and dynamic pressure in static tube. [6]  
b) With the help of neat diagram explain working of pitot tube flow meter.[6]  
c) With the help of neat diagram explain working of variable area meter/ Rotameter. State its advantages and disadvantages. [8]

**OR**

- Q2)** a) With the help of neat diagram explain working of transit time ultrasonic flow meters. [6]  
b) With the help of neat diagram explain capacitance level sensor for conductive liquid. [6]  
c) With the help of neat diagram explain Radiation type level detection and Hydrostatic pressure type level sensor. [8]

- Q3)** a) With the help of neat diagram explain linear absolute optical encoder. Compare absolute optical encoder and incremental optical encoder. [8]  
b) Explain structure of CMOS image sensor cell. Compare CCD and CMOS sensor. [8]

**OR**

- Q4)** a) Draw construction diagram and explain working of photo transistor. Compare photo diode and photo transistor. [8]  
b) Explain linear and rotary resistive displacement transducer and capacitive displacement transducer. [8]

**P.T.O.**

- Q5)** a) With the help of neat construction diagram explain Hall Effect magnetic field sensors and PZT sensors and actuators. [8]
- b) With the help of neat block diagram explain Smart sensor. State its advantages. [8]

OR

- Q6)** a) With the help of neat construction diagram explain Magneto - Resistive Elements (MRE) and Magneto transistors. [8]
- b) Explain surface micromachining process with the help of neat diagram.[8]
- Q7)** a) What is actuator? Explain structure of actuator. Compare sensors and actuators. [6]
- b) With the help of neat diagram explain Pressure control valve. [6]
- c) Draw relay driver circuit using transistor and explain design of relay driver circuit using transistor. [6]

OR

- Q8)** a) Draw and explain valve Actuation Symbol. [6]
- b) With the help of neat diagram explain the operation of solenoid actuators. [6]
- c) With the help of neat diagram explain double acting cylinder. [6]



Total No. of Questions : 8]

SEAT No. :

**P301**

[Total No. of Pages : 2

**[6003] - 380**

**T.E. (Electronics)**

**MACHINE LEARNING**

**(2019 Pattern) (Semester - I) (Elective-I) (304205)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** What is Hidden Markov Model? List the steps required for simplified matrix algorithm. **[8]**

b) What is knowledge Engineering in First Order Logic? Which are the steps required in knowledge Engineering projects? **[9]**

OR

**Q2) a)** What is first order logic in artificial intelligence? Which are the parts of first-order logic? With the help of suitable example draw the model for first-order-logic. **[8]**

b) Explain the following terms. **[9]**

i) Forward Chaining.

ii) Backward Chaining.

**Q3) a)** What is probabilistic language processing? Which are the Probabilistic Language Models? **[9]**

b) Define the term Parsing. Show syntactic parsing using Bottom Up parsing. Compare Top-Down and Bottom-Up Parsing. **[9]**

OR

**P.T.O.**



- Q4)** a) Which parsing approach/procedure is used in Augmented Transition Networks? How Augmented Transition Networks can be used in Natural Language understanding? [9]
- b) What is Natural Language Processing? Which Components play the role to implement Natural Language Understanding? [9]

- Q5)** a) How different nodes of decision trees are represented? Explain the structure of a decision tree. [9]
- b) What is Reinforcement learning? Distinguish between passive and active reinforcement learning. [8]

OR

- Q6)** a) Which are different learning paradigms? In short explain supervised learning. [9]
- b) Explain generalizations in reinforcement learning. [8]

- Q7)** a) What do you mean by membership function? Explain the features of the membership function. [9]
- b) Explain in short Fuzzy' logic based induction motor speed control with neat diagram. [9]

OR

- Q8)** a) Discuss - any four properties and operations of fuzzy sets. [9]
- b) Explain in short neural network based PWM controller with neat diagram. [9]



Total No. of Questions : 8]

SEAT No. :

**P302**

**[6003] - 381**

**[Total No. of Pages : 2**

**T.E. (Electronics/E&TC )**

**FUNDAMENTALS OF JAVA PROGRAMMING**

**(2019 Pattern) (Semester - 1) (Elective - I) (304185 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** What is method overriding? Explain the rules to be followed while method overriding. **[9]**

b) Explain the concept of an array. How to declare an array in Java? Compare arrays in C and Java. **[9]**

**OR**

**Q2) a)** What is the meaning of inheritance in Java? Explain each type of inheritance with the help of suitable example and diagram. **[9]**

b) Write a Java program to implement multilevel inheritance with three levels of hierarchy. **[9]**

**Q3) a)** What is a Package in Java? With suitable example, explain various ways to access a package from another package. **[9]**

b) What is meant by an interface? What is the need of an interface in Java? Write syntax and features of an interface. **[8]**

**OR**

**Q4) a)** Explain various forms of implementing an interface in Java. How multiple inheritance is supported in Java? **[9]**

b) What are the advantages of packages in Java? List and explain various Java API packages. **[8]**

**P.T.O.**

P.T.O.

- Q5)** a) What are the types of errors that occur in a Java program? Write a Java program to handle arithmetic exception. [9]
- b) Explain life-cycle of a thread. What are the ways to create a thread in a Java program? [9]

OR

- Q6)** a) What are applets and applications in Java programming? Write a simple Java program for an applet. [9]
- b) With reference to exception handling, explain the terms try, catch and throw. [9]
- Q7)** a) What are stream classes in Java? List and explain the methods of Byte Array Output Stream class. [9]
- b) Write a Java program using Swing to create and display JTextArea on a JFrame. [8]

OR

- Q8)** a) What is AWT in Java? Explain the limitations of AWT. How events are handled in AWT components. [9]
- b) Explain the methods of file input stream and file output stream classes in Java. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P303**

**[6003]-382**

**T.E. (Electronics)**

**DATA COMMUNICATION**

**(2019 Pattern) (Semester-I) (Elective-I)(304205-D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data if necessary.

**Q1) a)** Consider the generator polynomial for a (7,3) cyclic code defined by  $g(P)=P^4+P^3+P^2+1$  [8]

- i) Find the encoding table for the cyclic code.
- ii) What is the minimum distance  $d_{\min}$  of the code.

**b)** Consider a (6,3) linear block code defined by the generator matrix. [10]

$$\begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{pmatrix}$$

- i) Find parity check matrix in systematic form.
- ii) Find the encoding table for the linear block code.

OR

**Q2) a)** Write a note on [8]

- i) Go back N.
- ii) Selective repeat.

**b)** Convolutional encoder with constraint length=3,  $k=1$ ,  $n=3$ ,  $[g1]=[100]$ ,  $[g2]=[101]$ ,  $[g3]=[111]$  [10]

- i) Draw the encoder diagram.
- ii) Determine encoder output for input vector (111) and (1011)

*P.T.O.*

- Q3)** a) Apply Huffman coding coding to find entropy and Information rate at the rate of 9.6 symbols/Sec for the following symbols. [9]  
S1=0.3, S2=0.1, S3=0.02, S4=0.15, S5=0.4, S6=0.03
- b) Explain the concept of channel capacity and discuss on Bandwidth-SNR trade off. [8]

OR

- Q4)** a) Apply Shannon Fano procedure to find coding to find entropy and information rate at the rate of 9.6 Symbols/Sec for the following symbols. [9]  
S1=0.3 S2=0.1, S3=0.02, S4=0.15, S5=0.4, S6=0.03
- b) Prove that
- i)  $H(x,y) = H(x/y) + H(y)$
- ii)  $H(x,y) = H(y/x) + H(x)$  [8]

- Q5)** a) Explain the generation and reception of BFSK with the help of neat block diagram and draw the spectrum. [9]
- b) Explain MPSK modulation and demodulation in details. [8]

OR

- Q6)** a) Explain principle and block diagram of OFDM. [9]
- b) Explain the generation and reception of BPSK with the help of neat block diagram and write its equation. [8]

- Q7)** a) Explain FDMA and TDMA with neat diagram and spectrum. [9]
- b) Explain Orthogonal codes with an suitable example and list out the with properties of orthogonal codes. [9]

OR

- Q8)** a) Explain the operation of DS-SS transmitter and receiver with the help of block diagram. [9]
- b) Write short note on pure ALOHA and slotted ALOHA. [9]



Total No. of Questions : 8]

SEAT No. :

**P304**

[Total No. of Pages : 2

**[6003] - 383**

**T.E. (Electronics Engg.)**

**COMPUTER NETWORKS**

**(2019 Pattern) (Semester - I ) (Elective - I) (304205 )**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer any one question out of Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Express your views on flow control and error control function of Data Link Layer. [8]

b) Define random access and list three protocols in this category. [9]

OR

**Q2)** a) What is the function of following connecting devices used in computer networks. [8]

i) Active and Passive Hub.

ii) Two layer switch.

iii) Router.

iv) Gateway.

b) What is drawback of Go-Back-N ARQ Protocol? How is it overcome using Selective-Repeat ARQ. [9]

**Q3)** a) Explain in detail IPV4 frame format. [8]

b) List the functions of Transport layer. [2]

c) With neat diagram describe in brief Transport layer-Process to process delivery using port address. [8]

OR

**Q4)** Write short note on (6 each). [18]

a) RARP.

b) IGMP.

c) IPV6 address format.

**P.T.O.**

- Q5)** a) What is use of FTP? How it is executed. [8]  
b) How HTTP is related to WWW. Explain HTTP & WWW protocol in brief. [9]

OR

- Q6)** a) What is use of Ping and Trace Route protocol? [8]  
b) What are the main protocols used for electronic mail application. [9]
- Q7)** a) What is use of cable tester and network tester? How it is done. What is use of network monitoring? What information one can get during network monitoring. [9]  
b) Explain in brief NS2 network simulator. [9]

OR

- Q8)** a) What is use need of protocol analyzer? What are the different applications of protocol analyzer? Which information you get from protocol analyzer. Explain in detail. [9]  
b) How internet access can be done through dialup connection, DSL, Leased line and mobile handset. [9]



Total No. of Questions : 8]

SEAT No. :

**P305**

[Total No. of Pages : 2

[6003]-384

**T.E. (Electronics)**

**FUNDAMENTALS OF HDL**

**(2019 Pattern) (Semester-II) (304212)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams should be drawn whenever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** Explain with diagram SRAM Programming and Antifuse programming technology. [10]

b) Explain architecture of FPGA with neat diagram. [8]

OR

**Q2) a)** With neat Schematic explain the architectural building block of FPGA. Explain the selection Criteria of CPLD in the System? [8]

b) Sketch the neat diagram and explain the architectural building blocks of CPLD. Compare CPLD & FPGA. [10]

**Q3) a)** Illustrate the HDL Description of an N-Bit Ripple carry Adder using procedure and Task. [8]

b) Explain procedure syntax with example. Compare between procedure and task? [10]

OR

**Q4) a)** Illustrate the HDL description of a Full adder using procedure and task. [10]

b) Explain Task Syntax with example. [8]

**Q5) a)** Compose Verilog code for the following. [10]

- i) Full Adder
- ii) 3:8 Decoder

b) Explain Verilog repeat and forever statement with an example. [8]

OR

**P.T.O.**



- Q6)** a) Compose verilog code for the following: [10]
- i) 2 bit magnitude comparator
  - ii) 4 bit ALU
- b) Explain different verilog operators detail. Explain the following data types in verilog: [8]
- i) Net
  - ii) Parameters
- Q7)** a) Explain the System Tasks and CompilerDirectives in detail. [8]
- b) Describe the structure of the verilog module. Find the value of following expressions IF the two unsigned variables, A=4'B1001 and B=4'1101.[8]
- i) A|B
  - ii) A & B
  - iii) A^B
  - iv) {A,B}

OR

- Q8)** a) Explain the major capabilities of Verilog HDL? Explain the different levels abstraction in Verilog HDL. [8]
- b) Compare between task and function? Describe the following: [8]
- i) Data types
  - ii) Variables & constants declaration.



Total No. of Questions : 8]

SEAT No. :

**P306**

[Total No. of Pages : 2

**[6003]-385**

**T.E. (Electronics Engineering)**

**EMBEDDED PROCESSORS AND APPLICATIONS**

**(2019 Pattern) (Semester-II) (304213)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Assume Suitable data, if necessary.

- Q1)** a) Interface LED's to P1.0 to P1.7 port pins of LPC2148. Write an embedded C program to blink LED's along with flowchart. [6]
- b) What is PLL? Explain the steps in PLL programming in LPC 2148. [6]
- c) Explain the functions of PLL registers of LPC 2148 [8]
- i) PLLCON
  - ii) PLLCFG
  - iii) PLLSTA
  - iv) PLLFEED

OR

- Q2)** a) Interface buzzer using relay with LPC 2148. Write an embedded C program to turn ON and OFF the buzzer with suitable delay. [6]
- b) Explain the functions of control signals of LCD display. [6]
- c) Explain the functions of Match register, Compare Register, Capture register and Timer Match Control Register in timer of LPC 2148. [8]
- Q3)** a) List features of UART 1 of LPC2148 processor. Give the difference between UART 0 and UART 1. Explain Transmit Holding Register and Receiver Buffer Register. [8]
- b) List the features of on chip ADC in ARM7 LPC2148. With the help of format explain the functions of ADC Control Register and ADC Data Registers of on chip ADC of ARM7 LPC2148. [8]

OR

**P.T.O.**

- Q4) a)** Interface GSM module with LPC2148. Explain any four AT commands. Write an algorithm and draw flow chart for sending the message through GSM module. [8]
- b)** Explain DAC Register of on chip DAC of LPC 2148. Write an Embedded C program to generate Saw tooth/Ramp waveform generation using on chip DAC. Also Write algorithm and draw flowchart. [8]

- Q5) a)** Explain the following w.r.t Cortex M3 [8]
- i) Registers in Cortex-M3 processor
  - ii) Non-Vectored Interrupt Controller
  - iii) Tail-Chaining in NVIC
  - iv) Bus Interface and Debugging Support
- b)** What is CMSIS standard? Draw and explain the structure of CMSIS standard. [8]

OR

- Q6) a)** Explain evolution of ARM processor architecture. Explain the advanced 3 stage pipeline and Operating Modes of the Cortex-M3 processor with suitable diagram. [8]
- b)** What is ARM Cortex series? Explain how ARM cortex series is suitable for embedded system design. Write the applications of ARM cortex series? [8]

- Q7) a)** Draw architecture of Embedded System. State the characteristics of Embedded system. [6]
- b)** Explain case study of Smart Parking system using IoT with detailed diagram. [6]
- c)** Explain Sensors and Actuators with suitable examples. Give difference between Sensors and Actuators. [6]

OR

- Q8) a)** Draw architecture of Internet of Things. Explain functions of different layer. [6]
- b)** Explain case study of agriculture automation system using Internet of Things with detailed diagram. [6]
- c)** Define Internet of Things. What is the importance of Internet of Things? Explain benefits of Internet of Things technology. [6]



Total No. of Questions : 8]

SEAT No. :

**P307**

[Total No. of Pages : 2

**[6003]-386**

**T.E. (Electronics)**

**INDUSTRIAL MANAGEMENT**

**(2019 Pattern) (Semester - II) (304214)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3, or Q.4, Q.5 or Q.6 Q.7, or Q.8.*
- 2) *Figures to the right side indicate full marks.*

**Q1) a)** Elaborate Six sigma Quality Management Standards. **[8]**

b) Illustrate types of quality - quality of design, conformance and performance, phases of quality management. **[9]**

OR

**Q2) a)** Discuss in details - The ISO - Quality Management System Standard. **[8]**

b) Write a short note on Quality Management Assistance Tools. **[9]**

**Q3) a)** What do you mean by Changing Concepts and Objectives of Business? **[9]**

b) Elaborate Social Audit in details. **[9]**

OR

**Q4) a)** Illustrate Social Responsibility of Business in details. **[9]**

b) Explain Business ethics with suitable examples. **[9]**

**Q5) a)** Differentiate between Sole Proprietorship and Partnership firms in details. **[8]**

b) Illustrate Joint stock companies - their features, relative merits, demerits & suitability. **[9]**

OR

**Q6) a)** Differentiate between Private sector and Cooperative sector in details. **[8]**

b) Write a short note on Services sector. **[9]**

**P.T.O.**

- Q7)** a) Explain Concept of entrepreneurship, Identification of business opportunities in details. [9]
- b) Illustrate Preparation of business proposal with suitable example. [9]

OR

- Q8)** a) Explain Business plan in details. [9]
- b) What are Government policies and incentives for a Business? [9]



Total No. of Questions : 8]

SEAT No. :

**P308**

[Total No. of Pages : 2

**[6003]-387**

**T.E. (Electronics)**

**PLC & AUTOMATION**

**(2019 Pattern) (Semester - II) (Elective - II) (304215A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

- Q1)** a) Compare Digital Gate logic vs Relay logic. [6]  
b) Compare PLC vs Computer on basis of their advantages and disadvantages. [6]  
c) Describe PLC I/O modules and memory organization in details. [6]

OR

- Q2)** a) List timer and counters used in PLC programming? Draw a ladder diagram using timer function for a two motor system having a following conditions. [6]  
i) The start switch starts motor 1, and after 10 seconds motor 2 starts.  
ii) The stop switch stops motor 1 and after 15 seconds motor 2 will stops.  
b) Develop a ladder diagram to fulfil the following conditions, [6]  
i) When the start switch is ON the motor is ON.  
ii) When the stop switch is ON the motor is OFF.  
iii) When the motor is ON the green light is ON.  
iv) When the motor is OFF the red light is ON.  
c) Design ladder logic for a system using comparisons instructions, Motor 1 starts as soon as the PLC starts as soon as PLC starts. After 10 seconds, Motor 1 goes OFF and Motor 2 starts. After 5 seconds Motor 2 goes OFF and Motor 3 Starts. After another 10 seconds Motor 2 restarts and after 5 seconds it stops and Motor 1 starts and cycle is repeated? [6]

- Q3)** a) List the parameters need to be check while PLC installation? How will you protect PLC from Electrical noise and Voltage variation & Surge?[9]  
b) Which are the preventive maintenance tasks should be carried for PLC systems? [8]

OR

*P.T.O.*

**Q4)** a) Extend your view on Troubleshooting of a PLC system for following sections, [9]

- i) Processor module,
- ii) Input & Output malfunctions

b) What do you mean by Program Editing & Commissioning of PLC? List general steps followed when commissioning a PLC system? [8]

**Q5)** a) Explain with block diagram SCADA system. [9]

b) What is RTU & MTU? Explain its functions with diagram. [9]

OR

**Q6)** a) What is HMI? Explain Interfacing technique of PLC with HMI. [9]

b) Illustrate MTU Operating interfaces & applications? [9]

**Q7)** a) List the Types of communication interface? Explain Serial communication with its advantages? [9]

b) Explain working of Modbus and Fieldbus with diagram? [8]

OR

**Q8)** a) What is CAN? Explain working principle of it in detail? [9]

b) Which types of networking channels used in PLC? Discuss any one in brief? [8]



Total No. of Questions : 8]

SEAT No. :

**P309**

[Total No. of Pages : 2

**[6003]-388**

**T.E. (Electronics/E & TC)**

**ADVANCED JAVA PROGRAMMING**

**(2019 Pattern) (Semester - II) (Elective - II) (304195 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume the suitable data, if necessary.

- Q1)** a) What is Container Class in Java? Explain types of Java Swing Containers. [6]  
b) Write a short note on. [6]  
i) Hashing in java.  
ii) java. util Package.  
c) Distinguish between Array List and Vector in the Java collection framework. [6]

OR

- Q2)** a) Write a Program using swing Components to add two Use text Fields for inputs and output. Your Program should display the result when the user presses a button. [10]  
b) What are AWT component? Explain some AWT component. [8]

- Q3)** a) What is database connection? Explain how to connect any java application with the database using JDBC. [9]  
b) What is prepared Statement? Write a code that makes use of prepared Statement for inserting data. [8]

OR

- Q4)** a) What is JDBC? Explain driver types of JDBS. [9]  
b) Give the details of the Executing SQL commands. [8]

- Q5)** a) Compare between Stub and Skelton? Explain with neat diagram the RMI Architecture. [9]  
b) Develop an RMI application which accepts a string or a number and checks that string or number is palindrome or not. [9]

OR

*P.T.O.*



- Q6)** a) Explain in detail with necessary steps required to write distributed application with RMI. [9]  
b) Define RMI and explain the architecture of RMI with suitable diagram. State the goals of RMI. [9]

- Q7)** a) What is TCP/IP client socket in JAVA? Discuss some methods of TCP/IP client socket class. [7]  
b) Write a simple Java socket programming where client sends a text and server receives and prints it. [10]

OR

- Q8)** a) Explain datagram, Datagram Socket and Datagram packet. [10]  
b) Explain in detail Life cycle of a Servlet? [7]



Total No. of Questions : 8]

SEAT No. :

**P310**

[6003]-389

[Total No. of Pages : 2

**T.E. (Electronics Engineering)**  
**DIGITAL SIGNAL PROCESSING**  
**(2019 Pattern) (Semester - II) (Elective - II) (304215B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn whenever necessary.
- 4) Assume suitable data, if necessary.

**Q1) a)** Obtain  $H(Z)$  if  $H(s) = \frac{2}{(s+1)(s+3)}$  and  $T = 0.1$  Sec using bilinear transformation. **[10]**

- b) Write the Mathematical equation and draw the window shape of rectangular window, hamming window, and Kaiser windows. Compare them for bandwidth. **[8]**

OR

**Q2) a)** For analog transfer function determine  $H(z)$  using impulse invariant technique. Assume  $T = 1$  sec.  $H(s) = \frac{1}{(s+1)(s+2)}$ . **[10]**

- b) Write differences between FIR and IIR filter design techniques. **[8]**

**Q3) a)** Draw a general ladder structure for any transfer function. Show how the coefficients of the transfer function are represented for ladder structure. What is the advantage of ladder structure while realizing a filter? **[6]**

- b) Obtain direct form I and II realisation of a system described by. **[12]**  
 $Y(n) + 0.81 Y(n-1) + 0.75 Y(n-2) = X(n) + 0.25 X(n-1).$

OR

**Q4) a)** What is the effect of quantization of FIR filter coefficient? How to minimize this error? **[8]**

- b) Draw cascade realization of a system having transfer function

$$H(z) = \frac{2(z+2)}{z(z-0.1)(z-0.5)(z+0.4)}. \quad \text{[10]}$$

**P.T.O.**

- Q5) a)** Draw a block diagram of decimator. Explain the working of decimator with the help of waveforms. Explain the role of antialiasing filter. [8]
- b) Implement a two stage decimator satisfying the following specifications: [10]

Input sampling frequency : 20kHz

$M = 100$

Pass band = 0 to 40 Hz

Passband ripple : 0.01 dB

Transition band : 40-50 Hz

Stopband ripple : 0.002.

OR

- Q6) a)** Draw a block diagram of interpolator. Explain the working of an interpolator with the help of waveforms. Explain the role of anti imaging filter. [8]
- b) What do you understand by Multirate DSP? What is need for multirate DSP? Explain types of multirate DSP based on sampling rate. [10]

- Q7) a)** Describe any 5 important features of digital signal processor. [8]
- b) List various applications of DSP in speech processing. Explain any one application in detail by drawing a neat block diagram and appropriate waveforms. [8]

OR

- Q8) a)** Explain how DSP can be used to monitor heart signal. Explain using block diagram and appropriate waveform. [8]
- b) Compare a microprocessor and DSP processor. Write any 6 differences. [8]



Total No. of Questions : 8]

SEAT No. :

**P311**

[Total No. of Pages : 2

**[6003]-390**

**T.E. (Electronics)**

**FIBER OPTIC COMMUNICATION**

**(2019 Pattern) (Semester - II) (Elective - II) (304215D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume the suitable data, if necessary.

**Q1) a)** Explain the following mechanisms associated with optical fibers. **[8]**

- i) Scattering Loss.
- ii) Bending losses.

**b)** Describe the fiber structure to provide. **[10]**

- i) Dispersion shifted single mode fiber.
- ii) Dispersion flattened single mode fiber.
- iii) NZDSF.
- iv) Polarization maintaining fibers.

OR

**Q2) a)** Explain intramodal and intermodal dispersion in graded index fiber. **[8]**

**b)** Explain the term critical bend radius with reference to optical fibers. Estimate the critical bend radius of curvature at which large bending losses would occur for a 62.5/125  $\mu\text{m}$  MMSI fiber with core refractive index of 1.5 &  $\Delta = 3\%$  and operating wavelength of 820 nm. **[10]**

**Q3) a)** Describe the common LED structures for optical fiber communication. Discuss their relative merits and drawbacks. **[9]**

**b)** Radiative and non-radiative recombination lifetimes of the minority carriers in the active region of a DH In GaAsP-LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 1.55  $\mu\text{m}$  at a drive current of 40 mA. **[8]**

OR

**Q4) a)** Explain the structure & the working of APD with the help of suitable diagram. Illustrate advantages & disadvantages of APD over PIN diode. **[9]**

**b)** Compare the properties of laser diode and LED's used for optical communication. Justify usage for laser as light source along with single mode fibers. **[8]**

**P.T.O.**

- Q5)** a) Describe the concept of SONET/SDH. [9]  
b) Explain the following WDM components: [9]  
i) Multiplexer.  
ii) Demultiplexer.  
iii) Optical Isolators and Circulators.

OR

- Q6)** a) A  $2 \times 2$  biconical tapered fiber coupler has an input optical power level of  $P_0 = 200 \mu\text{W}$ . The output powers at the other three ports are  $P_1 = 90 \mu\text{W}$ ,  $P_2 = 85 \mu\text{W}$ , and  $P_3 = 6.3 \text{ nW}$ . Determine Coupling ratio, Excess loss, Insertion loss and crosstalk in optical fiber [9]  
b) Explain the application of fiber bragg grating (FBG) for Multiplexing and Demultiplexing. Also describe in short Explain the Erbium doped fiber amplifier. [9]

- Q7)** a) Explain link power budget with the help of power loss model for point-to-point link. [9]  
b) An analog optical fiber system employs an LED which emits 3dBm mean optical power into air. However, a coupling loss of 17.5 dB is encountered when launching into a fiber cable. The fiber cable which extends for 6 km without repeaters exhibits a loss of 5 dB/km. It is spliced every 1.5 km with an average loss of 1.1 dB per splice. In addition there is a connector loss at the receiver of 0.8 dB. The PIN-FET receiver has a sensitivity of -54 dBm at the operating bandwidth of the system. Assuming there is no dispersion equalization penalty, Prepare an optical power budget for the system and establish a system margin. [8]

OR

- Q8)** a) Explain the concept of rise time budget for optical fiber communication. [9]  
b) Components are chosen for a digital optical fiber link of overall length 7 km & operating at a 20Mbps using an RZ code. It is decided that an LED emitting at  $0.85 \mu\text{m}$  with GI fiber to a PIN photodiode is a suitable choice for the system components giving no dispersion equalization penalty. An LED which is capable of launching an average of  $100 \mu\text{W}$  of optical power (including connector loss into a  $50 \mu\text{m}$  core diameter GI fiber is chosen). The proposed fiber cable has an attenuation of 2.6 dB/km & requires splicing every km with a loss of 0.5 dB per splice. There is also a connector loss at the receiver of 1.5 dB. The receiver requires mean incident optical power of -41dBm in order to give the necessary BER of  $10^{-10}$  & it is predicted that a safety margin of 6 dB will be required. Illustrate the optical power budget for the system & hence determine its viability. [8]



Total No. of Questions : 8]

SEAT No. :

P-3408

[Total No. of Pages : 2

[6003]-391

T.E. (Electronics Engineering)

e-MOBILITY

(2019 Pattern) (Semester - II) (304215) (Elective - II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams and waveforms must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of nonprogrammable calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Explain flywheel energy storage system. [5]  
b) Compare Sodium based batteries, Lithium based batteries. [5]  
c) What are various types of batteries? Explain construction & working of any one battery. [7]

OR

- Q2)** a) Compare Li-ion & Li-poly & Zinc Chloride battery. [5]  
b) Explain construction & working of Lead Acid Battery. [6]  
c) Explain hydraulic energy storage system. [6]

- Q3)** a) Explain Microprocessor based charger circuit for battery. [6]  
b) Explain various battery indication methods. [6]  
c) Explain Standard power levels of conductive chargers. [5]

OR

- Q4)** a) Explain with diagram Principle of inductive charging. [6]  
b) What are requirements for a battery charger in EVs. Explain in brief. [5]  
c) Explain Soft-switching in power converter for inductive charging. [6]

P.T.O.

- Q5)** a) What are various charging infrastructure Explain any one in detail. [6]  
b) Explain European EV Plug Standards. [6]  
c) Explain with diagram battery swapping station. [6]

OR

- Q6)** a) Explain with diagram Combined Charging System. [6]  
b) Explain DC Fast Charge EV Plug Standards in North America. [6]  
c) Explain Move-and-charge zone. [6]

- Q7)** a) Explain 12C protocol. Give its applications. [6]  
b) Explain DNP3, IEC 61850 protocols. [6]  
c) What is Modbus protocol? Explain where it is used. [6]

OR

- Q8)** a) Explain CAN Bus, LIN Bus protocol. [6]  
b) What is Ethernet? Why it is used? Give its advantages & disadvantages.[6]  
c) Explain with diagram IEEE 802.15.4 protocol. [6]



Total No. of Questions : 8]

SEAT No. :

P-312

[Total No. of Pages : 3

[6003]-392

T.E. (E & TC)

DIGITAL COMMUNICATION

(2019 Pattern) (Semester - I) (304181)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer any one question out of Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** a) What is Inter Symbol Interference? Explain the practical solution to control ISI. Explain the concept of roll off factor along with its equation. [8]

b) Explain M-ary FSK transmitter and receiver with suitable block diagram. [6]

c) Compare M-ary PSK and M-ary FSK. [3]

OR

**Q2)** a) Sketch the waveforms of MSK for the given bit stream 11001001. [8]

b) Explain digital OFDM system implementation for transmitter and receiver. [6]

c) Draw signal space representation for 16-QAM i.e. 16-QASK and write the equation for energy associated with signals in the first quadrant. [3]

**Q3)** a) Explain in brief : Processing gain, Jamming Margin in DSSS. [4]

b) A BPSK-DSSS system, using coherent detection, is used to transmit data at 3Kbps  $N_o = 10^{-10}$  with  $N_o = 10^{-10}$ . Calculate the processing gain if the system has to work in a hostile jamming environment with minimum error performance of  $10^{-6}$ . The jamming signal is 10 times stronger than the received signal. Given  $\text{erf}(3.3) = 0.999998$ . [6]

c) List the advantages and disadvantages of CDMA. [8]

P.T.O.



OR

- Q4)** a) Compare slow and fast frequency hopping. [8]  
b) Explain in detail DSSS - BPSK transmitter and receiver along with waveforms. [10]

- Q5)** a) Write a short note on : [9]  
i) Source coding theorem  
ii) Channel Coding theorem  
iii) Information Capacity theorem.  
b) A discrete memory less source has five symbols  $X_1, X_2, X_3, X_4$  and  $X_5$  with probabilities  $P(X_1) = 0.4, P(X_2) = 0.19, P(X_3) = 0.16, P(X_4) = 0.15, P(X_5) = 0.10$ . Construct the Shannon Fano code and calculate the code efficiency and redundancy. [8]

OR

- Q6)** a) Consider the five source symbols of discrete memory less source and their probabilities as given in the table below. Follow the Huffman's algorithm to find the code words for each message. Also find the average code word length and average information / message i.e. entropy. [8]

Message	$M_1$	$M_2$	$M_3$	$M_4$	$M_5$
Probability	0.4	0.2	0.2	0.1	0.1

- b) What is Mutual Information? Explain the properties of mutual information. [3]  
c) Write short note on frequency hop spread spectrum. [6]

- Q7)** a) Generator matrix for (7, 4) linear block code is given below : [9]

1	0	0	0	1	1	0
0	1	0	0	0	1	1
0	0	1	0	1	1	1
0	0	0	1	1	0	1

Construct the syndrome table for single bit error patterns. Using syndromes, find error pattern and code word for each of the following received vectors :

$$r_1 = 0111101, r_2 = 0001010.$$

b) Define and also write mathematical expression for the following terms, [9]

- i) Information rate
- ii) Mutual Information
- iii) Shannon Hartley theorem

**Q8)** a) Define and Explain following terms, [10]

- i) Hamming distance
- ii) Hamming weight
- iii) Code rate
- iv) Constraint length
- v) Systematic & nonsystematic codes

b) Write short note on : [8]

- i) Turbo Codes
- ii) LDPC Codes



Total No. of Questions: 8]

SEAT No. :

**P313**

**[6003]-393**

[Total No. of Pages : 2

**T.E. (E&TC Engineering)**  
**ELECTROMAGNETIC FIELD THEORY**  
**(2019 Pattern) (Semester-I) (304182)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Use of a Calculator is allowed.
- 5) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Derive the Poisson's and Laplace's equation from Gauss's Law. State Laplace's equation in three co-ordinate system [10]  
b) Derive an boundary expression for dielectric-dielectric medium [8]

OR

- Q2)** a) For a parallel plate capacitor, area of plate  $A=12\text{cm}^2$ , spacing between plate  $d = 5\text{mm}$  separated by dielectric of  $\epsilon_r=12$ , connected to 40 V battery find: [8]  
i) Capacitance  
ii) E  
iii) D  
iv) Energy stored in capacitor  
b) Derive an boundary expression for an interface between two magnetic medium with permeability  $\mu_1$  and  $\mu_2$  [10]

- Q3)** a) State and Explain Displacement Current Density and Displacement Current. Explain Physical Significance of displacement current [8]  
b) Write a Short note on Faradays' Law and Lenz's law [8]

OR

- Q4)** a) State and Prove Poynting Theorem [8]  
b) Write Maxwell equation for free space in point form and integral form [8]

*P.T.O.*

- Q5) a)** Explain Snell's law of refraction. Derive the same. [10]  
**b)** Explain reflection of Uniform Plane wave [8]

OR

- Q6) a)** Define depth of penetration, Derive the expression for depth of penetration for good conductor. [8]  
**b)** Define [10]  
 i) Phase velocity  
 ii) Group Velocity  
 iii) Propagation Constant  
 iv) Intrinsic impedance  
 v) Wavelength
- Q7) a)** Explain different distortions of transmission lines? What is meant by distortionless line and explain the condition of distortionless lines? [8]  
**b)** A lossy dielectric is characterized by  $\epsilon_r = 2.5$ ,  $\mu_r = 4$  and  $\sigma = 10^3$  per ohm.m at frequency 10 MHz find [10]  
 i) attenuation Constant  
 ii) Phase constant  
 iii) Velocity of Propagation  
 iv) Wavelength and  
 v) Intrinsic impedance

OR

- Q8) a)** Derive relation between Primary constant and secondary constant of transmission line [8]  
**b)** A 50 ohm transmission line is terminated in a load  $Z_L = 25 + j50 \Omega$ . The length of transmission line is  $3.3 \lambda$ . Find the following using Smith chart [10]  
 i) VSWR  
 ii) Reflection coefficient  
 iii) Input impedance  
 iv) input admittance.



Total No. of Questions : 8]

SEAT No. :

P-314

[Total No. Of Pages : 2

**[6003]-394**  
**T.E. (E & TC)**  
**MICROCONTROLLERS**  
**(Semester-I) (2019 Pattern) (304184)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Draw and explain the block schematic of PIC18F4550 MCU unit. [6]  
b) Explain functions of ALU in PIC18F4550 with example. [6]  
c) State features of PIC18F4550 [6]

OR

- Q2)** a) Explain the criteria for choosing PIC18F184550 Microcontroller. [6]  
b) Explain PSW of PIC18F4550 [6]  
c) Draw and explain the data memory organization of PIC18F4550 [6]
- Q3)** a) Draw and explain the Timer 0, 8bit operation in details compare the Timer 0,1,and 2. [9]  
b) Write a program for 2.5 KHz and 75% duty cycle PWM generation with N=4.Fosc=10MHz. [8]

OR

- Q4)** a) Write program to generate delay of 10 ms using timer 0, 16 bit and no prescaler. [9]  
b) Explain in details capture mode of PIC18F4550 [8]

**P.T.O**

- Q5)** a) Explain step wise procedure and design methodology of PIC test board.[6]  
b) Draw an interfacing diagram of LCD with PIC18F4550 and explain function of RS and EN. [6]  
c) Draw port structure with SFRs used in Programming. [6]

OR

- Q6)** a) Draw an interfacing diagram of LEDs connected to port B and write an embedded C program for continuous flashing. [6]  
b) Draw an interfacing diagram of 4×4 matrix keyboard and explain the concept of key detection. [6]  
c) Draw home protection system using motion detectors and IR sensors, display the status on LED and LCD. [6]
- Q7)** a) State features of SPI bus and compare RS232 and RS 485 [9]  
b) State features of EEPROM, draw an interfacing diagram with PIC18F4550. [8]

OR

- Q8)** a) Explain use of 12C bus with start, stop and busy condition, compare 12C and SPI bus. [9]  
b) Draw and explain block diagram of UART Transmitter. [8]



Total No. of Questions : 8]

SEAT No. :

**P315**

[Total No. of Pages : 2

**[6003]-395**

**T.E. (E & TC)**

**DIGITAL SIGNAL PROCESSING**

**(2019 Pattern) (Semester - I) (Elective - I) (304185(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Your answers will be valued as a whole.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

- Q1)** a) Compute the 5-point DFT for the given sequence  $x[n] = \{1, 0, 1, 0, 1\}$ . [6]
- b) State and prove any two important properties of DFT. [6]
- c) Compare DFT and FFT on the basis of computational complexity for  $N = 64, 256$  &  $1024$ . [6]

OR

- Q2)** a) Determine the sequence  $y(n) = x(n) \otimes h(n)$  where  $x(n) = \{1, 2, 3, 1\}$  and  $h(n) = \{4, 3, 2, 2\}$ . [8]
- b) Find the 8 point DFT of sequence  $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$  using decimation in time radix-2 FFT algorithm. [10]

- Q3)** a) List out the advantages and disadvantages of digital filters. [7]
- b) Find out  $H(z)$  using impulse invariance method at 5 Hz sampling frequency from  $H(s)$  as given  $H(s) = \frac{2}{(s+1)(s+2)}$ . [10]

OR

**P.T.O.**

- Q4)** a) Compare impulse invariance and bilinear transformation methods. [7]  
 b) The system transfer function of analog filter is given by

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16} \cdot \text{Obtain the system transfer function of digital}$$

filter using bilinear transformation which is resonant at  $\omega_r = \frac{\pi}{2}$ . [10]

- Q5)** a) List out the advantages and disadvantage of FIR filters. [6]  
 b) Explain the Gibb's phenomenon. [6]  
 c) Design a linear phase FIR low pass filter of length seven with cut-off frequency 1 rad/sec using rectangular window. [6]

OR

- Q6)** a) Find the magnitude and phase response function of seventh order low pass linear phase FIR filter with cut-off frequency 1rad/sec using Hanning window. [8]  
 b) Design an FIR filter with Hamming window for following specification[10]

$$H_d(\omega) = e^{-j3\omega} \quad -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4}$$

$$= 0 \quad \frac{\pi}{4} < \omega \leq \pi$$

- Q7)** a) Write short notes on: [4×2.5=10]  
 i) Identification of voiced and unvoiced sound  
 ii) LTI representation of speech signal  
 iii) Basics of ECG signal  
 iv) Power line interference  
 b) Describe the ECG signal with the help of neat sketch and elaborate types of interference. [7]

OR

- Q8)** a) List out the R-peak detection methods and explain in detail any one of the prominent technique. [9]  
 b) Write short notes on: [8]  
 i) Spatial and temporal resolution  
 ii) 2D convolution for feature extraction





Total No. of Questions : 8]

SEAT No. :

**P316**

[Total No. of Pages : 2

**[6003] - 396**

**T.E. (E&TC Engineering)**

**ELECTRONIC MEASUREMENTS**

**(2019 Pattern) (Semester - I) (Elective - I) (304185 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Figures to the right indicate full marks
- 3) Neat diagrams must be drawn whenever necessary.

- Q1)** a) Discuss the frequency range of different types of signal generator. [8]  
b) Explain the functioning of Random Noise generators and explain parameters of noise. [9]

OR

- Q2)** a) With the Help of Block diag. Explain the functioning of microwave signal generator. [8]  
b) Explain the operation of sweep frequency generator with the help of suitable block diag. [9]

- Q3)** a) Describe the function of each block of CRU. [9]  
b) Illustrate the Z-modulation and X-Y mode operation? List and explain the Measurement on oscilloscope? [9]

OR

- Q4)** a) Give the function of an attenuator in signal generator. [9]  
b) What is the main specification, advantages, disadvantages and application of using DSO? [9]

**P.T.O.**

- Q5) a)** Write a short note on: [9]
- i) LCD display.
  - ii) Plasma display.
  - iii) OLED display.
- b) With suitable diagram. Explain the construction and working of strip chart recorders. List its applications. [8]

OR

- Q6) a)** With the help of neat sketch, explain the all functional pins of a LCD Displays? [9]
- b) Explain why recorders are essential? With neat diagram explain X-Y Plotter. [8]

- Q7) a)** Explain the concepts of Microwave measurement using network Analyzer. [9]
- b) Describe in detail EMI/ EMC test instruments. Illustrate the OTDR? [9]

OR

- Q8) a)** With help of neat sketch, describe the all functional blocks microwave measurements using Network Analyzer? [9]
- b) Write a note on spectrum Analyzer. [9]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P317**

**[6003] - 397**

**T.E. (E&TC)**

**COMPUTER NETWORK**

**(2019 Pattern) (Semester - I) (Elective - I) (304185)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Figure to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of calculator is allowed.*

- Q1)** a) Draw IPV4 datagram format and Discuss in details. [6]  
b) Compare circuit vs packet switching [4]  
c) What are the network layer services? Explain in brief Network layer services. [6]

OR

- Q2)** a) Discuss the Transition from IPV4 to IPV6. [6]  
b) Compare IPV4 and IPV6 network addresses. [4]  
c) For a network address 192. 168. 10.0 and subnet Mask 255. 255. 255. 224, Then calculate. [6]  
i) Number of subnet and Number of host.  
ii) Valid subnet.

- Q3)** a) What is routing? What are the Types of routing? What are the characteristics of routing algorithm. [8]  
b) Comparison between Intra and Interdomain routing. [4]  
c) What is the use of OSPF? Discuss OSPF. [6]

OR

- Q4)** a) Describe in brief the distance vector routing algorithm with diagram. [8]  
b) Discuss direct VS Indirect delivery. [4]  
c) Discuss Link state routing algorithm. [6]

*P.T.O.*

- Q5)** a) Discuss process to process delivery in Transport layer with suitable diagram. [6]  
b) Explain stream control Transmission protocol. [6]  
c) Discuss the TCP connection establishment using three way handshaking. [6]

OR

- Q6)** a) Discuss the TCP Termination using three-way handshaking in TCP Protocol. [6]  
b) Discuss Leaky Bucket algorithm. [6]  
c) Discuss the scheduling Technique to Improve the Quality of Services (QoS). [6]

- Q7)** a) Explain how electronic mail system work? Explain basic function in Electronic mail. [6]  
b) Explain how DNS server work. [6]  
c) Explain HTML programming and related TAGS in brief. [6]

OR

- Q8)** Write short notes (Any three): [18]  
a) FTP.  
b) BOOTP.  
c) DHCP.  
d) Telnet.



Total No. of Questions : 8]

SEAT No. :

P-3154

[Total No. of Pages : 3

[6003]-398

T.E. (E & TC)

CELLULAR NETWORKS

(2019 Pattern) (Semester - II) (304192)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer any one question out of Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) List types of handoffs. With neat diagram, describe the significance of handover in cellular systems with algorithm. [8]
- b) Explain in detail with diagram. Cellular Network Architecture. [5]
- c) Write a brief note on Cell Geometry in mobile communication. [5]

OR

- Q2)** a) List out steps in Cellular radio system design and need of frequency reuse channels. [8]
- b) Write a brief note on :
- i) Cell splitting [5]
  - ii) Cell sectoring [5]
- Q3)** a) With state-transition diagram. explain Tele-traffic System Model with Poisson distribution. [9]
- b) List out assumptions, to derive the equation for blocking probability using Steady State Analysis. [9]

OR

P.T.O.

- Q4)** a) Draw and explain Tele-traffic Theory system for 100 users with 100 channels. [6]
- b) Describe the significance of listing Power losses and Gains of different intermediate components in the transceiver chain for Link-Budget Analysis. [6]
- c) Classify path loss models of different types of cells. Write only the expression for median path loss under Hata model for small to medium sized city signifying the importance of mobile antenna correction factor. [6]

- Q5)** a) With neat diagram, explain in detail Evolved Packet Core architecture of LTE. [6]
- b) Draw LTE-A Radio Protocol Architecture. Explain the significance of RLC and RRC in the architecture. [6]
- c) List out detail specification of LTE. [5]

OR

- Q6)** a) Classify and explain in brief Wireless Local area Network. [6]
- b) Compare LTE and LTE-A. [4]
- c) List out three, why there is a need of series of 802.11 standards. Describe the utility of IEEE802.11a and 802.11n. [7]

- Q7)** a) Explain step by step with neat diagram, how performance evaluation of a Real System is done. [6]
- b) Explain following network performance parameters used to manage service performance : [5]
- i) Throughput
  - ii) Packet loss
  - iii) Latency
  - iv) Availability and
  - v) Reliability
- c) What are four mechanisms to improve link robustness of wireless network. Explain any one in detail. [6]

OR

- Q8)** a) Write a brief note on the Layered analysis in wireless networks. [6]
- b) What is Network Coding. With neat diagram, explain how network coding helps in video broadcasting from one device to multiple receivers. [5]
- c) With reference to Scheduler Design, explain following components in brief : [6]
- i) Classifier
  - ii) Channel Quality
  - iii) Scheduler



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P318**

**[6003]-399**

**T.E. (E & TC)**

**PROJECT MANAGEMENT**

**(2019 Pattern) (Semester-II) (304193)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of a Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Draw and Explain Organizational structure. [5]
- b) Write short note on Leadership styles of Project Manager [5]
- c) Explain in details the types of conflicts in Project Management [8]

OR

- Q2)** a) Write short note about team management. [5]
- b) Write in short the relationship between the Project Manager and Line manager. [5]
- c) Explain in details the conflict resolution strategies. [8]

- Q3)** a) Write short note on resource allocation in Project [5]
- b) Explain three time estimates in PERT. [5]
- c) Draw and explain CPM Model in detail [8]

OR

- Q4)** a) Write short note on project cost estimate and budget [5]
- b) Explain Project scheduling in detail. [5]
- c) Draw and explain PERT Model in detail [8]

**P.T.O.**



- Q5)** a) Write five steps involved in effective risk management process and explain in short. [5]  
b) Write in details of conducting the feasibility study. [5]  
c) Explain in details about steps involved in process of project financial management. [7]

OR

- Q6)** a) Explain about Project Management Tool and its benefits [5]  
b) Write in details of planning the Project finance. [5]  
c) Explain in detail how to manage the project Risk effectively. [7]

- Q7)** a) Explain in detail 6 stages of the product development stages. [8]  
b) Explain in detail characteristic of successful entrepreneurship. [9]

OR

- Q8)** a) Discuss the factors impacting emergence of entrepreneurship. [8]  
b) Write in details and explain Patent, Trademark and copyright. [9]



Total No. of Questions : 8]

SEAT No. :

**P319**

[Total No. of Pages : 3

**[6003]-400**

**T.E. (E & TC Engineering)**

**POWER DEVICES & CIRCUITS**

**(2019 Pattern) (Semester - II) (304194)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams and waveforms must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of nonprogrammable calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) How feedback diodes differ from freewheeling diodes [4]
- b) Explain working of single phase full bridge inverter (using MOSFET/ IGBT) for R -L load with input & output waveforms. [7]
- c) Single phase full bridge inverter is operated from 100V dc supply, it has a resistive load of  $R = 10 \Omega$ . Find: [6]
- i) rms o/p voltages at third & fifth harmonic ( $V_{03}$  &  $V_{05}$ )
  - ii) Distortion factor (DF) of 3<sup>rd</sup> harmonic component
  - iii) Total harmonic distortion (THD)

OR

- Q2)** a) What are PWM techniques in inverter? Explain any one PWM technique with waveforms. [5]
- b) Draw a three phase inverter for balanced star R load? Explain its operation of 120° mode with gate signals & output waveforms. [12]

**P.T.O.**

- Q3) a)** Explain with block schematic working of SMPS. [6]
- b) A step down chopper is operated from dc supply voltage of 230 V. It has resistive load with  $R = 10 \Omega$ . When chopper operates, voltage drop across chopper is 2V. If duty cycle is 40%, Calculate:
- Average & rms o/p voltages
  - Average & rms o/p currents
  - Chopper efficiency.
- c) Explain with diagrams various control techniques in DC chopper operation. [6]

OR

- Q4) a)** Explain with circuit diagram operation of step up chopper and derive an expression for its o/p voltage :  $V_o = \frac{V_s}{(1-D)}$  where D is duty cycle. [8]
- b) Explain operation of four quadrant chopper with circuit diagram. [6]
- c) A step up chopper is operated from 200 V dc supply and it provides 360 V output. If chopping frequency is 5KHz, calculate ON & Off times of chopper. [4]
- Q5) a)** What are different over current protection techniques in power electronics? Explain any one in detail. [7]
- b) Why isolation is required in power electronic circuits? Explain with neat diagram working of isolation transformer. [6]
- c) For a thyristor, Maximum junction temperature is  $180^\circ \text{C}$ . The thermal resistances are  $\theta_{jc} = 0.16^\circ \text{C/W}$ ,  $\theta_{cs} = 0.08^\circ \text{C/W}$ . for heat sink temperature of  $70^\circ \text{C}$ , calculate total average power loss in thyristor - sink combination. If heat sink temperature is reduced to  $50^\circ \text{C}$ , find new total average power loss in thyristor - sink combination. [4]

OR

- Q6)** a) What is the need of resonant converter? Explain ZVS resonant converter with circuit & waveforms. [8]
- b) Why heatsink is used in power electronic circuits? Draw its thermal equivalent circuit. [4]
- c) What are various EMC standards? Explain any two. [5]
- Q7)** a) What is UPS? What are its types? Explain operation of any one UPS with block schematic. [7]
- b) Explain working of electronic ballast with block schematic. [6]
- c) Why driver is required for LED lamp? Explain with suitable circuit diagram working of a LED lamp drive. [5]

OR

- Q8)** a) Explain single phase full converter drive for single phase separately excited dc motor. [6]
- b) Explain with neat diagram BLDC drive. [6]
- c) Explain various performance parameters of batteries used in battery operated power systems. [6]

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Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P320**

**[6003]-401**

**T.E. (E & TC)**

**DIGITAL IMAGE PROCESSING**

**(2019 Pattern) (Semester - II) (Elective - II) (304195(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Your answers will be valued as a whole*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1) a)** With reference to relation between pixels, Explain. **[6]**

i) 4 connectivity.

ii) 8 Connectivity.

b) Explain Edge detection procedure using Sobel Mask? **[6]**

c) What is Image thresholding? Explain Local, global and adaptive thresholding? **[6]**

OR

**Q2) a)** Explain Image segmentation using. **[6]**

i) Region growing.

ii) Region Splitting.

b) Define Image Segmentation? Explain the necessity of Image segmentation? **[6]**

c) With the help of suitable masks, explain the following. **[6]**

i) Point detection.

ii) Line detection.

**Q3) a)** Explain the need of fidelity criteria in Image compression. Write any two fidelity measure. **[6]**

b) Define redundancy? Explain different types of Redundancies in Image? **[6]**

c) What is lossless compression, Explain in detail? **[5]**

OR

*P.T.O.*

- Q4)** a) Generate Huffman code for the following data calculate efficiency of Huffman code? [6]

Gray level	Probability
$a_1$	0.1
$a_2$	0.4
$a_3$	0.06
$a_4$	0.1
$a_5$	0.04
$a_6$	0.3

- b) What is DCT? How DCT helps to achieve compression? [6]  
c) Draw block diagram of JPEG coder and decoder with detail explanation? [5]
- Q5)** a) Explain image restoration process with help of block diagram? [6]  
b) Explain any three noise models in short? [6]  
c) Explain restoration of image in the presence of noise using spatial filtering. [6]

OR

- Q6)** a) Write a short note on image restoration using Weiner filtering? [6]  
b) Explain estimating the degradation function with respect to image restoration? [6]  
c) Compare in detail between image enhancement and image restoration?[6]
- Q7)** a) Explain the patterns and pattern classes in object recognition in detail?[6]  
b) Explain the recognition based on decision theoretic methods? [6]  
c) Explain in detail application of image processing as character recognition? [5]

OR

- Q8)** a) Write a short note on image classification? [6]  
b) Write short note on following structural methods. [6]  
i) Matching shape numbers.  
ii) String matching.  
c) Explain in detail deep learning using CNN? [5]



Total No. of Questions : 8]

SEAT No. :

**P321**

[Total No. of Pages : 2

**[6003]-402**

**T.E. (E &TC)**

**SENSORS IN AUTOMATION**

**(2019 Pattern) (Semester - II) (304195 (B)) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain Standards Strain Gauge Sensors also state the advantages and application of the same. [6]
- b) With the help of neat circuit diagram explain operation of Metal Strain Gauge also state the advantages and application of the same. [6]
- c) Explain the Basic principle of Bernoulli's theorem with neat diagram.[5]

OR

- Q2)** a) With the help of neat diagram explain operation of E8FC-25D with day to day life application. [6]
- b) Explain the Ultrasonic Sensor with neat diagram. [5]
- c) With the help of neat circuit diagram explain operation of Semiconductor Strain Gauge also state the advantages and application of the same.[6]

- Q3)** a) Explain working principle of hall effect sensor with labeled diagram. Write application of hall effect sensor. [9]
- b) Explain working principle of Gyroscope , state its applications. What is difference between working of Gyroscope and accelerometer. [9]

OR

- Q4)** a) Explain working principle of potentiometric displacement sensors with diagram. Write its applications. [9]
- b) What are Optical encoders. Explain its working principle with diagram and write its applications. [9]

**P.T.O.**

- Q5)** a) List out advantages and disadvantages of RFID Sensor. [8]  
b) Enlist properties and specification of Arduino Data Sheet MLX90614 non-contact temperature sensor. [5]  
c) Enlist Gas sensors with example. [4]

OR

- Q6)** a) Explain in detail about working principle of photo transistor and photo diode with example. [8]  
b) How the Ultrasonic proximity detector works for motion detection. [5]  
c) What are the different sensors used for Environmental studies. [4]

- Q7)** a) What is a data acquisition system? What are different types of data acquisition systems? Explain any one DAS system. [7]  
b) With the help of block diagram explain the IOT Functional blocks. [5]  
c) Explain SDI-12 Interface in details using block diagram. [4]  
d) Explain various applications of IOT. [2]

OR

- Q8)** a) Describe the different components of IOT with the help of block diagram. [6]  
b) Explain the IOT based Engine Management system with the help of block diagram. [6]  
c) What are different types of sensors in IOT? [4]  
d) State application of DAC. [2]





Total No. of Questions : 8]

SEAT No. :

**P322**

[Total No. of Pages : 2

**[6003]-403**

**T.E. (E & TC)**

**EMBEDDED PROCESSOR**

**(2019 Pattern) (Semester - II) (304195D) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, & Q.3 or Q.4, & Q.5 or Q.6, & Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Explain UART module of LPC2148 in short. [6]
- b) Write down the code to transmit the data “Hello” continuously using serial port. [6]
- c) Draw an Interfacing diagram of GSM module with LPC2148 and write an initialization program to send a message. [6]

OR

- Q2)** a) Draw an interfacing diagram of DHT11 with LPC2148 and write an algorithm to display the temperature on LCD. [6]
- b) Enlist the features of on-chip ADC in LPC2148. Explain AD0GDR register. [6]
- c) Draw an interfacing diagram of servomotor with LPC2148 and write down the code to rotate the motor in clockwise direction. [6]

- Q3)** a) Explain CMSIS Standard use for Firmware development. [9]
- b) Write the features of STM32F4xx. [8]

OR

- Q4)** a) Explain with diagram ARM STM Bus Architecture. [9]
- b) Differentiate between CORTEX A, R, M processors. [8]

**P.T.O.**

- Q5)** a) Enlist various registers required to configure Serial Communication of STM32F4xx Microcontroller. Explain any one with suitable example. [6]
- b) Write a C program to generate a Ramp Waveform, Square Waveform using on chip DAC of STM32F4xx controller. [6]
- c) Enlist various registers required to configure Timers of STM32F4xx Microcontroller Explain any one with suitable example. [6]

OR

- Q6)** a) Draw an interfacing diagram and write a C program to blink LED's connected to Pin numbers (Port D) PD 12, 13, 14 and 15 using STM 32F4xx Controller. [6]
- b) Draw an interfacing diagram and draw flowchart to interface "7 Segment" with STM32F4xx controller and display count digit "1" or "7" on it. [6]
- c) Explain GPIO\_ODR and GPIO \_ BSRR of STM32F4xx with simple example. [6]

- Q7)** a) Draw an interfacing diagram and write a algorithm to interface accelerometer MPU 6050 using STM32F4xx microcontroller. [9]
- b) Draw an interfacing diagram and draw a flowchart to interface Ultrasonic Sensor HC-SR04 using STM32F4xx microcontroller. [8]

OR

- Q8)** a) Write the features of CAN bus? Explain CAN bus frame? [9]
- b) Draw an interfacing diagram and write algorithm to Control DC Motor using PWM using STM32F4xx microcontroller. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P323**

**[6003]-404**

**T.E. (E & TC)**

**NETWORK SECURITY**

**(2019 Pattern) (Semester - II) (Elective - II) (304195 (E))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn whenever necessary.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain symmetric key encryption in detail. [6]  
b) Elaborate the steps in the various rounds of AES. [6]  
c) Discuss steps of RSA algorithm using suitable example. [6]

OR

- Q2)** a) Explain the steps of Diffie-Hellman key exchange algorithm. [6]  
b) Which basic steps are performed in one round of operation in DES? Explain in detail. [6]  
c) Discuss the idea of algorithm modes, explain any two of them in detail. [6]

- Q3)** a) What are biometric authentication techniques? Explain its importance in today's digital world. [6]  
b) Compare MD5 with SHA. Why is SHA more secure than MD5? [6]  
c) Write a note on Knapsack algorithm. [5]

OR

- Q4)** a) Elaborate the working of hash based message Authentication codes (HMAC). [6]  
b) How the Authentication application Kerberos work? Explain. [6]  
c) Discuss X.509 authentication service. [5]

- Q5)** a) What are the advantages and applications of IP security? [6]  
b) Write a short note on S/MIME. Which Cryptographic algorithms are used in it? [6]  
c) Explain authentication header and encapsulation in email security. [6]

OR

*P.T.O.*

- Q6)** a) Explain the concept of key rings in PGP. [6]  
b) What do you mean by Security Association? What are the fields of SAD? [6]  
c) Describe IPsec security services. [6]

- Q7)** a) Define following with example. [6]  
i) Threat  
ii) Vulnerability  
iii) Risk  
b) Discuss SET process in detail. [6]  
c) Why is the SSL layer positioned between the application layer and the transport layer. [5]

OR

- Q8)** a) Elaborate different types of firewalls. [6]  
b) Explain the three aspects of a 3 factor authentication in password management scheme. [6]  
c) Write a short note on: intrusion detection system using Honeypots. [5]



Total No. of Questions : 8]

SEAT No. :

P-324

[Total No. of Pages : 2

[6003]-405

**T.E. (Instrumentation & Control)**

**EMBEDDED SYSTEMS**

**(2019 Pattern) (Semester - I) (306261)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or Q. No. 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain the mathematical instructions in 8051. [8]

b) Differentiate between conditional and unconditional programming. [10]

OR

**Q2)** a) How is look-up tables made in 8051 programming? [10]

b) What is Embedded C? [8]

**Q3)** a) Draw and explain how to interface a matrix keypad to 8051. [8]

b) Draw and explain how to interface a DC motor to 8051. [9]

OR

**Q4)** a) Draw and explain how to interface ADC to 8051. [9]

b) Draw and explain how to interface DAC to 8051. [8]

**Q5)** a) Draw block diagram of AC heater for 8051. [8]

b) What the water sensors are used in a washing machine? [5]

c) What is use of timer in a washing machine? [5]

OR

**P.T.O.**

- Q6)** a) Draw flowchart of temperature controller using thermocouple for 8051. [8]  
b) Explain line tracing robot with flowchart. [10]

- Q7)** a) What are RISC controllers? [8]  
b) What is Arduino board? [4]  
c) Explain characteristics of microcontroller. [5]

OR

- Q8)** a) Write a short note on PLDs. [8]  
b) Explain types of operating system with example. [9]



Total No. of Questions: 8]

SEAT No. :

**P325**

**[6003]-406**

[Total No. of Pages : 2

**T.E. (Instrumentation and Control)  
INDUSTRIAL AUTOMATION-I  
(2019 Pattern) (Semester-I) (306262)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

**Q1) a)** Explain Comparison Instructions in brief with examples **[10]**

**b)** Write Note on: **[8]**

- i) MOVE
- ii) Masked MOVE
- iii) JUMP
- iv) LABEL

OR

**Q2) a)** Explain Math Instructions in brief with examples **[10]**

**b)** Write a ladder logic program to ADD the values of analog tags TAG-1 and TAG-2 and move the value to float soft tag using the push button. Explain the scenario and assumptions. **[8]**

**Q3) a)** Design and explain the flow control loop using the PID with ladder logic. **[9]**

**b)** Enlist the various manufactures of PLC **[2]**

**c)** Describe PID tuning **[6]**

OR

**Q4) a)** Explain the PID block **[7]**

**b)** Write note on analog modules **[5]**

**c)** Explain overview of any one of the following PLC **[5]**

- i) Allen Bradley
- ii) Siemens
- iii) Schneider

**P.T.O.**

- Q5)** a) Explain the need and advantages of HMI [6]  
b) Write a note on VFD [6]  
c) Enlist differences between SCADA and HMI [6]

OR

- Q6)** a) Describe the motion control in PLC [10]  
b) Describe Drives [8]

- Q7)** a) Explain SCADA [9]  
b) Write Note on: [8]  
i) RTU  
ii) MTU

OR

- Q8)** a) Explain the need and benefits of SCADA system [9]  
b) Describe Alarm Management [8]





**[6003]-407****T.E. (Instrumentation and Control)****MODERN CONTROL THEORY****(2019 Pattern) (Semester-I) (Theory) (306263)***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** Check Controllability and Observability of system whose state space representation as below;

$$\dot{x} = \begin{bmatrix} -3 & 1 & 0 \\ 1 & -2 & 1 \\ 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix} u \text{ and } y = [1 \ 2 \ -1] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \text{ Use Kalman Test. [10]}$$

- b) Determine stability of system defined by  $\dot{x} = \begin{bmatrix} -1 & 1 \\ -1 & -4 \end{bmatrix} x$

Using Lyapunov direct method of stability analysis. Assume symmetric positive definite matrix Q is identity matrix. [8]

**OR**

**Q2) a)** Check controllability of system represented in state space form; [10]

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

Use Gilbert Test.

- b) Determine stability of system defined by  $\dot{x} = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix} x$

Using Lyapunov direct method of stability analysis. Assume symmetric positive definite matrix Q is identity matrix. [8]

**P.T.O.**

**Q3)** A regulator system has the plant

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } y = [1 \ 0 \ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Design a state-feedback controller which will place the closed-loop poles at  $s = -2 + j3.46, s = -2 - j3.46, s = -5$  [17]

OR

**Q4)** A regulator system has the plant

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } y = [1 \ 0 \ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Design a full order state observer, the observer-error poles are required to be located at  $s = -2 + j3.46, s = -2 - j3.46, s = -5$  [17]

**Q5) a)** State the different advantage of Digital Control. Discuss any four advantages in detail. [10]

b) A analog signal is given as follows;

$$x(t) = 3\cos(50\pi t) + 10\sin(300\pi t) - \cos(100\pi t):$$

Calculate the Nyquist rate. [7]

OR

**Q6) a)** Discuss ADC and DAC operation in DTCS with block diagram. [10]

b) Derive necessary transfer function for zero order hold also sketch frequency response of ZOH. [7]

**Q7) a)** Solve difference equation for  $y(k)$ . [10]

$$y(k) = r(k) - r(k-1) - y(k-1), k \geq 0$$

Where

$$r(k) = 1; \text{ when } \dots k \text{ is even}$$

$$r(k) = 0; \text{ when } \dots k \text{ is odd}$$

$$y(-1) = r(-1) = 0$$

- b) Determine the pulse transfer function of system shown in figure below;[8]

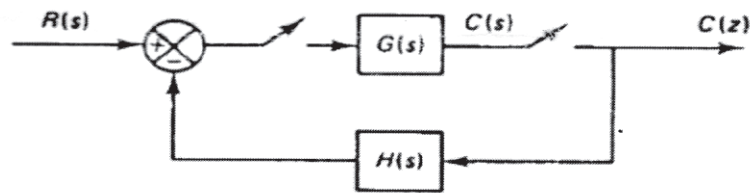


Figure. Closed Loop Control System

OR

- Q8) a) Test the system stability of system using jury's stability method for system whose characteristic equation is as follows;  $z^3 - 0.2z^2 - 0.25z + 0.05 = 0$ . [10]
- b) Determine Pulse Transfer function for system represented by block diagram  $Y(z)/R(z)$ . [8]

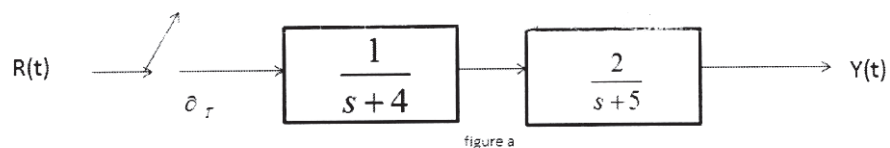


figure a

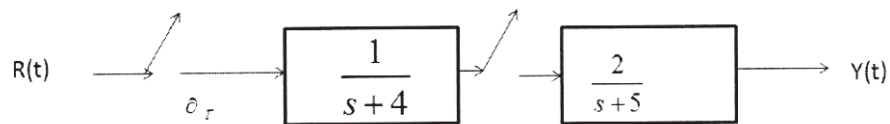


figure b



Total No. of Questions : 8]

SEAT No. :

P-327

[Total No. Of Pages : 2

[6003]-408

**T.E. (Instrumentation & Control)**

**OPERATING SYSTEM**

**(Semester-I) (2019 Pattern) (306264)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Illustrate compaction technique in contiguous memory allocation, enlist limitations of compaction technique and suggest the suitable technique used to overcome the limitation. **[8]**

b) State the significance of virtual memory, enlist the techniques used for page replacement and illustrate first in first out page replacement technique with an example. **[9]**

OR

**Q2) a)** Illustrate contiguous memory allocation in brief, elaborate its limitations in detail and suggest suitable technique to avoid external fragmentation in contiguous memory allocation. **[8]**

b) Enlist page replacement techniques and illustrate least recently used technique with suitable example. **[9]**

**Q3) a)** Suggest the conditions used for prevention of deadlock and elaborate the same with suitable examples. **[9]**

b) Specify the necessary conditions for dead lock and illustrate each technique in detail with suitable example **[9]**

OR

**P.T.O**

- Q4)** a) Suggest suitable technique for deadlock detection and recovery and elaborate with an suitable examples [9]
- b) Elaborate banker's algorithm with suitable example for deadlock avoidance. [9]

- Q5)** a) Illustrate efficiency and performance of file system in detail with neat sketch. [8]
- b) Suggest suitable methods to overcome the problem of external fragmentation in file allocation and illustrate linked based file allocation approach with suitable example. [9]

OR

- Q6)** a) Enlist types of directory structure. Illustrate two level directory and tree structure directory with suitable examples. [8]
- b) Specify the limitation of sequential access method. Suggest suitable methods used to overcome the problem of sequential access method and elaborate indexed sequential access with example. [9]
- Q7)** a) Specify the difference between protection and security. Enlist goal of protection in detail. [9]
- b) Illustrate domain of protection access matrix with suitable example in detail. [9]

OR

- Q8)** a) Specify need of security and difference between program and system threats with suitable examples. [9]
- b) Enlist problems of security and illusttate any two security tools to overcome the problem of security in detail. [9]



Total No. of Questions : 8]

SEAT No. :

**P328**

[Total No. of Pages : 2

**[6003]-409**

**T.E. (Instrumentation & Control)**

**MECHATRONICS AND ROBOTICS**

**(2019 Pattern) (Semester - I) (306265A) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1)** Represent Mechatronic Design Process with block diagram and explain in brief: **[18]**

- a) Conceptual Design and Function Specification
- b) Design Optimization
- c) Life Cycle Optimization

OR

**Q2)** a) Explain the concept of concurrent engineering used in mechatronic design process? How it is different than normal engineering or sequential engineering approach? Draw suitable block diagram to support your answer? **[6]**

- b) Explain the concept of real-time interfacing or hardware-in-the-loop used in modeling and simulation environment in mechatronic design process?**[6]**
- c) Explain in brief how the concept evaluation is carried out in mechanical design process? Draw suitable block diagram? **[6]**

**Q3)** a) Draw appropriate diagrams to represent four basic robot anatomies or configurations? Which one is the best in terms of repeatability and reach?**[6]**

- b) Draw and Explain the principle of operation of stepper motor? **[6]**
- c) What is the safety measures for Robot? Describe any two guarding methods used for safety? **[6]**

OR

**P.T.O.**

- Q4)** a) Draw a diagram for cylindrical robot? How many axes are present in it? Give advantages and disadvantages of this anatomy with respect to lift capacity and repeatability? [6]
- b) Explain the working principle of IR sensor and LDR sensor along with their diagrams? [6]
- c) Give classifications of dc motors? Explain the principle of operation of permanent magnet dc motor along with its diagram? [6]
- Q5)** a) What is mean by Direct Kinematics? Explain. [6]
- b) Define the terms and also draw related diagrams: [6]
- i) cylindrical configuration
- ii) and its work volume?
- c) How Python Programming is used in Robotics? Explain with suitable examples? [5]

OR

- Q6)** a) What is the Inverse Kinematics? Explain. [6]
- b) Define the terms Expert Systems and Meta-knowledge used in Artificial Intelligence? [6]
- c) Draw and explain working of the finger type mechanical gripper? [5]
- Q7)** a) It is decided to implement black line following robot. Describe the process, selection of components and microcontroller, development of algorithm and program? [12]
- b) Write a short note on kinematic calculations used while development of Robotic arm-design? [5]

OR

- Q8)** a) It is decided to implement remote control car as a mini project. Describe the selection criteria of components, microcontroller and development of the algorithm and program for it? [12]
- b) Write a short note on pick and place robot applications? Give selection criterion of components such as motor, microcontroller used in it? [5]



Total No. of Questions : 8]

SEAT No. :

**P329**

**[6003] - 410**

**[Total No. of Pages : 2**

**T.E. (Instrumentation and Control)**  
**DATA SCIENCE**  
**(2019 Pattern) (Elective - I) (306265B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1) a)** Explicate the various logical operations that can be performed on arrays using Numpy. **[9]**

b) Discuss on data representation plots in Matplotlib. **[9]**

OR

**Q2) a)** Explain basic pandas operation on data frame with suitable examples. **[9]**

b) Illustrate line, pie, bar chart with suitable examples. **[9]**

**Q3) a)** Explain the concept of continuous and discrete data with examples. **[8]**

b) Discuss on missing value treatments-mean, median and mode methods. **[9]**

OR

**Q4) a)** Comment on the advantages and disadvantages of outlier treatment algorithms using percentile and IQR. **[9]**

b) Discuss the analysis of multivariate data with suitable example. **[8]**

**P.T.O.**



- Q5)** a) Explain the concept of Box plot and Z score with example. [9]  
b) Discuss on advantages and applications of Label Encoding. [9]

OR

- Q6)** a) Demonstrate correlation analysis in categorical to numerical with suitable example. [9]  
b) Discuss about the concept of feature rescaling. [9]

- Q7)** a) Explain concept of Tableau online. [8]  
b) Explain concept of Tableau public. [9]

OR

- Q8)** a) Explain the different components of Tableau desktop dashboard. [9]  
b) Differentiate between tree map and heat map with its advantages, limitations and applications. [8]



Total No. of Questions : 8]

SEAT No. :

**P330**

**[6003] - 411**

**[Total No. of Pages : 2**

**T.E. (Instrumentation and Control)**

**POWER ELECTRONICS**

**(2019 Pattern) (Semester - I) (Elective - I ) (306265 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1) a)** Describe a single phase half controlled converter with RL load along with necessary circuit diagram and waveforms. **[9]**

**b)** How four-quadrant operation is achieved in a Type E Chopper? Explain with neat circuit diagram. **[8]**

OR

**Q2) a)** Draw the circuit of 3 phase fully controlled rectifier with RLE load and explain the working for  $\alpha = 60^\circ$  with necessary waveforms. Derive the expression for output voltage. **[9]**

**b)** What is meant by Pulse Width Modulation? Describe the various PWM techniques used in Voltage control of Inverters. **[8]**

**Q3) a)** Compare electronics P, PI and PID controllers. **[9]**

**b)** Draw neat sketch of analog PD controller using Operational Amplifier and explain in brief. **[9]**

OR

**Q4) a)** Give the circuit diagram and the transfer function for an electronic “PID” controller. **[9]**

**b)** Write mathematical expression of PI and PID controller in a discrete mode. **[9]**

**P.T.O.**

- Q5)** a) Elaborate Configuration of a typical standby UPS system. [8]  
b) List various non conventional energy sources. Explain any two sources in brief. [9]

OR

- Q6)** a) Explain with neat diagram operation of battery system. [8]  
b) Explain basic principle of induction heating. Draw and discuss operation of induction heating with neat circuit diagram. [9]

- Q7)** a) How to choose MPPT solar charge controller for PV battery and module. [9]  
b) Compare On-Grid and Off-Grid solar system . [9]

OR

- Q8)** a) What is MPPT? Explain working of MPPT. [9]  
b) Discuss with neat diagram On-Grid solar power system. [9]



Total No. of Questions : 8]

SEAT No. :

**P331**

**[6003] - 412**

**[Total No. of Pages : 2**

**T.E. (Instrumentation and Control)**  
**BIOMEDICAL INSTRUMENTATION**  
**(2019 Pattern) (Semester - I) (Elective - I ) (306265 D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

- Q1)** a) State the significance of the blood flow in human body and how it affect the daily routine of human. Describe the Working Principle of any one type of Electromagnetic Blood Flow meter with neat diagram. **[10]**
- b) Define Blood Pressure? Compare Indirect (Non-Invasive) and Direct (Invasive) Blood Pressure Measurements. **[7]**

OR

- Q2)** a) Define Cardiac Output. Draw and Discuss the working principle of Plethysmography with neat diagram. **[10]**
- b) State the significance of the heart sounds. Draw and Discuss the working principle of Phonocardiography with neat diagram. **[7]**

- Q3)** a) State the parts of the brain, its lobes and its functions. With neat diagram, explain the structure of neuron with neat diagram. **[10]**
- b) Explain the 10-20 system of electrode placement with the help of neat diagram. **[8]**

OR

- Q4)** a) List the different waves and its significance from different parts of the brain. Explain the Neuro Muscular Transmission with the help of neat diagram. **[10]**
- b) Define myoelectric voltages. Explain the working principle of EEG Amplifier with the help of neat diagram. **[8]**

**P.T.O.**

- Q5) a)** Elaborate the concept of Bone Conduction system with neat diagram. Explain the working of Evoked response Audiometry system with the help of neat diagram. **[10]**
- b)** With the help of neat diagram, Explain the Anatomy of Eye with the help of neat diagram. **[7]**

OR

- Q6) a)** Describe the mechanism of hearing with the help of neat diagram. Elaborate on Pure tone Audiometer with the help of block diagram. **[10]**
- b)** Describe the Visual Acuity (Errors in Vision) and its remedy. **[7]**
- Q7) a)** With the help of neat diagram, explain the O<sub>2</sub> and CO<sub>2</sub> Transport. Explain the working of Spirometer with the help of neat diagram. **[10]**
- b)** With the help of neat diagram, Explain the working of Oxygen Gas Analyzer with the help of neat diagram. **[8]**

OR

- Q8) a)** State the function of Oxygenator . With the help of neat diagram, Explain the working of Membrane Type Oxygenators with the help of neat diagram. **[10]**
- b)** With the help of neat diagram, Explain the working of Ventilators with the help of neat diagram. **[8]**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P332**

**[6003]-413**

**T.E. (Instrumentation and Control Engineering)**

**INTERNET OF THINGS**

**(2019 Pattern) (Semester-II) (306268)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat circuit diagram should be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Differentiate between Arduino board and Raspberry pi board. **[8]**

b) Enlist various IoT platforms and explain any three of them. **[9]**

OR

**Q2) a)** What are the various sensors and actuators used in IOT. **[8]**

b) What do you mean by IoT platform? Explain any four selection criteria for IoT platforms. **[9]**

**Q3) a)** What is identity management in IoT? Explain user centric identity management. **[9]**

b) What are the four main types of cloud deployment models? Explain any two in detail. **[9]**

OR

**Q4) a)** Enlist different identity management models. Explain local and network identity management models. **[10]**

b) Compare traditional software and software as a service. **[8]**

**P.T.O.**

- Q5) a)** What do you mean by security in IoT? Draw and explain the security frame work for IoT? [9]
- b) What do you mean by privacy in IoT network? Define Bootstrapping.[8]

OR

- Q6) a)** Explain briefly the broad categories of threats? Which are the well-known active threats? [8]
- b) With reference to IoT security overview, describe the network and transport layer challenges. which are the different routing attacks? [9]

- Q7) a)** Enlist components of Home Area Network. Describe the standards involved in it. [9]
- b) What are the enabling technologies in Health care IoT and challenges in It? [9]

OR

- Q8) a)** Write short note on Energy management in Smart cities. [9]
- b) Briefly explain the characteristics of smart grid. What are the benefits of it? [9]



Total No. of Questions : 8]

SEAT No. :

**P333**

[Total No. of Pages : 2

**[6003]-414**

**T.E. (Instrumentation and Control)**  
**INDUSTRIAL AUTOMATION-II**  
**(2019 Pattern) (Semester-II) (306269)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** a) Draw the architecture of MODBUS and discuss the hardware, software details. **[9]**

b) What do you mean by OPC server? Write its functions. **[8]**

OR

**Q2)** a) Draw the OSI-7 layer model architecture and explain each layer used for Industrial process control in detail. **[9]**

b) Differentiate between foundation field bus and Profibus. **[8]**

**Q3)** a) Explain the importance of data log and trends in DCS. **[9]**

b) Write note on features and requirements of HMI. **[9]**

OR

**Q4)** a) Write note on Integration and optimization of DCS. **[10]**

b) Explain Alarm management system and Alarm control in DCS. **[8]**

**Q5)** a) Develop the AND, OR logic using Function Block Diagram (FBD). What are advantages of FBD? **[10]**

b) Write a short note on Artificial Neural Network and its use in DCS. **[7]**

OR

**Q6)** a) What is transition in Sequential flow chart? Implement OR logic using SFC. **[10]**

b) Describe the IEC 61131 standard for DCS programming language. **[7]**

**P.T.O.**



- Q7)** a) Explain latest features of DCS system with reference to industry 4.0[10]  
b) Draw basic flow chart of Pulp and paper process. Illustrate hierarchical level of DCS used in Pulp and paper plants. [8]

OR

- Q8)** a) Explain application of DCS system in Oil and Gas industry. [12]  
b) Explain how the DCS system can be configured with Enterprise Resources Planning (ERP) system. [6]



Total No. of Questions : 8]

SEAT No. :

**P334**

**[6003] - 415**

[Total No. of Pages : 3

**T.E. ( Instrumentation & Control Engineering)**

**DIGITAL SIGNAL PROCESSING**

**(2019 Pattern) (Semester -II) (306270)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data if necessary.
- 4) Use of non - programmable calculator is allowed.

**Q1) a)** Define Discrete Time Fourier series and explain the need of Discrete time Fourier series. **[5]**

b) State the properties of discrete time Fourier series. **[8]**

c) Write short notes on “Energy Density Spectrum” **[5]**

OR

**Q2) a)** Determine DTFS representation for the signal  $x(n) = \cos \frac{(n\pi)}{3}$  **[6]**

b) Find the DTFT of following sequences. **[6]**

i)  $\delta(n)$

ii)  $u(n)$

iii)  $\delta(n - m)$

c) Write short notes on “Power Density Spectrum”. **[6]**

**P.T.O.**

**Q3) a)** Compute DFT of the following sequence  $x(n) = \{0,1,2,3\}$  [6]

b) Compute DFT of the sequence  $x(n) = \cos\left(\frac{n\pi}{2}\right)$  where  $N=4$  using DIT-FFT algorithm. [6]

c) Explain the advantages of FFT over DFT [5]

OR

**Q4) a)** Compute the circular convolution of following sequences [9]

$$x(n) = \{1,1,1,1,-1,-1,-1,-1\}, h(n) = \{0,1,2,3,4,3,2,1\}$$

b) Explain Radix-2 Decimation in Time FFT algorithm with Signal flow Graph. [8]

**Q5) a)** The system function of the analog filter is given as  $H_a(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$   
Obtain the system function of the IIR digital filter by using impulse Invariance method. [9]

b) Compare Butterworth approximation and Chebyshev approximation. [5]

c) Define and explain IIR filter. [4]

OR

**Q6) a)** Explain Frequency transformations in IIR filters. [8]

b) Explain Bilinear Transformation method of IIR filter design. [6]

c) What are the specifications required to design digital IIR filter? [4]

- Q7)** a) Define FIR filter. Explain the characteristics of FIR filter. [5]
- b) Design a low pass FIR filter using rectangular window with passband gain of 0dB, cutoff frequency of 200Hz, sampling frequency of 1KHz. Assume the length of the impulse response as 7. [7]
- c) Explain different types of windows used in FIR filter design. [5]

OR

- Q8)** a) Compare FIR and IIR filters. [7]
- b) Check whether following filter has linear phase?  $h(n) = \{5, 3, 2, 3, 5\}$  [3]
- c) Design a lowpass FIR filter using frequency sampling technique having cut - off frequency of  $\frac{\pi}{2} \text{ rad/sample}$ . The filter should have linear phase and length of 17. [7]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P335**

[Total No. of Pages : 2

**[6003]-416**

**T.E. (Instrumentation and Control)**

**BUILDING AUTOMATION**

**(2019 Pattern) (Semester - II) (306271A) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** a) What are the components of air handling unit? What is Constant Volume System? [9]

b) How does the AHU work? What is Variable Air Volume System & Dual Duct System? [9]

OR

**Q2)** a) What is the FCU? Where the FCU's are used? [9]

b) What are the components of an AHU? [9]

**Q3)** a) What are the components of a chiller system? What is the working principle of chiller? How many types of chilled water systems are there? [8]

b) What are the main components of water tube boiler? What is the working principle of water tube boiler? What is the difference between water tube and fire tube boiler? [9]

OR

**Q4)** a) How does the chiller work internally? [8]

b) How is the traditional chiller? (Refrigeration cycle) [9]

**Q5)** a) What is the working principle of fire alarm system? [9]

b) What is SLC? [9]

OR

**P.T.O.**

- Q6)** a) What are the basic components of fire alarm & detection system? [9]  
b) What is the difference between conventional and addressable fire alarms? [9]

- Q7)** a) How does access control work? [8]  
b) What is a card access system? What technology is used in access control list? [9]

OR

- Q8)** a) What are the differences between a Network Video Service and a Digital Video Recorder? [8]  
b) What are the key Video Analytics features of a Retail Video Management Software? [9]



Total No. of Questions : 8]

SEAT No. :

**P336**

[Total No. of Pages : 2

**[6003]-417**

**T.E. (Instrumentation Engineering & Control)**

**MACHINE LEARNING**

**(2019 Pattern) (Semester - II) (306271-B) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) State pros, cons and applications of Naive Bayes algorithm. [10]

b) What is the distance metrics used in KNN? Explain with formulae. [8]

OR

**Q2)** a) Differentiate the concepts of logistic regression, KNN and Naïve Bayes. [10]

b) Derive Bayes Theorem and Naïve Bayes Theorem. [8]

**Q3)** a) Explain SVM machine learning algorithm. [9]

b) Explain separable and non-separable data with an application to SVM.[8]

OR

**Q4)** a) Define Hyperplane, hard margin and soft margin. [9]

b) Explain types of kernels used by SVM. [8]

**Q5)** a) Explain Decision tree algorithm with example. [10]

b) Describe the methods to avoid the Over fitting in Model. [8]

OR

**Q6)** a) What is mean by hyper parameter? Explain hyper parameter tuning.[10]

b) Describe Ensemble learning. [8]

**P.T.O.**

- Q7)** a) Explain applications of K means clustering algorithm. [9]  
b) Explain Elbow method. [8]

OR

- Q8)** a) How to choose the value of “K number of clusters” in K-means Clustering? [9]  
b) Explain Silhouette method. [8]

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Total No. of Questions : 8]

SEAT No. :

**P337**

[Total No. of Pages : 2

**[6003]-418A**

**T.E. (Instrumentation and Control)**

**ELECTRICAL DRIVES**

**(2019 Pattern) (Semester - II) (306271 C) (Elective - IIC)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** What is a universal motor and how is it different from other types of DC motors? Discuss with construction diagram and characteristics. **[9]**

b) What is converter control of DC drives and how to series and separately excited DC motors operate with single phase and three phase converters?**[9]**

OR

**Q2) a)** How does the performance of a DC servomotor compare to other types of DC motors, and where are they typically used? Discuss with diagram. **[9]**

b) What is four-quadrant control and how does it enable bidirectional operation of DC motors? **[9]**

**Q3) a)** How is the speed of synchronous motors controlled, and what are some common methods used for speed control? **[8]**

b) What are the different modes and configurations of inverter-fed AC drives, and how do these impact the operation and performance of the AC motor? **[9]**

OR

**Q4) a)** What is adjustable frequency operation in synchronous motors? How does it impact the performance and control of the motor? What are some common applications where adjustable frequency operation is beneficial? **[8]**

b) What are different modes and configurations of AC voltage controllers. Discuss some key considerations for selecting a controller for a given application. **[9]**

**P.T.O.**

- Q5)** a) What are some common types of electric traction systems. Discuss the role electrical drives in powering these systems. [9]  
b) Discuss the role of electrical drives in refrigeration and air conditioning systems. Discuss the type of drive used in it with justification. [9]

OR

- Q6)** a) How do different types of pumps impact the performance of electrical drives, and what are some key factors to consider when selecting a pump for a given application? [9]  
b) What types of electrical drives are commonly used in cranes and hoists, and how do these drives impact the lifting capacity and speed of the system? [9]

- Q7)** a) How do power electronic systems contribute to the overall sustainability and environmental impact of electric vehicles, and how can these systems be designed to minimize their carbon footprint? [8]  
b) What are some of the key emerging trends and innovations in power electronic systems for electric vehicles. How do power electronic systems impact the cost and affordability of electric vehicles. [9]

OR

- Q8)** a) Describe the various types of electrical drives used in electric vehicles. How do these drives help improve the performance of the electric vehicles? [8]  
b) How do power electronic systems impact the cost and affordability of electric vehicles, and what are some of the key strategies for reducing the cost of these systems while maintaining high levels of performance and reliability? [9]



Total No. of Questions : 8]

SEAT No. :

**P338**

[Total No. of Pages : 2

**[6003]-419**

**T.E. (Instrumentation and Control)**

**ANALYTICAL INSTRUMENTATION**

**(2019 Pattern) (Semester - II) (Elective - II) (306271 (D))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, 7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary

**Q1) a)** Explain the principle of working of Liquid Chromatograph with suitable block diagram? Give its applications? **[8]**

b) What are the different types of Chromatography? Enlist them? Draw the schematic diagram of Gas Chromatography and explain function of each part? **[9]**

OR

**Q2) a)** Explain the working principle of Katharometer or thermal conductivity meter used as detector in Gas Chromatography? Draw diagram or circuit of it? **[8]**

b) Explain in detail various types of columns in HPLC. **[9]**

**Q3) a)** Explain the working of flue gas analyzer or exhaust gas analyzer using block diagram? Which are the gases measured by this technique? **[9]**

b) Draw and explain the principle of operation of Zirconium oxide based oxygen analyzer? Draw Zirconia cell in basic form? State the expression of voltage generated across the cell? **[9]**

OR

**Q4) a)** Draw and explain the Turbidity analyzer? State the formula for calculation of turbidity? State conversion formula between ppm and NTU units? **[9]**

b) Write a note on pollution monitoring instruments? Include the CO, CO<sub>2</sub> and Nox measuring techniques in your note? **[9]**

**P.T.O.**

**Q5)** a) Define Osmosis and reverse osmosis? Draw a block diagram of household RO water filter? Explain in brief different filters used in it and their functions? [9]

b) Explain the Principle operation of Mass Spectrometer? Explain the working of Magnetic deflection mass spectrometers? [9]

OR

**Q6)** a) Define and explain the process of electro-dialysis? Why it is called ion exchange method? [9]

b) Explain with sketch quadrupole mass analyzer. [9]

**Q7)** a) Draw the schematic diagram of scintillation counter and explain how it detects nuclear radiation? [8]

b) Explain working of Gamma Spectrometry? Draw diagram of it? [9]

OR

**Q8)** a) Explain principle of working of GM tube in detail? Draw suitable diagram of it? Compare it with Proportional Counter (any two points)? [8]

b) Enlist the three types of particles emitted in Radioactive decay? Compare their properties /characteristics (any three points)? Define the unit of radioactivity? [9]



Total No. of Questions : 8]

SEAT No. :

P-339

[Total No. of Pages : 3

[6003]-420

**T.E. (Mechanical/Mechanical Sandwich)**

**NUMERICAL AND STATISTICAL METHODS**

**(2019 Pattern) (Semester - I) (302041) (End Sem.)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6 and Q.7 OR Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Scientific Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** a) Find double integral of  $f(x, y) = x^2 + y^2 + 5$  for  $x = 0$  to 2 and  $y = 0$  to 2 taking increment in both  $x$  and  $y$  as 0.5. Applying Simpson's  $1/3^{\text{rd}}$  rule. **[12]**

b) Draw a flow chart for Simpson's  $1/3^{\text{rd}}$  rule to evaluate integration of any function. **[6]**

OR

**Q2)** a) Find integration of  $e^x \cos(x) - 2x$  in limits 0 to 1 by using 3-point Gauss Legendre formula with 6 strips. **[5]**

b) Draw a flow chart for Trapezoidal rule to evaluate integration of any function. **[5]**

c) The velocity 'v'(km/hr) of a vehicle which starts from rest, is given at fixed intervals of time 't' (min) as follows : **[8]**

t(min)	2	4	6	8	10	12	14	16	18	20
V(km/hr)	10	18	25	29	32	20	11	05	02	00

Estimate approximately the distance covered in 20 minutes. Select appropriate method.

**P.T.O.**

- Q3) a)** Following data refers data refers to the load lifted and corresponding force applied in a pulley system. If the load lifted and effort required are related by equation,  $\text{Effort} = A \times (\text{Load lifted}) + B$ , where 'A' and 'B' are constants. Find The Values of A and B. [9]

Load lifted in kN	10.0	15.0	20.0	25.0	30.0
Effort applied in kN	0.750	0.935	1.100	1.200	1.300

- b) The following data gives the values of y corresponding to certain values of x. Find the value of x when  $y = 167.59789$  by applying Lagrange's method. [9]

x	1	2	5	7
y	1	12	117	317

OR

- Q4) a)** Growth of bacteria (N) in a culture after t hours is given in following table : [9]

t	0	1	2	3	4
N	32	47	65	92	132

Fit a curve of the form  $N = ab^t$  and estimate N when  $t = 4.5$  and  $t = 7$ .

- b) From the following table of yearly premium for policies maturing at coming ages, estimate the premiums for policies maturing at the age of 46 years. Use suitable method [9]

Age	x :	45	50	55	60	65
Premium	y :	2.871	2.404	2.083	1.862	1.712

- Q5) a)** Fluctuations in the Aggregate of marks obtained by two groups of students are given below. Find out which of the two shows greater variability and which is more consistent. [8]

Group A	518	519	530	530	544	542	518	550	527	527	531	550	550	529	528
Group B	825	830	830	819	814	814	844	842	842	826	832	835	835	840	840

- b) Illustrate the following statistical diagrams with real life example. [9]
- Scattered diagram
  - Histogram
  - Pie chart

OR

- Q6) a)** Calculate the first four moments about the mean of the given distribution, Arithmetic mean, standard deviation. Also find  $\beta_1$  and  $\beta_2$ . [10]

X	2.0	2.5	3.0	3.5	4.0	4.5	5.0
f	4	36	60	90	70	40	10

- b)** Compute Karl Pearson's coefficient of correlation between X and Y for the following data : [7]

X	100	98	78	85	110	93	80
Y	85	90	70	72	95	81	74

- Q7) a)** Supposing that out of 12 test matches played between India and Pakistan during last 3 years, 6 are won by India, 4 are won by Pakistan and 2 have ended in a draw. If they agree to play a test series consisting of three matches, find the probability that India wins the test series on the basis of past performance. [9]

- b)** In a distribution of 'NSM' marks exactly normal, 7% of students are under 35 and 89% are under 63. Find the mean and standard deviation of the distribution. [ $A_1 = 0.43$ ,  $Z_1 = 1.48$ ,  $A_2 = 0.39$ ,  $Z_2 = 1.23$ ]. [8]

OR

- Q8) a)** Among 64 offsprings of a certain cross between guinea pigs 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in the ratio 9:3:4. Are the data consistent with the model at 5% level? Given ( $\chi^2_{2,0.05} = 5.99$ ). [9]

- b)** Let  $F: \mathbb{R}^4 \rightarrow \mathbb{R}^3$  be the linear mapping defined by  $F(x, y, z, t) = (x - y + z + t, x + 2z - t, x + y + 3z - 3t)$ . Find a basis and the dimension of (a) the image of F, (b) the kernel of F. [8]



Total No. of Questions: 8]

SEAT No. :

**P340**

**[6003]-421**

[Total No. of Pages : 4

**T.E. (Mechanical /Mechanical Sandwich Engg.)**

**HEAT AND MASS TRANSFER**

**(2019 Pattern) (Semester-I) (302042)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) Explain briefly various regimes in pool boiling with sketch of typical pool boiling curve. [6]
- b) Explain the following Non-dimensional numbers [4]
- i) Reynold Number
  - ii) Grashoff Number
- c) Water flows at a velocity of 12 m/s in a straight tube of 60 mm diameter. The tube surface temperature is maintained at 70 °C and the flowing water is heated from the inlet temperature of 15 °C to an outlet temperature of 45 °C. Taking the physical properties of water at the mean bulk temperature of 30°C as  $\rho = 995.7 \text{ kg/m}^3$ ,  $C_p = 4.174 \text{ kJ/kgK}$ ,  $k = 61.718 \times 10^{-2} \text{ W/mK}$ ,  $\nu = 0.805 \times 10^{-6} \text{ m}^2/\text{s}$  and  $Pr = 5.42$ , Use correlation,  $Nu_d = 0.023(Re_d)^{0.8}(Pr)^{0.4}$ . Calculate (a) the heat transfer coefficient from the tube surface to the water, (b) the heat transfer and (c) the length of tube. [8]

OR

- Q2)** a) Distinguish between filmwise and dropwise condensation [4]
- b) Explain the thermal boundary layer formation for flow over a flat plate with sketch. [6]
- c) A 6 m long and 8 cm diameter horizontal hot water pipe passes through a large room whose temperature is 20 °C. If the outer surface temperature of the pipe is 70 °C, determine the rate of heat loss from the pipe by natural convection. The properties of air at 45 °C are,  $K = 0.02699 \text{ W/mK}$ ,  $Pr = 0.7221$ ,  $\nu = 1.749 \times 10^{-5} \text{ m}^2/\text{sec}$ , Use correlation  $Nu = [0.6 + (A/B)]^2$  Where,  $A = 0.387 (Gr \cdot Pr)^{1/6}$  and  $B = [1 + (0.559/Pr)^{9/16}]^{8/27}$  [8]

**P.T.O.**



- Q3) a)** Explain following Laws of Radiation [8]
- i) Stefan - Boltzmann Law
  - ii) Plank's Law
  - iii) Kirchoff's Law
  - iv) Wein's Displacement Law
- b) The radiation shape factor of the circular surface of a thin hollow cylinder of 10 cm diameter and 10 cm length is 0.1716. What is the shape factor of the curved surface of the cylinder with respect to itself? [4]
- c) Two parallel plates have emissivity of 0.8 and 0.5. A radiation shield having same emissivity on both sides is placed between them. Calculate the emissivity of the shield in order to reduce the radiation losses from system to one tenth of that of without shield. [5]
- OR
- Q4) a)** Explain the following terms [8]
- i) Gray Body
  - ii) Monochromatic emissivity
  - iii) Radiation Intensity
  - iv) Radiosity
- b) A Furnace Cavity which is in the form of cylinder of 75mm diameter and 150 mm length is open at one end to large surrounding that is at 27 °C. The curved surface -3 and bottom surface-2 are approximated as black surfaces and electrically heated. The curved surface -3 and bottom surface -2 are maintained at 1350°C and 1650 °C respectively and outer surfaces are well insulated. Take view factor- $F_{23} = 0.06$ . Estimate heat loss by radiation from opening-1 of the furnace [4]
- c) A pipe carrying steam, having an outside diameter of 20cm runs in a large room and is exposed to air at a temperature of 30 °C. The pipe surface temperature is 200°C. Find the total heat lost per meter length of the pipe taking the emissivity of the pipe surface as 0.8 and convective heat transfer coefficient as  $7\text{W/m}^2\text{°C}$ . [5]

- Q5)** a) State and Explain Fick's Law of Diffusion [6]  
 b) A vessel contains a binary mixture of  $O_2$  and  $N_2$  with partial pressure in the ratio 0.21 and 0.79 at  $15^\circ C$ . The total pressure of the mixture is 1.1 bar. Calculate the following [8]  
 i) Molar concentrations  
 ii) Mass densities  
 iii) Mass fractions and  
 iv) Molar fraction of each species  
 c) Write applications of mass transfer [4]

OR

- Q6)** a) Derive the general mass transfer equation in cartesian coordinates. [6]  
 b) Hydrogen gas is maintained at pressures of 2.4 bar and 1 bar on opposite sides of a plastic membrane 0.3mm thick. The binary diffusion coefficient of hydrogen in the plastic is  $8.6 \times 10^{-8} m^2/s$  and solubility of hydrogen in the membrane is  $0.00145 \text{ kg moles} / m^3\text{-bar}$ . Calculate, under uniform temperature conditions of  $24^\circ C$ , the following [8]  
 i) Molar Concentrations of hydrogen at the opposite faces of the membrane and  
 ii) Molar and mass diffusion flux of hydrogen through the membrane.  
 c) Explain modes of mass transfer [4]

- Q7)** a) Derive an expression for Logarithmic Mean Temperature Difference (LMTD) for parallel flow heat exchanger. [6]  
 b) Draw temperature profile diagrams for parallel flow heat exchanger and condenser. [4]  
 c) In a double pipe heat exchanger hot water flows at the rate of  $5000 \text{ kg/h}$  and gets cooled from  $95^\circ C$  to  $65^\circ C$ . At the same time  $50000 \text{ kg/h}$  of cooling water at  $30^\circ C$  enters heat exchanger. The flow conditions are such that overall heat transfer coefficient remains constant at  $2270 \text{ W/m}^2\text{K}$ . Determine the heat transfer area required and the effectiveness, assuming two streams are in parallel flow. Assume for both the streams  $C_p = 4.2 \text{ KJ/kg K}$ . [7]

OR

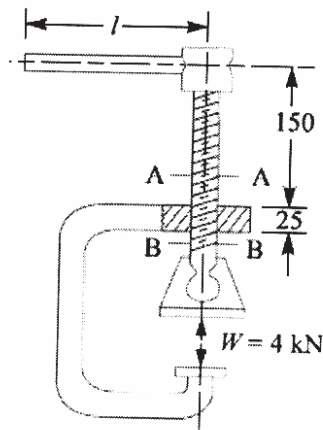
- Q8)** a) Derive an expression for effectiveness for parallel flow heat exchanger in terms of heat capacity ratio ( $C_{\min}/C_{\max}$ ) and Number of Transfer Unit (NTU) [6]
- b) What are the types of heat exchanger? [4]
- c) A counter-flow double pipe heat exchanger using superheated steam is used to heat water at the rate of 10500kg/h. The steam enters the heat exchanger at 180°C and leaves at 130°C. The inlet and exit temperatures of water are 30°C and 80°C respectively. If Overall Heat Transfer Coefficient from steam to water are 30°C and 80°C respectively. If overall heat transfer coefficient from steam to water is 814W/m<sup>2</sup>°C, Calculate the heat transfer area. What would be the increase in area if the fluid flows were parallel? [7]



**[6003]-422****T.E. (Mechanical /Mechanical Sandwich)****DESIGN OF MACHINE ELEMENTS****(2019 Pattern) (Semester-I) (302043)***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1) a)** A C-clamp, as shown in Figure, has trapezoidal threads of 12 mm outside diameter and 2 mm pitch. The coefficient of friction for screw threads is 0.12 and for the collar is 0.25. The mean radius of the collar is 6 mm. If the force exerted by the operator at the end of the handle is 80 N, find:
- i) The length of handle;
  - ii) The maximum shear stress in the body of the screw and where does this exist; and
  - iii) The bearing pressure on the threads.
- [8]**



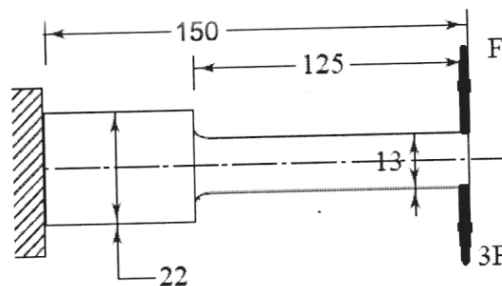
- b) Derive expression for torque required to lower the loads in case of square threads. **[5]**
- c) What are the different types of screw threads used for power screw? What are the advantages and limitations of power screw? **[4]**

**OR****P.T.O.**

- Q2) a)** A vertical two start square threaded screw of 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The nut of the screw is fitted in the hub of a gear wheel having 80 teeth which meshes with a pinion of 20 teeth. The mechanical efficiency of the pinion and gear wheel drive is 90 percent. The axial thrust on the screw is taken by a collar bearing 250 mm outside diameter and 100 mm inside diameter. Assuming uniform pressure conditions, find, minimum diameter of pinion shaft and height of nut, when coefficient of friction for the vertical screw and nut is 0.15 and that for the collar bearing is 0.20. The permissible shear stress in the shaft material is 56 MPa and allowable bearing pressure is 1.4 N/mm<sup>2</sup>. [8]
- b) Explain self-locking and over-hauling property of screw. Prove the condition for screw to be self-locking. [5]
- c) Prove that efficiency of self-locking square threads is less than 50%. [4]
- Q3) a)** A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm<sup>2</sup>. The bar is made of steel 40C8 ( $S_{ut}=600$  N/mm<sup>2</sup>). Calculate the life of the bar for a reliability of 90%. Take surface finish factor 0.44, Size factor 0.85, Reliability factor 0.897. [8]
- b) What is modifying factor to account for stress concentration? Explain Endurance strength modifying factors? [5]
- c) Explain with neat sketch the Gerber curve, Soderberg and Goodman lines? [5]

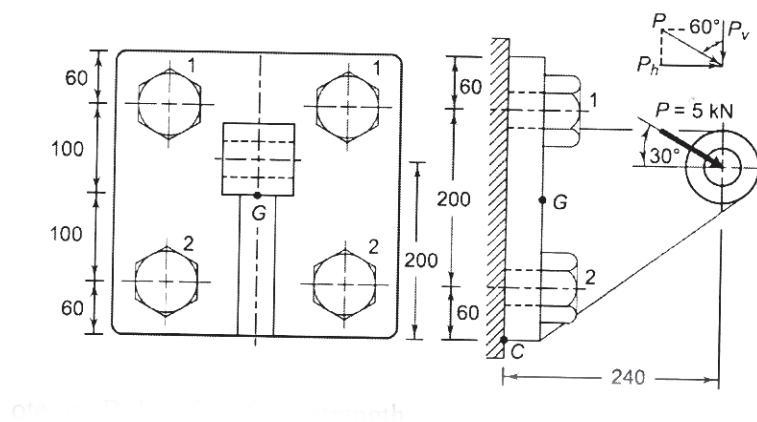
OR

- Q4) a)** A cantilever beam made of steel material with  $S_{ut}=550$  N/mm<sup>2</sup>,  $S_{yt}=320$  N/mm<sup>2</sup> as shown in figure is subjected to load which varies from  $-F$  to  $3F$ . Take surface finish factor 0.89, Size factor 0.85, Theoretical stress concentration factor 1.42, notch sensitivity 0.9, factor of safety 2. Determine maximum value of load  $F$  which the cantilever beam can withstand for infinite life. [8]



- b) Explain modified Goodman diagram. Draw neat labeled sketches of modified Goodman diagram for axial & Bending stresses. [5]
- c) Explain Fatigue Design under Combined Stresses. [5]

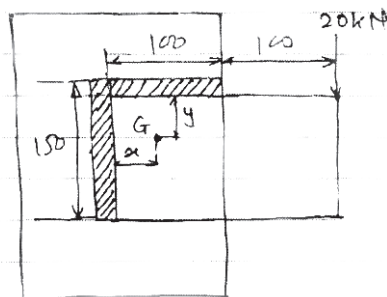
**Q5) a)** A bracket, subjected to a force of 5 kN inclined at an angle of  $60^\circ$  with the vertical, is shown in figure. The bracket is fastened by means of four identical bolts to the structure. The bolts are made of plain carbon steel 30C8 ( $S_{yt} = 400 \text{ N/mm}^2$ ) and the factor of safety is 5 based on maximum shear stress. Assume maximum shear stress theory and determine the size of the bolts. [8]



- b) Write a note on: Bolts of uniform strength. [5]
- c) Explain the procedure for the design of bolts for eccentrically loaded bolted joints in shear. [5]

OR

**Q6) a)** Figure shows a welded joint subjected to a load of 20 kN. Find size of weld if permissible shear stress 80 MPa. [10]



- b) Discuss the procedure for designing Axially Loaded Unsymmetrical Welded Sections. [5]
- c) What are the assumptions made in the design of welded joint? [3]

- Q7)** a) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm<sup>2</sup>, find the axial load which the spring can carry and the deflection per active turn. [8]
- b) What is mean by spring surge and what is its effect? [5]
  - c) Explain with the neat sketch, nipping of leaf spring. [4]

OR

- Q8)** a) Design a helical compression spring with following data; Maximum load=4460 N; Mean coil diameter=85 mm; Maximum shear stress 265 N/mm<sup>2</sup>; Spring stiffness= 67 kN/m; G=81.5 kN/mm<sup>2</sup>; std wire diameter: 14.5, 15, 15.5, 16, 16.5, 17 (mm). [8]
- b) Derive the expression for the shear stress induced in a helical compression springs. [5]
  - c) Explain A.M.Wahl's factor and state its importance in the design of helical springs. [4]



Total No. of Questions : 8]

SEAT No. :

**P343**

[Total No. of Pages : 2

**[6003]-424**

**T.E. (Mechanical /Automobile)**

**ADVANCED FORMING AND JOINING PROCESSES**

**(2019 Pattern) (Semester - I) (302045-A) (Elective - I) (Theory)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) All questions are compulsory i.e. Solve Que. 1 or Que. 2, Que. 3 or Que. 4, Que. 5 or Que. 6, Que. 7 or Que. 8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

- Q1)** a) Explain in detail, weld thermal cycles and their effects with sketches.[8]  
b) Explain in details concept of Heat Affected Zone (HAZ) with sketches and Effects of HAZ on the different properties? [9]

OR

- Q2)** a) Explain in detail importance of effects of pre and post weld heat treatments processes? [8]  
b) Explain in detail concept of weldability & its assessment; explain the importance of weldability. [9]

- Q3)** a) Explain with sketch, Cold pressure welding process with advantages and limitations. [9]  
b) Explain in detail with sketch, Ultrasonic welding process features and applications. [9]

OR

- Q4)** a) Explain in detail with sketch, Explosive welding process with features and advantages. [9]  
b) Explain in detail with sketch, Forge welding process with advantages and limitations. [9]

**P.T.O.**



- Q5)** a) Analyze with the sketch, working of Electroslag welding process and its applications. [8]
- b) Explain with sketch, working principle of Electron beam welding and its applications. [9]

OR

- Q6)** a) Analyze with the sketch, working of Laser Beam welding process and its applications. [8]
- b) Explain the role of welding automation in aerospace, nuclear and surface transport vehicles. [9]

- Q7)** a) Explain in detail, sustainability and drivers for sustainable development and sustainable manufacturing. [9]
- b) Explain the importance of Safety norms in forming and welding also explain Socio-economic aspects related to forming and welding. [9]

OR

- Q8)** a) Explain one case study on waste recycling and one on material recycling.[9]
- b) Explain various Environment protection norms and recycling techniques.[9]



Total No. of Questions : 8]

SEAT No. :

**P344**

[Total No. of Pages : 2

**[6003]-425**

**T.E. (Mechanical/Automobile/Mechanical SW)  
MACHINING SCIENCE AND TECHNOLOGY  
(2019 Pattern) (Semester - I) (302045-B) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of non-programmable electronic calculator is allowed.

- Q1)** a) Explain centerless grinding machine. [6]  
b) Discuss the buffing process with its application. [6]  
c) Explain any three types of grinding wheel with sketch and application.[6]

OR

- Q2)** a) Explain Dressing and Truing of Grinding wheel with sketch. [6]  
b) Explain the meaning of Grinding wheel signature: 20-C-60-M-7-V-28.[6]  
c) Differentiate between Lapping and Honing. [6]

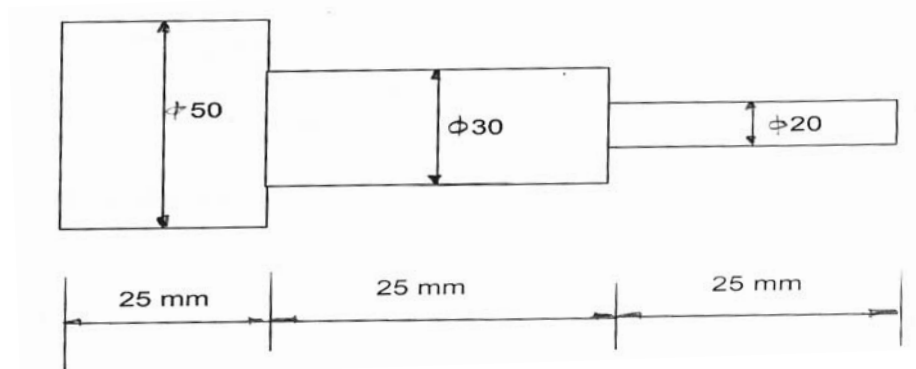
- Q3)** a) Explain 3-2-1 Principle of location with neat sketch. [6]  
b) Explain with neat sketch Pokayoke concept in jigs and fixture. [6]  
c) State the various types of clamping devices used in jigs and fixtures and explain any one. [6]

OR

- Q4)** a) Write a short note on Modular fixtures. [6]  
b) Draw and Explain Diamond pin locator. [6]  
c) Explain template and box jig with a neat sketch. [6]

**P.T.O.**

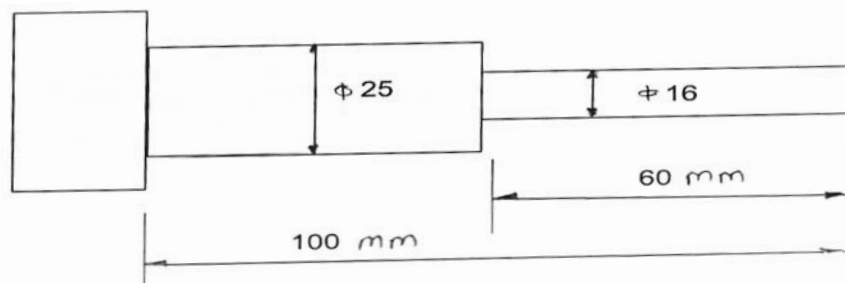
- Q5)** a) Explain any two process planning activities in brief. [8]  
 b) Prepare the operation list to produce the following component, [8]



OR

- Q6)** a) Explain CAPP with advantages. [8]  
 b) Explain different cost involved in manufacturing. [8]

- Q7)** a) Explain in brief threading and grooving cycle with sketch. [8]  
 b) Write a part program for the following diagram, operations - facing, cleaning cut, reduction of dia. to 16 mm from 25 mm, feeds 200 mm/min, speed 800 rpm and depth of cut 2 mm per cut. [10]



OR

- Q8)** a) Differentiate between subroutine and canned cycles in CNC Programming along with one example of each. [8]  
 b) Explain the following codes with neat sketch: [10]  
 G02, G03, G40, G41 and G42



Total No. of Questions : 8]

SEAT No. :

**P345**

**[6003]-426**

[Total No. of Pages : 3

**T.E.(Mechanical)**

**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING  
(2019 Pattern) (Semester - II) (302049)**

**Time: 2½ Hours]**

**[Max. Marks : 70**

**Instructions to the candidates:**

- 1) *Neat diagram must be drawn wherever necessary.*
- 2) *Figures to right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data wherever necessary.*

**Q1) a) Explain following terms: [6]**

- i) Accuracy.
  - ii) Precision.
  - iii) Recall.
  - iv) F-1 Score.
- b) Explain the procedure to find out the optimum value of K in K-means clustering? [5]
- c) Explain the following terms: [6]
- i) Entropy.
  - ii) Information gain.

**OR**

**Q2) a) Explain the steps in KNN algorithm. [6]**

- b) What is SVM? How does it work? [5]
- c) Explain the evaluation parameters for regression model [6]

**Q3) a) Explain the steps involved in development of ML model. [7]**

- b) Quality Engineer wants to solve a two-class classification problem for predicting whether a product is defective. The actual number of products containing no defect are 950 (Truly predicted positives = 900), the actual number defective products are 150 (Truly predicted negatives = 130). So, calculate accuracy, precision, recall and fl score. [4]
- c) Explain hyperparameter tuning parameters in decision tree. [7]

**OR**

**P.T.O.**

- Q4) a)** What are the different cross validation techniques? Explain K-fold cross validation with neat sketch. [7]
- b) A sugar factory produces 3 sizes of sugar from three different nets. Daily 1000 tons of sugar produced from net-1, 3000 tons produced from net-2 and 2000 tons produced from net-3. The last year season experience shows that 1.5% of the total sugar produced from net 1 is waste sugar. the corresponding fractions of waste sugars for the remaining nets are 2.5% and 2% respectively. A certain amount of sugar is taken as a sample at random and is found to be waste sugar. Find out the probability that it is produced from. [4]
- i) Net 1
  - ii) Net 2
  - iii) Net 3
- c) What are the different classification algorithms? Explain logistic regression with neat sketch. [7]
- Q5) a)** Explain the concept of Reinforcement learning with suitable example. Define following terms in Reinforcement learning. [8]
- i) Agent
  - ii) State
  - iii) Environment
  - iv) Reward
- b) Define Markov property. Explain why Markov property is most applicable in solving Reinforcement learning problems. [6]
- c) The transfer function of neuron on one layer of a neural network is assumed to be of sigmoid form. Evaluate the output of neuron corresponding to input  $x = 0.62$ . How is the nature of sigmoid function? (Justify the answer with plot). [4]

OR

- Q6)** a) Explain Convolution Neural Network (CNN) using neat flow diagram. Explain padding and striding in CNN. [8]
- b) Explain Q-learning algorithm with flow diagram. [6]
- c) A neuron with 4 inputs has the weights 1,2,3,4 and bias 0. The activation function is linear, say the function  $f(x) = 2x$ . If the inputs are 4,8,5,6 compute the output. Draw a diagram representing the neuron. [4]
- Q7)** a) How deep learning can be used for Tuning of control algorithm? [6]
- b) Explain AI based fault detection. [5]
- c) Explain in detail various applications of AI in mechanical engineering. [6]

OR

- Q8)** a) How AIML can be used in Dynamic system reduction? [6]
- b) Explain HMI with suitable examples. [5]
- c) Explain applications of AI in process optimization. [6]



**P346****[6003]-427****T.E. (Mechanical)****COMPUTER AIDED ENGINEERING****(2019 Pattern) (Semester-II) (302050)***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

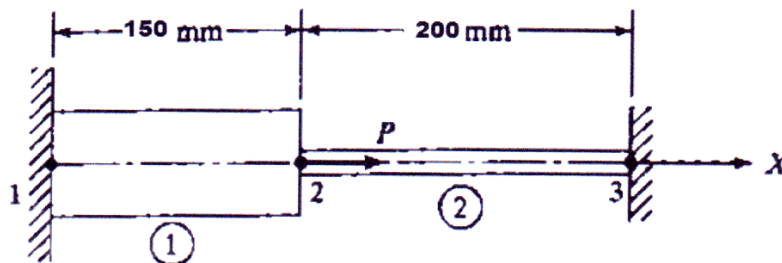
**Q1) a)** An axial load  $P=200$  kN is applied on a stepped steel bar as shown Figure 1.  $A_1 = 2000\text{mm}^2$ ;  $A_2 = 800\text{mm}^2$ ;  $E_1 = 70$  Gpa;  $E_2 = 200$ Gpa.

Formulate:

- i) Element stiffness matrix  $[k_1], [k_2]$
- ii) Global stiffness matrix  $[K]$

Determine using elimination approach:

- i) Nodal displacement vectors  $[u_1], [u_2], [u_3]$
- ii) Element Stresses  $[\sigma_1], [\sigma_2]$

**[12]****Figure 1****P.T.O.**

- b) An axial load of 400 kN is applied at 20 °C to the rod as shown in Figure 2. The temperature is then raised to 50 °C. [6]

Determine:

- Global stiffness matrix
- Global load vectors

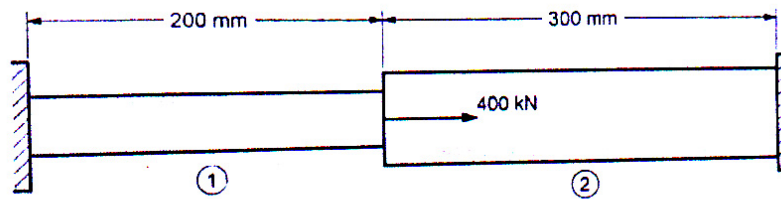


Figure 2

Property	Element 1	Element 2
Material	Aluminium	Steel
Modulus of Elasticity	70GPa	200GPa
Area	900 mm <sup>2</sup>	1200mm <sup>2</sup>
Coefficient of Thermal Expansion	2.3×10 <sup>-6</sup> per °C	11.7×10 <sup>-6</sup> per °C

OR

- Q2) a) An axial load P=400 kN is applied on a stepped steel bar as shown Figure 3. The temperature rise of 30 °C. Given: [12]

$$A_1 = 2400 \text{ mm}^2$$

$$A_2 = 1200 \text{ mm}^2$$

$$l_1 = 300 \text{ mm}$$

$$l_2 = 400 \text{ mm}$$

$$E_1 = 0.7 \times 10^5 \text{ N/mm}^2$$

$$E_2 = 2 \times 10^5 \text{ N/mm}^2$$

$$\text{and } \alpha_1 = 22 \times 10^{-6} / ^\circ\text{C}$$

$$\alpha_2 = 12 \times 10^{-6} / ^\circ\text{C}$$



Formulate:

- i) Element stiffness matrix  $[k_1]$ ,  $[k_2]$
- ii) Global stiffness matrix  $[K]$
- iii) Global load vector  $[F]$

Determine:

- i) Nodal displacement at node 2  $[u_2]$
- ii) Element Stresses  $[\sigma_1]$ ,  $[\sigma_2]$

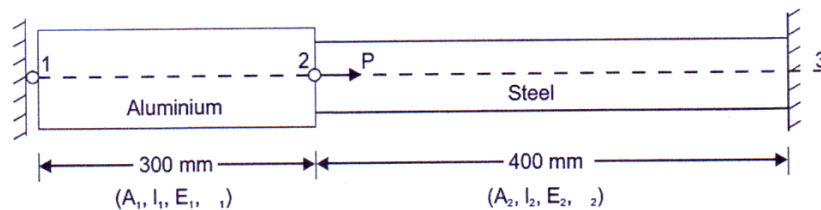


Figure 3

- b) Derive element stiffness matrix for two noded (linear) bar element connected in series. [6]

- Q3) a) A constant strain triangular element is defined by three nodes as shown in Figure 4. Evaluate the shape functions  $N_1, N_2$ , and  $N_3$  at the interior point P (6,6). [7]

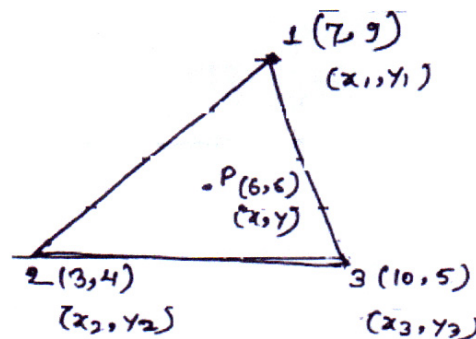


Figure 4

- b) In a triangular element, the nodes 1, 2 and 3 have cartesian coordinates: (30,40), (140,70), and (80, 140) respectively. The displacement in mm at nodes 1, 2 and 3 are (0.1,0.5), (0.6,0.5) and (0.4, 0.3) respectively. The point P within the element has cartesian coordinates (77, 96). [10]

For point. P, determine:

- The natural coordinates
- The shape functions
- The displacement of point P

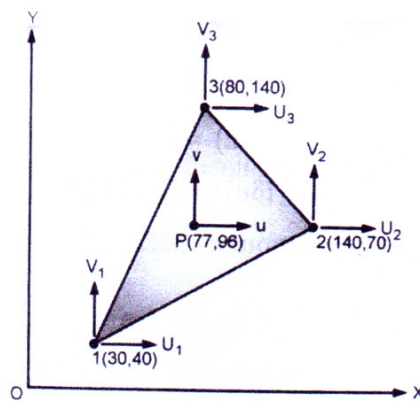


Figure 5

OR

- Q4)** a) What are the steps for interpretation of results during postprocessing in Computer Aided Engineering (CAE)? Suggest the modifications based on the interpretation of results during postprocessing in CAE. [10]
- b) Write down the tricks for post processing in CAE. [7]
- Q5)** a) What are the different kinds of geometric non-linearities in CAE project? Explain with figures. [9]
- b) Write down the comparison of linear and non-linear finite element analysis with reference to following characteristic points. [8]
- Load-displacement and stress-strain relation
  - Scalability and reversibility
  - Computational scheme and solution time
  - Superposition and user interaction with software

OR

- Q6)** a) Illustrate the concept of structural dynamics and acoustics finite element analysis used in Noise, Vibration and Harshness (NVH) analysis. [8]
- b) What is durability, reliability, and fatigue analysis? Explain S-N Curve with low cycle, high cycle, and infinite fatigue life. [9]

- Q7)** a) Elaborate the comparison of Explicit and Implicit method for following criteria: [10]
- i) Common software
  - ii) Stability
  - iii) Computational speed/cost
  - iv) Maximum size of computational problem
  - v) Numerical scheme
  - vi) Handling nonlinearity
  - vii) Filtering of frequencies
- b) Elaborate the use of finite element analysis in plastic injection of moulding in order to optimize the mold materials. [8]

OR

- Q8)** a) Elaborate the comparison between static, dynamic, and fatigue analysis. [10]
- b) Illustrate the applications of Computer Aided Engineering in Computational Fluid Dynamics in following sectors. [8]
- i) Aerospace Engineering
  - ii) Automobile Engineering



Total No. of Questions : 8]

SEAT No. :

**P347**

**[6003] - 428**

[Total No. of Pages : 4

**T.E. (Mechanical)**

**DESIGN OF TRANSMISSION SYSTEMS**

**(2019 Pattern) (Semester - II) (302051)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer four questions from the following.*
- 2) *Draw neat labeled diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non programmable electronic calculator is permitted.*
- 5) *Assume suitable/standard data if necessary.*

**Q1) a)** Compare Hydrodynamic bearing with hydrostatic bearing? **[5]**

b) Derive the stribucks equation for basic static capacity of bearings. State the assumption made. **[6]**

c) A single row deep groove ball bearing subjected to following work cycle. If  $L_{10h} = 12000$  hrs. at 95% reliability Find dynamic load carrying capacity at 90% reliability; and system reliability if such six bearings are there? **[6]**

$F_r$ (kN)	$F_a$ (kN)	X	Y	Race Rotating	$C_s$	Speed rpm	% Time
10	3.0	0.56	2	Inner	1.00	400	40
5.5	1.0	1	0	Outer	1.25	800	30
---	---	---	---	Inner	---	600	30

OR

**Q2) a)** Explain with neat sketch hydrodynamic bearing. State the advantages, limitations and applications of the same. **[5]**

**P.T.O.**

- b) Derive the Petroff's equation for hydrodynamic bearing. Also state its limitation? [6]
  - c) State the assumptions and write the Reynold's equation for 2-D flow and explain the significance of each term in it? [6]
- Q3)** a) Explain Differential band brake with neat sketch. Find the effort applied at the end of lever for Differential band brake. [4]
- b) What is the condition of self-locking in differential band brake? Why should it be avoided in speed-control brakes? Explain self-energizing block brake and self-locking block brake. [6]
  - c) Draw a figure for is internal expanding shoe brake and write the assumptions on which its analysis depends? State the observations made when the vehicle will be travelling in 'reverse' for anti - clockwise rotation of brake drum? [7]

OR

- Q4)** a) Why is the semi-cone angle of a cone clutch made  $12.5^\circ$ ? [4]
- b) What are the characteristics for material used for brake lining ? Name the materials used? [6]
  - c) Draw neat sketch diagram of centrifugal clutch and explain construction and working. What are the advantages, disadvantages and applications of centrifugal clutch? [7]
- Q5)** a) What is structural formula? Write any three structural formulae for twelve speed gear box. [4]
- b) Differentiate between arithmetic, geometric and Harmonic progressions in case of design of gear box. [6]

- c)) Draw structural diagrams for the following structural formulae and identify the optimum structural formula out of them. [8]

- i) 2(1) 3(2)
- ii) 2(3)3(1)
- iii) 3(2) 2(1)
- iv) 3(1) 2(3)

OR

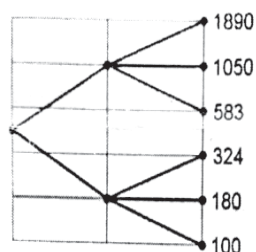
- Q6)** a) Explain the terms. [5]

- i) Range ratio with reference to machine tool gear box design.
- ii) Transmission range with reference to machine tool gear box.

- b) Explain significance of geometric progression ratio. [5]

- c) Read the structure diagram given below and answer the following questions: [8]

- i) What is geometric progression ratio and range ratio of this gear box?
- ii) Write structure formula for this gear box;
- iii) What is the speed of input shaft of the gear box?
- iv) Draw schematic layout diagram of the gearbox and calculate number of teeth on each gear by assuming 20 teeth on smallest gear of each stage.



- Q7)** a) Explain any six components of Hybrid Electric Vehicles? [6]
- b) Explain Power Split Device with neat sketch? [6]
- c) Explain the basic modes of operations used of Hybrid Electric Vehicles? Define Degree of Hybridization. [6]

OR

- Q8)** a) Explain the sizing performance for HEV Components? Explain the optimal sizing in HEV components? [6]
- b) What are the advantages and disadvantages of Hybrid Electric Vehicles? [6]
- c) Explain the power Management for HEV system? Draw the flow chart for sizing methodology of powertrain? [6]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P348**

[Total No. of Pages : 2

**[6003]-429**

**T.E. (Mechanical)**

**COMPOSITE MATERIALS**

**(2019 Pattern) (Semester - II) (302052 - A) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Use of electronic pocket calculator is allowed.
- 4) Assume suitable data if necessary.

- Q1)** a) Give the advantages and drawbacks of metal matrix composites over polymer matrix composites. [6]
- b) Explain the Squeeze casting process of fabrication of a metal matrix composite in detail. [6]
- c) What is diffusion bonding? Explain the metal matrix composites produced using diffusion bonding techniques? [6]

OR

- Q2)** a) Describe liquid infiltration process with a neat sketch. [6]
- b) Explain in detail that metal matrix composites are fabricated using a powder metallurgy process. [6]
- c) Explain the spray forming process of fabrication of a metal matrix composite in detail. [6]

- Q3)** a) Find the ultimate transverse tensile strength for a unidirectional glass/epoxy lamina with a 70% fiber volume fraction. Assume that the fibers are circular and arranged in a square array. Take, Young's modulus of fiber ( $E_f$ ) is 85 GPa, Young's modulus of matrix ( $E_m$ ) is 3.4 GPa, Ultimate strength of fiber ( $\sigma_f$ ) ult is 1550 MPa, Ultimate strength of matrix ( $\sigma_m$ ) ult is 72 MPa. [6]
- b) Derive an expression for the volume and weight fraction of composites. [6]
- c) Write a short note on large particle composites. [5]

OR

**P.T.O.**



- Q4)** a) Derive the rule of mixture equation. [6]  
b) What is a void fraction? What are the properties it governs? [6]  
c) What do you mean by micro-mechanics and macro-mechanics of lamina? [5]

- Q5)** a) Describe with the help of a neat sketch the fatigue testing of polymer matrix composite. [6]  
b) What is bond strength or ply adhesion in polymer matrix composite? Demonstrate its test procedure according to ASTM F 904. [6]  
c) Explain any two non-destructive testing for polymer matrix composites. [6]

OR

- Q6)** a) Discuss common mechanical tests for composites mentioning the purpose of each test. [6]  
b) What is fracture toughness of composite? Sketch different fracture modes to interpret the fracture failure. [6]  
c) List the various international and national test standards developed to test mechanical properties of a lamina. [6]

- Q7)** a) State any three advantages and three disadvantages of using glass epoxy Composite in Aircraft. [6]  
b) State any six advanced properties of Composite materials that makes it a better substitute to steel in an Automobile industry. [6]  
c) What is multi-material technology? State any three benefits of multi-material technology in Automobiles. [5]

OR

- Q8)** a) State any three advantages and three disadvantages of using Boron-Epoxy Composite in Aircraft. [6]  
b) Name the composite that can make the automobile lightweight? State any four advantages of the vehicle being light weight? [6]  
c) Write any three advantages of Composite material over wood in building a boat? What will be preferred as a resin for building boat? [5]



Total No. of Questions : 8]

SEAT No. :

**P349**

[Total No. of Pages : 2

**[6003]-430**

**T.E. (Mechanical)**

**SURFACE ENGINEERING**

**(2019 Pattern) (Semester - II) (Elective - II) (302052 (B))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.
- 4) Neat diagrams must be drawn, wherever necessary.

- Q1)** a) What is the difference between diffusivity and diffusion coefficient? [6]  
b) State Fick's law. What are major points for formula of this law? [6]  
c) Explain process of Nitriding? Compare it with Carbonitriding? [6]

OR

- Q2)** a) Write short note on Laser Hardening. [6]  
b) Why Plasma Nitriding is useful for aeronautical component? [6]  
c) Why surface heat treatment is required? List surface heat treatment methods. Explain drip fed carburizing process in detail. [6]

- Q3)** a) Describe sol-gel coating technology and list application of it? [5]  
b) Differentiate Electrolysis coating and Electroless coating. [6]  
c) Classify Metallic and Non-Metallic Coatings in detail. [6]

OR

- Q4)** a) How nitrides, silicides, and carbides help in corrosion resistance coating? Explain with example of steel or Stainless steel? [7]  
b) What do you mean by "Electroless Coating"? Write advantages, limitations and applications of the following: [10]  
i) Electroless Copper Plating.  
ii) Electroless Nickel Plating.  
iii) Electroless Gold Plating.

**P.T.O.**

- Q5)** a) Highlight need of coatings for aerospace and aircrafts. List few applications of it? [6]  
b) Define the following processes. [6]  
i) Noble Coatings.  
ii) Sacrificial Coatings, list application of these process?  
c) List steps in : surface preparation in organic coatings? How it helps for better coating results? [6]

OR

- Q6)** a) Differentiate in metal, inorganic and organic coatings with respect to Application, effectiveness, cost, and time. [6]  
b) Explain process of cladding; List application of it. [6]  
c) Briefly describe any two processes of the following. [6]  
i) Need of priming coat.  
ii) Coatings for high temperature.  
iii) Hard-facing and its applications.

- Q7)** a) List the different types of Coating Defects. Mention the causes and remedies of any two. [6]  
b) Write a short note on Film Thickness Measurements. [6]  
c) Explain in brief the measurement of porosity of surface coating? [5]

OR

- Q8)** a) List process of measurement of coating thickness? Why thickness measurement is essential in coating process? [6]  
b) What is crawling, wrinkling? How this defect arises, mention steps to remove these defects? [5]  
c) Briefly describe any two processes of the following. [6]  
i) Measurement of residual stress and stability.  
ii) Destructive Film Thickness Measurements.  
iii) Atomic force microscopy.



Total No. of Questions : 8]

SEAT No. :

**P350**

[Total No. of Pages : 3

[6003]-431

**T.E. (Mechanical/S/W)**

**FUNDAMENTALS OF COMPUTER -AIDED ENGINEERING**

**(2019 Pattern) (Semester - I) (302061)**

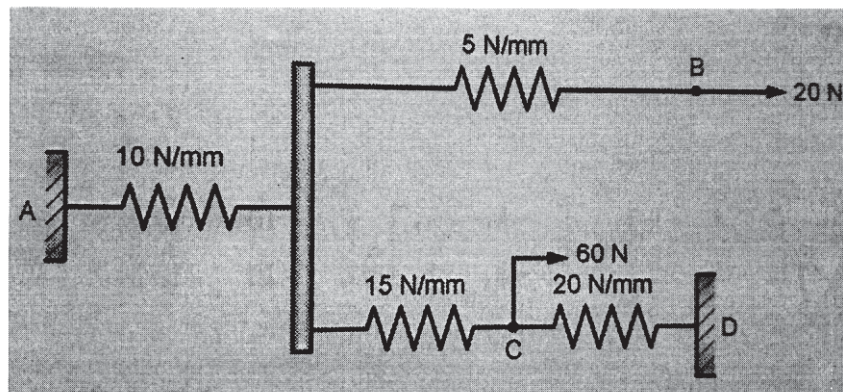
*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Draw neat figures wherever necessary.
- 4) Assume Suitable data if required.
- 5) Use of non-programmable scientific calculator is allowed.

- Q1) a)** A cluster of five springs is shown in the below figure. The assembly is fixed at points A and D while the forces of 20N and 60N are applied at points B and C respectively. Using the finite element method, determine the deflection of each spring and the reaction force at support. **[10]**



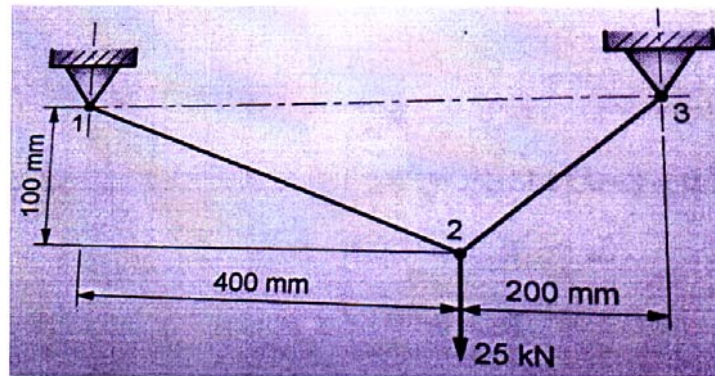
- b) Derive the displacement, stress and strain relationship for 1-D element.[7]

OR

*P.T.O.*

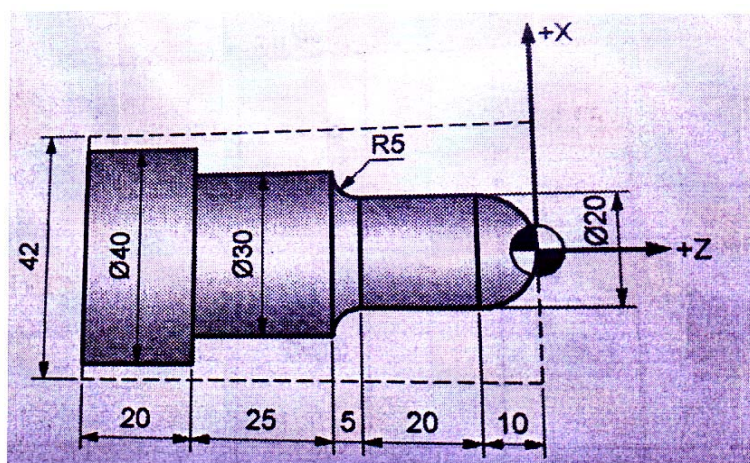
**Q2) a)** The plane truss, shown in the below figure, is subjected to a downward vertical load at node 2. If the cross-sectional area of both the elements is  $30 \text{ mm}^2$  and  $E = 2.1 \times 10^5 \text{ N/mm}^2$ ; Determine: [12]

- i) Nodal displacements
- ii) Stress in each element
- iii) Reaction force at the support



b) Explain the Galerkin approach of weighted residuals used in CAE. [5]

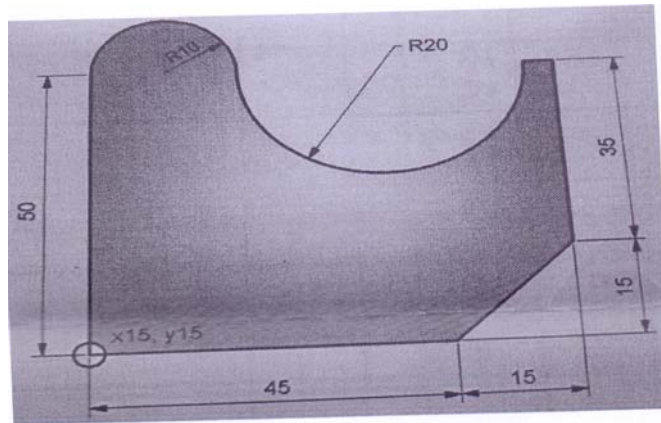
**Q3) a)** Develop a part program using G and M code to turn mild steel job of size as shown in below figure. Assume raw material size as  $\phi 42 \times 80 \text{ mm}$ , cutting tool material as High Speed Steel, cutting speed as  $30 \text{ m/min}$  and feed rate as  $0.05 \text{ mm/rev}$ . [12]



b) Explain DNC machine tools with block diagram. [5]



- Q4) a)** Write a NC part using G and M code to cut a slot for the component shown in the below figure by using an end mill of 10mm. Assume suitable data for machining parameters. [12]



- b) Compare absolute and incremental methods of CNC programming. [5]

- Q5) a)** Define robots and explain the basic architecture of industrial robots. [9]  
b) State different types of grippers used in material handling by robots with one application of each. Explain, with a neat sketch, the vacuum gripper and its advantages and disadvantages. [9]

OR

- Q6) a)** Explain various elements of a flexible manufacturing system with the help of a neat block diagram. [9]  
b) Explain different strategies used in Automation. [9]
- Q7) a)** How the CAE results are validated and checked for accuracy? Explain in brief. [7]  
b) Explain average and unaverage stresses. [7]  
c) Explain the Strain life (S-N) approach for durability analysis. [4]

OR

- Q8) a)** What are the common mistakes made by CAE Engineers? [7]  
b) Explain the Explicit integration scheme for crash analysis. [7]  
c) Write a short note on CAE Reports. [4]



Total No. of Questions : 8]

SEAT No. :

**P351**

**[6003]- 432**

[Total No. of Pages : 2

**T.E. (Mechanical - Sandwich)**

**PROCESS PLANNING & TOOL SELECTION (Self-Study-I)  
(2019 Pattern) (Semester - II) (302066)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data if necessary and mention it clearly.*

- Q1)** a) Draw the locating system for the steel tube of I.D.  $\phi$  40 mm and O.D.  $\phi$  60 mm and length 150 mm. [5]
- b) What are the rules for mechanical by proper use of Holding Forces. [6]
- c) Explain 3-2-1 principle of location for a cube with a neat diagram. [6]

OR

- Q2)** a) Draw the locating system for a square workpiece having a hole of  $\phi$  40 mm and height 30 mm. Side of square is 60 mm. [ $\phi$  40 mm Hole at centre of square face] [5]
- b) Explain Alternate Location Theory with example of cylindrical work piece. [6]
- c) Explain the causes of workpiece variations. [6]

- Q3)** a) Explain the steps involved in machine selection method with a neat flowchart. [6]
- b) What are the factors affecting machine selection? Explain. [6]
- c) Distinguish between general purpose machines and special purpose machines? [6]

OR

**P.T.O.**

- Q4)** a) What are the factors affecting tool selection? Explain in brief. [6]  
 b) What are the rules to be followed while assigning operation numbers in process sheet design? [6]  
 c) Explain the difference between commercial tooling and regular tooling. [6]
- Q5)** a) Explain purpose of cost estimating? [5]  
 b) Explain different elements of cost and cost structure. [6]  
 c) Explain in brief : direct material cost and direct labour cost. [6]
- Q6)** a) List the various steps of cost estimating. [5]  
 b) Discuss the various methods of cost estimating. [6]  
 c) What are the various ways of attributing indirect expenses towards the cost of a product. [6]
- Q7)** a) What are the advantages and limitations of computer aided process planning? [8]  
 b) Explain in detail the steps involved in variant process planning. List any four CAPP software packages used in manufacturing industry. [10]

OR

- Q8)** Prepare the process sheet for the component as shown in fig. 1. It requires a batch of 1000 Nos. The process sheet must contain detailed manufacturing plan with operation sequence, Equipment, tooling, process parameters and sample calculation of operation time. [18]

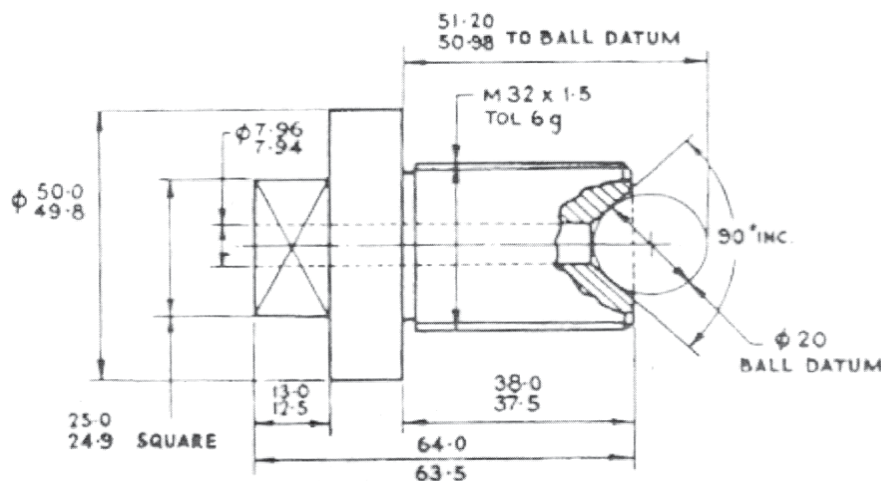


Fig. 1  
 Material : M.S - Bar Stock  
 Spindle





Total No. of Questions : 8]

SEAT No. :

**P352**

[Total No. of Pages : 2

**[6003]-433**

**T.E. (Mechanical Sandwich)**

**ADVANCED MATERIALS AND MANUFACTURING**

**(Self-Study-II)**

**(2019 Pattern) (Semester-II) (302067)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Figures to the right side indicate full marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Use of electronic pocket Calculator is allowed.*
- 5) Assume Suitable data, if necessary.*

**Q1) a)** Explain squeeze casting of metal matrix composites. State it's advantages & disadvantages. **[8]**

b) What is matrix interface? State different interface measurement techniques for composites. Explain pull out test. **[10]**

OR

**Q2) a)** Explain the concept of MMC and Classify MMC with suitable examples. **[9]**

b) Briefly explain spray process of MMC. (Construction & working). State the advantages & limitations. **[9]**

**Q3) a)** State the specifications of high-speed extrusion process and explain the process in detail. **[9]**

b) Draw a neat sketch of hydroforming process. Explain in detail construction and working. Name common applications of the process. **[8]**

OR

**Q4) a)** State the different metals used in metal spinning operations. Explain the process in detail along with its applications. **[9]**

b) Elaborate the process with the applications, advantages and limitations Magnetic pulse forming process. **[8]**

**P.T.O.**

- Q5)** a) Briefly explain the principle and working of Plasma arc welding process. State its advantages and limitations. [10]  
b) Differentiate between electron beam and laser beam welding. [8]

OR

- Q6)** a) State the principle of friction stir welding process and explain the construction and working. [10]  
b) Write a short note on Cold metal transfer process and applications. [8]

- Q7)** a) Briefly explain the principle and working of ultrasonic machining process. State its advantages and limitations. [9]  
b) Explain the construction and working of Electrochemical machining process. [8]

OR

- Q8)** a) Comment on Material removal rate of various non-conventional machining processes. Explain the influence of tool material, geometry, dielectric fluid and process parameters on machining characteristics. [9]  
b) Write a short note on micro-machining. [8]



Total No. of Questions : 8]

SEAT No. :

P-353

[Total No. of Pages : 2

[6003]-434

**T.Y. B.Tech.(Biotechnology)**  
**ANALYTICAL TECHNIQUES**  
**(2019 Pattern) (Semester - I) (315461)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of a calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1) a)** Which method can be used to separate DNA molecules by size? Why? **[9]**

b) Write the working principle of Electrophoresis. Draw a labeled diagram of the horizontal electrophoresis system. **[9]**

OR

**Q2)** Which are the major classes of electrophoresis methods? Explain each technique in detail. **[18]**

**Q3) a)** Explain the process of sedimentation. Write a note on factors affecting the process. **[10]**

b) Write a note on : **[7]**

- i) Disc-bowl Centrifuge
- ii) Tubular Centrifuge

OR

**Q4) a)** Write a note on the scale-up of the centrifugation process. **[10]**

b) Explain the working principle and process of filtration using Rotary Drum Filters. **[7]**

**P.T.O.**

**Q5)** Explain the instrumentation of the Spectrophotometer with the following points : **[18]**

- a) Source
- b) Wavelength selector
- c) Sample holder
- d) Detector

OR

**Q6)** a) What are the two major types of radiation detectors used in spectrophotometers? Describe the functioning of the following detectors in short : **[9]**

- i) Photovoltaic cell detector
  - ii) Photomultiplier Tubes detector
- b) What is spectrofluorometry? Describe applications of spectrofluorometer in detail. **[9]**

**Q7)** a) Explain the working principle of Infrared spectroscopy in detail, with any one example. **[10]**

- b) Give an introduction to Nuclear Magnetic Resonance spectroscopy (NMR) and its use in the identification of molecules. **[7]**

OR

**Q8)** How many types of Mass Spectrometry techniques are available? Give their classification. Explain the suitability for biological sample analysis. **[17]**



Total No. of Questions: 8]

SEAT No. :

**P354**

**[6003]-435**

[Total No. of Pages : 4

**T.E. (Biotechnology)**

**MATERIAL BALANCES AND STOICHIOMETRY**

**(2019 Pattern) (Semester-I) (315462)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4 Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Heat capacity data for gaseous SO<sub>2</sub> is given by the following equation:

**[9]**

$$C_p^0 = 43.458 + 10.634 \times 10^{-3}T - 5.945 \times 10^{-5}/T^2$$

Calculate the heat needed to raise the temperature of 1 kmol pure sulphur dioxide from 300K (27°C) to 1000K (727°C).

- b) A stream of nitrogen flowing at a rate of 100 kmol/hr is heated from 303K (30°C) to 373 K (100°C). Calculate the heat that must be transferred. **[9]**

$$C_p^0 \text{ for nitrogen} = 29.5909 - 5.141 \times 10^{-3} T + 11.1829 \times 10^{-6} T^2 - 4.968 \times 10^{-9} T^3$$

**OR**

**Q2) a)** If cooling tower water available at 298 K (25°C) is used for heat duty calculated is 119647.78 kJ/h at a rate of 1500 kg/h, calculate the outlet temperature of water (final temperature) assuming specific heat of water to be 4.187 kJ/(kg.K). **[6]**

- b) State and explain the terms Latent heat and sensible heat. **[4]**

- c) Toluene is to be heated from 290 K (170C) to 350 K (770C) at the rate of 250 g/s. Calculate heat to be supplied to toluene using the heat capacity data given below: **[8]**

$$C = a + bT + cT^2 + dT^3, \text{ kJ/(kmol.k)}$$

Component	a	b×10 <sup>3</sup>	c×10 <sup>3</sup>	d×10 <sup>6</sup>
Toluene	1.8083	812.223	-1512.67	1630.01

**P.T.O.**

**Q3) a)** Write a short note on: [8]

i) Limiting Reactant/Component

ii) Excess Reactant

b) In the synthesis of ammonia, fresh feed containing 24.7% nitrogen and 1% inerts is mixed with recycle feed. Mixed feed entering into reactor resulted in 25% conversion of ammonia. [9]

Calculate

i) The recycle ratio

ii) The purge ratio and

iii) The combined feed ratio

OR

**Q4) a)** Acetobacter Aceti bacteria convert ethanol to acetic acid under aerobic condition using the reaction: [5]



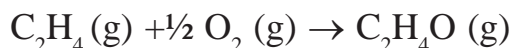
What is the maximum amount of  $\text{C}_2\text{H}_5\text{OH}$  required?

b) Considering the reaction define the term Yield and selectivity. [4]

c) In the production of sulphur trioxide, 100 kmole of  $\text{SO}_2$  and 100 kmole of  $\text{O}_2$  are fed to a reactor. If the percent conversion of  $\text{SO}_2$  is 80, calculate the composition of product stream on mole basis. [8]



**Q5) a)** Calculate the change in enthalpy between reactants and products if both are at 298K (25°C) and if 5 mol of ethylene oxide is produced as per the following reaction: [9]



Data:

Component	$\Delta H_f^\circ$ kJ/mol at 298.15 K (25°C)
$\text{C}_2\text{H}_6 (\text{g})$	52.50
$\text{C}_2\text{H}_4\text{O} (\text{g})$	- 52.63

- b) Calculate heat of formation of liquid 1-3 butadiene at 298.15 K (25°C) using the following data: [9]

Data:

Standard heat of formation of  $\text{CO}_2$  (g) = - 393. 51 kJ/mol

Standard heat of formation of  $\text{H}_2\text{O}$  (l) = - 285.83 KJ/mol

Standard heat of combustion of  $\text{C}_4\text{H}_6$  (l) at 298.15K (25°C) = - 2520.11 kJ/mol

OR

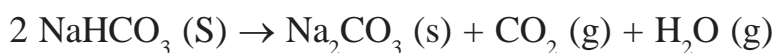
- Q6) a) Discuss in details about effect of temperature on heat of reaction. [4]

- b) Calculate the standard heat of reaction at 298.15 K (25°C) when the gaseous ammonia is dissolved in water to form 2% by weight ammonia solution. [7]

Data:

Component	$\Delta H_f^\circ$ , KJ/mol
$\text{NH}_3$ (g)	- 49.94
$\text{NH}_4\text{OH}$ (l)	- 361.20
$\text{H}_2\text{O}$ (l)	- 285.83

- c) Calculate the energy required to dissociate 1 kg of sodium bicarbonate at 298.15 K (25°C). The dissociation reaction is: [7]



Data:

Component	$\Delta H_f^\circ$ , KJ/mol at 298 . 15 K (25°C)
$\text{NaHCO}_3$ (s)	- 950.81
$\text{Na}_2\text{CO}_3$ (s)	- 1130.68
$\text{CO}_2$ (g)	- 393.51
$\text{H}_2\text{O}$ (g)	- 241.82

- Q7)** a) The gross calorific value of gaseous n-propanol at 298 K (25°C) is 2067.44 kJ/mol. Find its net calorific value using the latent heat of water vapour at 298 K (25°C). [6]
- b) Discuss about calorific values of fuels in combustion. [5]
- c) Crude oil is analysed to contain 87% carbon, 12.5% hydrogen and 0.5% sulphur (by weight). Calculate the net calorific value of the crude oil at 298 K (25°C).

Data: Gross calorific value of crude oil at 298 K (25°C) is 45071 KJ/kg oil  
Latent heat of water vapour at 298 K (250C)=2442.5 kJ/kg [6]

OR

- Q8)** a) A sample of fuel oil has C/H ratio 9:33 and contains 1.3% sulphur (weight basis). The net calorific value of fuel is 3968.5 KJ/kg. Calculate the Gross calorific using latent heat of water vapour at 298K.  
Latent heat of water vapour at 298 K (25°C) = 2442.5 KJ/kg [6]
- b) Discuss about air requirement in combustion. [5]
- c) Heat of combustion of  $C_2H_5OH$  is - 1368 kJ/mol. 100g of  $C_2H_5OH$  is completely combusted and heat supplied to water at 298 K to convert it steam at 373K. Find the mass of water converted into steam. [6]





Total No. of Questions : 8]

SEAT No. :

**P355**

[Total No. of Pages : 2

**[6003]-436**

**T.Y.B.Tech. (Biotechnology)**

**GENETIC ENGINEERING**

**(2019 Pattern) (Semester-I) (315463)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.

**Q1) a)** What are Genomic libraries? How are they prepared and what is their significance? **[9]**

b) What is the role of PCR in cloning? What are the important ingredients of PCR and which are the important steps? **[9]**

OR

**Q2) a)** Selection done based on nutrient deficiency - write a note. **[9]**

b) What are cDNA libraries? What is their significance? **[9]**

**Q3) a)** What is competency in bacteria? How is it important? **[7]**

b) Cloning is gram positive bacteria - Discuss with respect to its significance, problems and solutions. **[10]**

OR

**Q4)** *Saccharomyces cerevisiae* as a cloning host, touch upon its vector design, promoter elements and significance and drawbacks. **[17]**

**Q5) a)** Write notes on : **[9]**

- i) Electroporation
- ii) Transfection

b) Describe *Agrobacterium* mediated gene transfer. **[9]**

OR

**P.T.O.**

- Q6)** a) Describe viral vector-based strategy for transformation. [9]  
b) What is protoplast transformation? What is its significance? [9]

**Q7)** Write in brief about

- a) Factor VIII [5]  
b) Humulin [5]  
c) Transgenic plants [7]

OR

- Q8)** a) What is Bt cotton? How is it produced and what are the steps in its production? [10]  
b) Write a note on Gene Therapy. [7]



Total No. of Questions : 8]

SEAT No. :

P-356

[Total No. of Pages : 2

[6003]-437

**T.E. (Biotechnology)**

**INTRODUCTION TO IMMUNOLOGY**

**(2019 Pattern) (Semester - I) (315464)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6 and Q.7 OR Q.8.*
- 2) *Figures to right indicate full marks.*
- 3) *Assume Suitable data if necessary.*

- Q1)** a) What is antibody? Describe the structure of antibody in detail with neat sketch. [6]
- b) Write note on B cell activation. [6]
- c) Explain in detail about the process of production of monoclonal antibodies. [6]

OR

- Q2)** a) Explain in detail about primary and secondary immune response. [6]
- b) Write note on expression of Ig genes. [6]
- c) What are antigens? Explain about types of antigens and properties of antigens. [6]

- Q3)** a) Describe in detail about complement system mechanism. [9]
- b) Write in detail about cell mediated immunity and T-cell receptors (TCR) [8]

OR

- Q4)** a) Explain in detail about transplantation immunology. [9]
- b) What is MHC? Explain the antigen processing and presentation by MHC. [8]

**P.T.O.**

- Q5) a)** Write note on allergy test and organ specific autoimmunity. [8]  
**b)** What is hypersensitivity? Explain about delayed type of hypersensitivity. [10]

OR

- Q6) a)** Write in detail about immunodeficiency and autoimmune diseases.[10]  
**b)** Write note on anaphylaxis and immediate hypersensitivity. [8]

- Q7) a)** Write in detail about recombinant DNA vaccines. [8]  
**b)** Describe in detail about Immunoelectrophoresis and ODD. [9]

OR

- Q8) a)** Describe in detail about agglutination test and fluorescent antibody test. [8]  
**b)** Explain in detail about ELISA and RID. [9]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P357**

**[6003]-438**

**T.E. (Biotechnology Engineering)**

**ENZYME TECHNOLOGY**

**(2019 Pattern) (Semester - I) (315465A) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1)** Illustrate the role played by:

**[18]**

- a) Pyridoxal phosphate in transamination reactions.
- b) Pyridine nucleotides as electron carriers.

OR

**Q2)** Answer the following:

**[18]**

- a) Write notes on:
  - i) Coenzyme A
  - ii) Thiamine diphosphate
- b) What is the difference between NAD<sup>+</sup> coenzyme and flavin coenzymes? Explain in detail.

**Q3)** Write a short note on features of competitive, noncompetitive and uncompetitive type of enzyme inhibition.

**[17]**

OR

**Q4)** Distinguish between (a) Reversible and Irreversible inhibition (b) Feedback inhibition and Allosteric inhibition.

**[17]**

**P.T.O.**

**Q5)** Explain the Four methods of immobilization of enzymes with its advantages and disadvantages. **[18]**

OR

**Q6)** Answer the following: **[18]**

- a) What is difference between (i) Entrapment and Cross-linking (ii) Adsorption and Encapsulation.
- b) What are the different applications of immobilized enzymes?

**Q7)** What are the various applications of immobilized enzymes? Explain any one with suitable example. **[17]**

OR

**Q8)** Answer the following: **[17]**

- a) Enlist any four immobilized enzymes used in food industry along with its function.
- b) What is role of immobilized enzyme in chemical industry? Explain with an example.



Total No. of Questions : 8]

SEAT No. :

**P358**

[Total No. of Pages : 2

**[6003]-440**

**T.E. (Biotechnology)**

**AGRICULTURAL BIOTECHNOLOGY**

**(2019 Pattern) (Semester - I) (315465 C) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

**Q1) a)** Write an essay on applications of Plant Tissue Culture. **[9]**

b) What is shoot tip culture? Give a general account of the importance and principle of shoot tip culture. **[9]**

OR

**Q2) a)** Define the following terms - **[9]**

- |                           |                            |
|---------------------------|----------------------------|
| i) Totipotency            | ii) Callus Tissue          |
| iii) Clonal Propagation   | iv) Cybrid                 |
| v) Explant                | vi) Micropropagation       |
| vii) Organogenesis        | viii) In vitro mutagenesis |
| ix) Somatic hybridization |                            |

b) Describe the secondary metabolite production by PTC. **[9]**

**Q3) a)** Define molecular marker. Enlist general characteristics of different types of molecular markers. **[9]**

b) Differentiate between structural and functional genomics. **[8]**

OR

**P.T.O.**

**Q4) a)** Describe restriction fragment length polymorphism (RFLP) techniques with its principle and applications. [9]

b) Write short note on molecular marker assisted selection for crop improvement with example. [8]

**Q5) a)** Describe the role of Rhizobium bacterium in nodule formation & Nitrogen fixation. [8]

b) Define Biofertilizers. Explain the role of microbial biofertilizers in agriculture. [10]

OR

**Q6) a)** With one example from each category describe the isolation of agriculturally important (i) microbes as fertilizers (ii) biopesticides (iii) PGR (iv) Biostimulants (v) Antioxidants. [10]

b) Write short note on Azolla and Anabena symbiotic association. [8]

**Q7) a)** Briefly describe the role of Genetic Engineering Appraisal Committee (GEAC). [8]

b) Write short notes on: [9]  
UPOV Act 1991, PPVFR Act 2001 and patents.

OR

**Q8) a)** What is the Cartagena protocol on Biosafety? [8]

b) Write general principles of risk assessment. [9]





Total No. of Questions : 5]

SEAT No. :

**P359**

**[6003]-441**

**[Total No. of Pages : 2**

**T.Y. (Biotechnology Engineering)**  
**FERMENTATION TECHNOLOGY**  
**(2019 Pattern) (Semester - II) (315471)**

*Time : 2½ Hours]*

*[Max. Marks : 35*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of a Calculator is allowed.*
- 5) Assume suitable data if necessary.*

**Q1)** Describe the process of fermentative production of any one primary metabolites. **[18]**

OR

**Q2)** Describe the process of fermentative production of any one secondary metabolites. **[18]**

**Q3)** Write in detail about the isolation, production, and application of any one important enzymes. **[17]**

OR

**Q4)** Explain any two methods of enzyme immobilization in detail. **[17]**

**Q5)** Differentiate between Submerged Liquid Fermentation (SLF) and Solid State Fermentation (SSF). Explain the advantages of SSF over SLF. **[18]**

OR

**P.T.O.**

- Q6)** a) Explain the structure and working principles of Plug flow and Fluidized bed bioreactor. [9]
- b) Describe the working principle of stirred tank bioreactor (CSTR) in detail with the help of a schematic diagram. [9]

**Q7)** Describe the following concepts:

- a) Yield [5]
- b) Product Purity [6]
- c) Product Recovery [6]

OR

**Q8)** Explain the concept of Good Manufacturing Practices (GMPs) in detail. Explain GMP with the help of case study. [17]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P360**

**[6003]-442**

**T.E. (Biotechnology)**

**MASS TRANSFER**

**(2019 Pattern) (Semester-II) (315472)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume Suitable data if necessary.*

**Q1) a)** Give classification of crystallizers and write a short note on Oslo crystallizer. **[9]**

b) Write enthalpy balance equations for a crystallizer with no evaporation of solvent. **[9]**

OR

**Q2) a)** Explain mechanism of crystallization? How crystal formation takes place? How crystal formation varies based on the rate of cooling? **[9]**

b) Draw a sketch and write mass balance equations for batch crystallizer. **[9]**

**Q3) a)** Draw fractionating column. Give major units of column and explain in detail continuous distillation process. **[9]**

b) Define and explain the concept of distillation using terms equilibrium, bubble point and relative volatility. **[8]**

OR

**Q4) a)** What are types of efficiencies? How overall plate efficiency is calculated? **[8]**

b) Write a short note on entrainment and flooding of a distillation column. **[9]**

**P.T.O.**

- Q5) a)** What are azeotropes? Explain in detail positive and negative azeotropes. **[9]**  
**b)** What is feed plate and feed line? Explain with the help of graph how thermal conditions of the feed are introduced based on the q-value? **[9]**

OR

- Q6) a)** Write a detail note on partial condenser and reboilers. **[9]**  
**b)** What is reflux ratio? Draw and explain diagram showing relationship of cost versus reflux ratio. **[9]**
- Q7) a)** Explain the concept of HETP in absorption by correlating it with distillation column. **[9]**  
**b)** Write a material balance equation for simple countercurrent absorption column and derive equation in terms of L/G ratio. **[8]**

OR

- Q8) a)** What is absorption and stripping? Explain phenomena with few applications in industry. **[9]**  
**b)** Explain in detail concept of  $L_{\min}$  for absorption column. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P361**

**[6003]-443**

**[Total No. of Pages : 2**

**T.E. (Biotechnology)**  
**BIOSEPARATION ENGINEERING**  
**(2019 Pattern) (Semester - II) (315473)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

	Marks	Course Outcomes
<b>Q1)</b> a) Give few applications of adsorption in biotechnology.	[9]	CO3
b) Write a short note on temperature swing adsorption with one case study.	[9]	CO3
OR		
<b>Q2)</b> a) Write difference between physical and chemical adsorption.	[9]	CO3
b) Explain in detail principle and continuous operation of adsorption process.	[9]	CO3
OR		
<b>Q3)</b> a) What are the types of columns present in gas chromatography?	[9]	CO4
b) What are the different types of detectors? Explain FID in detail.	[8]	CO4
OR		
<b>Q4)</b> a) Explain different peak broadening effects. How Van Deemter plot co-relates peak broadening effect?	[8]	CO4
b) A chromatographic separation of a two component samples on a 50 cm column gave the retention times for the solutes A and B as 2.5 and 3.1 min with base widths of the two chromatographic peaks being 0.24 and 0.3 min respectively. Calculate the parameters:	[9]	CO4
i) Number of theoretical plates,		
ii) Plate height.		
iii) Resolution of the two peaks.		
OR		
<b>Q5)</b> a) What is membrane fouling? How to avoid it?	[9]	CO5
b) Write short note on:	[9]	CO5
i) Osmosis and Reverse Osmosis		
ii) Ultrafiltration		

OR

*P.T.O.*

- Q6)** a) Enlist the factors affecting the performance of membranes? How are they minimized? [9] CO5  
 b) Draw the diagram of membrane separation process and explain all components in the diagram. [9] CO5
- Q7)** a) What is isoelectric point? How isoelectric precipitation is performed in dairy industries? Why is it important? [9] CO6  
 b) What are the different types of molecular sieves? Give one recent application from literature where is it applied. [8] CO6
- OR
- Q8)** a) How supercritical extraction is used in extraction of caffeine? Write principle and process of supercritical extraction. [9] CO6  
 b) What is the purpose of using mass spectrometry in combination with GC and LC? Explain it with one case study of GC-MS and LC-MS. [8] CO6



Total No. of Questions : 8]

SEAT No. :

**P362**

[Total No. of Pages : 2

**[6003]-445**

**T.E. (Biotechnology)**

**FOOD BIOTECHNOLOGY**

**(2019 Pattern) (Semester - II) (315474 B) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

**Q1) a)** Explain the design principle and application of a freezer. Explain with a diagram the working of a refrigeration system. **[9]**

b) How is the design of a typical microwave equipment? Explain with a diagram. **[9]**

OR

**Q2) a)** What are the time and temperature considerations for HTST pasteurization? **[9]**

b) Describe the performance parameters of food processing? Comment on the food processing and its significance. **[9]**

**Q3) a)** Explain the microbial production process of any three food ingredients. **[9]**

b) How are polysaccharides produced using microbes? Which microbes are used and what are the products? **[8]**

OR

**Q4) a)** Write a note on use of solid state fermentation in food processing industry. **[9]**

b) How is fermentation technology used in traditional food products made in the Indian subcontinent? **[8]**

**P.T.O.**

- Q5) a)** What are the different classes of enzymes used in the food processing industry? Explain the application of any one enzyme along with its application. [9]
- b)** Describe in detail the application of enzymes in the starch processing industry. [9]

OR

- Q6) a)** Enzymes have been a boon to the food industry. Explain with any three enzymes. [9]
- b)** How are enzymes important in the bakery industry? Give all the enzymes useful in the bakery industry. [9]
- Q7) a)** What are the anaerobic processes for processing food waste? [10]
- b)** How is solid waste treated? What are the different methods and which is the best method for treatment of solid waste? . [7]

OR

- Q8) a)** With a neat labelled diagram describe any two liquid waste management methods. [8]
- b)** How is the activated sludge method of treatment different from the other anaerobic processes? [9]





Total No. of Questions : 8]

SEAT No. :

P-363

[Total No. of Pages : 3

[6003]-447

**T.E. (Printing Engineering)**

**PRINT STATISTICS**

**(2019 Pattern) (Semester - I) (308281)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

**Q1)** Explain the following :

**[17]**

- a) Measures of Accuracy or Centering
- b) Measures of Precision or Spread
- c) Normal Distribution

OR

**Q2)** From the given data, arrange the data, prepare frequency distribution table and draw the Histogram only and comment on the same. **[17]**

0.912	0.910	0.904	0.905	0.910	0.911
0.914	0.912	0.910	0.913	0.908	0.914
0.907	0.909	0.913	0.912	0.909	0.913
0.902	0.906	0.909	0.907	0.906	0.908
0.915	0.909	0.910	0.911	0.912	0.909
0.910	0.909	0.908	0.910	0.909	0.907

Note 1 : From G Chart, the recommended number of groups should be 7 for Number of measurements between 30 to 40.

And divide the range of the data by number of groups (7), to find out the class interval, and round it off to 3<sup>rd</sup> decimal value to form the groups

**P.T.O.**

**Q3)** Prepare X bar R chart from the given data on graph paper. [18]

Sample No.	1	2	3	4	5	6	7	8	9	10
Measurement	933	911	889	882	903	890	892	908	895	916
Values	897	898	915	913	930	940	912	920	920	890
	885	900	905	930	890	895	895	896	922	891
	900	905	902	900	890	909	896	894	928	920
	879	862	873	871	900	915	902	906	926	915

Note : Round off all the values as per standard rule

Shewhart's Constants :  $A_2 = 0.577$ ,  $D_3 = 0$ ,  $D_4 = 2.114$

OR

**Q4)** Make two Pareto Charts for the data given in the following table, one for the number of defectives and one for dollar loss. In each case, include a cumulative percentage graph as well. [18]

Department	Defectives	Dollar Loss
A	20	100
B	120	60
C	80	800
D	100	500
E	50	200
F	30	90

**Q5)** Explain in detail with suitable examples, data dispersion, its measurable characteristics, standard distribution and its  $\pm 3$  zones with suitable diagram. And also explain how standard deviation is more important than range. [17]

OR

**Q6)** From the following data, draw appropriate diagrams and also comment on the same (any two) : [17]

- Target 22 mm, Tolerance  $\pm 2$  mm, process mean 23 mm, LCL 20 mm, UCL 26 mm
- Target 530, process  $\mu$  532, standard deviation 8, LSL 505, USL 560
- Design specification 5.5,  $s = 1.5$ ,  $\mu$  6, specification width 8

**Q7)** Calculate the Process Capability Index for Dot Gain on an Offset Press.  
USL : 16 and LSL : 12,  $d_2 = 2.326$  **[18]**

Sample No.	Shift 1	Shift 2	Shift 3
1	15	14	15
2	14	14	14
3	13	12	15
4	16	13	14
5	14	11	16

OR

**Q8)** Explain the various quality control tools. **[18]**



Total No. of Questions: 8]

SEAT No. :

**P364**

**[6003]-448**

[Total No. of Pages : 2

**T.E. (Printing Engineering)**  
**OFFSET PRINTING TECHNIQUES**  
**(2019 Pattern) (Semester-I) (308282)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Black figures to the right indicate marks.*
- 3) Assume suitable data if necessary.*
- 4) Neat diagrams must be drawn wherever necessary*
- 5) Use of an electronic pocket calculator is allowed.*

**Q1)** Explain in detail the splicing mechanism of a web-fed offset press. **[18]**

OR

**Q2)** Explain in detail the feeder mechanism of the sheet-fed offset press. **[18]**

**Q3)** Describe the purpose, functions, and ingredients of a dampening solution. **[17]**

OR

**Q4)** Describe the various ink metering systems of an offset press. **[17]**

**Q5)** Explain the different types of dryers used in the web-offset press. **[18]**

OR

**Q6)** Explain the purpose of chill rollers and the designs used in the web-offset press. **[18]**

**P.T.O.**

**Q7) a)** Mention the problems associated with inadequate web tension. **[7]**

**b)** Calculate the Rewind Tension with the following specifications. **[10]**

Tension in the previous zone: 0 lbs.

Nip Roll Velocity: 100 fpm

Rewind velocity: 105 fpm

Elasticity\* Cross-sectional Area of the Material: 500 lbs.

Also calculate the error in tension for a 0.25% error in speed.

OR

**Q8)** Explain the various tension measuring systems used on a web-fed offset press.

**[17]**



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 3

**P365**

**[6003]-449**

**T.E. (Printing)**

**COLOR SCIENCE AND MEASUREMENT**

**(2019 Pattern) (Semester-I) (308283)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.No. 2, Q.No 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No 7 or Q.No 8.*
- 2) *Figures to the right indicate full marks*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** a) Explain the 3 basic perceptual attributes of color. [6]

b) Define saturation and explain out of 2 same samples, which attribute will have show higher degree of difference. [6]

c) Describe the CIE 1931 Yxy System [5]

OR

**Q2)** a) Describe the Munsell Color model system [6]

b) Draw a neat diagram of a color wheel indicating the different colors [5]

c) Explain which attributes can be derived from tri-stimulus values and how [6]

**Q3)** a) Explain difference between tint, shade and tone. [12]

b) Justify effect of light source on the color of an object [6]

OR

**Q4)** a) State different parts of a Spectrophotometer. Distinguish between a colorimeter and spectrophotometer [12]

b) Draw a neat diagram only (with proper labels) of spectrum indicating with optical brightening agents and without optical brightening agents. [6]

**P.T.O.**

**Q5) a)** Write short notes on any 3 [12]

$\Delta E^*_{ab}$ ,

$\Delta E_{CMC}$ ,

$\Delta E^*_{94}$ , and

CIEDE 2000

b) Compare any 2 color difference equations. State their differences [6]

OR

**Q6) a)** State the significance of measuring color difference with help of instrument. [5]

b) Solve following using delta Eab equation between Sample 1&2 And Sample 3 & 4 [6]

Sample 1

$L1^* 56.2$

$a1^* -32.5$

$b1^* 4.9$

&

Sample 2

$L2^* 56.0$

$a2^* -45.7$

$b2^* 5.7$

Sample 3

$L3^* 60.3$

$a3^* 33.0$

$b3^* 64.3$

&

Sample 4

$L4^* 41.0$

$a4^* 33.2$

$b4^* 25.5$

c) Explain standard viewing conditions. [6]

- Q7)** a) Why do automobiles face the problem of metamerism. [6]  
 b) How can it be solved? [6]  
 c) Explain difference between colorant and dye. [6]

OR

- Q8)** a) Explain the term Colour Index<sup>™</sup> Generic Name (CIGN). Give any 3 examples, how pigments are described using this term. [12]  
 b) Why are the spectral curves twisted of a metamer pair. [6]

<i>Authority's</i>	<i>Name</i>	<i>Sign</i>
<i>Paper Setter</i>	<i>Madhura Mahajan</i>	
<i>Head Of Department</i>	<i>Madhura Mahajan</i>	
<i>Exam Department</i>		





Total No. of Questions : 8]

SEAT No. :

P-366

[Total No. of Pages : 2

[6003]-450

T.E. (Printing)

INK TECHNOLOGY

(2019 Pattern) (Semester - I) (308284)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume Suitable data if necessary.
- 4) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Differentiate between a shear thinning and shear thickening liquids.[6]  
b) Factors which affects the rheological behavior of printing inks. [6]  
c) Explain in brief the influence of Ink rheology on printing quality. [6]

OR

- Q2)** a) Draw a stress and strain curve diagram and explain printing ink on the diagram. [6]  
b) Write short note on thixotrophy. [6]  
c) Write short note on viscometer. [6]

- Q3)** a) Explain in brief factors affecting ink drying. [5]  
b) Explain in brief the methods of ink drying. [6]  
c) Compare UV and IR curing. [6]

OR

- Q4)** a) Write short note on UV ink drying. [5]  
b) Write short note on setting of ink. [6]  
c) Compare evaporation and absorption drying. [6]

P.T.O.

- Q5)** a) List down the printing substrates and their ink requirements in terms of adhesion and gloss and drying methods. [6]  
b) Explain in brief the printing inks and their end use. [6]  
c) Explain in brief the factors to be considered while formulating printing inks. [6]

OR

- Q6)** a) Describe the ink manufacturing process and different methods for pigment dispersal. [6]  
b) Explain in brief the printing process and their ink ingredients and ink formulation. [6]  
c) What is the purpose of ink dispersing agents in ink formulation? [6]

- Q7)** a) Write short note on analysis of Ink component. [5]  
b) Write short note on VOC. [6]  
c) Write short note on Gloss. [6]

OR

- Q8)** a) Explain in brief the purpose to check the gloss of ink. [5]  
b) Explain in brief the solid contents of ink and the purpose of solid contents in ink. Explain the method to calculate the % of solid content. [6]  
c) Explain in brief the VOC. [6]



Total No. of Questions : 8]

SEAT No. :

**P367**

**[6003]-451**

**[Total No. of Pages : 1**

**T.E. (Printing)**

**CYBER SECURITY**

**(2019 Pattern) (Semester - I) (Elective -II) (308286A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain the following terms - Ransomware, Adware, Spyware. [6]  
b) What is an Operating System? Describe in brief about the Kali Linux OS. Name a few security tools present in Kali Linux along with their use cases. [12]

OR

- Q2)** a) Explain CIA and AAA with suitable examples. [9]  
b) What security measures can be taken by an individual to stay safe from android hacking? [9]

- Q3)** a) What is meant by booting? Differentiate between soft boot and hard boot. Is it possible to use multiple OS on a single machine? If yes, How? [9]

- b) What are the different methods of password cracking? Explain how is windows password cracked using "Utilman. exe". [8]

OR

- Q4)** a) What security measures can be taken by an individual to stay safe from android hacking. [8]

- b) What is a payload? Explain the process of developing a payload. How is it used to hack a system? Elaborate with suitable examples. [9]

- Q5)** a) Define Social? Engineering. Explain the motives behind such attacks. What does the hacker gain from social engineering? [12]

- b) Name and explain any 6 points to identify a phishing email. [6]

OR

- Q6)** a) What is SEToolkit? How can you use this tool to simulate a phishing attack? [8]

- b) Mention any 5 security measures to detect and prevent phishing frauds. [10]

- Q7)** a) Explain the historical background, Object, Extent, Scope and Commencement of the information Technology Act. [10]

- b) Explain Cyber Terrorism, Cyber bullying, and Cyber warfare. [7]

OR

- Q8)** a) Define and discuss various IT Act clauses related to cyber crimes. [12]

- b) Explain the liability aspect of the Internet Service Provider as per the Information Technology Act 2000. [5]



Total No. of Questions : 8]

SEAT No. :

**P368**

[Total No. of Pages : 1

**[6003]-452**

**T.E. (Printing Engineering)**

**WOOD, GLASS AND METAL BASED PACKAGING  
(2019 Pattern) (Semester - I) (Elective - I) (308286 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Use of electronic pocket calculator is allowed.

**Q1)** a) Explain Glass containers advantages and disadvantages with applications. [9]

b) Write down Benefits of Glass Packaging with facts. [9]

OR

**Q2)** a) Explain evaluation studies on glass containers and advantages of glass containers. [9]

b) Explain composition of glass containers. [9]

**Q3)** a) Explain procedure of Annealing Test with applications. [8]

b) Explain procedure of thermal shock test with applications. [9]

OR

**Q4)** a) Explain the cause of glass to spoil with advantages and disadvantages. [8]

b) Explain USP test with applications. [9]

**Q5)** a) Explain characteristics of black plate with diagram. [9]

b) Explain about packaging and marking of metal containers. [9]

OR

**Q6)** a) Write down applications of aluminium foil. [9]

b) Write down advantages and Disadvantages of Metal Based Packaging. [9]

**Q7)** a) Explain about oil Drums. [8]

b) Explain GI drums. [9]

OR

**Q8)** a) Write down type of closures. [8]

b) Explain recent developments of closures and drums. [9]



Total No. of Questions : 8]

SEAT No. :

**P369**

**[6003]-454**

[Total No. of Pages : 2

**T.E. (Printing Engineering)**  
**FLEXO PRINTING TECHNIQUES**  
**(2019 Pattern) (Semester - II) (308289)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Neat diagram must be drawn wherever necessary.

- Q1)** a) Explain the purpose and effects of Back-exposure. [6]  
b) Explain the purpose and effects of Main-exposure. [6]  
c) Discuss Environmental concerns in flexo industry. [5]

OR

- Q2)** a) Why we use developing solution and explain different type of washout solution. [6]  
b) Explain purpose and effects of Drying mechanism of plate. [5]  
c) What is Post-exposure and Light Finishing? Why we required these. [6]

- Q3)** a) How to prepare Digital Flexo Plates. [8]  
b) Explain different type of dots generated on flexo plate. [5]  
c) What is file format and its type? Discuss in detail. [5]

OR

- Q4)** a) Define Ablation technique. [6]  
b) Explain Digital Workflow in detail. [6]  
c) Discuss difference between digital plate and conventional plate. [6]

- Q5)** a) Explain flexography process with diagram. [6]  
b) Explain UV dryer in detail with diagram. [6]  
c) Define Central impression narrow web press and its advantages. [5]

OR

*P.T.O.*

- Q6)** a) Discuss on flexography product and application. [6]  
b) Define stack narrow web press and its advantages. [5]  
c) Explain EB dryer in detail with diagram. [6]

- Q7)** a) How to select anilox roller in flexography? [6]  
b) Explain different method of Anilox cleaning. [6]  
c) Explain doctor blade in detail with diagram. [6]

OR

- Q8)** a) “Anilox is heart of flexography”, If you agree then explain it in detail.[6]  
b) Explain anilox cell and Explain different type of anilox cell with diagram?[6]  
c) Explain fountain roller and its specification. [6]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P370**

**[6003]-455**

**T.E. (Printing)**

**COLOR MANAGEMENT**

**(2019 Pattern) (Semester-II) (308290)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Explain types of display technologies. [6]  
b) What are 3 C's of Monitor Profiling? [6]  
c) Comment on Monitor Profiling. [5]

OR

- Q2)** a) How to set monitor for display profiling? [6]  
b) Comment on color correction environment for monitor display. [5]  
c) How monitor profiling differs from output profiling? [6]

- Q3)** a) How to construct Printer profile? [6]  
b) What are 4 C's of profiling printer? [6]  
c) What are parameters to be considered for printer profiling? [6]

OR

- Q4)** a) How to ensure consistency of printing output? [6]  
b) Can you apply your knowledge to construct profile for given printing device? [6]  
c) What are different rendering intents? [6]

**P.T.O.**

- Q5)** a) What is device link? [6]  
b) What are 4 C's of proofer profiling? [6]  
c) Explain hard proofing procedure. [5]

OR

- Q6)** a) Make flow chart of activities you require to profile your proofing device. [6]  
b) Discuss proofer profiling. [5]  
c) Explain advantages of using device link. [6]

- Q7)** a) Comment on visual color evaluation concept. [6]  
b) Explain viewing conditions required for visual color evaluation. [6]  
c) Comment on Gray balance. [6]

OR

- Q8)** a) How do you set conditions for visual evaluation of print? [6]  
b) Explain gray balance setting. [6]  
c) Comment on Tone reproduction curve. [6]





Total No. of Questions : 8]

SEAT No. :

**P371**

[Total No. of Pages : 4

**[6003]-456**

**T.E. (Printing Technology)**

**DESIGN OF EXPERIMENTS**

**(2019 Pattern) (Semester - II) (308291)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q. No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** A cup manufacturer has reported average sale to 500 printing presses that he has to deal with during a month amount to Rs. 36,000/- with a standard deviation of Rs. 10,000/-. Assuming that the sale in these businesses is normally distributed, find: **[6]**

The number of business the sale is over Rs. 40,000.

- b) Also find if the percentage of business the fine is likely to range between Rs. 30,000 and Rs. 40,000. **[6]**
- c) Describe t-test. **[5]**

**OR**

**Q2) a)** Hourly wages of 1000 workmen are normally distributed around a mean of Rs. 70 and with a standard deviation of Rs. 5. Estimate the number of wages whose hourly wages will be: **[6]**

Between Rs. 70 and Rs. 72.

- b) Between Rs. 69 and 72. **[5]**
- c) What is Type 1 error and Type II error. **[6]**

**Q3) a)** To adjust the contact pressure between plate cylinder and blanket cylinder, which move towards each other at a fixed axial clearance, the plate or the blankets are underlaid, a process which results in a 0.05-0.15 mm radial deformation of the blanket. The changes in the underlay resulted in variations in tone value increase in the highlight areas and print contrast. The operator collected data for 6 of its treatments of underlay. **[12]**

**P.T.O.**

Treatment in micron thickness of packing					
0.01	0.05	0.075	0.08	0.1	0.2
27	29.3	29.3	29.45	30.11	34.7
26.7	27	28.99	30.33	33.47	31.77
28	28.01	29.02	31.1	31.55	32.98
27.3	25.9	29.1	31	34	33.0

Using the data given below for TVI, test whether the mean tone value increase due underlay is same for all thicknesses at 0.05 level of significance.

- b) Explain what is level and factors in ANOVA. [6]

OR

- Q4)** a) A CTP unit manufacturer is experimenting on time required for imaging in CTP plates. It is of interest for the researcher to study the effects of following factors: types of laser diodes and the coating type. Each factor is run at 3 levels. The setup is that of a completely randomized design. The data are given in table. The time measured is in microseconds. [12]

Factors	Coating Type	
Laser Power in Watt	A	B
60	39.5	47.4
	45.7	43.5
	49.8	39.8
	50.2	36.1
	63.8	41.2
80	33.5	44
	36.7	41.2
	42	47.3
	38.1	45.3
	31.2	42.7

Prepare ANNOVA Table. [4]

- b) i) What effect does coating type have on the time to image? [6]  
 ii) What effect does power have on the time to image?  
 iii) Do both coating types behave in the same manner in the two types?

- Q5) a)** Consider a  $2^2$  factorial with factors A and B and n experimental observations per factor combination. Prepare a geometric view and in tabular form of the  $2^2$ . Define Contrast A, B and AB among treatment totals. [6]
- b) Explain what is cause effect diagram. [6]
- c) Explain general full factorial in DOE. [5]

OR

- Q6) a)** In  $2^k$  series consider following factors polymer 1 and polymer 2. Each run at 2 levels low and high indicating concentration of the polymers. These experiments are conducted to test additives to inks. Data given is change in plastic viscosity which is a rheological measure reflecting the change in thickness of the ink. Various polymers are added to the ink to increase the viscosity. [11]

Prepare and display treatment combinations in graphical form.

	Polymer 1			
Polymer 2	Low		High	
Low	3	3.5	11.3	12.0
High	11.7	12.0	21.7	22.4

Calculate main effect and interaction effect.

- b) Write a short note on factorial design. [6]
- Q7)** A book making machine is set to deliver packets of a given weight, 10 samples of size 5 each were recorded. Below given are relevant data: [18]

Sample no	1	2	3	4	5	6	7	8	9	10
Mean $\bar{x}$	15	17	15	18	17	14	18	15	17	16
Range	7	7	4	9	8	7	12	4	11	5

Calculate the values for the central line and control limits for mean chart and range chart and then comment on the state of control

OR

**Q8) a)**

345	530	556	354	590
395	515	479	494	420
563	444	629	440	485
505	604	490	445	605
402	406	730	506	516
472	475	610	586	523
691	520	465	468	545
523	582	570	578	505
461	575	420	605	527
624	440	585	420	384

Construct a frequency distribution table with appropriate class limits and class boundaries. With reference to G chart divide the measurement scale into 8 groups. **[6]**

- b) Draw histogram to represent the above frequency distribution. **[6]**
- c) Comment on the results. **[6]**



Total No. of Questions : 8]

SEAT No. :

P-372

[Total No. Of Pages : 2

**[6003]-457**

**T.E. (Printing)**

**Maintenance Management of Printing Machines  
(Elective-II) (2019 Pattern) (Semester-II) (308293A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Prepare a Monthly Preventive Maintenance check sheet for dampening system offset press. [6]
- b) What are the Characteristics of Preventive Maintenance? [6]
- c) Important Steps for Establishing a CM Program. [5]

OR

- Q2)** a) Write a Brief Note on Corrective Maintenance for flexo inking unit [6]
- b) What are the Elements of Corrective Maintenance? [6]
- c) What are the Types Lubricants. [5]
- Q3)** a) What is Condition Based Monitoring. [6]
- b) Explain in detail about Air Leakage testing for Offset Press. [6]
- c) How Condition Based Monitoring helps to build data mine. [6]

OR

- Q4)** a) Describe in Detail the Predictive Maintenance with respect to Air Compressor used for Gravure Printing Press? [6]
- b) Describe in Detail the Predictive Maintenance with respect to compressor used for Offset Printing Press. [6]
- c) Explain any 3 Instruments used for Different Condition Monitoring [6]

*P. T. O*

- Q5)** a) What is OEE, Explain with respect to Quality [6]  
 b) How Need for Effectiveness Maintenance Important. [6]  
 c) What are the Key Performance Indicators for Gravure Maintenance. [5]

OR

- Q6)** a) What are the Safety Measures taken during Maintenance. [6]  
 b) What is significance of 5s in Maintenance Management. [6]  
 c) What is MTTR and MTBF [5]
- Q7)** a) What is TPM. Explain with respect to Single color Offset Press. [6]  
 b) What are the Pillars of TPM. Explain with suitable example. [6]  
 c) What is Critical Spares. [6]

OR

- Q8)** a) Describe the Replacement or Repair Decision Making Policy with respect to LCC Model Technique. [6]  
 b) What is Kaizen, Explain with suitable example for Offset Printing Machine. [6]  
 c) Conclude Replacement or Repair Decision by Calculating Average Maintenance Cost for a Single Color Flexo Machine & Write a Statement Considering Below

Mentioned Data for Calculation. [6]

Year	1	2	3	4	5	6	7	8
Maintenance Cost	1500/-	1700/-	1900/-	2100/-	2300/-	2500/-	2700/-	3000/-
Resale Value	2000/-	1700/-	1500/-	1300/-	1200/-	1100/-	1000/-	900/-



Total No. of Questions : 8]

SEAT No. :

P-373

[Total No. Of Pages : 2

**[6003]-458**

**T.E. (Printing Engineering)**

**Basic Communication System and Electronic**

**Instrumentation (Elective - II)**

**(2019 Pattern) (Semester - II) (308293 B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) Neat diagrams must be drawn wherever necessary.*
- 5) Use of electronic pocket calculator is allowed.*

**Q1) a)** Explain the RFID communication in detail along with applications. **[9]**

**b)** Explain the WiFi signal losses types in detail. **[9]**

OR

**Q2) a)** Explain the Wi-Fi Communication system with modulation techniques used in it. **[9]**

**b)** Explain the DSSS and FHSS techniques used in communication system. **[9]**

**Q3)** Describe static and Dynamic characteristics of measurement system. **[17]**

OR

**Q4) a)** Explain the selection criteria for the sensors and transducers. **[9]**

**b)** State types of measurements. **[8]**

*P. T. O*

**Q5)** Mention the applications of optical sensors and Transducer in printing industry. [18]

OR

**Q6)** a) Explain the working of capacitive sensor. [9]

b) Describe the working of LVDT. [9]

**Q7)** Describe the working and types of temperature sensors (any 2) . [17]

OR

**Q8)** Describe in detail any pressure sensor used in printing industry. [17]





Total No. of Questions : 8]

SEAT No. :

P-374

[Total No. Of Pages : 2

**[6003]-459**

**T.E. (Printing)**

**ELECTRONICS PUBLISHING**

**(2019 Pattern) (Semester-II) (Elective-II) (308293 C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** What are the features of Robust Computing. **[10]**

b) Draw Graphical representation of Types of Computing. **[8]**

OR

**Q2) a)** Explain Frontend and Backend Web Development with its structure **[10]**

b) Explain Semantic Web and its features **[8]**

**Q3) a)** Explain advantages and disadvantages of File Processing system and database system. **[10]**

b) Draw the diagram of Database Architecture **[7]**

OR

**Q4) a)** Explain various types of Online Media Writing **[10]**

b) Compare GIF and PNG file formats **[7]**

*P. T. O*

**Q5)** Develop a sitemap for newly started Travel Company. Highlight the homepage menu and discuss 2 different types of hierarchy you can use for this website [18]

OR

**Q6)** Develop a Questionnaire for online Perfume Shopping brand. Define the objective of the questionnaire and expected result of the questionnaire. [18]

**Q7) a)** What HTML, XML and CSS. What is Metadata? [10]

b) Write HTML Program to display following table of marks obtained out of 25

Roll Number	Subject 1	Subject 2	Subject 3
1001	18	15	19
1002	22	20	18
1003	19	17	16

[7]

OR

**Q8) a)** What are the roles and responsibilities of Website Administrators in Content Management System? [10]

b) Draw the workflow diagram of ATM machine to withdraw the cash [7]



[6003]-460

T.E. (Production)

**ENGINEERING METROLOGY & INSTRUMENTATION****(2019 Pattern) (Semester - I) (311081(A))***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Use of electronic pocket calculator is allowed.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Define quality and explain cost of internal and external failure. **[8]**

- b) A manufacturer uses injection moulding machine to produce a plastic insulation barrier. He inspects 100 barriers daily, picked up randomly from the production, and determines the number of rejects by visual inspection the results of daily inspection of 100 barriers for 10 days are given below. **[10]**

Day	1	2	3	4	5	6	7	8	9	10
No. of rejects	5	12	10	11	13	6	8	10	14	11

Construct a suitable chart to analyse the quality of production. Name the chart and state whether the process is in control?

OR

**Q2) a)** What is sampling inspection? Explain in detail single sampling inspection. **[8]**

- b) A subgroup of 5 items is taken from the manufactured items. After 24 subgroups the values of  $\bar{x}$  and R were found to be  $\sum \bar{x} = 270$  and  $\sum R = 6.6$ . The specification limits for the part are  $20.5 \pm 0.35$ . Assuming the process is in control, what conclusion would you draw about the ability of the process to produce the items within the specified limits? Take  $A_2 = 0.577$ ,  $D_3 = 0$ ,  $D_4 = 2.115$ ,  $d_2 = 2.326$  for subgroup size of 5. **[10]**

**P.T.O.**

- Q3) a)** What are Quality Assurance tools and techniques? Explain any one. [9]
- b) What is Q.F.D.? Explain house of quality. [9]

OR

- Q4) a)** Write short note on Kaizen and six sigma. [9]
- b) What are Technical Specification (T.S.) TS 16949 Standards? [9]

- Q5) a)** What are the different stages in generalized measuring system? [7]
- b) What are the types of Active and Passive transducers? [10]

OR

- Q6) a)** Explain in detail the following features of measuring instrument. [10]
- i) Hysteresis
- ii) Precision
- b) Differentiate between active and passive sensors with example. [7]

- Q7) a)** Explain any one measuring instrument used for - Stress and Strain? [8]
- b) What are the different types of dynamometers? Explain with neat sketch Prony Brake type dynamometer in Torque measurement. [9]

OR

- Q8) a)** Explain with neat sketch LVDT type of transducer for force measurement. [8]
- b) Define Force. Explain in detail Direct and Indirect methods of force measurement. [9]



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 3

**P376**

**[6003]-461**

**T.E. (Production)**

**MATERIAL FORMING TECHNOLOGY**

**(2019 Pattern) (Semester-I) (311082(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve, Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of electronic pocket calculator is allowed.
- 5) Assume suitable data, in necessary.

**Q1) a)** What are the defects in wire drawing? Describe the causes and remedies for these flaws. **[8]**

b) Explain stepped cone and multistage wire drawing machine with their relative merits and demerits. **[9]**

OR

**Q2) a)** Derive the equation of drawing stress for wire drawing **[9]**

b) Explain stepped cone and multistage wire drawing machine with neat sketch. **[8]**

**Q3) a)** For cold rolling; show that  $R.L. = \sigma_o \times Wm \times \sqrt{R\Delta h}$  Mention the assumption made **[8]**

b) Write short note on (any three) **[10]**

- i) Four high rolling mill
- ii) Sendzimir Cluster Rolling Mill
- iii) Planetary Rolling Mill

OR

**P.T.O.**

- Q4) a)** A steel strip of size, thickness 100mm×width 140mm×length 1000 mm is rolled in rolls of diameter 600 mm with reduction of 20%. The coefficient of friction is 0.35 The roll rotate at speed 160 rpm. Determine [12]
- Arc contact length
  - Angle of bite
  - Neutral section thickness
  - Neutral angle
  - Forward slip and Backward slip
- b)** State true or false with justification: [6]
- Friction is essential during rolling process.
  - Rolling load can be decreased by increasing roll diameter

- Q5) a)** Explain various difference between forward and backward extrusion with ram travel vs extrusion pressure diagram. [9]
- b)** Explain various extrusion defects with their causes and remedies. [8]

OR

- Q6) a)** Explain how seamless tubes are produced by extrusion process. [9]
- b)** An Aluminum billet of 50mm diameter and 1m long is extruded to the final shape shown in Fig1. Calculate: [8]
- Extrusion Ratio
  - CCD
  - Shear (Shape) Factor
  - Work done

The flow stress of Aluminum is  $60\text{N/mm}^2$  and coefficient of friction between billet and container is 0.2.

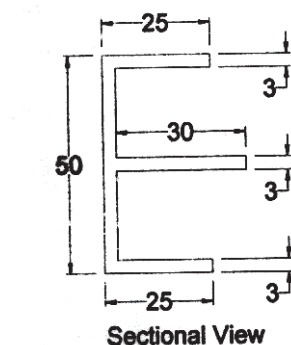


Fig.1: Extruded Aluminum Section

- Q7)** a) Explain with sketch Magnetic Pulse Forming. [6]  
b) Explain Confined explosive forming. [6]  
c) Write short note on Stretch Forming. [5]

OR

- Q8)** a) Compare high velocity forming with conventional forming. [6]  
b) Discuss various methods of flow forming. [6]  
c) Discuss tribological aspects in micro-forming. [5]



Total No. of Questions: 8]

SEAT No. :

**P377**

**[6003]-462**

[Total No. of Pages : 2

**T.E. (Production Engineering)**  
**MACHINING SCIENCE AND TECHNOLOGY**  
**(2019 Pattern) (Semester-I) (311083 A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2 Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** Discuss sources of heat generation in metal cutting with suitable sketches. **[9]**

b) What is the meaning of tool life? Discuss various factors affecting the tool life. **[6]**

OR

**Q2) a)** The useful tool life of a HSS tool machining mild steel at 20 m/min is 4 hours. Calculate the tool life when the tool operates at 25 m/min.  $n=125$  **[9]**

b) Define machinability and discuss various machinability criterias used for machinability assessment. **[9]**

**Q3) a)** With suitable sketches, explain adhesive wear and abrasive wear mechanisms. **[9]**

b) Explain effect of cutting parameters on tool life. **[8]**

OR

**Q4) a)** Describe in brief wear mechanisms due to fatigue, electrochemical effect, oxidation effect, and chemical decomposition. **[9]**

b) For a metal machining, the following information is available: **[8]**

Tool change time, = 12 min. Tool regrind time, = 7 min.

Machine running cost, = Rs. 9 per hour, Tool depreciation per re-grind, = 50 paise,  $n=0.25$ ,  $C=150$ . Calculate the optimum cutting speed.

**P.T.O.**



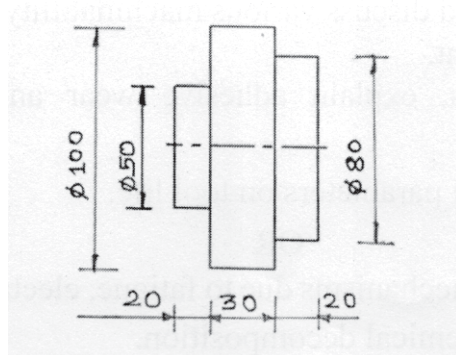
- Q5) a)** Discuss types of chip breakers with suitable sketches. [9]  
**b)** Explain design procedure of single point cutting tool for square shank with suitable sketches. [9]

OR

- Q6) a)** Which shapes are used for inserts? Draw sketches of various shapes of inserts and comment on strength, power requirement and vibration tendency. [9]  
**b)** Design a single point cutting tool to turn a M S bar with a linear cutting speed of 45 m/min on a lathe equipped with a 12 KW motor. Safe stress for tool material is 260 MPa and efficiency of machine tool is 70%. [9]
- Q7) a)** Discuss in detail with suitable sketches the procedure to be followed in designing a circular form tool by graphical method. [9]  
**b)** Explain guidelines for designing length of body and number of teeth for reamer with suitable sketch. [8]

OR

- Q8) a)** The hole size prior to broaching in an alloy steel component is 32.25 mm with tolerance +0.05 and -0.00mm. The required finish broached size is 32.75 mm with tolerance +0.01 and -0.00. If the length of bore is 60 mm and the cutting speed is 0.20 m/s. Determine the broaching power for broaching and design the broach. Assume,  $s = 0.05$  mm,  $C = 50$  N/mm<sup>2</sup> and  $B = 1.30$ ,  $n = 3$ . [8]  
**b)** Design flat form tool for a given job by graphical method when, Rake angle = 20°, Relief angle = 28°, Raw material -Aluminium [9]



All dimensions in mm



Total No. of Questions : 8]

SEAT No. :

P-378

[Total No. of Pages : 3

[6003]-463

**T.E. (Production Engineering)**

**KINEMATICS AND DESIGN OF MACHINES**

**(2019 Pattern) (Semester - I) (311084(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6 and Q.7 OR Q.8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculator and steam table is allowed.*

**Q1) a)** With suitable sketch explain following terms related to cam and follower system: **[7]**

- i) Pressure Angle
- ii) Pitch Point
- iii) Prime circle

**b)** A cam rotating clockwise at a uniform speed of 100 r.p.m. is required to give motion to knife-edge follower as below:

- i) Follower to move outwards through 25 mm during 120° of cam rotation,
- ii) Follower to dwell for the next 60° of cam rotation,
- iii) Follower to return to its starting position during next 90° of cam rotation, and
- iv) Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 50 mm and the line of stroke of the follower passes through the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, Draw the cam profile.

**[10]**

OR

**P.T.O.**

- Q2) a)** Explain the turning moment diagram for four stroke I. C. engine. [7]
- b)** A machine punching 38 mm holes in 32 mm thick plate requires 7 N-m of energy per square mm of sheared area, and punches one hole in every 10 seconds. Calculate the power of motor required. The mean speed of the flywheel is 25 m/sec. The punch has a stroke of 100 mm. Find mass of flywheel required, if total fluctuation of speed is not to exceed 3% of mean speed. Assume that motor supplies energy to machine at uniform rate. [10]

- Q3) a)** Explain the factors affecting the endurance limit of mechanical component. [8]
- b)** A steel bar having ultimate tensile strength of 600 N/mm<sup>2</sup> is subjected to a completely reversed bending stress of 250 N/mm<sup>2</sup>. The bar is of 50 mm diameter. Surface finish factor, size factor and reliability factor are 0.43, 0.85, and 0.897 respectively. Factor of safety is 1.5. Assuming there is no stress concentration, determine life of bar. [10]

OR

- Q4) a)** Discuss stress concentration and methods to reduce it. [6]
- b)** A transmission shaft made of cold drawn steel having ultimate tensile strength of 630 N/mm<sup>2</sup> and tensile yield strength 360 N/mm<sup>2</sup> is subjected to a fluctuating torque which varies from 600 Nm clockwise to 400 Nm clockwise. The surface finish factor and size factor are 0.8 and 0.85 respectively. The reliability factor is 0.897. If the factor of safety is 2, determine diameter of shaft. Use maximum shear stress theory of failure. [12]

- Q5) a)** Explain importance and limitations of 'normal distribution curve' in statistical analysis. [7]
- b)** Tensile test is carried out on 120 specimen of cast iron. It is observed that the ultimate tensile strength is normally distributed with a mean of 300 MPa and standard deviation of 25 MPa. Determine :
- The number of specimens having ultimate tensile strength less than 275 MPa
  - The number of specimens having ultimate tensile strength between 275 MPa and 335 MPa. [10]

The areas below standard normal distribution curve from  $Z = 0$  to  $Z$  are as follows.

Z	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
Areas	0.3159	0.3413	0.3643	0.3849	0.4032	0.4192	0.4332	0.4452

OR

- Q6)** a) Discuss the causes of variations in dimensions of component. [7]
- b) It is observed from the sample of 1000 bearings bushes that the internal diameters are normally distributed with a mean of 50.015 mm and standard deviation of 0.08 mm. Dimension of this diameter specified on the drawing is  $50.00 \pm 0.1$  mm. Calculate the approximate number of rejected bushes from the sample. [10]

The areas below standard normal distribution curve from  $Z = 0$  to  $Z$  are as follows.

Z	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
Areas	0.3159	0.3413	0.3643	0.3849	0.4032	0.4192	0.4332	0.4452

- Q7)** a) Explain different types of equations that are used in 'Johnson's method of optimum design.' [6]
- b) A tensile bar of length 450 mm is subjected to constant tensile force of 4000 N. If the factor of safety is 1.5, design bar with the objective of minimizing the material weight, using optimum material from the list given below. [12]

Material	Mass density kg/m <sup>3</sup>	Material cost per unit mass, Rs/kg	Yield strength N/mm <sup>2</sup>
Plain Carbon steel	7800	28	400
Aluminium alloy	2800	132	150
Titanium alloy	4500	2200	800

OR

- Q8)** a) What is design for safety? Explain the general principles to be followed while designing the product for safety. [8]
- b) Explain the following terms used in Johnson's method of optimum design: [10]
- Geometrical parameter
  - Material parameter



[6003]-464

T.E. (Production Engineering)

FINITE ELEMENT ANALYSIS

(2019 Pattern) (Semester - I) (Elective-I) (311085 (A)-I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.No.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Use of Non-programmable scientific calculators is allowed.
- 5) Figures to the right indicate full marks.

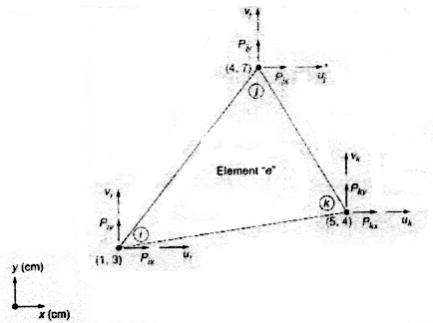
**Q1)** a) Derive relationship between stress-strain in 2D elastic body. What is meant by plain stress and plain strain condition? [9]

b) Determine the stresses and strains for the 2D CST element using any approach. [8]

OR

**Q2)** a) A triangular membrane element of thickness  $t = 0.1$  cm, with the  $(x, y)$  coordinates of nodes indicated beside the node numbers, is shown in Fig. Take  $E = 207$  GPa and  $\mu = 0.3$ , determine the following: [10]

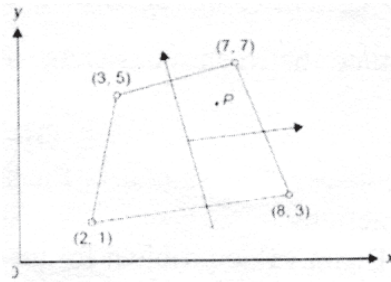
- i) Shape functions of the element,  $N_i(x, y)$ ,  $N_j(x, y)$ , and  $N_k(x, y)$ .
- ii) Matrix  $[B]$  that relates the strains to the nodal displacements.
- iii) Elasticity matrix  $[D]$ .
- iv) Element stiffness matrix,



P.T.O.

- b) Illustrate with examples the plane stress, plane strain, and axisymmetric problems. [7]

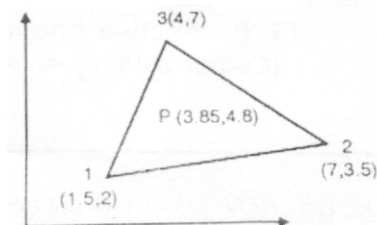
- Q3) a)** In the element shown in Fig., P is the point (6, 5). On this point the load components in x and y directions are 8 kN and 12 kN respectively. Determine its nodal equivalent forces. [10]



- b) Explain with neat sketch isoparametric, superparametric and subparametric elements. [7]

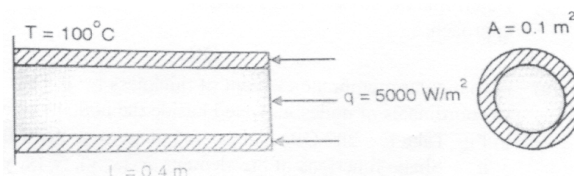
OR

- Q4) a)** Evaluate shape functions  $N_1$ ,  $N_2$  and  $N_3$ . [10]



- b) Explain FEA procedure used in solving 2D-quadrilateral element problems to calculate global and elemental stiffness matrix and stresses? [7]

- Q5) a)** The fin shown in fig. is insulated on the perimeter. The left end has a constant temperature of  $100^\circ\text{C}$ . A positive heat flux of  $q = 5000 \text{ W/m}^2$  acts on the right end. Let  $K_{xx} = 6 \text{ W/m}^\circ\text{C}$  and cross sectional area  $A = 0.1 \text{ m}^2$ . [10]



- b) Write notes on steps involved in processing step, to solve 1D heat transfer problem using FE Problem. [8]

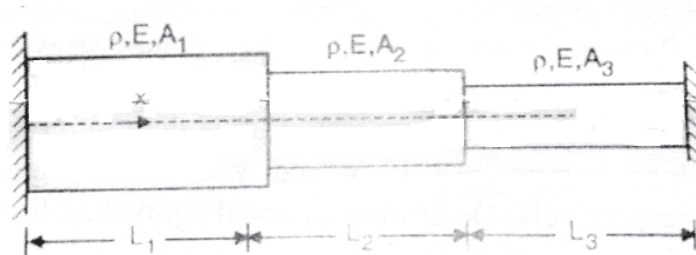
OR

- Q6)** a) Derive the element stiffness matrix formulation for 1D steady state heat conduction problems. [10]

- b) Write short notes on boundary conditions that prevail in 1D steady state heat conduction. [8]

- Q7)** a) Find the un-damped natural frequencies of longitudinal vibration of the stepped bar shown in fig. with the following data using consistent mass matrices: [12]

$L_1 = L_2 = L_3 = 0.2 \text{ m}$ ,  $A_1 = 2$ ,  $A_2 = 3$ ,  $A_3 = 0.4 \times 10^{-3} \text{ m}^2$ ,  $E = 2.1 \times 10^{11} \text{ N/m}^2$ , and  $\rho = 7.8 \times 10^3 \text{ Kg/m}^3$ .



- b) Differentiate between consistent mass matrix and lumped mass matrix. [6]

OR

- Q8)** a) Derive consistent mass matrix for bar and beam element by stating shape functions. [12]

- b) Explain Eigen value problem for un-damped free vibration system. [6]

\*\*\*

Total No. of Questions : 8]

SEAT No. :

**P380**

[Total No. of Pages : 2

**[6003]-465**

**T.E. (Production Engineering)**

**ADVANCES IN MANUFACTURING PROCESSES**

**(2019 Pattern) (Semester - I) (Elective - I) (311085 (A) - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of Non-programmable scientific calculators is allowed.*
- 5) *Figures to the right indicate full marks.*

- Q1)** a) Explain why squeeze casting produces parts with better mechanical properties, dimensional accuracy, and surface finish than do expendable-mold processes. [6]
- b) Describe the differences between expendable and permanent molds. [6]
- c) Explain with neat sketch the principle of working, advantages and applications of evaporative-pattern casting. [6]

OR

- Q2)** a) Outline of production steps in a typical sand-casting operation. [6]
- b) Explain with neat sketch the principle of working, advantages and applications of vacuum-mold casting. [6]
- c) Explain with neat sketch the principle of working, advantages and applications of continuous casting. [6]

- Q3)** a) Explain the in brief the significance and uses of estimation of peak temperature during welding? Write the expression for estimation of peak temperature during welding. [8]
- b) Determine the expression for cooling rate at the weld centreline by considering relative plate thickness factor. [9]

OR

- Q4)** a) Explain in brief the main causes for the development of residual stresses in welded structures. [8]
- b) With neat sketches discuss the defects in the welds their causes and remedies. [9]

**P.T.O.**



- Q5) a)** Explain with neat sketch the principle of working, equipment, mechanism of material removal, process parameters, performance characterization, applications of magnetic abrasive finishing process. [8]
- b)** Explain the constituents of magnetorheological fluids. Explain with cause and effect diagram of process parameters of magnetorheological abrasive flow finishing process. [9]

OR

- Q6) a)** Explain with neat sketch the effect of duty cycle on percentage decrease in surface roughness. [8]
- b)** Explain with neat sketch the principle of working, equipment, mechanism of material removal, process parameters, performance characterization, applications of magnetorheological abrasive flow finishing process. [9]

- Q7) a)** What are the different methods of thread manufacturing? Explain anyone with a neat sketch. [6]
- b)** Explain various types of broaching machines with neat sketches. [6]
- c)** Explain the principle of gear shaping. List advantages and limitations of gear shaping. [6]

OR

- Q8) a)** Sketch the tool shape of broach and write briefly about its elements. [3]
- b)** List the various gear grinding methods. Explain in brief the gear grinding process with neat sketch. [6]
- c)** Write short note on thread grinding, thread rolling, and thread milling. [9]



Total No. of Questions : 8]

SEAT No. :

**P381**

**[6003]-466**

**[Total No. of Pages : 1**

**T.E. (Production)  
MECHATRONICS**

**(2019 Pattern) (Semester - I) (Elective - I) (311085 (A)-III)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

- Q1)** a) Describe logic gate and its types? [6]  
b) Explain Boolean function in logic gates? [6]  
c) Discuss the significance of octal and hexadecimal number system. [6]

OR

- Q2)** a) What is sampling in analog to digital conversion? [6]  
b) Describe working of Digital to analog convertor. [6]  
c) A 5-bit DAC has a current output. For a digital input of 101000, an output current of 10mA is produced. What will  $I_{OUT}$  be for a digital input of 11101? [6]

- Q3)** a) Which are the elements of a Process Control System. [6]  
b) Write note on Laplace transform. [6]  
c) What are Dead Time Responses in Laplace form. [6]

OR

- Q4)** a) Explain Lag Responses in Laplace Form. [6]  
b) Which are the types of Second-Order Response in Laplace transform? [6]  
c) Describe Process Dynamics Laplace. [6]

- Q5)** a) What is a Controller? [6]  
b) Which are the different types of Controllers? [6]  
c) Describe Proportional Controllers. [5]

OR

- Q6)** a) Which are the advantages and disadvantages of Proportional Controller? [6]  
b) Explain Integral Controllers. [6]  
c) State advantages and disadvantages of Integral Controller. [5]

- Q7)** a) Describe programmable logic controller with sample ladder logic program. [6]  
b) Describe five basic programming models of PLC. [6]  
c) Explain an SFC program for tank level control using PLC. [5]

OR

- Q8)** a) Explain the ladder language of PLC programming. [6]  
b) State ladder relay instructions of PLC programming. [6]  
c) Explain Time instructions with example in PLC. [5]



Total No. of Questions : 8]

SEAT No. :

**P382**

**[6003]-467**

**[Total No. of Pages : 1**

**T.E. (Production)**

**SUPPLY CHAIN MANAGEMENT**

**(2019 Pattern) (Semester - I) (Elective - I) (311085 (A)-IV)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Use of Non-programmable scientific calculators is allowed.*
- 5) Figures to the right indicate full marks.*

- Q1)** a) Explain incoming material management. [5]  
b) Write short note on stock verification. [6]  
c) Explain Warehouse Management System (WMS) in detail. [6]

OR

- Q2)** a) Explain functions that the material transport system are designed to perform. [5]  
b) Write short note on Automated Storage/Retrieval. [6]  
c) Explain Obsolete, Surplus and Scrap Management. [6]

- Q3)** a) How to Select a distribution network design. [6]  
b) What are the benefits of supply chain network optimization? [6]  
c) Write a short note on uncertainty in network design. [6]

OR

- Q4)** a) Write in detail factors influencing distribution network design. [7]  
b) Explain types of distribution strategies with examples. [6]  
c) Explain distribution network design in the supply chain. [5]

- Q5)** a) Discuss the role of cycle inventory in the supply chain. [5]  
b) Explain revenue management for multiple customer segments. [6]  
c) Explain pricing and revenue management in detail. [6]

OR

- Q6)** a) Explain the managing of uncertainty in supply chain. [5]  
b) What is risk pooling in supply chain management? [6]  
c) Explain multiple-item, multiple-location inventory management. [6]

- Q7)** a) Explain building strategic partnerships and trust in detail. [6]  
b) Explain supply chain process restructuring. [6]  
c) Write a short note on information technology in the supply chain. [6]

OR

- Q8)** a) Explain lack of supply chain coordination in detail. [6]  
b) Explain postpone the point of differentiation in detail. [6]  
c) Explain agile supply chain. [6]



Total No. of Questions : 8]

SEAT No. :

**P383**

**[6003]-468**

[Total No. of Pages : 3

**T.E. (Production Engineering)**

**PRODUCTION TOOLING**

**(2019 Pattern) (Semester - II) (311088 (A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data, if necessary.

**Q1) a)** To design a drawing die for a component as shown in figure no.1, calculate following values for a sheet of thickness 4 mm and yield strength 320 MPa. **[10]**

- i) Blank size
- ii) Percentage reduction
- iii) Number of draws required
- iv) Cup diameter and height in each draw
- v) Die and punch dimensions in each draw
- vi) Press capacity required in each draw.

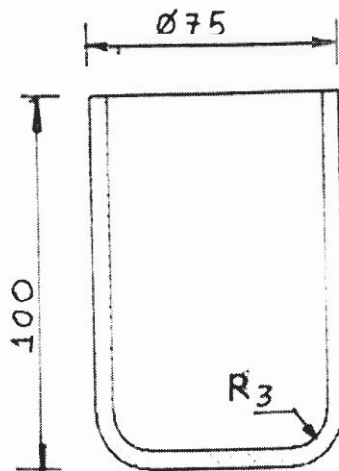


Figure No.1

All dimensions in mm.

Figure No. 1 All dimensions in mm.

**P.T.O.**

- b) Calculate developed length of the part as shown in figure no. 2. [8]

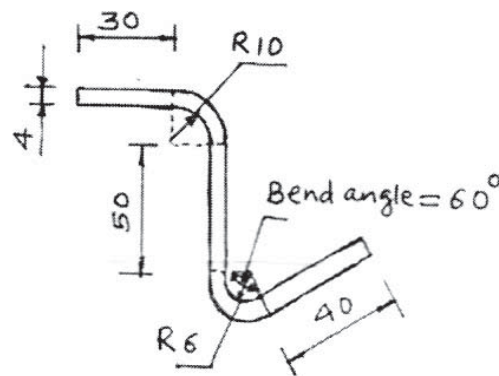


Figure No.2

All dimensions in mm

OR

- Q2)** a) Which methods are available to overcome the spring back in bending? Explain any two methods to overcome the spring back with suitable sketches. [10]
- b) What is the meaning of bend allowance in sheet bending? Explain working of types of bending dies with suitable sketches. [8]
- Q3)** a) Discuss various guidelines to be used for selection corner radius, fillet radius and drafts in forging die design [10]
- b) Explain design of trimming die in forging die design with suitable sketch. [7]

OR

- Q4)** a) Describe calculation stock size in closed die forging. [10]
- b) How inserts are useful in forging die. Explain types of die inserts used in forging with suitable sketches. [7]
- Q5)** a) Explain working of cold chamber die casting machine with suitable sketches. [10]
- b) What are the types of dies in die casting? Explain various types of die casting dies in detail. [8]

OR

**Q6) a)** Why lubrication is required in die casting? State various rules of die lubrication. [10]

b) Discuss die casting defects with causes and remedies. [8]

**Q7) a)** Explain direct sprue gate, side gate and ring gate with suitable sketches. [10]

b) Describe rotational molding with suitable sketches. [7]

OR

**Q8) a)** Determine, [10]

i) Shot capacity with Nylon 66.

ii) Number of cavities for a mould by shot capacity method for a given data.

Material = Nylon 66, Mass of the component = 40g., Swept volume = 100 cm<sup>3</sup>, Density = 1.14g/cm<sup>3</sup>, Constant = 0.85.

b) Explain any three cooling system designs with suitable sketches used in plastic molding. [7]



Total No. of Questions : 8]

SEAT No. :

**P3150**

[Total No. of Pages : 2

**[6003]-469A**

**T.E. (Production Engineering)**

**PRODUCTION AND OPERATIONS MANAGEMENT**

**(2019 Pattern) (311089(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Figure to the right indicates full marks.*
- 2) *Neat diagram must be drawn wherever necessary*
- 3) *Assume Suitable data if necessary.*
- 4) *Use of Logarithmic Table, Slide rule or Electronic pocket calculator is allowed.*
- 5) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*

- Q1)** a) Describe the Factors determining Production Planning & Control. [9]  
b) Describe functions of PPC. [8]

OR

- Q2)** a) Write a short note on: role of PPC in different production systems. [9]  
b) Describe in detail Centralized PPC and Decentralized PPC. [8]

- Q3)** a) Explain procedure for making location decisions. [9]  
b) Explain factors influencing layout choices. [8]

OR

- Q4)** a) Enlist various material handling equipment, explain any two in detail. [9]  
b) Describe in short CRAFT input requirements and Procedure adopted for using CRAFT. [8]

- Q5)** a) Explain various functions of inventory. [9]  
b) ABC corporation has got a demand for particular part at 10,000 units per year. The cost per unit is Rs.2 and it costs Rs. 36 to place an order and to process the delivery. The inventory carrying cost is estimated at 9 per cent of average inventory investment. Determine. [9]  
i) Economic order quantity.  
ii) Optimum number of orders to be placed per annum.  
iii) Minimum total cost of inventory per annum.

OR

**P.T.O.**

- Q6)** a) List and explain in detail different types of costs in inventory system. [9]  
b) A company makes bicycles. It produces 480 bicycles a month. It buys the tires for bicycles from a supplier at cost of Rs.21 per tire. The company's inventory carrying cost is estimated to be 17% of cost and the ordering is Rs. 55 per order. Calculate the EOQ, what is the number of orders per year? Compute the average inventory. Compute the total cost. [9]

- Q7)** a) What is Material Requirement Planning (MRP)? How does MRP system works? [9]  
b) What are the wastes considered in Lean Manufacturing? [9]

OR

- Q8)** a) What are the characteristics of Agile Manufacturing? [9]  
b) Explain the role of master production schedule, bill of material and inventory status file in developing output of material requirement planning. [9]





Total No. of Questions : 8]

SEAT No. :

**P385**

**[6003]-470**

**[Total No. of Pages : 1**

**T.E. (Production Engineering)**  
**PROCESS ENGINEERING AND RESOURCE PLANNING**  
**(2019 Pattern) (Semester - II) (311090 (A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Use of electronic pocket calculator is allowed. Assume suitable data, if necessary.*

**Q1) a)** Explain the Geometric Control. **[8]**

**b)** What are the causes of work piece Variation? **[9]**

OR

**Q2) a)** What do you mean by Equilibrium theories? **[8]**

**b)** What are variables influencing work piece control. **[9]**

**Q3) a)** What are types of tooling? And which factors are to be considered while selecting the tooling? **[8]**

**b)** Explain the term operation rout sheet design. **[9]**

OR

**Q4) a)** What are factors to be considered while selecting the Machine or equipment? **[9]**

**b)** Explain the importance of process picture sheet. **[8]**

**Q5) a)** What are the factors affecting process selection. **[9]**

**b)** Explain how the capacity planning is important. **[9]**

OR

**Q6) a)** Explain in brief-measuring capacity, Dimensions of capacity. **[9]**

**b)** What do you mean by OEE. **[9]**

**Q7) a)** How the CAPP (Computer Aided Process planning) is useful in Industry. **[9]**

**b)** What is mean by Generative process planning? **[9]**

OR

**Q8) a)** Explain Knowledge based process planning. **[9]**

**b)** What are advantages of CAPP over manual process planning. **[9]**



Total No. of Questions : 8]

SEAT No. :

P-386

[Total No. Of Pages : 2

**[6003]-471**

**T.E. (Production)**

**PRODUCT DESIGN AND DEVELOPMENT**

**(2019 Pattern) (Semester-II) (311091A-I) (Elective II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks*
- 4) *Assume suitable data, if necessary.*

- Q1) a)** Explain technology push & process intensive type of product. **[10]**
- b)** Sketch Spiral & generic product development process flow. **[6]**

OR

- Q2) a)** What is the role of reverse engineering in establishing the engg. Characteristics? Explain with suitable example. **[10]**
- b)** Enlist the Voice of customer (VOC's) methods **[6]**
- Q3) a)** Draw the Kano model for customer requirement. How time affects the customer requirements. **[10]**
- b)** Discuss concurrent engineering in product development **[8]**

OR

- Q4) a)** What are the steps of benchmarking? Explain the competitive performance benchmarking. **[8]**
- b)** Explain in details the product life cycle. **[10]**

*P. T. O*

- Q5)** a) Explain overview of DFM process. [12]  
b) Explain how to reduce the cost component? [6]

OR

- Q6)** a) Short note on Quality Function Deployment. [6]  
b) Select one product from following list that you intend design & answer the questions

Sr.No	Name of Product
1.	Chair
2.	Water bottle
3.	Pressure cocker

- i) Identify primary function of the product  
ii) Develop the correlation matrix for the selected product  
iii) Construct the house of quality for the selected product. [12]

- Q7)** a) Explain the guideline of Design for Assembly (DFA). [12]  
b) Explain Design for casting. [6]

OR

- Q8)** a) Explain Design for Manufacturing guidelines with example. [12]  
b) Explain any two components of product life cycle management (PLM)[6]



Total No. of Questions : 8]

SEAT No. :

P-387

[Total No. of Pages : 2

[6003]-472

T.E. (Production)

NANO MANUFACTURING

(2019 Pattern) (Semester - II) (Elective - II) (311091A-II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right in black indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1)** a) What is the reason for using unconventional or advanced machining?[10]

b) Which non-conventional machining process has highest material removal rate? [6]

OR

**Q2)** a) What are the different energy sources used in nonconventional machining processes? [10]

b) What are the needs of unconventional manufacturing process? [6]

**Q3)** a) What is the purpose of nano finishing process? [10]

b) What is the need for nano finishing process? [8]

OR

**Q4)** a) What are the different types of nano finishing process? [10]

b) Why finishing is necessary on metal surface? [8]

P.T.O.

- Q5) a) What are the two fundamental approaches to nanomanufacturing? [12]**  
**b) What are the key issues in the synthesis of nanomaterials? [6]**

**OR**

- Q6) a) What are the difference between bottom-up fabrication and top-down fabrication? [6]**  
**b) What are the approaches used in nano fabrication? [12]**

- Q7) a) What are the different methods of measurement of nano materials? [12]**  
**b) What is importance of Nanometrology? [6]**

**OR**

- Q8) a) Which device can be used for nano measurement? [12]**  
**b) What is the role of size in nanomaterials? [6]**

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-388

[Total No. of Pages : 2

[6003]-473

T.E. (Production)

STATISTICS AND NUMERICAL METHODS

(2019 Pattern) (Semester - II) (Elective - II) (311091(A)-III)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right in black indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1)** a) What do you understand from relative error, inherent error and round off error? [9]

b) If  $x = 3.26426$ , Find absolute, relative & percentage error if [9]

- i)  $x$  is truncated to 4 decimal places.
- ii)  $x$  is rounded off to 4 decimal places

OR

**Q2)** a) Describe root of an equation also explain types of root for algebraic and transcendental equations. [9]

b) Find the root of equation  $x^3 - 20x + 20 = 0$ , by Newton Raphson method. Take initial guess as 1, up to accuracy 0.001 [9]

**Q3)** a) Explain various methods of fitting data? [9]

b) Following is the data given for the values of  $x$  &  $y$ . fit a second degree polynomial of type  $ax^2 + bx + c$ , where  $a, b, c$  are constants. [8]

$x$	-3	-2	-1	0	1	2	3
$y$	12	4	1	2	7	15	30

OR

P.T.O.

- Q4)** a) What is polynomial regression? And Explain how it is fitted? [9]  
 b) In some determinations of the values  $v$  of  $\text{CO}_2$  dissolved in a given volume of water at different temp  $\theta$ , the following pairs were obtained [8]

$\theta$	0	5	10	15
$v$	1.80	1.45	1.18	1.00

Obtain by method of least square, a relation of the form  $v = b + a\theta$  which best fits to these observations. Also find the value  $\text{CO}_2$  dissolved in volume of water at temp.  $25^\circ\text{C}$ .

- Q5)** a) Evaluate  $\int_0^3 2x - x^2 \cdot dx$ , taking 6 intervals by Trapezoidal rule. [9]

- b) Use Simpson's 3/8 rule to evaluate  $\int_0^{\pi/2} \sqrt{\sin x + \cos x} dx =$   
 $\int_0^{\pi/2} (\sin x + \cos x)^{1/2} dx$  (Consider only one strip i.e. 3 sub strips). [9]

OR

- Q6)** a)  $\int_0^1 \frac{\sin x}{2 + 3\sin x} \cdot dx$  Find the integration using Simpson's 3/8 rule (6 strips). [9]

- b) A set of values  $x$  and  $f(x)$  are given below. Using Lagrange's interpolation formula, find  $f(g)$  when  $x_g = 9$  [9]

$x$	5	7	11	13	17
$Y = f(x)$	150	392	1452	2866	5202

- Q7)** a) What do you understand from optimization? How is it useful for advanced manufacturing process? [9]  
 b) Discuss Genetic Algorithm (GA) with advanced manufacturing case study. [8]

OR

- Q8)** a) Explain Lagrange multipliers and Steepest descent methods? [9]  
 b) What are classical and multiple optimization? And which is used in practice? [8]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-389

[Total No. of Pages : 5

[6003]-474

T.E. (Production)

**FINANCIAL MANAGEMENT AND COSTING**

**(2019 Pattern) (Elective - II) (Semester - II) (311091(A)-IV)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right in black indicate full marks.
- 4) Assume Suitable data if necessary.

- Q1)** a) What is meant by fixed or permanent working capital? [6]
- b) An engineering company is considering its working capital investment for the next year. Estimated fixed assets and current liabilities for the next year are ₹2.60 crore and ₹2.34 crore, respectively. Sales and profit before interest and taxes (PBIT) depend on current assets investment particularly inventories and book debts. The company is examining the following alternative [6]
- working capital policies: (₹ crore)

Working capital policy	Investment in Current Assets	Estimated Sales	EBIT
Conservative	4.50	12.30	1.23
Moderate	3.90	11.50	1.15
Aggressive	2.60	10.00	1.00

You are required to calculate the following for each policy

- i) rate of return on total assets,
  - ii) net working capital position,
  - iii) current ratio, and
  - iv) current asset to fixed asset ratio.
- c) Explain the concept of working capital. Are gross and net concepts of working capital exclusive? Discuss. [5]

OR

**P.T.O.**



- Q2)** a) What should be the mix of short and long-term sources in financing current assets? [6]
- b) The current market price of the shares of A Ltd. is ₹95. The floatation costs are ₹5 per share amounts to ₹4.50 and is expected to grow at a rate of 7%. You are required to calculate the cost of equity share capital.[6]
- c) Is there a difference between the project's and the firm's cost of capital? Explain. [5]

- Q3)** a) What are the important techniques of costing? Explain in brief. [6]
- b) From the following details of stores receipts and issues of materials in a manufacturing unit, prepare the stores ledger using Base Stock Method of valuing the issues of LIFO; assume base stock 200 tonnes. [6]

1.1.2021	Purchased 500 tones at ₹2 per ton
10.1.2021	Purchased 300 tones at ₹2.10 per ton
15.1.2021	Issued 600 tons
20.1.2021	Purchased 400 tones at ₹2.20 per ton
25.1.2021	Issued 300 tons
27.1.2021	Purchased 500 tons at ₹2.10 per ton
31.1.2021	Issued 200 tons

- c) Ramesh Ltd. has three production departments A, B and C and six service departments. The following figures are extracted from the records of the company : [5]

Production Departments		Service Departments
A	₹6,000	Stores ₹2,000
B	₹10,000	Timekeeping ₹3,000
C	₹12,000	Maintenance ₹1,000
	₹38,000	Power ₹2,000
		Welfare ₹1,000
		Supervision ₹2,000
		Total ₹49,000

The other information available in respect of the production departments:

Particulars	Production Departments		
	A	B	C
No. of Employees	40	30	20
No. of Stores Requisition	30	20	10
Horse Power of Machines	500	500	600
Machine Hours	2500	1500	1000

You are required to apportion the costs of various service departments to production departments.

OR

- Q4)** a) Discuss the various methods of pricing materials issues to production.[6]  
b) Calculate the earnings of workers A and B under Straight Piece Rate System and Taylor's Differential Piece Rate System from the following particulars: [6]

Standard time allowed 50 units per hour.

Normal time rate per hour ₹100.

Differentials to be applied.

80% of Piece rate below standard.

120% of Piece rate at or above standard.

In a day of 8 hours A produced 300 units and B produced 450 units

- c) Following information is made available from the costing records of a factory : [5]

- i) The original cost of the machine : ₹1,00,000  
Estimated life : 10 years  
Residual Value : ₹5,000

Factory operates for 48 hours per week: 52 weeks in a year.

Allow 15% towards machine maintenance down time. 5% (of productive time assuming unproductive) may be allowed as setting up time.

- ii) Electricity used by the machine is 10 units per hour at a cost of 50 paise per unit.
- iii) Repair and maintenance cost is ₹500 per month.
- iv) Two operators attend the machine during operations along with two other machines. Their total wages including fringe benefits, amounting to ₹5,000 per month is paid.
- v) Other overheads attributable to the machine are ₹10,431 per year.

Using above data, calculate machine hour rate.

- Q5)** a) Define Standard Costing. What do you understand by Standard Cost and Standard Costing? [6]
- b) Discuss the preliminary steps for determination of Standard Cost. [6]
- c) Calculate Material Cost Variance from the following information : [6]

Standard Price of material per kg = ₹4

Standard Usage of materials = 800 kgs

Actual Usage of materials = 920 kgs

Actual Price of materials per kg = ₹3

Actual Cost of materials ₹2,760

Standard cost of material for actual production ₹3,200

OR

- Q6)** a) What are the differences between Standard Costing and Estimated Costing? [6]
- b) Explain the different types of Material Cost Variance. [6]
- c) From the following particulars, calculate Labour Variance : [6]

Standard hours = 200

Standard rate for actual production = ₹1 per hour

Actual hour = 190

Actual Rate = ₹1.25 per hour

- Q7)** a) What do you understand by Marginal Costing? Define Marginal Costing. Briefly explain the features of marginal costing. [6]
- b) What are the merits and demerits of process costing? [6]
- c) From the following information, calculate the amount of profit using marginal cost technique : [6]

Fixed cost ₹3,00,000

Variable cost per unit ₹5

Selling price per unit ₹10

Output level 1,00,000 units

OR

- Q8)** a) What is meant by Cost Driver? Explain role of Cost Driver in tracing costs to products. [6]
- b) Write Short notes on : [6]
- i) Normal Process Loss.
  - ii) Abnormal Process Loss.
  - iii) Abnormal Gain.
- c) In Process A, 1,000 units were introduced at a cost of ₹20,000, the other expenditure incurred in the process were materials ₹10,000 and wages ₹5,000. 10% is the normal loss during production and possess a scrap value of ₹3 each. The output of process A was only 800 units. Find out the value of Abnormal Loss. [6]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-390

[Total No. of Pages : 2

[6003]-475

**T.E. (Production Sandwich)**

**MANUFACTURING TECHNOLOGY (Self Study)**

**(2019 Pattern) (Semester - I) (311122(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Figures to the right indicate full marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** Differentiate between Preventive Maintenance and Breakdown Maintenance. **[9]**

b) Describe the condition monitoring technique using maintenance practices. **[8]**

OR

**Q2) a)** Explain Spectrometric oil Analysis procedure (SOAP). **[9]**

b) State and explain the various objectives of maintenance planning. **[8]**

**Q3) a)** What is the purpose of 7 quality control tools? How these 7 QC tools are used to solve problems? **[9]**

b) What is the main aim of JIT principle? What are the 3 elements of JIT? How does JIT improve quality? **[8]**

OR

**Q4) a)** What are 8 pillars of TPM? Explain each pillar in detail. **[9]**

b) What is Poka yoke ? How does a Poka yoke improve quality? **[8]**

**P.T.O.**

- Q5) a)** What is the MRP II concept? What are the main advantages of MRP II systems? Differentiate between MRP-I & MRP-II. [9]
- b)** What do you understand by Diminishing Marginal Utility? Explain it with example. [9]

OR

- Q6) a)** Explain in detail the term Computer Aided Process Planning and the types of Computer Aided Process Planning. [9]
- b)** What does capital market mean? How does the company raise funds in capital market? [9]

- Q7) a)** What are the Principle factors of estimating cost. Elaborate with example. [9]
- b)** What do you mean by Depreciation? List out and explain different Methods of depreciation. [9]

OR

- Q8) a)** What is the importance of Estimating Weights and volume of materials? Do we consider volume and weight of scrap while minimizing manufacturing time? Justify your answer. [9]
- b)** Write a short note on Time Value of Money. [9]



Total No. of Questions : 8]

SEAT No. :

**P391**

**[6003]-476**

[Total No. of Pages : 4

**T.E. (Production Sandwich)**  
**KINEMATICS AND DESIGN OF MACHINES**  
**(2019 Pattern) (Semester - II) (311084 (A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Figures to the right side indicate full marks.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of Logarithmic Table, Slide rule and pocket calculator is allowed.*
- 5) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

**Q1) a)** Define the following terms as applied to cam with neat sketch: **[8]**

- i) Base Circle
- ii) Pitch Circle
- iii) Pressure angle
- iv) Stroke of the follower

b) A single cylinder double acting steam engine develops 150k W at a mean speed of 80 r.p.m. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is  $\pm 2\%$  of mean speed. If the mean diameter of the flywheel rim is 2 metre and the hub and spokes provide 5% of the rotational inertia of the flywheel, find the mass and cross-sectional area of the flywheel rim. Assume the density of the flywheel material as 7200 kg/m<sup>3</sup>. **[10]**

**OR**

**Q2) a)** Sketch different types of cams and follower and name it. **[6]**

b) A punching press is driven by a constant torque electric motor. The press is provided with a flywheel that rotates at maximum speed of 225 r.p.m. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour; each punching operation takes 2 seconds and requires 15 kN-m of energy. Find the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 r.p.m. **[12]**

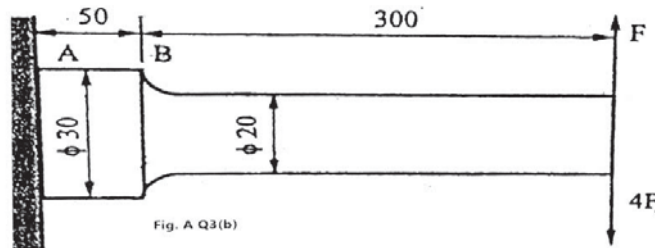
**Q3) a)** Define the following terms:

- i) Notch sensitivity.
- ii) Endurance Limit.
- iii) Stress Concentration.

**[6]**

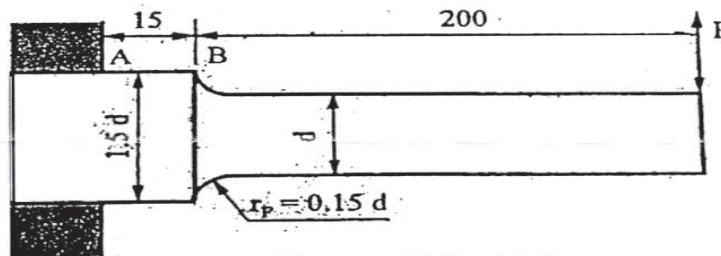
**P.T.O.**

- b) A cantilever beam as shown in Fig. A, is subjected to a load which varies from  $-F$  to  $4F$ . Determine the maximum load that this member can withstand for infinite life using a factor of safety as 2. The theoretical stress concentration may be assumed as 1.42 and the notch sensitivity is 0.8. Assume surface factor as 0.85 and the size factor as 0.8. The beam material has an ultimate tensile strength of 500 MPa, yield strength of 350 MPa. [11]



OR

- Q4) a) Explain the Modified Goodman Diagram for fluctuating axial/bending stresses with neat sketches. [8]
- b) A cantilever beam of circular cross-section is fixed at one end and is subjected to a force  $P$  at the free end, which varies from  $-5$  kN to  $+15$  kN as shown in figure B. The force is perpendicular to the axis of the beam. The distance between the free end and the critical section is 200 mm. The beam is made of cold drawn steel with an ultimate tensile strength of 550 MPa and a yield strength of 350 MPa. The theoretical stress concentration factor at the stepped end is 1.35 and the notch sensitivity is 0.85. The surface finish factor for the beam is 0.76 and the size factor can be taken as 0.85. The expected reliability is 90% and the reliability factor is 0.897. Assume a factor of safety as 2. Determine the cross-sectional diameter ' $d$ ' using Soderberg's criterion. [9]



- Q5) a) What is the significance of the 'normal distribution curve' in engineering statistical analysis? State its limitations. [8]



- b) The bolt diameters are normally distributed with a mean of 10.01 mm and a standard deviation of 0.015 mm. The tolerance specified by the designer for the bolt diameter is  $10 \pm 0.025$  mm. Calculate the percentage of bolts likely to be rejected.

Z	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
Area	0.3413	0.3643	0.3849	0.4032	0.4192	0.4332	0.4452	0.4554
Z	1.8	1.9	2.0	2.1	2.0	2.1	2.2	2.3
Area	0.4641	0.4713	0.4772	0.4821	0.4772	0.4821	0.4861	0.4893
Z	2.4	2.5	2.6	2.7				
Area	0.4918	0.4938	0.4953	0.4965				

[Use linear interpolation for values in between.]

[10]

OR

- Q6)** a) Explain the difference between 'design tolerance' and 'natural tolerance'. [6]

- b) A shaft and hole assembly have the following dimensions.

Shaft diameter =  $40 \pm 0.18$  mm.

Hole diameter =  $40.2 \pm 0.24$  mm

Assuming the shaft and hole diameters are normally distributed. Determine the probability of interference fit between the shaft and the hole.

Z	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
Area	0.3413	0.3643	0.3849	0.4032	0.4192	0.4332	0.4452	.4554
Z	1.8	1.9	2.0	2.1	2.0	2.1	2.2	2.3
Area	0.4641	0.4713	0.4772	0.4821	0.4772	0.4821	0.4861	0.4893
Z	2.4	2.5	2.6	2.7				
Area	0.4918	0.4938	0.4953	0.4965				
Use linear interpolation for values in between.								

[12]

- Q7)** a) What is design for manufacture (DFM)? Explain the general principles to be followed while designing the parts for manufacture. [8]

- b) Explain desirable, undesirable effects and functional requirement parameter in optimum design. State various step involved in optimum design for normal specification. [9]

OR

- Q8)* a) Explain the guidelines to be followed in the design of casting process. [8]
- b) What is concurrent engineering? What is its significance in the product design? [9]



Total No. of Questions : 8]

SEAT No. :

**P392**

[Total No. of Pages : 3

**[6003]-477**

**T.E. (Production Sandwich Engineering)**  
**MATERIAL FORMING AND MOULD DESIGN**  
**(2019 Pattern) (Semester-II) (311124 A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and mention it clearly.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1) a)** Determine rolling load based on deformed roll radius of CI rolls 600 mm diameter while rolling copper strip of 800 mm wide & 75 mm thick to give 30% reduction given that yield stress of copper is 675 N/mm<sup>2</sup>. Assume young's modulus (E)=1.005 MN/mm<sup>2</sup> and Poissons ratio (r)=0.35. **[9]**
- b) Calculate the rolling load to reduce steel 600 mm wide and 30mm thick by 20%. Roll diameter is 800 mm and flow stress of steel is 150 N/mm<sup>2</sup>. Assume coefficient of friction as 0.15. What would be rolling load if, Sliding friction occurs. **[9]**

OR

- Q2) a)** Explain rolling geometry and rolling mechanism with neat sketch. **[8]**
- b) Derive an expression for rolling load. **[5]**
- c) Write the derivation of  $\Delta h = \mu^2 R$ . **[5]**

- Q3) a)** What is chovornov's rule? Explain its importance in design of casting. **[8]**
- b) Calculate size of cylindrical riser (height & diameter equal) necessary to feed a steel slab casting 25×25×5 cm with side riser, casting poured horizontally into mould. For steel take constant a=0.10, b=0.03 & c=1.0. **[5]**

**P.T.O.**

- c) Explain following in case of Die casting. [5]
- i) Draft
  - ii) Parting line shape & location
  - iii) Die wear
  - iv) Die lubricants

OR

- Q4)** a) Explain pressurized & unpressurized gating system. [8]
- b) Explain various elements of gating system with neat sketch. [5]
- c) Explain various points (aim) to be considered while designing sand casting. [5]
- Q5)** a) Explain various forging design factors in detail. [4]
- b) Explain following for forging (any two) [8]
- i) Flash & Flash gutter
  - ii) Rotary swaging
  - iii) Press Forging
- c) Explain following. [5]
- i) No draft forging
  - ii) Powder metallurgy forging

OR

- Q6)** a) Explain how die block dimensions are determined in forging die design. [8]
- b) Explain how stock size is determined for forging operation. Explain friction screw press with neat sketch. [9]
- Q7)** a) Explain following in case of injection mould [9]
- i) Guide pillar & guide bush
  - ii) Register ring

b) For injection moulding explain following types of gates with their advantages & disadvantages. [8]

i) Sprue gate

ii) Rectangular edge gate

OR

**Q8)** a) Calculate gate dimensions for rectangular gate used in moulding polythene blocks having length 150 mm, width 130 mm, height 50 mm & thickness 1.3 mm. take density of material as 0.9 gms/cm<sup>3</sup> also find runner dimensions. Assume length of gate as 0.5 mm, length of runner as 50 mm. take material constant (n) as 0.6. [6]

b) Explain sleeve ejection technique for injection moulding with suitable sketch. [6]

c) For injection moulding explain following (any two) [5]

i) Sprue puller

ii) Cooling systems and heat transfer consideration.

iii) Ejector plate assembly return system.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P393**

**[6003]-478**

**T.E. (Production Sandwich)**

**METROLOGY AND QUALITY CONTROL**

**(2019 Pattern) (Semester - II) (311125(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Classify measurement system in detail? Explain with detail. **[9]**

b) Elaborate constructional features of CMM with neat diagram. **[8]**

OR

**Q2) a)** Explain basic concepts of machine vision system. **[9]**

b) State and explain types of probes with neat sketch. **[8]**

**Q3) a)** How Taylors principle is applied to screw thread gauge? **[9]**

b) What are the various methods used for measuring the gear tooth thickness? **[8]**

OR

**Q4) a)** Name the various stylus probe instruments used for surface finish measurement. **[9]**

b) What is meant by “Best size wire” in screw thread measurement? **[8]**

**Q5) a)** List any methods employed for measuring torque. **[9]**

b) State any two principles of force measurement. **[9]**

OR

*P.T.O.*

- Q6)** a) How are end standards derived from line standard? Explain. [9]  
b) With suitable example, explain the difference between precision and accuracy. [9]

- Q7)** a) Discuss frequency distribution in Statistical quality control. [9]  
b) Explain details about “X” and “R” chart. [9]

OR

- Q8)** a) Write a short note on n, np and C chart. [9]  
b) Explain double sampling plan with suitable example. [9]



Total No. of Questions : 8]

SEAT No. :

P-3657

[Total No. of Pages : 3

[6003]-479A

T.E. (Production Sandwich)

(Semester - II) STATISTICS AND NUMERICAL  
OPTIMIZATION METHODS  
(2019 Pattern) (311088A)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Assume Suitable data if necessary.
- 5) Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.

- Q1) a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation  $f(x) = \cos x - xe^x = 0$  [9]
- b) Perform Four iterations of Newton Raphson method to obtain the approximate value of  $f(x) = x^3 - 17 = 0$ . [8]

OR

- Q2) a) Solve following equation using gauss elimination method [8]
- $$10X_1 - X_2 + 2X_3 = 4$$
- $$X_1 + 10X_2 - X_3 = 3$$
- $$2X_1 + 3X_2 + 20X_3 = 7$$
- b) Solve following equation using gauss Seidal method upto three approximations [9]
- $$20X + Y - 2Z = 17$$
- $$3X + 20X - Z = -18$$
- $$2X - 3Y + 20Z = 25$$

- Q3) a) Fit a straight line using least square method to the following data. [8]

x	6	7	7	8	8	8	9	9	10
y	5	5	4	5	4	3	4	3	3

P.T.O.



- b) Evaluate  $f(3)$  by Using Lagrange's Interpolation formula from the following data. [9]

x	0	1	2	5
f(x)	2	3	12	147

OR

- Q4)** a) State the order of the polynomial which might be suitable for the following Function. Calculate  $f(45)$  using Newton Forward Difference Method. [9]

x	40	50	60	70	80
y	31	73	124	159	190

- b) Using a method of least square fit the curve  $y = ae^{bx}$  to the following data : [8]

x	0	1	2	3
y	1.05	2.10	3.85	8.30

- Q5)** a) Find the value of  $y$  at  $x = 9$  by Using Newton Divided Difference Method formula from the following data : [9]

x	5	7	11	13	17
y	150	392	1452	2366	5202

- b) Evaluate  $\int_0^{0.6} e^{x-2}$  by using Trapezoidal method and Simpson's  $1/3^{\text{rd}}$  rule corresponding to seven intervals. [9]

OR

- Q6)** a) Using Newton Backward Difference Method formula. Construct an interpolating Polynomial of degree 3 for the data : [9]

$$f(-0.75) = -0.0718125$$

$$f(-0.5) = -0.02475$$

$$f(-0.25) = 0.3349375$$

$$f(0) = 1.10100$$

Hence find  $f(-1/3)$

- b) Use Simpsons 1/3<sup>rd</sup> rule and Trapezoidal Method to evaluate

$$\int_0^1 \left( \frac{x^2}{1+x^3} \right) dx \text{ corresponding to Four intervals.} \quad [9]$$

- Q7)** a) Describe in brief Method of Lagrange multipliers. [9]

- b) Explain the Generalized reduced gradient Method. [9]

OR

- Q8)** a) Write in brief steepest descent method suitable example. [9]

- b) Brief on : genetic algorithm and simulated annealing. [9]



Total No. of Questions : 8]

SEAT No. :

**P395**

[Total No. of Pages : 2

**[6003]-480**

**T.E. (Production Engineering S/W)**

**ADVANCED MATERIAL**

**(2019 Pattern) (Semester - II) (Elective - II) (311126 (A) - I)**

*Time : 2½ Hour]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.

**Q1) a)** Explain dual phase steel with application and microstructure. **[9]**

b) Explain High Strength Low alloy with its properties. **[8]**

OR

**Q2) a)** Explain Maraging Steel with its microstructure. **[9]**

b) Discuss Micro alloyed steels with its application. **[8]**

**Q3) a)** Classification of Composite material with Advantage and Disadvantage. **[9]**

b) Explain Natural composite with its application? **[8]**

OR

**Q4) a)** Explain Metal matrix composite with its diverse application. **[9]**

b) What is metal matrix composites? Explain with advantage and disadvantage. **[8]**

**Q5) a)** Explain with neat diagram Autoclave manufacturing process. **[9]**

b) Draw schematic diagram of Shape memory alloys. Explain with application. **[9]**

OR

**P.T.O.**

- Q6)** a) Explain Nanomaterial in comparison with bulk material. [9]  
b) Explain the bio metallic alloys like: Ni-Ti, Co-Cr-Mo alloys with application. [9]

- Q7)** a) Why to Aluminum is used in the aero plane Industry. [9]  
b) Explain Iron base, nickel base and cobalt base super alloys. [9]

OR

- Q8)** a) Explain biocompatibility in the biomedical industry. [9]  
b) Explain cobalt base super alloys. [9]



Total No. of Questions : 8]

SEAT No. :

**P-396**

[Total No. of Pages : 4

**[6003]-481**

**T.E. (Production Engineering) (Sandwich)**

**COSTING AND COST CONTROL**

**(2019 Pattern) (Semester - II) (Elective - II) (311126 (A) - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket Calculator is allowed.

**Q1) a)** What is Machine Hour Rate? What are its advantages and disadvantages? **[8]**

b) Calculate the machine hour rate from the following:

	Rs.
Cost of machine	18,000
Cost of installation	2,000
Scrap value after 10 years	2,000
Rates and rent for a quarter for the shop	600
General lighting	200 p.m.
Shop supervisor's salary	Rs. 6,000 per quarter
Insurance premium for a machine	120 p.a.
Estimated repair	200 p.a.
Power 2 units per hour @ Rs.150 per 100 units	
Estimated working hours p.a. 2,000	
The machine occupies 1/4th of the total area of the shop. The supervisor is expected to devote 1/6th of this time for supervising the machine. General lighting expenses are to be apportioned on the basis of floor area.	
	<b>[10]</b>

OR

**Q2) a)** What are the principal factors to be considered when fixing a machine hour rate? Give a specimen computation. **[8]**

**P.T.O.**

- b) The following particulars relate to a processing machine treating a typical material. You are required to calculate the machine hour rate. [10]

The cost of the machine Rs. 10,000

Estimated life 10 years

Scrap value Rs. 1,000

Working time (50 weeks of 44 hrs. each) 2,200 hrs.

Machine maintenance per annum 200 hrs.

Setting up time estimated @ 5% of total productive time

Electricity is 16 units per hour @ 10 paise per unit.

Chemicals required weekly Rs. 20

Maintenance cost per year Rs. 1,200

Two attendants control the operations of the machine together with 6 other machines, their combined weekly wages are Rs. 140. Departmental overhead allocated to this machine per annum Rs. 2,000.

- Q3) a) Discuss the reasons for overheads being analyzed into fixed and variable components. [8]

- b) The production department of factory furnishes the following information for the month of March 2015 : [9]

Materials used	Rs. 2,50,020
Direct wages	Rs.2,08,350
Overheads	Rs.1,66,680
Labour hours worked	1,66,680
Hours of machine operation	1,38,900

For an order executed by the department during a particular period, the relevant information was as under:

Materials used	Rs.27,78,000
Direct Wages	Rs.14,81,600
Labour hours worked	14,816
Machine hours worked	11,112

Calculate the over head charges chargeable to the job by the following methods:

- Direct materials cost percentage rate
- Labour hour rate; and
- Machine hour rate

OR

**Q4)** a) Distinguish clearly between direct and indirect materials. Under what circumstances may direct materials be charged indirectly to the product? [9]

b) Explain any two methods of secondary distribution of Overheads. [8]

**Q5)** a) Distinguish between traditional costing system and activity based costing. [8]

b) The under given data is supplied by Fair deal travel services, From the following information calculate fare for passenger Km. [9]

The cost of the Bus	Rs. 4,50,000
Insurance charges	3% p.a.
Annual tax	Rs. 4500
Garage rent	Rs.500 p.m.
Annual repairs	Rs. 4800
Expected life of the bus	5 yrs
Value of scrap at the end of 5 years	Rs.30,000
Route distance	20 km long
Driver's salary	Rs. 550 p.m.
Conductor's Salary	Rs. 500 p.m.
Commission to Driver & conductor (shared equally)10% of the takings	
Stationary	Rs.250 p.m.
Manager-cum-accountant's Salary	Rs.1,750 p.m.
Diesel and Oil (for 100 kms)	125

The bus will make 3 rounds trips for carrying on the average 40 passenger's in each trip. Assume 15% profit on takings. The bus will work on the average 25 days in a month.

OR

- Q6)** a) Draw up a job cost-sheet for a simple product, to find out the cost of a product. [8]
- b) What are the benefits of activity based costing? Distinguish between traditional costing system and activity based costing. [9]

**Q7)** Write short note on: [18]

- a) Value analysis and Value engineering
- b) Zero Base Budgeting

OR

**Q8)** Write short note on: [18]

- a) Cost volume profit Analysis
- b) Profit volume ratio





Total No. of Questions : 8]

SEAT No. :

**P397**

[Total No. of Pages : 2

**[6003]-482**

**T.E. (Production Sandwich)**

**ADVANCED JOINING TECHNOLOGY**

**(2019 Pattern) (Semester - II) (Elective - II) (311126 (A)-III)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

**Q1) a)** Explain Ultrasonic welding stating its advantages, disadvantages, and applications of the process. **[10]**

b) Explain Roll welding and Hot pressure welding processes in short. Give its applications. **[8]**

OR

**Q2) a)** Write short notes on: **[10]**

i) Adhesive bonding

ii) Brazing and Braze welding

b) Explain Friction welding stating its advantages, disadvantages, and applications of the process. **[8]**

**Q3) a)** Explain Friction stir welding stating its advantages, disadvantages, and applications of the process. **[9]**

b) Explain laser beam welding stating its advantages, disadvantages, and applications of the process. **[8]**

OR

**Q4) a)** Explain Electron beam welding stating its advantages, disadvantages, and applications of the process. **[9]**

b) Write short notes on: **[8]**

i) Cold Metal Transfer Joining

ii) Under Water welding

**P.T.O.**

- Q5) a)** Describe various weld symbol used in welding with sketch in short. [9]  
**b)** Explain various Non-Destructive Testing methods of weldments. [9]

OR

- Q6) a)** Write short notes on: [10]  
i) Radio graphs of weldments  
ii) Life assessment of weldments  
**b)** Describe in short, Weldability Testing of weldments. [8]

- Q7) a)** Write short notes on: [8]  
i) Weld thermal cycles and their effects  
ii) Concept of HAZ  
**b)** What do you understand by weldability? Explain how weldability is assessed in short. [9]

OR

- Q8) a)** Explain the following weld defects, their causes, and remedies. [9]  
i) Lack of penetration  
ii) Porosity  
iii) Lack of fusion  
**b)** Explain pre and post weld heat treatments in welding? [8]



Total No. of Questions : 8]

SEAT No. :

**P-398**

[Total No. of Pages : 2

**[6003]-483**

**T.E. (Production Engineering Sandwich)**

**WORLD CLASS MANUFACTURING**

**(2019 Pattern) (Semester - II) (Elective - II) (311126 (A)-IV)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

**Q1)** a) What do you understand by cell design? What are the criteria used for cell design? [9]

b) Differentiate between Hierarchical code and Attribute code structure?[8]

OR

**Q2)** a) Explain in details the Optiz classification system. [9]

b) What do you understand concept of part family? [8]

**Q3)** a) How do we measure effectiveness of TPM? Explain PQCDSDM in TPM concept? [9]

b) What are the four steps of Jidoka? What are the four steps of Jidoka?[8]

OR

**Q4)** a) What are the three core elements of Overall Equipment Efficiency (OEE)? [9]

b) How does a heijunka board help to reduce the waiting time for a project? What are the key principles of heijunka? [8]

**P.T.O.**

**Q5) a)** Explain the arrangement of any four of the following components at workplace [9]

- i) Visual Displays
- ii) Control Panels
- iii) Hand Controls
- iv) Multifunction Hand controls
- v) Mirror hand arrangements

b) What is 5S methodology? State and explain in details steps in 5S Methodology. [9]

OR

**Q6) a)** What is visual management? What is the difference between visual displays and visual controls? What are types of visual displays? [9]

b) Define Throughput Accounting. What are the steps to be followed to increase the Throughput? [9]

**Q7) a)** Define IOT. Discuss IOT barriers. Explain the applications of IOT in manufacturing. [9]

b) What is meant by smart industry? What are the components of smart factory? What Technologies are used in a Smart Factory? [9]

OR

**Q8) a)** Explain enablers of Industry 4.0 and barriers of Industry 4.0. [9]

b) What are Cyber-Physical Systems? [9]

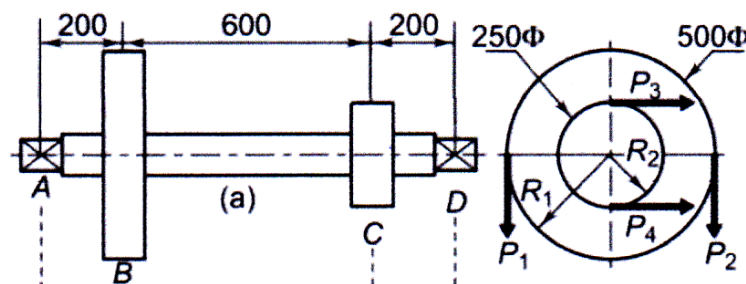


[6003]-484

**T.E. (Automation and Robotics)****DESIGN OF ROBOT ELEMENTS****(2019 Pattern) (End Sem.) (Semester - I) (302521)***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) *Draw neat labeled diagrams wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of non programmable electronic calculator is permitted.*
- 4) *Assume suitable/standard data if necessary.*

- Q1) a)** The layout of a transmission shaft carrying two pulleys B and C and supported on bearings A and D is shown in Figure. Power is supplied to the shaft by means of a vertical belt on the pulley B, which is then transmitted to the pulley C carrying a horizontal belt. The maximum tension in the belt on the pulley B is 2.5 kN. The angle of wrap for both the pulleys is  $180^\circ$  and the coefficient of friction is 0.24. The shaft is made of plain carbon steel 30C8 ( $S_{yt} = 400 \text{ N/mm}^2$ ) and the factor of safety is 3. Determine the shaft diameter on strength basis.

**[13]**

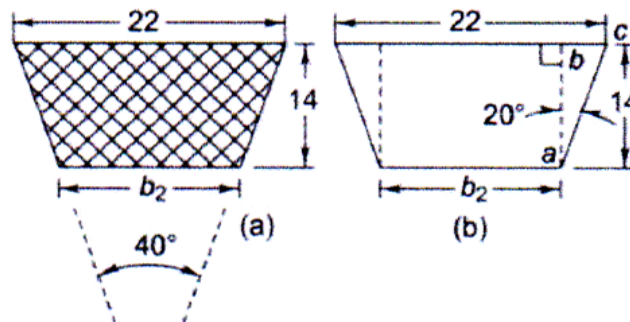
- b)** Explain significance of equivalent bending moment and equivalent twisting moment. **[5]**

OR

**P.T.O.**

- Q2) a)** The following data is given for a V-belt drive connecting a 20 kW motor to a compressor. The centre distance between pulleys is 1 m and the dimensions of the cross-section of the belt are given in Figure. The density of the composite belt is 0.97 g/cc and the allowable tension per belt is 850 N. How many belts are required for this application? [11]

	Motor-pulley	Compressor-pulley
Pitch diameter (mm)	300	900
Speed (rpm)	1440	480
Coefficient of friction	0.2	0.2



- b) Derive equations of flat belt for analysis of tensions in the belt. [7]

- Q3) a)** What do you mean by integrated end effector attachment. Explain with neat labelled diagram. [8]

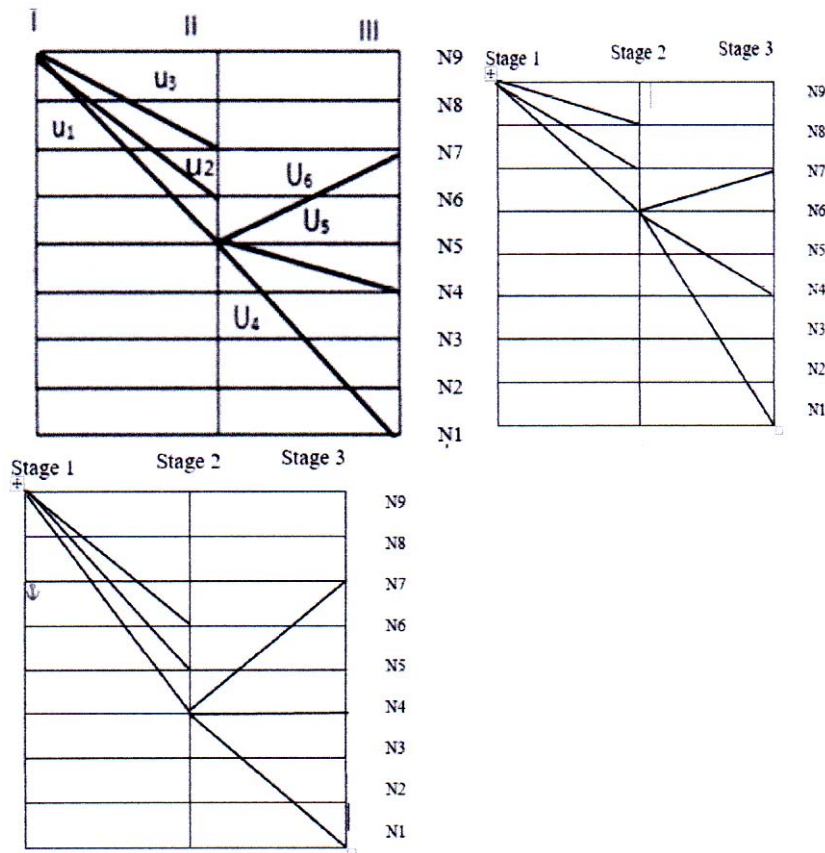
- b) Write basic design process of gripper. [9]

OR

- Q4) a)** Write a note on remote compliance center design with neat labelled diagram. [9]

- b) What do you mean by payload in the design of robots. Explain payload force analysis with neat diagram and mathematical equations. [8]

- Q5) a)** A  $3 \times 3$  Gear box is transmitting a power of 10 KW. Choose the best ray diagram based on minimum summation of shaft diameters made of same material with permissible shear stress of  $36 \text{ N/mm}^2$ , Use GP ratio of 1.26 and Lowest speed  $N_1 = 100 \text{ RPM}$ . [10]



- b) Write a note on general recommendation for developing the gearing diagram. Explain with suitable example. [8]

OR

- Q6)** Design a nine-speed gear box having  $N_{min} = 100 \text{ rpm}$  and  $N_{max} = 630 \text{ rpm}$ . Assume motor speed  $1400 \text{ rpm}$ . The design should include structural diagram, ray diagram, speed chart gearing diagram and number of teeth of the gear. (Gearing diagram is not essential) [18]

- Q7) a)** A taper roller bearing has a dynamic load capacity of  $26 \text{ kN}$ . The desired life for 90% of the bearings is  $8000 \text{ h}$  and the speed is  $300 \text{ rpm}$ . Calculate the equivalent radial load that the bearing can carry. [5]

- b) Explain in details equivalent bearing load in rolling contact bearing. [5]

- c) A single-row deep groove ball bearing is subjected to a 30 second work cycle that consists of the following two parts: The static and dynamic load capacities of the ball bearing are 50 and 68 kN respectively. Calculate the expected life of the bearing in hours. [7]

	Part I	Part II
<i>duration (s)</i>	10	20
<i>radial load (kN)</i>	45	15
<i>axial load (kN)</i>	12.5	6.25
<i>speed (rpm)</i>	720	1440

Refer table for values of X and Y factors as follows :

$\left(\frac{F_a}{C_0}\right)$	$\left(\frac{F_a}{F_r}\right) \leq e$		$\left(\frac{F_a}{F_r}\right) > e$		$e$
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

OR

- Q8) a) Derive Petroff's Equation for sliding contact bearing. [7]
- b) The following data is given for a 360° hydrodynamic bearing: radial load = 3.2 kN, journal speed = 1490 rpm, journal diameter = 50 mm bearing length= 50mm, radial clearance = 0.05 mm, viscosity of lubricant = 25 cP. Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate (i) coefficient of friction; (ii) power lost in friction; (iii) minimum oil film thickness; (iv) flow requirement in litres/min; and (v) temperature rise. [10]





Total No. of Questions: 8]

SEAT No. :

**P400**

**[6003]-485**

[Total No. of Pages : 2

**T.E. (Automation and Robotics)**  
**ROBOT KINEMATICS AND DYNAMICS**  
**(2019 Pattern) (Semester-I) (302522)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.No. 1 or Q.No.2, Q.No.3 or Q.No.4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8.*
- 2) *Draw neat labeled diagrams wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of non programmable electronic calculator is permitted.*
- 5) *Assume suitable, Standard data if necessary.*

- Q1)** a) Explain the inverse kinematics of four axis SCARA robot. [9]
- b) Derive the equation for two link robot considering inverse kinematics with geometrical method. [9]

OR

- Q2)** a) Explain the concept of tool configuration in details. [9]
- b) Derive the equation for three link robot considering inverse kinematics with geometrical method. [9]

- Q3)** a) Evaluate the concept of work envelop of four axis articulated robot. [9]
- b) Explain the joint space trajectory in details. [8]

OR

- Q4)** a) What is path generation? Explain its types. [9]
- b) Explain Cartesian coordinate method. [8]

- Q5)** a) Explain Lagrange's Equation in details. [9]
- b) What do you mean by kinetic energy concept and potential energy concept in manipulator dynamics? [9]

OR

*P.T.O.*

- Q6)** a) Write the equations for manipulator inertia tensor? Explain in details [9]  
b) Explain the dynamic model of a tree axis SCARA robot. [9]

- Q7)** a) What are the Control considerations in robots? [9]  
b) Explain Hardware architecture of robots [8]

OR

- Q8)** a) What are the Hardware for Joint Controllers? [9]  
b) Explain actuators used in robotics. [8]



**T.E. (Automation and Robotics)****COMPUTER AIDED ENGINEERING AND MANUFACTURING  
(2019 Pattern) (Semester-I) (302523)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates:**

- 1) Answer four questions from the following.
- 2) Draw neat labeled diagrams wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of non programmable electronic calculator is permitted.
- 5) Assume Suitable/Standard data if necessary.

**Q1) a)** Evaluate the stiffness matrix for the CST element shown in fig. 1a. Coordinates are in mm. Assume Plain stress conditions. Take  $E = 200$  GPa,  $\nu = 0.3$ , Thickness = 1cm **[15]**

Nodal displacements are given as:

$$u_1 = 1 \text{ mm}; u_2 = 0.5 \text{ mm}; u_3 = 2 \text{ mm}; v_1 = 1 \text{ mm}; v_2 = 0; v_3 = 1 \text{ mm}$$

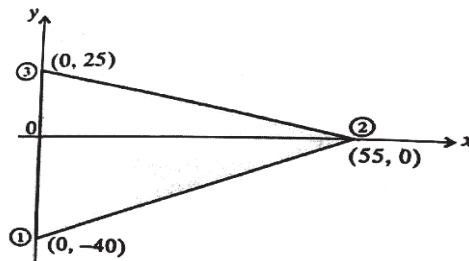


fig. 1a

b) Distinguish between plain stress and plain strain condition. **[3]**

OR

**Q2) a)** For the triangular element fig. 2a defined by nodes 1:(5,5), 2:(20,6), 3:(6,30), obtain the strain displacement relation matrix B and determine the strains  $\epsilon_x, \epsilon_y, \gamma_{xy}$ . **[15]**

The displacements at the nodes are:

$$U_1 = 0.2, U_2 = 0.4, U_3 = 0.3 \text{ and } V_1 = -0.1, V_2 = -0.5, V_3 = -0.3.$$

Assume the units of displacements and the coordinates are the same; also determine the displacement at point (12, 10).

**P.T.O.**

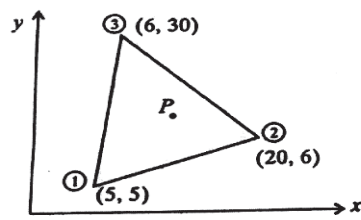


fig. 2a

- b) Explain pre-processing and post-processing steps in FEA. [3]

**Q3)** a) Write a manual part program for the component shown in fig. 3a. Assume the raw product as cast iron and the machining is to achieve the various dimensions. [12]

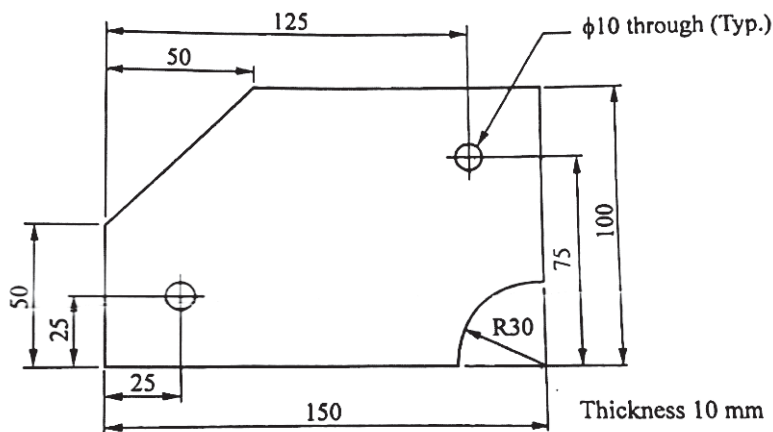


fig. 3a

- b) Explain different CNC machine control systems. [5]

OR

**Q4)** a) Write a manual part program to machine the contour for the component shown in fig. 4a. and drill a hole. The thickness of component is 18mm. Assume suitable data. [12]

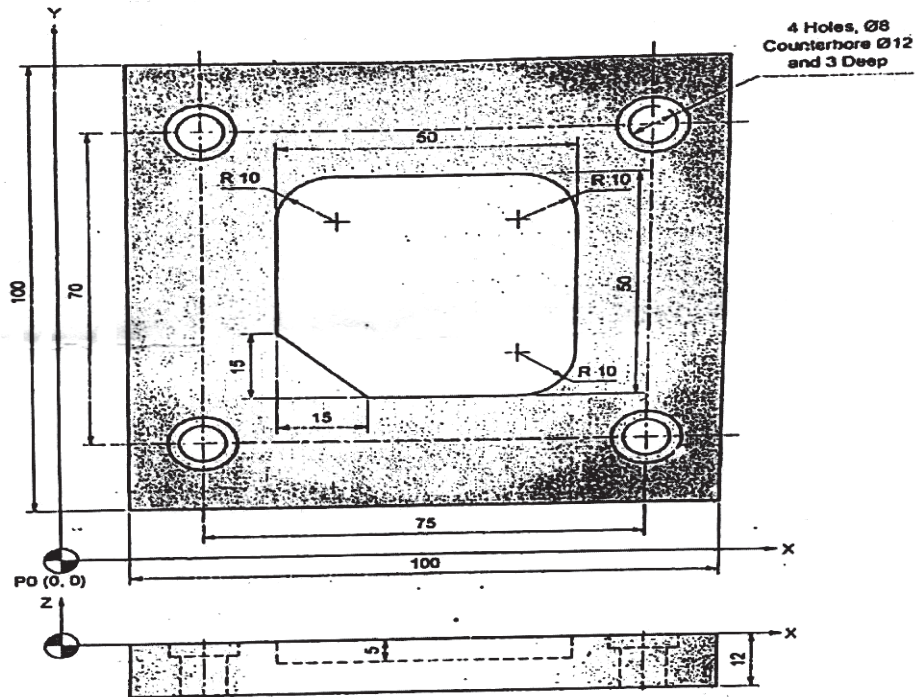


fig. 4a

- b) Distinguish closed loop NC system with open loop system. [5]

**Q5) a)** What are the types of manufacturing layout in cellular manufacturing and explain them briefly. [10]

- b) Explain the five phases of six sigma in details. [8]

OR

**Q6) a)** Briefly explain the different types of lean manufacturing tool with their significance in industry. [10]

- b) What is meant by Just-In-Time? Where is it implemented? [8]

**Q7) a)** A T-slot is to be cut in C.I. slab as shown in fig. 7a. Estimate the machining time. Take cutting speed 25 m/min, feed is 0.25 mm/rev. Diameter of cutter for channel milling is 80 mm Assume suitable data if required with justification. [10]

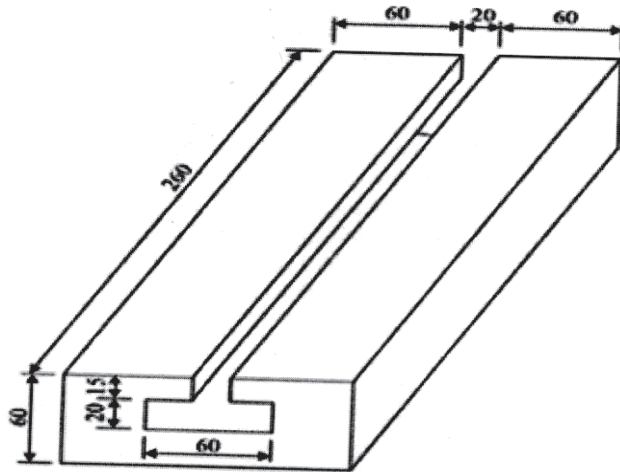


fig. 7a

- b) Give a procedure for planning for the manufacturing of a component in machine shop. [7]

OR

- Q8) a) The following information is obtained from ABC co. Ltd. in a certain year: [10]

Sales = Rs 2,00,000/-

Variable cost = Rs 1,20,000/-

Fixed cost = Rs 60,000/-

- i) Find
  - 1) P/V ratio
  - 2) Breakeven point
  - 3) Margin of safety at this level
- ii) Calculate the effect of
  - 1) 20% increase in selling price
  - 2) 10% decrease in selling price
  - 3) 5% decrease in sales volume

- b) What are the factors influencing process selection and write down the process selection parameters. [7]



Total No. of Questions : 8]

SEAT No. :

P-402

[Total No. of Pages : 2

[6003]-487

**T.E. (Automation and Robotics)**

**SIGNAL PROCESSING AND CONDITIONING**

**(2019 Pattern) (Semester - I) (302524)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Draw neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable/standard data if necessary.*
- 5) *Use of non programmable electronic calculator is permitted.*

**Q1)** a) With the help of neat diagrams explain sampling theorem and Aliasing effect. [8]

b) Explain signal communication and the types of data transmission. [9]

OR

**Q2)** a) Draw a suitable block diagram and explain the working of a DAQ system with its components. [8]

b) A 4-bit SAR type ADC has reference voltage of 16 volts. If the ADC is supplied with an analog input of 11.2 volts, determine the equivalent digital output with the help of neat circuit diagram. Also draw a graph of output waveform. [9]

**Q3)** a) Draw and explain Architecture of PLC. [9]

b) Write at least 9 aspects to be considered while selection of a PLC for the application. [9]

OR

**Q4)** a) Draw and explain Ladder Logic programming for any three logic gates. [9]

b) Explain a PLC ladder diagram for Bottle filling machine with the help of neat diagram of this system. [9]

**P.T.O.**

- Q5) a)** A mass spring damper system is mounted on and massless cart as shown in below figure. Derive the transfer function between output  $y$  and input  $u$ . [8]

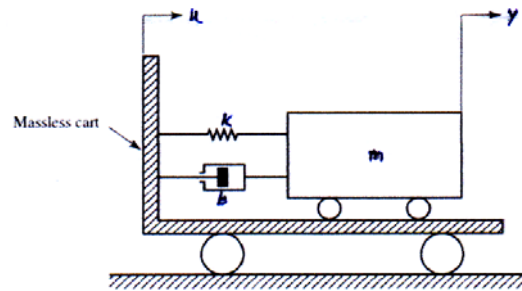
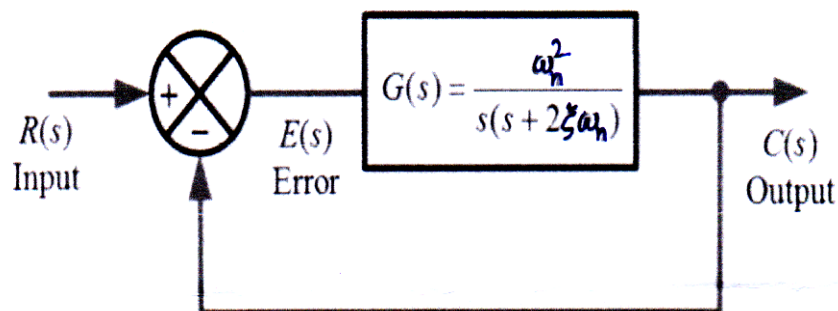


Figure : A spring-mass-dashpot system

- b) Write a short note on Bode Plot, Gain margin and Phase margin with the help of neat diagram. [9]

OR

- Q6) a)** Using Sutable diagram explain Unit step response analysis via transient response specifications. [8]
- b) Draw pole zero map for following second order control system. [9]



- Q7) a)** Explain Proportional (P), Integral (I) and Derivative (D) control actions. [9]
- b) Explain Manual tuning of PID control with variation in different values of control parameters and plot the respective graphs. [9]

OR

- Q8) a)** Draw and explain PD and PID control systems in parallel form. [9]
- b) Explain Linear Quadratic Control (LQR) with equations. Also draw a block diagram for robot application using LQR Controller. [9]





Total No. of Questions : 8]

SEAT No. :

**P404**

[Total No. of Pages : 3

**[6003]-489**

**T.E. (Automation and Robotics)**

**OPTIMIZATION TECHNIQUES**

**(2019 Pattern) (Semester - I) (302525-B) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Use of electronic calculator is allowed.
- 4) Assume suitable data if necessary.

**Q1) a)** State the classification of Integer Programming Problems. **[5]**

- b) The owner of a readymade garment store sells two types of Tshirts - Zee shirts and button down shirts. He makes a profit of Rs. 3 and Rs. 12 per shirt on zee shirt and button own shirt resp. He has two tailors A and B, at his disposal for stitching the shirts. Tailor A and B can devote at the most 7 hrs and 15 hrs per day, resp. Both these shirts are to be stitched by both the tailors. Tailor A & B spend 2 hrs and 5 hrs resp. In stitching one Zee shirt and 4 hrs and 3 hrs resp. in stitching button down shirt. How many shirts of both the types should be stitched in order to maximize the daily profit? **[12]**

- i) Formulate and solve the problem as an LP.
- ii) If the optimal solution is not integer valued use Gomory's Technique to derive the optimal integer solution.

**OR**

**Q2) a)** What do you mean by Simulation? Explain Monte - Carlo Simulation. **[5]**

- b) Solve the following using Branch and Bound Method: **[12]**

$$\text{Max} Z = 3x_1 + 5x_2$$

$$\text{Subject To : } 2x_1 + 4x_2 \leq 25$$

$$x_1 \leq 8$$

$$2x_2 \leq 10$$

$$x_1, x_2 \geq 0, \text{ all integers}$$

**P.T.O.**

- Q3) a)** Explain the concept of Genetic Algorithm with suitable examples. [6]  
**b)** A firm produces two products A, and B each product must be processed through two departments namely 1 and 2. [12]

Department one has 30 hours of production capacity per day and Department two has 60 hours. Each unit of product A requires 2 hours in department 1 and 60 in department 2. Each unit product B requires 3 hours in department 1 and 4 hours in department 2 Management has rank ordered the following goals it would like to achieve in determining the daily product mix

P1: Minimize the underachievement of joint total production of 10 units

P2: Minimize the underachievement of producing 7 unit of product B

P3: Minimize the underachievement of producing 8 unit of product A

Formulate the problem as a GP model and then solve it by using the graphical method.

OR

- Q4) a)** State applications of Particle Swarm Optimization. [4]  
**b)** In 18th century when transportation systems were not developed a family wanted to travel from their home to reach a friend's house in other part of the country. But they has a choice of various routes and haltages in between from their home to final destination. Cost of travel from each point to the other points on route, based on relevant factors such as distance, difficulties, mode of transportation etc are given: [10]

	2	3	4		5	6	7
1	7	5	4	2	8	3	9
				3	10	7	6
				4	4	5	6
	8	9					
5	6	8			10		
6	7	4		8	5		
7	3	6		9	4		

- c)** What is the concept of Goal programming? [4]

- Q5) a)** Explain brief about PROMETHEE? [6]  
**b)** Short note on Weighted Product method (WPM). [6]  
**c)** What is the concept of analytical network process? [5]

OR

- Q6) a)** Explain Multiple Criteria Decision Making (MCDM)? Also list out its method. [6]  
**b)** Which is the highest accuracy method in MCDM? Why? [6]  
**c)** Write brief note on TOPSIS. [5]

**Q7)** Write a short notes on:

**[18]**

- a) Artificial Neural Network.
- b) Ant Colony Optimization.
- c) Fuzzy based optimization.

OR

**Q8)** a) Write down application of Modern Optimization Techniques.

**[6]**

b) Explain the training or learning process in ANN with diagram.

**[6]**

c) What are the uses and disadvantages of Genetic Algorithm.

**[6]**



Total No. of Questions : 8]

SEAT No. :

P-405

[Total No. of Pages : 2

**[6003]-490**

**T.E. (Electronics and Computer Engineering)**

**DATABASE MANAGEMENT SYSTEM**

**(2019 Pattern) (Semester - I) (310341)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) Differentiate between stored procedure and stored function. [6]  
b) What is cursor? Explain types of cursor. [6]  
c) Explain DDL, DML, DCL and TCL commands with example. [8]

OR

- Q2)** a) Explain the any three Set operations with example. [6]  
b) Explain any three Aggregate Functions with suitable example. [6]  
c) Explain INSERT, DELETE, UPDATE and SELECT queries with suitable examples. [8]

- Q3)** a) What is serializability? Explain conflict serializability and view serializability with example. [8]  
b) Explain the need of a concurrency control system? How is it achieved with timestamp based protocol? [8]

OR

- Q4)** a) Explain in detail ACID properties of transactions. [8]  
b) What is a deadlock? Explain how deadlock detection and prevention is done. [8]

*P.T.O.*

- Q5)** a) Explain two tier and three tier architecture with example. [8]  
b) Define a distributed database. Explain advantages and disadvantages of distributed database. [8]

OR

- Q6)** a) Enlist different Parallel database architectures. Explain any two in detail.[8]  
b) Describe concurrency control in distributed databases. [8]

- Q7)** a) Explain MapReduce operation in MongoDB with suitable example. [6]  
b) Explain concept of indexing in MongoDB. [6]  
c) Write the difference between RDBMS and NoSQL. [6]

OR

- Q8)** a) Explain any three aggregation functions using MongoDB with suitable example. [6]  
b) List different NoSQL data Models and explain Document based Data Model. [6]  
c) Enlist CRUD operations in MongoDB database with syntax. [6]



Total No. of Questions: 8]

SEAT No. :

**P406**

**[6003]-491**

[Total No. of Pages : 3

**T.E. (Electronics and Computer Engineering)**

**ADVANCED JAVA PROGRAMMING**

**(2019 Pattern) (Semester-I) (310342)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No. 1 or Q.No.2, Q.No.3 or Q.No.4 Q.No. 5 or Q.No. 6 Q.No. 7 or Q.No. 8
- 2) Figures to the right indicates full marks.
- 3) Assume suitable data, if necessary.

**Q1) a)** Explain the use of overriding the following methods for an applet **[6]**

- i) init()
- ii) Start()
- iii) Stop()
- iv) destroy()
- v) Paint()

**b)** Explain the following AWT/swing components **[6]**

- i) JTabbedPane
- ii) Frame
- iii) JCheckBox

**c)** Write a program to create an applet with some background color and foreground color with a message. The message string is stored in msg and is to be displayed in paint () method. **[6]**

**OR**

**Q2) a)** Explain the following **[6]**

- i) adapter classes
- ii) inner classes.

**P.T.O.**

- b) Write a program to pass name and salary to an applet and get the tax calculated. Make use of get Parameter () method. [6]
- c) Write a program to create a combo box with names of some countries. The user can select any one of them from the list and the selected country name is displayed again in the frame. [6]

- Q3)** a) Explain the following [6]
- i) The FocusEventClass
  - ii) The InputEventClass
- b) Write a program to trap a key which is pressed on the keyboard and display its name in the Text [6]  
area. (Consider F1, F2, F3, Page Up, Page Down Keys).
  - c) Write a Java program to create a text area and display the mouse event when the button on the mouse is clicked. [6]

OR

- Q4)** a) Write a short note on [6]
- i) Event Classes
  - ii) Event Listeners
- b) Write a program which first creates a frame and then closes it on clicking the close button. [6]
  - c) Write a Java program that allows you to fill the shapes with some colors. [6]

- Q5)** a) Which are the five types of Layout Managers? Explain each one in brief. [8]
- b) Write short notes on [8]
    - i) The String Tokenizer class
    - ii) The Formatter class
    - iii) The Scanner class
    - iv) The Collection Interface

OR

- Q6)** a) Write a Graphical User Interface program in Java to create a choice menu with names of some languages from where the user has to select any one item. The selected item must also be displayed in the frame. [8]

- b) Write a Java program to create a card layout and display 3 buttons, Button1, Button2 & Button3 in card Layout. [8]

**Q7) a)** Explain the following in JDBC (Any five) [10]

- i) DSN
- ii) ScrollableResultSet
- iii) CLOB
- iv) CallableStatement
- v) PreparedStatement
- vi) Stored Procedure
- vii) BLOB
- viii) ODBC

b) Explain the following in relation to JDBC [8]

- i) Class.forName (dname) method
- ii) Driver manager.getConnection (“jdbc:oracle:thin:@localhost:1521:xe”, “scott”, “tiger”);
- iii) ExecuteQuery() method
- iv) ExecuteUpdate () method

OR

**Q8) a)** Write a JDBC program to retrieve data from the table emptab of test database. [8]

b) Explain in brief the following (Any five) [10]

- i) ResultSetMeta Data
- ii) Reader
- iii) SetFetchSize ()
- iv) Type 4 (JDBC driver)
- v) execute () method
- vi) get Property()
- vii) Java.sql. Ref interface
- viii) Java.sql. Struct interface





Total No. of Questions: 8]

SEAT No. :

**P407**

**[6003]-492**

[Total No. of Pages : 2

**T.E. (Electronics & Computer Engineering)**

**DATA COMMUNICATION**

**(2019 Pattern) (Semester-I) (310343)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No. 1 or Q.No.2, Q.No.3 or Q.No.4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Explain QPSK with its Transmitter. [8]  
b) Explain M-ary FSK in detail with the help of Transmitter and Receiver. [8]

OR

- Q2)** a) For a given data (101101), draw the modulated output waveforms for [8]  
i) BASK  
ii) BFSK  
iii) BPSK  
iv) QPSK  
b) Explain with the help of neat block diagram Explain Binary Frequency Shift Keying (BFSK) Transmitter and receiver. [8]

- Q3)** a) Explain different Multiple Access Techniques in detail. [9]  
b) A PN sequence is generated using feedback shift registers of length  $m=4$ , Find the generated output sequence if the initial contents of the shift register are 1000. If the chip rate is  $10^7$  chips/sec. Find the following Parameter [9]  
i) Design PN sequence  
ii) Chip Duration  
iii) Length of PN sequence  
iv) Duration of PN Sequence

OR

*P.T.O.*

- Q4)** a) With the help of mathematical expressions and block diagram explain DS-SS system [9]  
 b) Write a short note on [9]  
 i) Pure ALOHA  
 ii) Slotted ALOHA  
 iii) CSMA

- Q5)** a) Apply Shannon Fano coding procedure to find the coding efficiency for the following Message ensemble.  $X_1=1/4$ ,  $X_2=1/8$ ,  $X_3=1/16$ ,  $X_4=1/16$ ,  $X_5=1/16$ ,  $X_6=1/4$ ,  $X_7=1/16$ ,  $X_8=1/18$  Take  $M=2$  [9]  
 b) Define information rate, Entropy, Mutual information and channel capacity, Minimum Distance. [9]

OR

- Q6)** a) An information source produces a sequence of independent symbols having the following probabilities.  $S_1=1/3$ ,  $S_2=1/27$ ,  $S_3=1/3$ ,  $S_4=1/9$ ,  $S_5=1/9$ ,  $S_6=1/27$ ,  $S_7=1/27$  Construct using Huffman binary encoding procedure and find its efficiency. [9]  
 b) State and explain Shannons thorem on channel capacity. [9]
- Q7)** a) Explain in detail ARQ Stop and Wait & Selective repeat ARQ. [6]  
 b) Explain the need of Error detection and Error Correction. [6]  
 c) What is Generator matrix and parity matrix? What is their role? [6]

OR

- Q8)** The Generator matrix of a particular (6,3) block code is given below. Find all code vectors of this code [8]

a) 
$$G = \begin{bmatrix} 100 & 011 \\ 010 & 101 \\ 001 & 110 \end{bmatrix}$$

- b) Compare Forward error correction and Automatic repeat request [4]  
 c) Write a short note on Linear block code. [4]



Total No. of Questions : 8]

SEAT No. :

P-408

[Total No. of Pages : 2

[6003]-493

**T.E. (Electronics and Computer Engineering)**  
**MICROCONTROLLER AND APPLICATIONS**  
**(2019 Pattern) (Semester - I) (310344)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Figures to the right side indicate full marks.*
- 3) Assume Suitable data if necessary.*

- Q1)** a) Draw an interfacing diagram of stepper motor with 8051 microcontroller and write an embedded C code to rotate it in clockwise continuously. [6]
- b) Draw interfacing of relay with 8051 microcontroller also write an embedded c program to turn on and off with same delay. [6]
- c) Draw an interfacing diagram of DAC with 8051 microcontroller and write an embedded C code to generate sine wave. [8]

OR

- Q2)** a) Draw an interfacing diagram of opto-isolator with 8051 microcontroller and write an embedded C code to flash lamp connected to it with delay of 10 msec. [6]
- b) Draw an interfacing diagram of the buzzer connected at port pin P2.0 of 8051 microcontroller and write an embedded C code to turn it ON and OFF with highest delay generated using timer 0 mode 1. [6]
- c) Draw an interfacing diagram of DAC with 8051 microcontroller and write an embedded C code to generate triangular wave of 5 KHz using timer 1 in mode 2. [8]
- Q3)** a) Explain with neat diagram MSP430x5xx microcontroller architecture. [8]
- b) Explain various low power modes of MSP430. [8]

**P.T.O.**

OR

- Q4)** a) Enlist the features of MSP430x5xx microcontroller. [8]  
b) Compare variants of the MSP430 family. [8]
- Q5)** a) Generate a square wave using Timer 0 of MSP430 microcontroller.[8]  
b) Draw an interfacing diagram of 8 LEDs with MSP430 microcontroller and write an embedded C code to flash the LEDs with 1s delay. [8]

OR

- Q6)** a) Explain various registers used to generate square wave using internal DAC of MSP430 microcontroller. [8]  
b) Write a short note on I2C and UART protocol of MSP430 microcontroller. [8]
- Q7)** a) Explain with neat block diagram DAS using 8051 microcontroller.[6]  
b) Design an environment monitoring system using MSP430 microcontroller, write the algorithm for the same. [6]  
c) Design a soil monitoring system for agriculture using MSP430 microcontroller. Draw the flow chart for the same. [6]

OR

- Q8)** a) Design a water level monitoring system using 8051 microcontroller. Draw the flow chart for the same. [6]  
b) Design a home automation system using MSP430 microcontroller. Also write an embedded C program for same. [6]  
c) Design frequency counter using 8051 microcontroller and display the result on LCD. [6]



Total No. of Questions : 8]

SEAT No. :

**P409**

[Total No. of Pages : 2

**[6003]-494**

**T.E. (Electronics and Computer Engineering)**

**DISTRIBUTED SYSTEMS**

**(2019 Pattern) (Semester - I) (310345 (A)) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Figures to the right indicate full marks.*

- Q1)** a) Discuss about the distributed file system. What is the difference between Peer to Peer file system and distributed file system? [6]
- b) With neat sketch explain Routing Overlays in detail. [6]
- c) What is Identifiers? Explain the Uniform Resource Identifiers, Uniform Resource Locator and Uniform Resource Names. [8]

**OR**

- Q2)** a) What is the need of Peer to Peer middleware system? Write the non-functional requirements of Peer to Peer middleware system? [6]
- b) With the help of neat diagram explain about the file server architecture. [6]
- c) Explain the following in details. [8]
- i) File system access model and its sharing semantics.
  - ii) Peer to Peer middleware systems.

- Q3)** a) Describe in detail about Cristian's and Berkley algorithm for synchronizing clocks. What are the issues resolved by Berkley's algorithm? Describe briefly about global states. [8]
- b) What is network partition? Write the features of Network Time Protocol. Explain the different modes of synchronization of Network Time Protocol servers. [8]

**OR**

- Q4)** a) What is mutual exclusion? Explain the central server algorithm and ring based algorithm for mutual exclusion. [8]
- b) Explain the Chandy and Lamports snapshot algorithm for determining the global states of distributed systems. [8]

**P.T.O.**

- Q5)** a) What are thread models? What are the design issues in threads? Explain the different thread scheduling policies/algorithms. [8]  
b) What is process migration? Give the classification of process migration. Explain non-preemptive and preemptive migration during its execution. [8]

OR

- Q6)** a) What is task assignment approach? What are the typical assumptions for the task assignment approach? Explain the task assignment approach algorithms in detail. [8]  
b) What is load balancing? What are the benefits of load balancing? What are the rules of load balancing operation? Explain Sub-optimal load balancing algorithm. [8]

- Q7)** a) What is distributed file system? Explain various components of distribution file system in its services. [6]  
b) What do you mean by Google file system? With the help of neat diagram explain architecture of Google file system. [6]  
c) Explain design overview of Coda distributed file system. Which method is used for communication in Coda file system? [6]

OR

- Q8)** a) Explain characteristics of distributed file system. State the advantages and disadvantages of distributed file System. [6]  
b) What is Network File System (NFS) of distribution file system? Explain the need for distributed file systems. How does the network file system work? [6]  
c) Explain in detail NFS protocol and implementation in distributed file system. [6]



Total No. of Questions : 8]

SEAT No. :

**P410**

[Total No. of Pages : 2

**[6003]-495**

**T.E. (Electronics & Computer Engg.)**

**BLOCK CHAIN TECHNOLOGY**

**(2019 Pattern) (Semester - I) (310345 (B)) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is cryptography? Explain three characteristics of cryptography. [6]  
b) What is Hash function? Explain in detail. Also, explain the features of Hash functions. [6]  
c) Explain symmetric and Asymmetric key cryptography. [6]

OR

- Q2)** a) Describe the properties of Hash function for an effective cryptographic tool. Describe any two applications of Hash function. [8]  
b) What is Message Authentication Code (MAC)? Describe process of MAC for authentication. [6]  
c) Enlist the popular Hash functions. Describe SHA-1 in detail. [4]

- Q3)** a) What is ethereum? Write use of solidity, Remix, Ganache and Myether Wallet in ethereum. [10]  
b) Explain working process, features and applications of ethereum. [8]

OR

- Q4)** a) What is Hashing in data structure? Write types of hashing in data structure. [6]  
b) How does Hashing in data structure works? Explain with example. [6]  
c) Explain Secure Hash Algorithm Version 3 in detail. [6]

- Q5)** a) What is Bitcoin? Explain working of bitcoin. [6]  
b) Draw and explain Bitcoin block structure. [6]  
c) Explain Bitcoin Transaction process in detail. [6]

OR

**P.T.O.**

- Q6)** a) What is Merkle Trees in blockchain technology? How it works? Explain significance of Merkle Tree. [8]  
b) Explain the terms Bitcoin Address, Bitcoin Transactions, Bitcoin Network, Bitcoin Supply and Bitcoin Payments in brief. [10]

- Q7)** a) What is the role of blockchain in cloud computing? Explain advantages of integrating blockchain into cloud computing. [5]  
b) Explain in detail, how Blockchain and Artificial Intelligence integration is changing the business process. [5]  
c) Compare Blockchain Technology, Cloud computing and Artificial Intelligence. [6]

OR

- Q8)** a) Explain, why the future Internet of Things (IoT) depends on Blockchain technology. [5]  
b) Explain how RPA and Blockchain can function together. Explain advantages of using RPA in conjunction with Blockchain Technology.[8]  
c) Differentiate between Blockchain and Machine Learning. [3]





Total No. of Questions : 8]

SEAT No. :

**P411**

[Total No. of Pages : 2

[6003]-496

**T.E. (Electronics & Computer)**

**DIGITAL SIGNAL PROCESSING**

**(2019 Pattern) (Semester - I) (Elective - I) (310345C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume Suitable data if necessary.

**Q1) a)** Compare IIR & FIR filters based on the following points. **[6]**

- i) Filter governing mathematical equation.
- ii) Memory requirement.
- iii) Stability.
- iv) Recursiveness.
- v) Phase response.
- vi) Processing time.

**b)** Convert analog filter with system function  $H(s)$  into digital IIR filter using

impulse invariance method  $H(s) = \frac{10}{s^2 + 7s + 10}$ . **[7]**

**c)** Compare Butterworth filter & Chebyshev filter on following points. **[5]**

- i) Frequency response.
- ii) Order for given specification.
- iii) Transition band.
- iv) Phase response.
- v) Pole location.

OR

**Q2) a)** Explain following window functions. **[6]**

- i) Rectangular window.
- ii) Hamming window.

**b)** What is Gibbs phenomenon? How the effect of Gibbs phenomenon is reduced? **[6]**

**c)** What is the meaning of linear phase filters? Prove that FIR filters are inherently stable. **[6]**

**P.T.O.**

- Q3)** a) What is finite word length effect and how it affects FIR filter performance. [8]  
 b) State the advantage of direct form II realization over direct form I. Hence implement the following difference equation in direct form I and II.  
 $y(n) = 0.5x(n) - 0.5x(n-2) - 1.3y(n-1) - 0.36y(n-2)$ . [9]

OR

- Q4)** a) Explain Lattice-Ladder structure of IIR filter. [8]  
 b) Obtain the direct form - I, direct form - II realization of the system. [9]  
 $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$

- Q5)** a) What is sampling rate conversion? What is multirate DSP? Why is it required? [6]  
 b) What is the principle of down sampling? What is importance of Antialiasing filter? [6]  
 c) Draw block schematic for interpolation and Decimation. [6]

OR

- Q6)** a) With the help of neat waveform and diagram explain sampling rate conversion by non-integer factor. [6]  
 b) Give the mathematical expressions for sampling rate conversion by non-integer factor. Can the positions of the decimator and interpolator be interchanged? Justify your answer. [6]  
 c) What is the role of anti-aliasing and anti-imaging filters in a Decimator and interpolator respectively? [6]

- Q7)** a) Explain speech coding and compression technique. [9]  
 b) Compare the features of DSP processor and microprocessor with respect to architecture. [8]

OR

- Q8)** a) Explain the following related to Digital Signal Processor. [9]  
 i) Mac Unit  
 ii) ALU  
 iii) VLIW Architecture  
 b) Explain how DSP is useful in Interference cancellation in ECG. [8]



**[6003]-497**

**T.E. (Electronics and Computer Engineering)**

**SENSORS AND APPLICATIONS**

**(2019 Pattern) (Semester - I) (310345 (D)) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Use of non-programmable scientific calculator is allowed.*

**Q1) a)** Explain working principle of. **[8]**

- i) Ultrasonic level sensor and.
- ii) Float type level sensor.

b) Explain with neat sketch working principal of transit time ultrasonic flow meter. State advantages and applications of ultrasonic flow meters. **[9]**

OR

**Q2) a)** Explain capacitance probe type of level measurement technique for- **[8]**

- i) Conductive liquid.
- ii) Non-conductive liquid.

b) Explain with a neat sketch working principle of rotameter. Can a rotameter be used in a horizontal pipe line? If not, explain why? **[9]**

**Q3) a)** Explain working principle of following proximity sensors- **[8]**

- i) Optical proximity sensors.
- ii) Inductive proximity sensors.

b) Explain working principle of Geiger Muller counter used for detection of nuclear radiation. **[9]**

OR

**Q4) a)** Explain the process of charge transfer in CMOS image sensors. **[8]**

b) Explain with neat sketch working principle of incremental optical encoder. What is the use of index pulse in incremental encoder? Explain how an incremental encoder is used to sense direction of rotation of shaft. **[9]**

**P.T.O.**

- Q5)** a) Explain working principle of PZT actuators. State its applications. [9]  
b) Explain magneto-transistor and magneto-resistive elements (MRE). [9]

OR

- Q6)** a) Write a short note on surface micromachining for MEMS devices. [9]  
b) Explain with neat block diagram the concept of SMART sensor system. [9]

- Q7)** a) Draw and explain the symbols of following pneumatic valves. [6]  
i)  $5 \times 2$  valve  
ii)  $4 \times 2$  valve  
iii)  $3 \times 2$  valve  
b) Explain how a solenoid is used as an actuator. [6]  
c) Draw control valve characteristics and explain the terms. [6]  
i) Quick Opening  
ii) Linear and  
iii) Equal Percentage.

OR

- Q8)** a) Explain pneumatic lift system using a poppet valves and pneumatic cylinder. [6]  
b) Explain control of single acting cylinder using an appropriate directional control valve. [6]  
c) Explain how actuators are classified. Explain any one type of actuators. [6]



Total No. of Questions : 8]

SEAT No. :

P-2804

[Total No. Of Pages : 2

[6003]-498

**T.E. (Automation and Robotics)**

**SENSORS AND VISION SYSTEMS IN ROBOTS**

**(Semester-II) (2019 Pattern) (302527) (Theory)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer four questions from the following.*
- 2) *Draw neat labeled diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non programmable electronic calculator is permitted.*
- 5) *Assume suitable/standard data if necessary.*

- Q1)** a) Draw the structure of human eye and explain any eight parts of eye. [8]
- b) Draw and Explain components of general-purpose image processing system. [9]

OR

- Q2)** a) Explain adjacency, Connectivity, Regions and Boundaries using arrangement of pixels. [8]
- b) Draw and Explain Stereo Imaging Model and calculate equation of disparity. [9]

- Q3)** a) Explain Gray level transformation and its types with Transformation Curves. [9]
- b) Explain mechanics of Linear Spatial filtering with neat diagram of kernel. [9]

OR

- Q4)** a) Explain smoothing (low pass) spatial filter and its two types of kernels.[9]
- b) Sketch Laplacian kernels used for image sharpening using second order derivative equations. [9]

**P.T.O**

- Q5)** a) Explain Edge Linking using Hough Transform. [8]  
b) Explain the basics of Intensity Thresholding using intensity Histogram.[9]

OR

- Q6)** a) Explain Region segmentation using K-means Clustering and its algorithm. [8]  
b) Explain Topological Descriptor using suitable examples. [9]

- Q7)** a) Write Installation and testing of ROS camera Drivers. [9]  
b) Explain ROS to Open CV - The CV bridge Package. [9]

OR

- Q8)** a) Explain open CV image processing library. [9]  
b) Explain image processing using MATLAB programming. [9]



Total No. of Questions : 8]

SEAT No. :

**P3165**

**[6003] - 499**

**[Total No. of Pages : 3**

**T.E. (Automation and Robotics)**  
**ARTIFICIAL INTELLIGENCE IN ROBOTS**  
**(2019 Pattern) (Semester - II) (302528)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Draw neat labeled diagrams wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of non-programmable electronic calculator is permitted.*
- 4) *Assume suitable/standard data if necessary.*

- Q1)** a) Explain following feature engineering techniques with suitable example.[8]  
i) Imputation.  
ii) Scaling.  
b) Write a note on different data wrangling techniques employed in the data pre-processing. [9]

OR

- Q2)** a) What do you mean by feature scaling? Why is need of scaling in data pre-processing? When scaling is essential? [7]  
b) Refer the following datasheet and write the python code for the followings: [10]

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
	0	1	5.1	3.5	1.4	0.2 Iris-setosa
	1	2	4.9	3.0	1.4	0.2 Iris-setosa
	2	3	4.7	3.2	1.3	0.2 Iris-setosa
	3	4	4.6	3.1	1.5	0.2 Iris-setosa
	4	5	5.0	3.6	1.4	0.2 Iris-setosa
	...	...	...	...	...	...
	145	146	6.7	3.0	5.2	2.3 Iris-virginica
	146	147	6.3	2.5	5.0	1.9 Iris-virginica
	147	148	6.5	3.0	5.2	2.0 Iris-virginica
	148	149	6.2	3.4	5.4	2.3 Iris-virginica
	149	150	5.9	3.0	5.1	1.8 Iris-virginica

**P.T.O.**

- i) Write a python code for the encoding of the feature 'Species'.
- ii) Write a python code for the scaling of data set using normalization and standardization scaling techniques.

**Q3) a)** Write a note on following algorithms [8]

- i) Random Forest.
  - ii) Logistic Regression.
- b) How to choose right value of K in KNN using elbow method. [5]
  - c) Explain terminology in the decision tree with neat labeled diagram. [5]

OR

**Q4) a)** Distinguished between bagging and boosting algorithms. [8]

- b) Calculate information gain for the features 'outlook', 'temperature', 'humidity' and 'windy'. Refer following datasheet. [10]

	outlook	temperature	humidity	windy	play
0	overcast	hot	high	False	yes
1	overcast	cool	normal	True	yes
2	overcast	mild	high	True	yes
3	overcast	hot	normal	False	yes
4	rainy	mild	high	False	yes
5	rainy	cool	normal	False	yes
6	rainy	cool	normal	True	no
7	rainy	mild	normal	False	yes
8	rainy	mild	high	True	no
9	sunny	hot	high	False	no
10	sunny	hot	high	True	no
11	sunny	mild	high	False	no
12	sunny	cool	normal	False	yes
13	sunny	mild	normal	True	yes



- Q5)** a) Explain Markov decision process and Q-learning. [8]  
b) Draw fully connected deep learning network and explain elements of the deep learning. [5]  
c) Explain in detail any two activation functions used in the neural networks.[4]

OR

- Q6)** a) Write applications of reinforcement learning with suitable examples. [5]  
b) Explain key constituents of reinforcement learning with neat labelled sketch. [7]  
c) Distinguish between machine learning and deep learning. [5]

- Q7)** a) How does the K-means clustering works? [8]  
b) Describe in details steps involved in the development of classification problems. [10]

OR

- Q8)** a) Explain in details linear SVM and non-linear SVM. [9]  
b) Write a note on human machine interaction. [9]



Total No. of Questions : 8]

SEAT No. :

P-3166

[Total No. Of Pages : 2

**[6003]-500**

**T.E. (Automation and Robotics)  
MODELING AND SIMULATION  
(2019 Pattern) (Semester-II) (302529)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer two questions from the following.*
- 2) *Draw neat labeled diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non programmable electronic calculator is permitted*
- 5) *Assume suitable/Standard data if necessary.*

- Q1)** a) List out the techniques for increasing model validity and credibility. [10]  
b) Explain pseudo random numbers with examples. [7]

OR

- Q2)** a) List out techniques for identifying data distribution. Explain any one of them. [9]  
b) Use the linear congruential method to generate a sequence of random numbers with  $X_0 = 27$ ,  $a = 17$ ,  $c = 43$ , and  $m = 100$ . Here, the integer values generated will all be between zero and 99 because of the value of the modulus. These random integers should appear to be uniformly distributed the integers zero to 99. Random numbers between zero and 1 can be generated by  $R_i = X_i/m$ ,  $i=1,2,.....$  [8]

- Q3)** a) Explain output data analysis for a single model. [9]  
b) What are the different techniques for generating random variates? Explain any one of them. [9]

OR

*P. T. O*

- Q4)** a) Explain inverse transform technique for exponential distribution with detailed procedure. [8]
- b) What are the different types of simulation with respect to output analysis? Explain with example. [10]

- Q5)** a) What is the need of simulation in manufacturing and material handling systems? Also list out its application in same perspective. [9]
- b) Explain conveyor system with its input parameters that should be considered when designing and implementing them. [8]

OR

- Q6)** a) Explain simulation of Job shop with Material Handling System. [10]
- b) What are the different types of simulation that can be used in manufacturing and material handling systems? [7]
- Q7)** a) Compare simulation software with the programming languages. [6]
- b) Explain object oriented simulation package. [6]
- c) List out the desirable software features in detail. [6]

OR

- Q8)** a) Explain the features needed in programming the discrete-event type simulation model. [6]
- b) Explain the classification of simulation software with example. [6]
- c) State advantages and disadvantages of object oriented simulation approach. [6]



Total No. of Questions : 8]

SEAT No. :

P-413

[Total No. of Pages : 3

[6003]-501

T.E. (Automation and Robotics)

MACHINING SCIENCE AND TECHNOLOGY

(2019 Pattern) (Semester - II) (Elective - II) (302530-A)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer four questions from the following.
- 2) Draw neat labeled diagrams wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of non programmable electronic calculator is permitted.
- 5) Assume Suitable/Standard data if necessary.

**Q1)** a) Explain in details Mechanism of tool wear with neat sketch. [8]

b) A tool life 80 minutes is obtained at a speed of 30 m/min and 8 minutes in 60 m/min. Determine the following : [10]

- i) Tool life Equation
- ii) Cutting speed for 4 minutes of tool life.

OR

**Q2)** a) What are the modes of tool wear? Write a short note on crater wear and flank wear. [8]

b) The following cutting speed of tool life observations have been noted in a machining process. [10]

Cutting Speed (V)	25 m/min	35 m/min
Tool Time (T)	90 minutes	20 minutes

Find

- i) 'n' and 'C'
- ii) Recommend the cutting speed for desired tool life of 60 minutes.

P.T.O.

- Q3)** a) Explain in details requirements of dynamometer. [8]  
b) What is lathe tool dynamometer, explain its construction and working with neat sketch. Write its applications. [9]

OR

- Q4)** a) What is the need of measurement of cutting forces? [8]  
b) Write a classification of cutting force dynamometers. Explain any two of them. [9]

- Q5)** a) Explain in details Economics of Machining. [7]  
b) Suppose a turning operation is to be performed with HSS tooling on mild steel, with Taylor tool life parameters  $n = 0.125$ ,  $C = 70$  m/min. Work part length = 500 mm and diameter = 100 mm. Feed = 0.25 mm/rev. Handling time per piece = 5.0 min, and tool change time = 2.0 min. Cost of machine and operator = \$30/hr. and tooling cost = \$3 per cutting edge. [10]

Find :

- i) cutting speed for maximum production rate, and
- ii) cutting speed for minimum cost
- iii) the hourly production rate and cost per piece for the two cutting speeds computed.

OR

- Q6)** a) Derive equation for optimum cutting speed and tool life for minimum cost. [7]  
b) A high-speed steel tool is used to turn a steel work part that is 300 mm long and 80 mm in diameter. The parameters in the Taylor equation are:  $n = 0.13$  and  $C = 75$  (m/min) for a feed of 0.4 mm/rev. The operator and machine tool rate = \$30/hr, and the tooling cost per cutting edge = \$4. It takes 2 min to load and unload the work part and 3.5 min to change tools. Determine (a) cutting speed for maximum production rate, (b) cutting speed for minimum cost, (c) tool life of cutting in (a) and (b), (d) cycle time and cost per unit of product in (a). [10]

- Q7)** a) Write a short note on Modern Machining Techniques. [8]
- b) Describe in detail Electrical Discharge Machining (EDM) with working principle, diagram, construction, working, and application. [10]

OR

- Q8)** a) Differentiate between conventional and non-conventional machining process. [8]
- b) Describe in detail Ultrasonic Machining (USM) with working principle, diagram, construction, working, and application. [10]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-414

[Total No. of Pages : 2

**[6003]-502**

**T.E. (Automation and Robotics)**

**MAINTENANCE AND SAFETY ENGINEERING**

**(2019 Pattern) (Semester - II) (302530-B) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer four questions from the following (Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8).*
- 2) Draw neat labeled diagrams wherever necessary*
- 3) Figures to the right side indicate full marks.*
- 4) Use of non programmable electronic calculator is permitted*
- 5) Assume Suitable/Standard data if necessary.*

**Q1)** a) What is Planned and unplanned Maintenance? Explain in details. **[9]**

b) Explain Condition Base Maintenance System. **[9]**

OR

**Q2)** a) What is Vibration Monitoring? What are its causes, identification and monitoring? **[9]**

b) Differentiate between Preventive Maintenance, Predictive Maintenance. **[9]**

**Q3)** a) Explain the factors involved in effective planning of maintenance work. **[9]**

b) What are the various methods of scheduling work? **[8]**

OR

**Q4)** a) Explain the Short term and Long Term Maintenance Plans. **[9]**

b) Write a short note on : **[8]**

- i) Annual Overhauls
- ii) Renovation
- iii) Revamping and
- iv) Modernization.

**P.T.O.**

- Q5)** a) What are the methods for Accidents preventions? [9]  
b) What do you mean by Job Safety Analysis? Explain in detail. [9]

OR

- Q6)** a) What is Safety Survey? Write the steps involved in safety survey. [9]  
b) What are the Onsite offsite Emergency Plans? Why it is necessary? [9]

- Q7)** a) Explain the Procedure for Ensuring Safety in. Planning, Building and Operating Plants. [9]  
b) What points are considered in Construction and Commissioning of Plants? Explain in details. [8]

OR

- Q8)** a) Why safety measures are required in plant? Classify Safety measures?[9]  
b) Demonstrate Personal Safety and Personal Protective Equipment? [8]





Total No. of Questions : 8]

SEAT No. :

**P415**

**[6003]-503**

[Total No. of Pages : 2

**T.E. (Electronics and Computer Engineering)**  
**SOFTWARE ENGINEERING AND PROJECT MANAGEMENT**  
**(2019 Pattern) (Semester - II) (310352)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** What is Software Estimation? What are the Software Estimation Techniques? **[9]**

b) What is Functional Point Method? Explain with an example. **[9]**

OR

**Q2) a)** What is Empirical Estimation model? What are the Empirical Estimation techniques? **[9]**

b) What is LOC-Based Estimation Method? Explain with an example. **[9]**

**Q3) a)** Explain the Software Design Process How to design a Traffic Control System? **[8]**

b) What is design engineering in software engineering? What are the three types of design in software engineering? **[9]**

OR

**Q4) a)** What is Software Architecture? Why is Software Architecture Important? **[8]**

b) What are Component-Level Design Elements? Explain Component Level Design for Web Apps. **[9]**

**Q5) a)** What is software configuration management? What are the 4 main functions of software configuration management? **[9]**

b) What is the RMMM Plan? Explain in detail. **[9]**

OR

**P.T.O.**

**Q6)** a) Explain software Configuration Management for any suitable software system. [9]

b) What is the SCM Repository? Explain in details. [9]

**Q7)** a) What are the different methods of testing? What are the phases involved in Software Testing Life Cycle? [9]

b) What are the different levels of testing? What is the difference between functional and non-functional testing? [8]

OR

**Q8)** a) What is Verification and Validation in Software Testing? On what basis the acceptance plan is prepared? [9]

b) What is a test case? Explain Bug Life Cycle or Defect life cycle. [8]



Total No. of Questions : 8]

SEAT No. :

**P416**

[Total No. of Pages : 2

**[6003]-504**

**T.E. (Electronics & Computer Engineering)**  
**COMPUTER NETWORKS AND SECURITY**  
**(2019 Pattern) (Semester-II) (310353)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Black figures to the right indicate full marks.
- 3) Neat diagrams must be draw wherever necessary.

- Q1)** a) Explain the purpose of flow control and error control in data link layer.[4]  
b) Explain the working HDLC protocol with neat diagram. [6]  
c) What are the noisy channels? Explain stop and wait protocol with suitable diagram. [6]

OR

- Q2)** a) Explain frame format of point to point protocol. [4]  
b) What are the types of media access control? Explain in detail random access technique. [6]  
c) Explain router with suitable diagram. [6]

- Q3)** a) Write a short note on Address Resolution protocol (ARP) [6]  
b) Explain IPv6 address in detail [6]  
c) Explain Internet control message protocol (ICMP) with suitable architecture diagram. [6]

OR

- Q4)** a) Explain Transmission Control Protocol with header diagram. [6]  
b) Explain in detail link state routing vector with suitable diagram. [6]  
c) What is congestion control? List the typical QoS parameters in the transport layer and explain each one. [6]

*P.T.O.*

- Q5)** a) Explain with architecture of WWW. [4]  
b) What is DNS? Explain Domain Name Space in detail. [6]  
c) What are the different commands used in SMTP. Explain Simple Mail Transfer protocol. [8]

OR

- Q6)** a) What is streaming of Audio/Video. Explain. [4]  
b) Write a short note on Email with message format. [6]  
c) Explain SNMP with suitable diagram. What is the role of structure management Information in SNMP explain. [8]

- Q7)** a) List the different security goals. Explain. [4]  
b) Explain public key cryptography (cipher) with suitable diagram. [6]  
c) What is Network Monitoring? How to perform network monitoring effectively. [8]

OR

- Q8)** a) Write a short note on network tester. [4]  
b) Explain with neat diagram internet access through dial up. [6]  
c) What is Protocol Analyzer? Explain the working with neat diagram. [8]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P417**

**[6003]-505**

**T.E. (E & CE)**

**EMBEDDED PROCESSOR & APPLICATIONS**

**(2019 Pattern) (Semester - II) (310354)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

- Q1)** a) Interface of LPC 2148 with PC using UART. Draw interfacing diagram and explain it. [9]  
b) What are the advantages of using LPC 2148 instead of other processors in embedded system? [9]

OR

- Q2)** a) Write down the characteristic features of UART of LPC 2148. [4]  
b) Write an embedded C program to transmit character 'A' to PC. [6]  
c) Draw and explain interfacing of on chip DAC with LPC2148 with flowchart. [8]

- Q3)** a) What are the features and advantages of ARM CORTEX M3 in embedded system. [8]  
b) Compare CORTEX A, CORTEX M, CORTEX R processors. [5]  
c) Write a note on ARM processor development. [5]

OR

- Q4)** a) Write down the specifications of ARM CORTEX M3. [5]  
b) Draw detailed architecture of ARM CORTEX M3. [8]  
c) Compare between ARM Cortex-M3 and ARM-7 [5]

- Q5)** a) Explain programmer model of ARM CORTEX M4 with neat labelled diagram. [9]  
b) Explain an algorithm to send "SPPU" serially via STM32F4xx controller to Desktop PC on Hyper Terminal. Assume (UART, 9600 Baud Rate). [8]

OR

*P.T.O.*

- Q6)** a) Write a note on different types of timers of STM32F4xx. [6]  
b) Draw an diagram or flowchart to interface Seven segments LED with STM32F4xx microcontroller. [6]  
c) Compare ARM Cortex M3 with ARM Cortex M4. [5]

- Q7)** a) What is IoT? Enlist the characteristics of IoT. [8]  
b) Write a note on Sensors and actuators. [6]  
c) Write down the characteristics of Embedded System. [3]

OR

- Q8)** a) Draw and explain basic block diagram of Embedded System with IoT.[8]  
b) Explain any one of the below with flow/block diagram. [9]  
Agriculture automation.

OR

Health monitoring system.



Total No. of Questions : 8]

SEAT No. :

P-3646

[Total No. of Pages : 2

**[6003]-507**

**T.E. (Electronics and Computer Engineering)**  
**ADVANCED DATABASE MANAGEMENT SYSTEMS**  
**(2019 Pattern) (Semester - II) (310355B) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Figures to the right side indicate full marks.*
- 3) Assume suitable data, if necessary.*

- Q1)** a) Explain No SQL database Development Tool: Map Reduce. [6]  
b) Differentiate between apache Cassandra and MongoDB. [6]  
c) What is MongoDB? Explain key components of MongoDB architecture.[8]

OR

- Q2)** a) What is a JSON database? Explain data types of JSON. [6]  
b) Enlist key features of NoSQL databases. Compare Relational and NoSQL databases. [6]  
c) Explain Key Features of Column-Oriented Database. What are the advantages and disadvantages of Column-Oriented NoSQL databases?[8]

- Q3)** a) With the help of diagram explain Hybrid OLAP (HOLAP) Architecture. State its advantages and disadvantages. [8]  
b) What is a data warehouse? What are the benefits of data warehousing? Compare data warehouse and data lake. [8]

OR

- Q4)** a) Explain in brief characteristics and limitations of data warehouse. [8]  
b) With the help of diagram explain Star and Snowflake Schema used data warehouse. [8]

*P.T.O.*

- Q5) a)** What is Data Mining? Explain the challenges of implementation in data mining. [8]
- b)** List the different mining software. Explain any three software's in detail and also write their features. [8]

OR

- Q6) a)** With suitable diagram explain data mining implementation process. [8]
- b)** What is KDD-Knowledge Discovery in Databases? Write the advantages and disadvantages of KDD. [8]

- Q7) a)** Explain in detail Spatial databases. Compare Spatial and Temporal databases. [6]
- b)** What are active databases? Write the features of active databases. [6]
- c)** What is multimedia database? Explain different types of multimedia database. Explain content of multimedia database. [6]

OR

- Q8) a)** Explain different types of genome data. Explain characteristics of genome data management. [6]
- b)** What is a Geographic Information System (GIS)? Write the GIS applications. [6]
- c)** What is mobile database? Write advantages and disadvantages of mobile database. [6]





**[6003]-508**

**T.E. (Electronics and Computer Engineering)**

**POWER ELECTRONICS**

**(2019 Pattern) (Semester - II) (Elective - II) (310355C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of nonprogrammable calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** What are the effects of inductive load in full converter? **[4]**

b) Draw & explain single phase full converter for R-L load with circuit diagram & waveforms for. **[13]**

- i) Rectifier mode ( $\alpha < 90^\circ$ )
- ii) Operation when ( $\alpha = 90^\circ$ )
- iii) Inversion mode ( $\alpha > 90^\circ$ )

Derive an expression for its average o/p voltage

**OR**

**Q2) a)** Compare symmetrical & asymmetrical configurations in three phase semi-converters with R-L load. **[6]**

b) Draw the circuit diagram of three phase full controlled converter with R load Draw load current and load voltage waveforms with  $\alpha=60^\circ$  and  $\alpha=90^\circ$ . **[11]**

**Q3) a)** A step down chopper is operated from dc supply voltage of 200V. It has resistive load with  $R=20\ \Omega$ . When chopper operates, voltage drop across chopper is 2V. If duty cycle is 50%, calculate: **[6]**

- i) Average & rms o/p voltages
- ii) Average & rms o/p currents
- iii) Chopper efficiency

**P.T.O.**

- b) Explain with diagrams various control techniques in DC chopper operation. [6]
- c) Explain with circuit diagram single phase full wave AC voltage controller for R-load with i/p voltage & o/p voltage & current waveforms. [6]

OR

- Q4)** a) A step up chopper is operated from 230V dc supply and it provides 500V output. If chopping frequency is 2KHz, calculate ON & Off times of chopper. [4]
- b) Explain with circuit diagram operation of step up chopper and derive an expression for its o/p voltage  $V_o = \frac{V_s}{(1-D)}$  where D is duty cycle. [8]
- c) Explain operation of step down chopper with R-L load for continuous & discontinuous current mode. [6]

- Q5)** a) Single phase full bridge inverter is operated from 120V dc supply, it has a resistive load of  $R = 20 \Omega$ . Find:
- i) rms o/p voltages at third & fifth harmonic ( $V_{o3}$  &  $V_{o5}$ )
  - ii) Distortion factor (DF) of 3<sup>rd</sup> harmonic component
  - iii) Total harmonic distortion (THD) [6]
- b) Give classification of inverters? Explain role of feedback diodes in inverters. [4]
- c) Explain working of single phase full bridge inverter for R load with input & output waveforms. [7]

OR

- Q6)** a) Draw a three phase inverter for balanced star R load? Explain its operation of 180° mode with gate signals & output waveforms. [11]
- b) Explain three phase PWM inverters for three phase variable frequency drives. [6]

- Q7)** a) Explain with block diagram HVDC transmission system. [6]
- b) Explain various battery charging models for EVs. [6]
- c) Explain with diagram working principle of induction heating. [6]

OR

- Q8)** a) What are various types of electric Vehicles? Explain any one with block diagram. [6]
- b) Explain operation of On-line & Off-line UPS with block schematic. [12]



Total No. of Questions : 8]

SEAT No. :

**P3167**

[Total No. of Pages : 2

**[6003]-509**

**T.E. (Electronics and Computer Engineering)**

**PLC AND AUTOMATION**

**(2019 Pattern) (Semester - II) (Elective - II) (310355 D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain Functions and applications of timers in PLC. **[8]**

- b) Draw a ladder diagram for a two-motor system having the following conditions: The start Push button starts Motor 1 ; 10 seconds later Motor 2 will start. The stop Push button stops Motor 1 : 15 seconds later Motor 2 stops. **[10]**

OR

**Q2) a)** Explain Functions and applications of Counters in PLC? **[8]**

- b) Draw a ladder diagram for following statement: Motor 1 (M1) starts as soon as start switch is ON; after 10 Seconds M1 goes off and Motor 2 (M2) starts. After 5 seconds M2 goes OFF and M3 starts. After 10 Seconds M3 goes off, M1 starts, and the cycle is repeated. When stop switch is ON, all Motors are stop. **[10]**

**Q3) a)** Explain Consideration of operating environment for PLC while PLC Installation? **[9]**

- b) Explain electrical noise, leaky inputs and outputs for PLC installation and maintenance? **[9]**

OR

**P.T.O.**

- Q4)** a) What the factors to be considered for PLC maintenance? Explain ladder logic program for PLC maintenance? [9]  
b) Explain Troubleshooting [9]  
i) Processor module  
ii) Input & Output malfunctions

- Q5)** a) Explain Proportional, Derivative and Integral control in detail. [9]  
b) Explain functions of RTU and MTU in SCADA? [8]

OR

- Q6)** a) Write a short note on SCADA? [9]  
b) Write a short note on Human Machine Interface (HMI)? [8]

- Q7)** a) Write a short on CAN and MODBUS? [8]  
b) Write a short note on two-axis, three axis robot control with PLC? [9]

OR

- Q8)** a) Write a short note on PROFIBUS-PA/DP with suitable diagram? [8]  
b) Write short note on [9]  
i) Fieldbus  
ii) EtherNet/IP Protocol  
iii) ControlNet



Total No. of Questions : 8]

SEAT No. :

P-418

[Total No. of Pages : 4

[6003]-510

T.E. (Mechatronics Engineering)

MACHINE DESIGN

(2019 Pattern) (Semester - I) (317541)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Use of drawing instruments, electronic pocket calculators are allowed.
- 4) Figure to the right indicates full marks.
- 5) Assume suitable data if necessary.

**Q1)** a) A square threaded screw having 50 mm nominal diameter and 10 mm pitch is used for lifting a load of 20 KN through distance of 170 mm. Find the work done in lifting the load and the efficiency of the screw when:

- i) the load rotates with the screw; and
- ii) the load rests on the loose head which does not rotate with the screw.

The external and internal diameters of the bearing surface of the loose head are 60mm and 10mm respectively, while the coefficient of friction for the bearing surface is 0.08. [10]

- b) Discuss efficiency of Power Screw. [4]
- c) Explain the differential screw with neat sketch. [4]

OR

**Q2)** a) In a machine tool application, the tool holder is pulled by means of an operating nut mounted on a screw. The tool holders travels at a speed of 5m/min. The screw has a single start square thread of 48 mm nominal diameter and 8 mm pitch. The operating nut exerts a force of 500 N to drive the tool holder. The mean radius of friction collar is 40 mm. If the coefficient of friction for thread and collar surface is 0.15, calculate :[10]

- i) the power required to drive the screw
- ii) the efficiency of the mechanism.
- b) Derive the formula for torque required to raised the load by a square threaded power screw. [4]
- c) Explain the self-locking and over-hauling screw. [4]

P.T.O.

- Q3) a)** A cantilever beam of circular cross section, made of alloy steel 30Ni4Cr1 ( $S_{ut} = 1500\text{N/mm}^2$ ), is fixed at one end and subjected to a completely reversed force of 1000N at the free end. The force is perpendicular to the axis of beam. The distance between fixed and free end of the cantilever beam is 400 mm. The theoretical stress concentration factor and notch sensitivity are 1.33 and 0.85 respectively. The surface finish factor and size factor are 0.79 and 0.85 respectively. The temperature factor and reliability factor are 0.975 and 0.868 respectively. The desired life of beam is 50000 cycles. If the required factor of safety is 1.5, determine the diameter of beam. [10]
- b) Explain the modified Goodman's diagram for axial and bending fluctuating stresses. [4]
- c) Write short note on : [4]
- Stress Concentration
  - Endurance strength

OR

- Q4) a)** A circular bar, made of steel, is subjected to an axial load which varies from -300 KN to 700 KN. The endurance limit is 265 MPa, while tensile yield strength is 350MPa. The stress concentration factor is 1.8. If the required factor of safety is 2.0, determine the diameter of rod. [10]
- b) List and explain the factors affecting the endurance strength. [4]
- c) What are the causes of stress concentration? [4]
- Q5) a)** A bracket, fixed to a vertical column by means of four identical bolts, is subjected to an eccentric load of 25 kN as shown in fig.1. If the permissible shear stress for the bolt is  $60\text{N/mm}^2$ , determine the size of the bolt. [7]

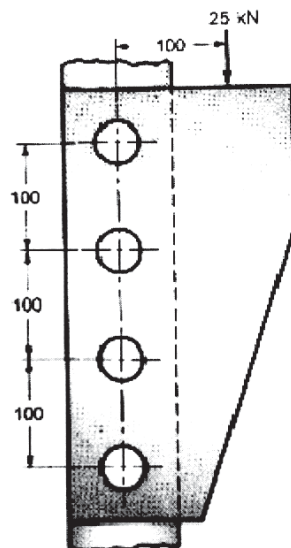


Fig.1

- b) What is meant by preloading of bolts? State the advantages and Applications. [5]
- c) Give a welding symbol system standardized by the American Welding Society. [5]

OR

- Q6) a) A steel bracket is fixed to the vertical support by three bolts of size M20, two at the top and one at the bottom, as shown in fig. 2. If the permissible tensile stress for the bolt is  $60 \text{ N/mm}^2$ , determine the maximum load that can be supported by bracket at 350 mm from the vertical support. [7]

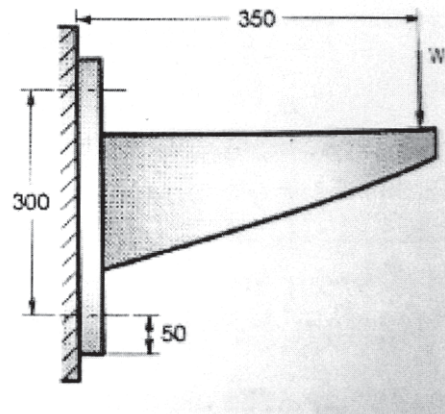
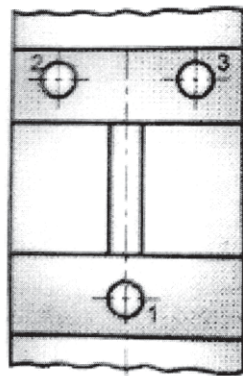


Fig.2

- b) Explain Turn Buckle, also state two applications of it. [5]
- c) State advantages and limitations of welded Joints. [5]
- Q7) a) It is required to design a helical compression spring of circular wire, subjected to an axial load, which varies from 2.5 KN. to 3.5KN. For this range of load the deflection of spring should be limited to 5 mm. The spring index is 5 and the spring has square and ground ends. For spring wire material,  $S_{ut} = 1050 \text{ MPa}$ . and  $G = 81370 \text{ MPa}$ . If permissible shear stress for the spring wire is  $0.5 S_{ut}$ , calculate : [7]
- the wire diameter and mean coil diameter
  - the required spring rate
  - the number of active coils and total number of coils
  - the solid length of spring
  - the free length of spring
- b) Write the difference between Helical tension spring and Helical compression spring. [5]
- c) Explain leaf spring with neat sketch. [5]

OR



- Q8)** a) A load of 1KN. Is dropped axially on a closed coiled helical compression spring from a height of 250 mm. The spring has 20 active coils. The wire diameter is 20mm while spring index is 8. If the modulus of rigidity for the spring material is  $0.84 \times 10^5$  MPa, determine : [7]
- i) the deflection of spring and
  - ii) the stress induced in the spring
- b) Explain different types of stresses induced in the helical spring. [5]
- c) Explain with a neat sketch nipping of leaf springs. [5]



Total No. of Questions: 8]

SEAT No. :

[Total No. of Pages : 3

**P419**

**[6003]-511**

**T.E. (Mechatronics Engineering)  
MANUFACTURING PROCESSES  
(2019 Pattern) (Semester-I) (317542)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No. 1 or Q.No.2, Q.No.3 or Q.No.4 Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8
- 2) Neat diagram must be drawn wherever necessary.
- 3) Use of drawing instruments, electronic pocket calculators are allowed.
- 4) Figure to the right indicates full marks.
- 5) Assume suitable data if necessary.

- Q1)** a) Index 69 division by compound indexing method [10]
- b) Explain single point cutting tool geometry with figure [4]
- c) Explain with neat sketch orthogonal and oblique cutting method [4]

OR

- Q2)** a) In an orthogonal cutting process following data were observed: Chip length of 80 mm was obtained with an uncut chip length of 200 mm and the rake angle used was  $20^\circ$  and depth of cut was 0.5mm. The horizontal and vertical components of cutting force were 2000 N and 200 N respectively. Determine: [10]
- i) Shear Plane angle
  - ii) Chip thickness
  - iii) Frictional angle
  - iv) Resultant cutting force.

Draw Merchant's Circle

- b) Explain the relation between shear velocity, cutting velocity and chip flow velocity [4]
- c) Explain with neat sketch whitworth quick return mechanism of shaper machine [4]

**P.T.O.**

- Q3)** a) Explain with a neat sketch of oxy-acetylene gas welding. Describe the types of flame with neat sketch [8]
- b) What is adhesive bonding? What are its types? what are its application? [5]
- c) What is the soldering process? Why flux is used in soldering [5]

OR

- Q4)** a) Explain with a neat sketch of the Arc welding process. Also give the advantages, limitations and application of Arc welding [10]
- b) Describe the types of bond between the added material and base metal [4]
- c) What precaution are necessary in handling oxy acetylene cylinder [4]

- Q5)** a) Explain the construction and working principle of EDM with neat sketch [7]
- b) What are the application of ultrasonic machining? Why can very hard material be cut better by ultrasonic machining than soft ones? [5]
- c) What is FDM in 3D printing? What are the advantages of fused deposition modeling [5]

OR

- Q6)** a) What is the principle behind Electrical Discharge Machining? Discuss briefly the process indicating voltage, current and temperature [7]
- b) Give a schematic diagram of laser beam machining. Explain interaction of laser beam with workpiece. [5]
- c) Explain selective laser sintering process. Give its advantages and limitations [5]

- Q7)** a) Explain diffusion process in I C. Fabrication with neat sketch [7]  
b) Explain digital integrated circuit with neat sketch. [5]  
c) What is electric packaging? How are electronic components packaged? [5]

OR

- Q8)** a) Explain the basic fabrication process of the integrated circuit [7]  
b) Which material is used for PCB fabrication? Give applications of PCB? [5]  
c) Short note on: [5]  
i) Processing sequence steps in ICs  
ii) Trends in ICs



Total No. of Questions : 8]

SEAT No. :

**P420**

[Total No. of Pages : 2

**[6003]-512**

**T.E. (Mechatronics Engineering)**

**CONTROL SYSTEM**

**Manufacturing Processes**

**(2019 Pattern) (Semester - I) (317543)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of drawing instruments, electronic pocket calculators are allowed.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Using Routh Hurwitz stability criterion, determine the range of K for stability for  $Q(s) = s^4 + 2s^3 + (4 + K)s^2 + 9s + 25 = 0$ . [6]
- b) Explain the significance of auxilliary equation. [6]
- c) Describe the various rules to sketch the root locus. [6]

OR

- Q2)** a) State and explain Routh Hurwitz stability criterion. [6]
- b) Comment on the stability of a system using Roth's stability criteria whose characteristic equation is :  $s^4 + 2s^3 + 4s^2 + 6s + 8 = 0$ . How many poles of systems lie in right half of S plane. [6]
- c) State the advantages of root locus. [6]

- Q3)** a) What are the limitations for frequency domain approach [4]
- b) For the system with closed loop transfer function  $G(s) = \frac{100}{s^2 + 10s + 100}$ , determine resonant peak, resonant frequency, damping factor, and undamped natural frequency. [6]
- c) What is a polar plot? Explain with examples. [8]

OR

**P.T.O.**

- Q4) a)** What are the advantages of frequency domain approach. [4]
- b) For the system with closed loop transfer function  $G(s) = \frac{36}{s^2 + 6s + 36}$ , determine resonant peak, resonant frequency, damping factor, and undamped natural frequency. [6]
- c) Explain steps to sketch Nyquist plot. [8]

- Q5) a)** Define and explain : [8]
- gain margin
  - phase margin
  - gain cross over frequency
  - phase crossover frequency
- b) Explain the procedure to obtain gain margin and phase margin from the Bode plot. [8]

OR

- Q6) a)** Discuss the nature of bode plot of : [8]
- pole at origin
  - simple pole
  - Simple zero
  - Quadratic pole
- b) Explain steps to sketch Bode plot. [8]

- Q7) a)** What is derivative control mode. State its characteristics. [6]
- b) Explain concept of industrial automation. [6]
- c) What is a PID controller? Explain in detail. [6]

OR

- Q8) a)** What is integral control mode? State its characteristics. [6]
- b) Explain PD control mode state its characteristics. [6]
- c) Explain applications of IoT. [6]



**[6003]-513**  
**T.E. (Mechatronics)**  
**DIGITAL SIGNAL PROCESSING**  
**(2019 Pattern) (Semester - I) (317544)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume Suitable data if necessary.*
- 5) Use of calculator is allowed.*

**Q1) a)** Obtain DTFT of Unit Impulse,  $\delta(n)$ . **[6]**

b) Obtain DTFT & sketch the magnitude spectrum for  
 $x(n) = u(n) - u(n - 4)$ . **[6]**

c) State & prove circular convolution property of Fourier Transform. **[6]**

OR

**Q2) a)** Find Fourier transform of **[6]**

i)  $\left(\frac{1}{3}\right)^{n-2} u(n-2)$

ii)  $\left(\frac{1}{4}\right)^n u(n+4)$

b) State & Prove time shifting and frequency shifting property of DTFT. **[6]**

c) Obtain DTFT of Rectangular pulse  $x(n) = A; 0 \leq n \leq L - 1 = 0$  **[6]**

**Q3) a)** Define DFT & State and explain properties of DFT. **[5]**

b) Find N=5 point DFT for  $x(n) = \{1, 0, 1, 0, 1\}$ . **[5]**

c) A 8-point sequence  $x(n)$  is given by  $\{1, 2, 3, 2, 1, 5, 2, 1\}$  Find the DFT of the sequence using DIF-FFT. **[8]**

**P.T.O.**

OR

- Q4)** a) Explain the relationship between DTFT and DFT. [5]  
b) State & prove circular time shift & circular frequency shift property of Fourier Transform. [5]  
c) Find Linear & circular convolution of following sequences [8]  
 $x_1(n) = \{4, -2, 2, 1\}$ ,  $x_2(n) = \{1, 2, 3\}$

- Q5)** a) Explain with diagrams ideal frequency selective filters. [5]  
b) Comparison between Butterworth & Chebyshev filter. [4]  
c) Design a digital low pass Butterworth filter using bilinear transformation for the following specifications:  $f_c = 1\text{KHZ}$ ,  $F_s = 8\text{KHZ}$ ,  $A_p = 2\text{dB}$ ,  $A_s = 15\text{dB}$ . [8]

OR

- Q6)** a) Compare Impulse invariant method & Bilinear transformation method. [5]  
b) Draw basic structure of direct form for IIR system [4]  
c) For the analog transfer function  $H(s) = \frac{2}{(s+1)(s+2)}$  determine  $H(z)$  using impulse invariance method Assume  $T = 1$  sec. [8]

- Q7)** a) Discuss interference cancellation in ECG using DSP. [5]  
b) Compare IIR & FIR filters. [6]  
c) Design linear phase FIR low pass filter using Hanning Window for the frequency characteristic of the filter given as, [6]

$$H_d(\omega) = e^{-j3\omega}; \text{ For } -\frac{n}{4} \leq \omega \leq \frac{n}{4} = 0; \text{ otherwise.}$$

OR

- Q8)** a) Explain Gibbs Phenomenon. [5]  
b) Draw basic structure of direct form for FIR system. [6]  
c) Explain the design technique of FIR filter with rectangular window. [6]





Total No. of Questions : 8]

SEAT No. :

**P422**

[Total No. of Pages : 2

**[6003]-514**

**T.E. (Mechatronics Engineering)**

**MICROCONTROLLER**

**(2019 Pattern) (Semester - I) (317545)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Write a detailed note on Time delay programming in C. [6]  
b) Write Significance of GATE pin in 8051. [6]  
c) Explain with the help of diagrams the structure of TCON and TMOD Register. [6]

OR

- Q2)** a) Write in short about 8051 Programming in C and Data types using in C Programming of 8051. [6]  
b) Explain various timer modes for 8051. [6]  
c) Explain the modes of operation of the timer /counter 8051 [6]

- Q3)** a) Write a note on Programming of External hardware interrupts in C. [5]  
b) Draw an interfacing diagram of ADC 0809 with 8051. [5]  
c) Write an 8051 C program to switch “ON” OR “OFF” A LED connected on P 1.3. Complement the LED whenever the switch is connected on P 3.2 is pressed. [7]

OR

- Q4)** a) Write a detailed note on the interrupt structure and priorities of the 8051 microcontroller. [5]  
b) Explain different types of SFR's associated with Interrupt. [5]  
c) Write an Assembly program to switch “ON” OR “OFF” A LED connected on P 1.3 when external interrupt INTO is activated. [7]

**P.T.O.**

- Q5)** a) Write a note on serial communication in 8051. [5]  
b) Discuss the modes of operation of the serial port of the 8051 microcontroller. [5]  
c) Describe the SCON and SBUF - SFR's in 8051 . The serial port is full duplex, which means that it can transmit and receive simultaneously. [7]

OR

- Q6)** a) Write short notes on: SCON Register of 8051. [5]  
b) Explain interfacing diagram for measurement of electrical measurement with the help of 8051. [5]  
c) Write a note on Measurement of Voltage and current with the help of 8051. [7]

- Q7)** a) Draw and explain the interfacing diagram of Stepper Motor with 8051 microcontroller. [10]  
b) Draw and explain the interfacing diagram of Single key with 8051 microcontroller. [8]

OR

- Q8)** a) Draw and explain the interfacing diagram of LED with 8051 microcontroller. [10]  
b) Draw and explain the interfacing diagram of the LCD with the 8051 microcontroller. [8]



Total No. of Questions : 08]

SEAT No. :

P-3155

[Total No. of Pages : 2

**[6003]-515**  
**T.E. (Mechatronics Engineering)**  
**INDUSTRIAL AUTOMATION**  
**(2019 Pattern) (Semester - II) (317547)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Use of drawing instruments, electronic pocket calculators are allowed.*
- 4) Figure to the right indicates full marks.*
- 5) Assume suitable data if necessary.*

**Q1) a)** Draw ladder diagram for math operations ADD, SUB. **[9]**

b) Draw ladder diagram for math operations MUL, DIV. **[9]**

OR

**Q2) a)** Draw ladder diagram for comparison operations Equal, not equal to. **[9]**

b) Draw ladder diagram for comparison operations less than, greater than. **[9]**

**Q3) a)** Explain analog signal processing. **[9]**

b) Explain analog output application using any one example. **[9]**

OR

**Q4) a)** What is PID tuning? Explain typical PID functions **[9]**

b) What are different manufacturers of PLCs. Explain their revolution in detail. **[9]**

**Q5) a)** Explain working of HMI with sketch. **[8]**

b) Write Need Of HMI. Also explain Advantages of HMI. **[9]**

OR

*P.T.O.*

- Q6)** a) Explain Selection criterion of drives. [8]  
b) Explain need of drives. Also explain types of drives. [9]

- Q7)** a) Give definition of SCADA system and explain features of SCADA. [8]  
b) Explain Comparison of different SCADA packages. [9]

OR

- Q8)** a) Explain need of SCADA system with applications and benefits. [8]  
b) Comparison of PLCs Vs RTUs. [9]



Total No. of Questions : 8]

SEAT No. :

**P3168**

[Total No. of Pages : 2

**[6003] - 516**

**T.E. (Mechatronics Engineering)**  
**ELECTRO-MECHANICAL SYSTEMS**  
**(2019 Pattern) (Semester - II) (317548)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of drawing instruments, electronic pocket calculators are allowed.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

- Q1) a)** Draw the Construction of following Flow control Components: **[6]**
- i) Shuttle valve.
  - ii) Pressure reducing valve.
  - iii) Sequence valve.
- b) Explain with a neat sketch the types of Pressure Intensifiers. **[6]**
- c) Discuss the classification of Accumulator. Explain its functioning. **[6]**

OR

- Q2) a)** Draw the Construction of following Flow control Components: **[6]**
- i) Directional control valves.
  - ii) Unloading valves.
  - iii) Check valve.
- b) Explain with neat sketches spring loaded and gas charged accumulators. Explain their advantages and disadvantages. **[6]**
- c) Explain Meter in and Meter out circuits. **[6]**
- Q3) a)** Sketch and explain the general layout of Pneumatic Systems. **[6]**
- b) Write a short note on “Lubricators, Mufflers and dryers” for a pneumatic system. **[6]**
- c) What is FRL unit? What is its function? **[5]**

OR

*P.T.O.*

- Q4)** a) What are the major components of Pneumatic systems? [6]  
b) What are the factors for selection of Air compressor for Pneumatic system. [6]  
c) State the classification of pneumatic actuators. [5]

- Q5)** a) Draw Pneumatic Circuits using a quick exhaust valve and explain it. [6]  
b) Draw the Circuit for - Operating SAC using 3/2 DCV and explain it.[6]  
c) Explain Throttling-in Circuit for DAC [6]

OR

- Q6)** a) Draw the circuit for Controlling speed of the Pneumatic double acting cylinder and explain it. [6]  
b) Draw the circuit for - operating only One SAC using a 4/2 DCV and explain it. [6]  
c) Draw the circuit for - Operating SAC and DAC in Sequence and explain it. [6]

- Q7)** a) Explain the selection criterion of PLC in detail [6]  
b) Explain the function of electrical control solenoid valves. [6]  
c) Explain the use of PLC for industrial process control. [5]

OR

- Q8)** a) Explain basic structure of programmable Logic Controller (PLC) in automation. [6]  
b) What is Dominant OFF and Dominant ON circuit. [6]  
c) What is ladder logic diagram in PLC. Explain its functions. [5]



Total No. of Questions : 8]

SEAT No. :

**P3169**

[6003] - 517

[Total No. of Pages : 4

**T.E. (Mechatronics Engineering)**  
**FINITE ELEMENT ANALYSIS**  
**(2019 Pattern) (Semester - II) (317549)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

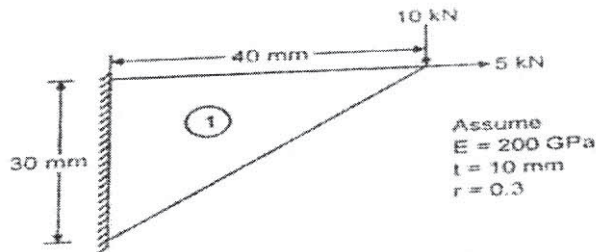
*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1) Statement**

**[10]**

- a) In a plane stress condition of a CST element shown in figure. Determine element stiffness matrix and nodal displacement.



displacement.

E=200GPa, Thickness=10mm and poissos ratio=0.3

- b) How to verify and validate results in FEA post-processing?

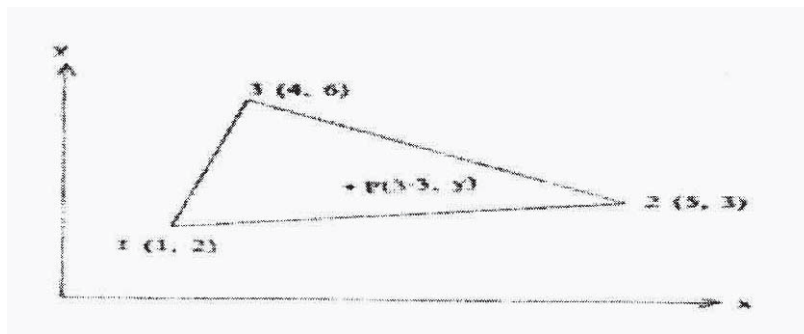
**[8]**

OR

*P.T.O.*

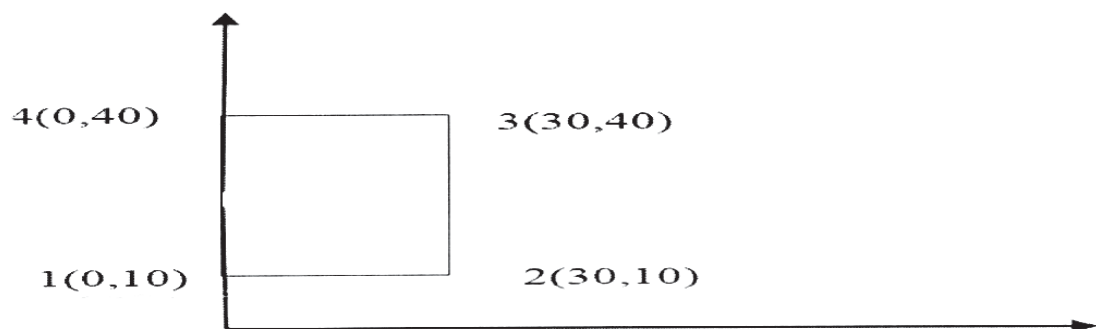
**Q2) a)** The nodal coordinate of triangular element are shown in the figure. At the interior point 'P' the x-co ordinate is 3.3.

$N_1 = 0.3$ . Determine  $N_2$ ,  $N_3$  and the y - coordinate of point P [10]



b) What are the steps for interpretation of results during post processing in Finite element analysis? [8]

**Q3) a)** For the element shown in fig., assemble Jacobian Matrix and strain displacement matrix for the Gaussian point (0.7,0.5). [10]

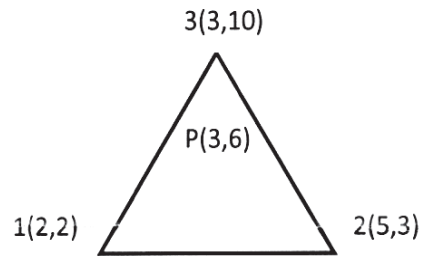


b) Explain the terms isoparametric, subparametric and superparametric elements.[7]

OR



- Q4) a)** The iso parametric shape functions for CST element as shown in fig. are given as  $N_1 = \zeta$ ,  $N_2 = \eta$  and  $N_3 = 1 - \zeta - \eta$ . Evaluate the shape functions of interior point P. If temperature of node 1,2 and 3 are 25o, 30o, 50o respectively, evaluate the temperature at the interior Point P. [10]



- b) Differentiate between p-refinement and h-refinement. [7]

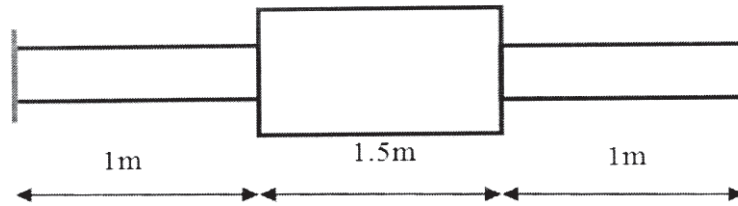
- Q5) a)** A brick wall has a thickness of 0.6m and thermal conductivity of  $0.8 \text{ W/m}^\circ \text{K}$ . The inner surface of wall is at  $28^\circ\text{C}$  and outer surface is exposed to cold air at  $-10^\circ\text{C}$ . The heat transfer coefficient at outer surface is  $40 \text{ W/m}^2$ . Using two elements for finite element formulation, determine the steady state temperature distribution within the wall and heat flux through the wall. [10]

- b) Explain steps involved in the processing to solve for 1D heat transfer problem using Finite Element Problem. [7]

OR

- Q6)** A metallic fin with thermal conductivity  $\text{W/m}^\circ \text{K}$ , 1 cm radius and 5 cm long extends from a plate having temperature as  $140^\circ\text{C}$ . Determine the temperature distribution along the fin, if heat is transferred to ambient air at  $20^\circ\text{C}$  with heat transfer coefficient of  $5 \text{ W/m}^2\text{K}$ . Take two elements along the fin. [17]

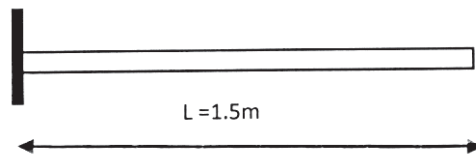
- Q7) a)** For the stepped bar shown in fig., determine the first two natural frequencies in terms of rad/s for un-damped free vibration. Let  $A_1 = A_3 = 5\text{cm}^2$ ,  $A_2 = 10\text{cm}^2$ ,  $E = 210\text{ GPa}$  and density  $= 7860\text{ kg/m}^3$ . use consistent mass matrices for each element. **[10]**



- b)** Enlist and explain different types of Dynamic Analysis. **[8]**

OR

- Q8) a)** Estimate the natural frequencies of axial vibrations of bar shown in fig. using consistent mass matrices. The bar is having uniform cross-section as  $A = 50 \times 10^{-6}\text{ m}^2$ . Length  $= 1.5\text{m}$ , modulus of elasticity  $= 2 \times 10^{11}\text{ N/m}^2$  and density  $= 7800\text{ kg/m}^3$ . Model the bar using two elements. **[10]**



- b)** Differentiate between Lumped mass system and consistent mass system. **[8]**

\* \* \*

Total No. of Questions : 8]

SEAT No. :

P-3628

[Total No. of Pages : 2

[6003]-518

**T.E. (Mechatronics Engineering)**  
**EMBEDDED SYSTEM DESIGN**  
**(2019 Pattern) (Semester - II) (317550)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 .*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain in detail with block schematic of compare mode of CCP module. [6]
- b) Explain PWM generation with example. [6]
- c) Create a 2KHz PWM frequency with 10% duty cycle on CCPI pin. Assume XTAL =10 MHz. [6]

OR

- Q2)** a) Explain Capture mode of PIC 18FXX in detail. [6]
- b) Draw an interfacing diagram and write an algorithm for DC Motor speed control using PIC18XXX. [6]
- c) Create a 1KHz PWM frequency with 25% duty cycle on CCP1 pin. Assume XTAL = 10 MHz, N = 16. [6]

- Q3)** a) Draw and Explain Interrupt Structure of PIC 18FXXX. [9]
- b) Write a program using Timer 0 and Timer 1 interrupts to generate square wave on PINS RBI and RB7, while data is been transferred from PORT C to PORT D. [9]

OR

- Q4)** a) What is peripheral Interrupt, ISR Explain in detail with example. [9]
- b) Explain External Interrupt INT 0 and its programing in PIC 18FXX. [9]

**P.T.O.**

- Q5)** a) Draw and explain the interfacing of LCD port D and Port E OF PIC18XXL microcontroller without BUSY FLAG. [9]
- b) Design a PIC 18 based data acquisition system for Temperature Measurement using LM 35. Write a program to display temperature on LCD. [8]

OR

- Q6)** a) Design a frequency counter for counting number of pulses and display same on LCD. [9]
- b) Draw a neat interfacing diagram to display “SPPU” on 4<sup>th</sup> position in the line one and “UNIVERSITY” at 5<sup>th</sup> position on second line, write an embedded C Program. [8]

- Q7)** a) Compare RS 232 and RS 485 in detail. [8]
- b) Explain the use of BRG register for calculation of Baud rate with UART block Diagram. [9]

OR

- Q8)** a) Draw and explain MSSP structure of PIC 18FXX. [9]
- b) Explain the SPI mode of MSSP structure used for serial communication. [8]



Total No. of Questions : 08]

SEAT No. :

P-3647

[Total No. of Pages : 2

**[6003]-519**

**T.E. (Mechatronics)**

**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING  
(2019 Pattern) (Semester - II) (317551)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Assume suitable data if necessary.

- Q1)** a) What is a criterion for splitting, such as Gini index or entropy, and how is it used to determine the best split in a decision tree? [6]
- b) What is KNN and how does it differ from K-means? [6]
- c) Compare Bayes algorithm and decision trees? [5]

OR

- Q2)** a) What is pruning in the context of decision trees and how does it help to avoid overfitting? [6]
- b) How does an SVM classify new data points and what is the role of the “margin”? [5]
- c) Differentiate between Classification & Regression. [6]

- Q3)** a) What is the process of hyperparameter tuning and how can it be used to optimize the performance of a model? [8]
- b) What is data pre-processing and what are some common techniques used to clean, transform, or normalize data? [6]
- c) How do you interpret the elements of a confusion matrix, such as true positives, false positives, true negatives and false negatives? [4]

OR

*P.T.O.*

- Q4)** a) What is the difference between training data and testing data in a machine learning dataset, and why is it important to separate them? [8]  
b) What are some common performance metrics that are used to evaluate the performance of a machine learning model? List and explain any four. [10]

- Q5)** a) What are some common types of agents in reinforced learning, such as Q-learning, SARSA, or actor-critic methods, and how do they differ in terms of their value-based or policy-based approaches? [8]  
b) What is an Artificial Neural Network and how does it differ from traditional machine learning algorithms. [6]  
c) What are some common types of layers in CNN? Explain any one. [4]

OR

- Q6)** a) How can activation functions affect the training process of a neural network, and what are some techniques for dealing with vanishing or exploding gradients? [8]  
b) How can reinforcement learning be used to optimize control strategies for mechanical systems, such as robots, cranes, or manufacturing processes? [6]  
c) What is Q-learning and how does it work. [4]

- Q7)** a) What are some applications of AI and ML in virtual and augmented reality systems, and how do they improve the user experience and interaction? [8]  
b) What is Predictive Maintenance and how can AIML be used to improve its effectiveness in industrial settings? [6]  
c) What are some applications of AI and ML in Fault diagnosis. [3]

OR

- Q8)** a) What is image-based part classification and how can AIML techniques be used to classify parts based on their visual features. [8]  
b) What is process optimization and how can AI and ML be used to optimize industrial processes, such as manufacturing, chemical processing, or logistics? [6]  
c) What is control tuning, and how can AI and ML be used to automate and optimize the process? [3]



Total No. of Questions : 8]

SEAT No. :

P-423

[Total No. of Pages : 2

**[6003]-520**

**T.E. (Robotics & Automation Engineering)  
EMBEDDED SYSTEMS IN ROBOTICS  
(2019 Pattern) (Semester - I) (311501(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6. & Q.7 or Q.8.*
- 2) Assume suitable data, if necessary.*
- 3) Use of electronic pocket calculator is allowed.*
- 4) Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Compare synchronous and asynchronous communication. **[8]**

b) Explain wireless sensor network in detail. Enlist the applications. **[9]**

OR

**Q2) a)** Write short note on : **[8]**

i) Embedded system in robotics

ii) USB

b) Explain zig-bee in detail. Enlist its applications. **[9]**

**Q3) a)** Write a short note on : **[8]**

i) Functions

ii) System Software

b) Define data types. Explain all in detail. **[9]**

OR

**Q4) a)** Explain SFR in detail. **[8]**

b) Explain serial communication and its types. **[9]**

*P.T.O.*

**Q5) a) What is RTOS? Explain need of RTOS with example. [9]**

**b) Define kernel. Explain architecture of kernel. [9]**

**OR**

**Q6) a) Define operating system. Explain RTOS services in contrast with traditional OS. [9]**

**b) Explain pre-emptive scheduling and round-robin scheduling algorithms in RTOS. [9]**

**Q7) a) Write a short note on : [8]**

**i) LINUX Fundamentals**

**ii) Pieces of Linux (any 4)**

**b) Write any five commands from Linux with description. [10]**

**OR**

**Q8) a) What is intertask communication? Describe intertask communication in RTOS. [8]**

**b) Write a short note on : [10]**

**i) Kernel module**

**ii) Advantages and Disadvantages of Linux**





Total No. of Questions:8]

SEAT No. :

**P424**

**[6003]-521**

[Total No. of Pages :4

**T.E. (Robotics & Automation Engg.)**  
**HYDRAULICS & PNEUMATICS**  
**(2019 Pattern) (Semester-I) (311502 (A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4 Q.5 or Q.6 & Q.7 or Q.8.*
- 2) *Figure to the right indicates full marks.*
- 3) *Neat Diagram must be drawn wherever necessary.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of Calculator is allowed.*

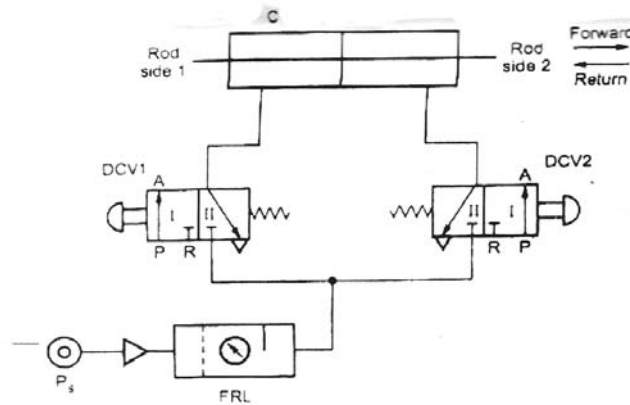
- Q1)** a) Draw a simple sketch and ISO symbol of a pressure relief valve, and explain its working. State its importance in hydraulic systems. [8]
- b) Draw ISO symbols for the following Hydraulic and Pneumatic Components: [9]
- i) 4×2 pneumatically Pilot operated spring offset DCV
  - ii) Spring loaded accumulator
  - iii) Quick Exhaust Valve

OR

- Q2)** a) Draw neat sketch and explain the following with their applications in circuit [8]
- i) Three Way, Three Position Direction Control Valve
  - ii) Four Way, Three Position Direction Control Valve (Closed Centre).
- b) Explain shuttle valve with a neat sketch. State its application with a typical circuit. [9]
- Q3)** a) Explain with neat sketch, meter-out speed control methods in hydraulics System and also mention 3 differences between meter-in & meter-out circuit? [9]

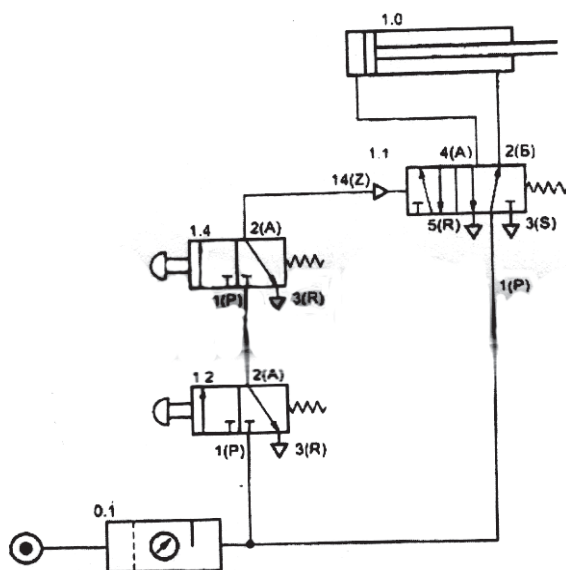
*P.T.O.*

[9]



**Q4) a)** Explain with neat sketch bleed off circuit. **[9]**

b) Analyse the circuit: [9]



**Q5) a)** Draw a typical symbol of FRL unit and explain the working principle of lubricator. [9]

b) Draw circuit for [9]

i) Pneumatic motor actuation circuit

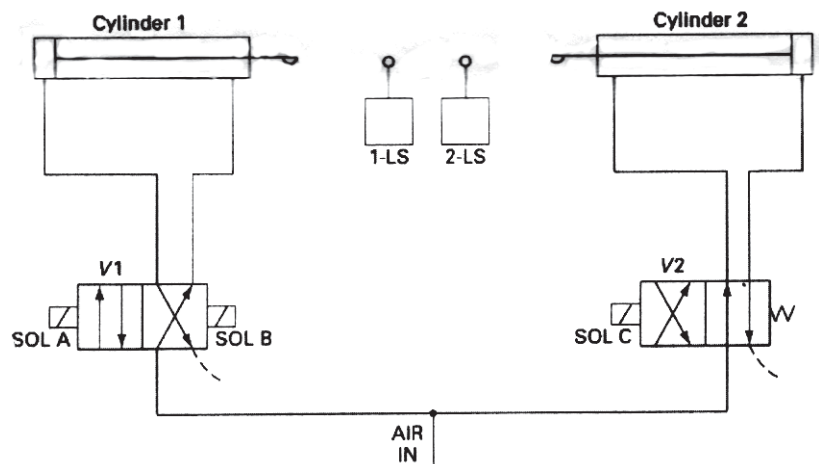
ii) Pneumatic circuit equivalent to AND gate.

OR

**Q6) a)** Explain with neat sketch working of “AND” valve and with the help of circuit diagram explain any one typical application of it. [9]

b) Explain with neat sketch typical compressed air generation and distribution system. [9]

**Q7) a)** Explain the complete operation of the system shown in fig. [8]



b) Explain in short: [9]

i) How does a limit switch differ from a push-button switch

ii) What is an electrical relay? How does it work.

OR

**Q8) a)** What is a programmable logic controller? State the main function of each of the following elements of a PLC: [8]

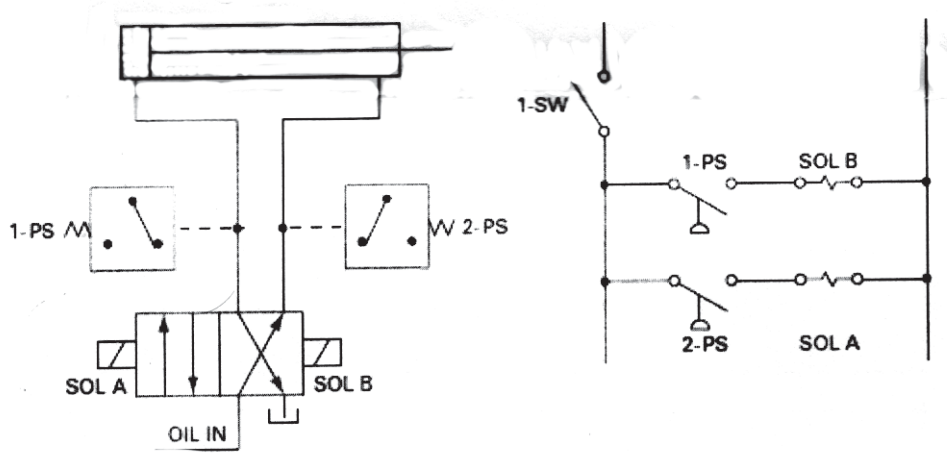
i) CPU

ii) Programmer/monitor

iii) I/O module

b) Draw the PLC Ladder logic Diagram for the given figure.

[9]



[6003]-522

**T.E. (Robotics and Automation)**  
**ROBOT KINEMATICS AND DYNAMICS**  
**(2019 Pattern) (Semester - I) (311503 (A))**

Time : 2½ Hours]

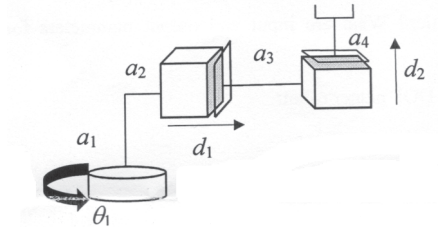
[Max. Marks : 70]

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data, if necessary.

**Q1) a)** Draw flowchart and explain the steps of pattern search algorithm for solving inverse kinematics problems. [6]

- b) For the robot shown in Figure, use inverse kinematics to obtain the joint parameters  $\theta_1$ ,  $d_1$  and  $d_2$  to bring the robot end effector to the position (37.9, 45.2, 46). Consider  $a_1 = 30$  cm,  $a_2 = 15$  cm,  $a_3 = 40$  cm,  $a_4 = 10$  cm. [12]



OR

**Q2) a)** What is inverse kinematics problem? Explain various approaches to solve inverse kinematics problem. [6]

- b) In a genetic algorithm, calculate the value of  $z = 3x_1^2 \cdot x_2 - 5x_2 + 10$  if the coded values of  $x_1$  and  $x_2$  are 10011 and 00101 respectively. Consider  $3 \leq x_1 \leq 6$  and  $1 \leq x_2 \leq 5$ . [6]

c) What is the gradient of a function? What is its significance? [6]

P.T.O.

- Q3)** a) Explain the principle of working of electromagnetic grippers. What are advantages and disadvantages of using these grippers? [8]
- b) A mechanical gripper having two fingers is used to hold the part weighing 5 kg. The coefficient of friction between the fingers and the part surface is 0.25. The g factor to be used in force calculations should be 3.0. Compute the required gripper force. [6]
- c) What are the limitations of friction based grippers? [4]

OR

- Q4)** a) A vacuum gripper is used to hold a part having mass 100 kg. Determine the number of suction cups required if the applied pressure is 0.9 bar, Coefficient of friction between part and cup surface is 0.35 and the diameter of each vacuum cup is 80 mm. [6]
- b) Write short note on: Mechanical grippers. [6]
- c) Explain the principal of working of acoustic sensor to measure the distance of the object from the gripper. [6]
- Q5)** a) Determine the angular position, angular velocity, and angular acceleration of a robot arm with revolute joint at  $t = 4$  seconds if it rotates from  $20^\circ$  to  $65^\circ$  in 10 seconds. [9]
- b) Explain Lagrangian formulation for manipulator dynamics. [8]

OR

- Q6)** a) What is forward robot dynamics? What are input and output parameters for forward dynamics? [5]
- b) Following data operates for a 2 DOF planer robot: [8]
- Length of link 1=0.5 m
  - Length of link 2=0.3 m
  - Mass of link 1=1.5 kg
  - Mass of link 2=1.2 kg
  - Angular position of link 1= $30^\circ$
  - Angular position of link 1= $65^\circ$
- If the links are of rectangular cross section with negligible width and height, determine the inertia tensor of link 1 in the base co-ordinate system.

- c) Explain the Recursive Newton-Euler algorithm to derive manipulators dynamic equations of motion. [4]

**Q7)** a) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them. [7]

- b) Define the following terms: [10]

- i) Swaying Couple
- ii) Hammer blow
- iii) Tractive force
- iv) Primary balancing
- v) Secondary balancing

OR

**Q8)** a) How the different masses rotating in different planes are balanced? [8]

- b) Four masses  $m_1$ ,  $m_2$ ,  $m_3$  and  $m_4$  are 100 kg, 200 kg, 160 kg and 170 kg respectively. The corresponding radii of rotation are 0.25 m, 0.16 m, 0.30 m and 0.32 m respectively and the angles between successive masses are  $30^\circ$ ,  $45^\circ$  and  $125^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. [9]



Total No. of Questions : 8]

SEAT No. :

P-426

[Total No. of Pages : 2

[6003]-523

**T.E. (Robotics & Automation Engineering)**

**SENSOR TECHNOLOGY**

**(2019 Pattern) (Semester - I) (311504(A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All questions are compulsory. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Assume Suitable data if necessary.*
- 3) *Use of electronic pocket Calculator is allowed.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Explain the following terms : **[8]**

- i) Bimetal strips
- ii) Gas thermometers

b) Explain resistance-temperature detectors (RTD) with respect to sensitivity, response time, construction, and signal conditioning. **[9]**

OR

**Q2) a)** Explain the following terms : **[8]**

- i) Thermocouple
- ii) Thermoelectric effect

b) Define temperature and explain following terms : **[9]**

- i) Thermal energy
- ii) Absolute and relative temperature

**Q3) a)** With neat sketch, explain the working of piezoresistive accelerometer. **[8]**

b) Compare point type and continuous type level sensors. **[9]**

OR

**P.T.O.**



- Q4) a)** With neat sketch, explain the working of piezoelectric Accelerometer.[8]  
**b)** Explain how Accelerometer used as shock sensing element with suitable example. [9]

- Q5) a)** With the help of neat diagram explain quartz sensors also state the advantages and application of the same. [9]  
**b)** What are the different types of strain Gauges explain any two with neat diagram also state the advantages and application of the same.[9]

OR

- Q6) a)** Explain working of load cell with suitable diagram also state the advantages and application of the same. [9]  
**b)** Explain different applicable standards for strain Gauge circuits. [9]

- Q7) a)** Write a short note on : [9]  
i) Photo sensors  
ii) Bio sensors  
**b)** Draw the suitable diagram and explain the operation of phototransistor also state the advantages and application of the same. [9]

OR

- Q8) a)** Explain in detail : [9]  
i) Position and motion sensors  
ii) Thermal detectors  
**b)** Explain nanotechnology in detail how nanotechnology plays important role in sensor technology. [9]



Total No. of Questions : 5]

SEAT No. :

**P427**

[Total No. of Pages : 3

**[6003]-524**

**T.E. (Robotics & Automation)**

**STATISTICS AND NUMERICAL METHODS**

**(2019 Pattern) (Semester - I) (Elective - I) (311505 (A) - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figure to the right indicates full marks.
- 3) Neat diagram must be drawn whenever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of calculators is allowed.

**Q1) a)** Round off the number 865250 and 37.46235 to four significant figures and compute find absolute, relative and percentage errors. **[8]**

b) Find the positive root of  $f(x)=2x^3-3x-6=0$  by Newton-Raphson method correct to five decimal places. **[9]**

OR

**Q2) a)** Using Bisection Method determine a real root of the equation **[8]**  
 $f(x) = 8x^3 - 2x - 1 = 0$

b) Explain in short: **[9]**  
i) Round off Error  
ii) Truncation Error  
iii) Absolute Error

**Q3) a)** Certain experimental values of x & y are given below: **[9]**  
(0, -1), (2, 5), (5, 12), (7, 20), if the straight line  $y = a_0 + a_1x$  is fitted to the above data, Find the approximate values of  $a_0$  and  $a_1$ .

b) The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface: **[9]**

**P.T.O.**

$x = \text{height}$	100	150	200	250	300	350	400
$y = \text{distance}$	10.63	13.03	15.04	16.81	18.42	19.00	21.27

Find the values of  $y$  when  $x = 160$  ft.

OR

**Q4)** a) The function  $y = \sin x$  is tabulated below: [9]

$x$	$y = \sin x$
0	0
$\pi/4$	0.70711
$\pi/2$	1.0

b) Find the cubic polynomial which takes the following values: [9]

$x:$	0	1	2	3
$F(x):$	1	2	1	10

Evaluate  $f(4)$ .

**Q5)** a) Given  $dy/dx = y - x$  where  $y(0) = 2$ . Find  $y(0.1)$  and  $y(0.2)$  correct to four decimal places. [9]

b) Evaluate - correct to three decimal places. Using Trapezoidal rule with

$$h = 0.5, 0.25 \text{ and } 0.125. \quad I = \int_0^1 \frac{1}{1+x} dx. \quad [9]$$

OR

**Q6)** a) Evaluate - correct to three decimal places. Using Simpson's  $1/3^{\text{rd}}$  rule.

$$\text{With } h = 0.5, 0.25 \text{ and } 0.125. \quad I = \int_0^1 \frac{1}{1+x} dx. \quad [9]$$

- b) Given  $dy/dx = 1+y^2$ , where  $y = 0$  when  $x = 0$ , find  $y(0.2)$ ,  $y(0.4)$  and  $y(0.6)$ . [9]

**Q7)** a) How is an inequality constrained optimization problem converted into an unconstrained problem for use in GAs? What are the basic operations used in GAs? [8]

- b) Steel plates are available in thicknesses (in inches) of [9]

$$\frac{1}{32}, \frac{1}{16}, \frac{3}{32}, \frac{1}{8}, \frac{5}{32}, \frac{3}{16}, \frac{7}{32}, \frac{1}{4}, \frac{9}{32}, \frac{5}{16}, \frac{11}{32}, \frac{3}{8}, \frac{13}{32}, \frac{7}{16}, \frac{15}{32}, \frac{1}{2}$$

from a manufacturer. If the thickness of the steel plate, to be used in the construction of a pressure vessel, is considered as a discrete design variable, determine the size of the binary string to be used to select a thickness from the available values.

OR

**Q8)** a) Find the minimum of the following function using simulated annealing:[8]  
 $f(x) = 500 - 20x_1 - 26x_2 - 4x_1x_2 + 4x_1^2 + 3x_2^2$

- b) What is the physical basis of SA? Can you consider SA as a zeroth-order search method? [9]



Total No. of Questions : 8]

SEAT No. :

**P-428**

[Total No. of Pages : 4

**[6003]-525**

**T.E. (Robotics & Automation)**

**FINITE ELEMENT ANALYSIS**

**(2019 Pattern) (Semester - I) (Elective-I) (311505 (A)-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of calculator is allowed.

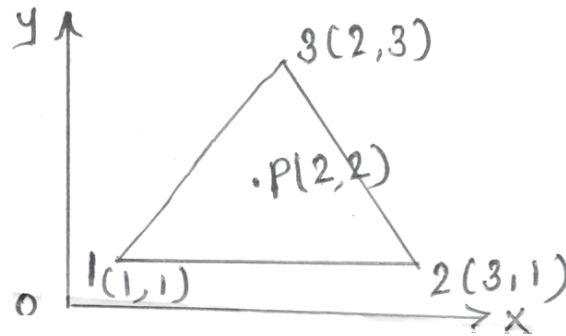
- Q1)** a) What is meant by Banded and Skyline Matrix methods and how these are used for reduction in memory required to simulation in FEA? [6]
- b) Explain the concept of Plane Stress and Plane Strain in Finite Element Method. [4]
- c) The triangular element has nodal coordinates (10, 10), (40, 20) and (30, 50) for nodes 1, 2 and 3 respectively for a point 'p' inside triangle. Determine the  $x$  and  $y$  coordinates if shape functions  $N_1$  and  $N_2$  are 0.15 and 0.25 respectively. [8]

OR

- Q2)** a) What are the characteristics of shape function? [4]
- b) Write short note on CST element and LST element. [4]
- c) For the triangular element shown in fig, the nodal values of displacement in  $x$  and  $y$  directions respectively are  $u_1 = 2.0$ ,  $u_2 = 3.0$ ,  $u_3 = 5.0$  and  $v_1 = 1.0$ ,  $v_2 = 2.0$ ,  $v_3 = 3.0$ . Find out for plane stress conditions [10]
- i) Displacement of point P,
  - ii) Strain-displacement relationship

**P.T.O.**

- iii) Element stress
- iv) strains

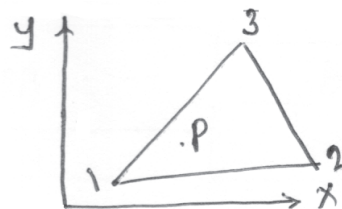


**Q3)** Write short notes on:

[9]

- a)
  - i) Uniqueness of mapping of isoparametric elements.
  - ii) Jacobian matrix.
  - iii) Gaussian quadrature integration technique.
- b) The coordinates and function values at the three nodes of a triangular linear element are given below. Calculate the function value at (20, 6).  
 Node 1 Coordinates (13, 1) Function value 190  
 Node 2 Coordinates (25, 6) Function value 160  
 Node 3 Coordinates (13, 13) Function value 185.

[8]



OR

- Q4)**
- a) What are the Condition for Axisymmetric Problem? [4]
  - b) Explain the terms isoparametric, subparametric and superparametric elements. [5]
  - c) Triangular elements are used for stress analysis of a plate subjected to plane load. The components of displacement along  $x$  and  $y$  axes at the nodes  $i, j$  and  $k$  of an element are found to be  $(-0.001, 0.01)$ ,  $(-0.002, 0.01)$  and  $(-0.002, 0.02)$  cm respectively. If the  $(x, y)$  coordinates

of the nodes  $i, j$  and  $k$  are (20, 20) (40, 20) and (40, 40) in cm respectively. find

i) The distribution of the two displacement components inside the element and

ii) Components of displacement of the point  $(x_p, y_p) = (30, 25)$  cm. [8]

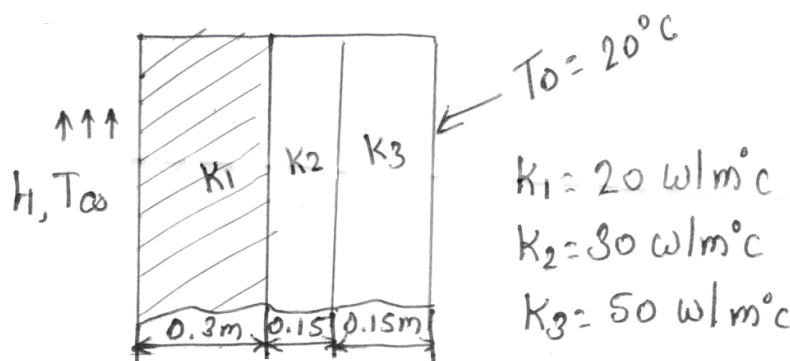
**Q5) a)** Derive FEA stiffness matrix for pin fin heat transfer problem. [7]

b) A metallic fin with thermal conductivity  $360 \text{ W/m}^\circ\text{C}$ ,  $0.1 \text{ cm}$  thick and  $10 \text{ cm}$  long extends from a plane wall whose temperature is  $235^\circ\text{C}$ . Determine the temperature distribution and amount of heat transferred from the fin to the air at  $20^\circ\text{C}$  with heat transfer coefficient of  $9 \text{ W/m}^2\text{C}$ . Take the width of the fin to be  $1 \text{ m}$ . [10]

OR

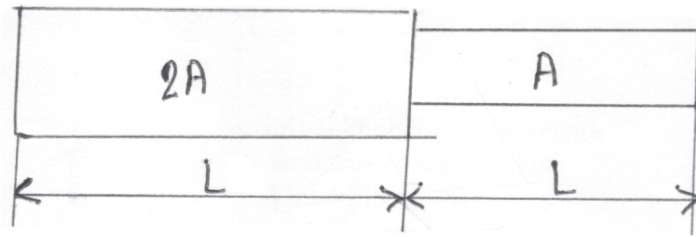
**Q6) a)** Derive elements stiffness matrix formulation for one dimensional steady state Heat Conduction problems. [7]

b) A composite wall consists of three materials as shown in fig. the outer temperature is  $T_0 = 20^\circ\text{C}$ . Convection heat transfer takes place on the inner surface of the wall  $T_\infty = 800^\circ\text{C}$  and  $h = 25 \text{ W/m}^2\text{ }^\circ\text{C}$ . Determine the temperature distribution in the wall. [10]



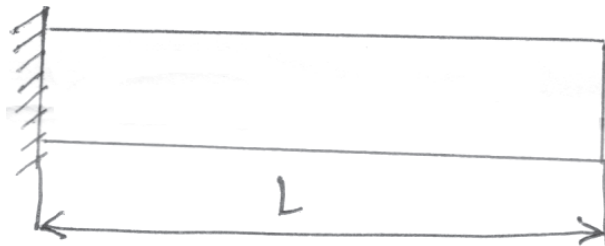
**Q7) a)** What is meant by Eigen Values and Eigen Vector? How it is related to Modal analysis of structures? [8]

- b) Find the natural frequencies of longitudinal vibrations of the same steppe shaft of areas  $A = 12000 \text{ mm}^2$  and  $2A = 2500 \text{ mm}^2$  and of equal length ( $L=1\text{m}$ ), when it is constrained at one end, as shown below: [10]



OR

- Q8) a) List difference between consistent and lumped mass matrix technique for modal analysis of structure. [8]
- b) Find the natural frequency of longitudinal vibration using consistent and lumped mass matrix method, with one element of bar as shown in figure. Take  $E = 2 \times 10^{11} \text{ N/m}^2$ ,  $\rho = 7800 \text{ kg/m}^3$ ,  $L = 1\text{m}$  [10]



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Total No. of Questions : 8]

SEAT No. :

**P429**

[Total No. of Pages : 2

**[6003]-526**

**T.E. (Robotics & Automation Engineering)**  
**INDUSTRIAL ROBOTICS AND MATERIAL HANDLING**  
**SYSTEMS**  
**(2019 Pattern) (Semester - I) (311505 (A) - III) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculators is allowed.*
- 5) Assume suitable data, if necessary.*

- Q1) a)** Define precision. How are robots classified based on geometry? **[9]**
- b)** Explain CNC machine tool loading in detail. **[9]**

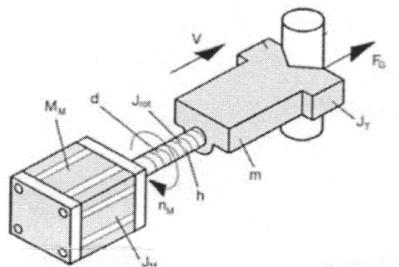
**OR**

- Q2) a)** What are the characteristics of an industrial robot? Explain the anatomy of a robot manipulator in detail? **[9]**
- b)** What is a robotic joint? List the various types of joints used in robots. Distinguish between prismatic and revolute joints. **[9]**
- Q3) a)** Explain the working principle of an end effector with the help of a sketch and give its important applications. **[8]**
- b)** How are the robot end effectors classified? Explain the different end effectors used on robots. **[9]**

**OR**

**P.T.O.**

- Q4) a)** Discuss the various factors to be considered in selecting a gripper. [5]
- b)** The data for mechanical gripper shown in fig is: [12]
- Lead of the screw : 3 mm
- Required Speed of the gripper : 8 m/min
- Mass of the gripper : 300 N
- Gripper force calculated : 2000 N
- Efficiency of mechanism : 100%
- Coefficient of friction between gripper surface and work surface : 0.14
- Calculate the motor power required.



- Q5) a)** Write a short note on Spot welding Robots used in automobile Industry. [8]
- b)** Write a short note on Spray painting Robot used in manufacturing Industry. [9]

OR

- Q6) a)** Explain Coating, Deburring, cleaning operations and explain the robots used to for these operations. [8]
- b)** Write in brief about Robotic vision systems. [9]

- Q7) Write a short note on:** [18]
- a)** Climbing Robots.
- b)** Mechine mounted Robots.

OR

- Q8) Write a short note on:** [18]
- a)** Interfacing Robots with computers
- b)** Lee's Algorithm for obstacle avoidance

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Total No. of Questions : 8]

SEAT No. :

P430

[Total No. of Pages : 3

[6003]-527

**T.E. (Robotics and Automation) (Semester - I)**  
**INTELLIGENT MANUFACTURING SYSTEM**  
**(311505-A) (2019 Pattern)**

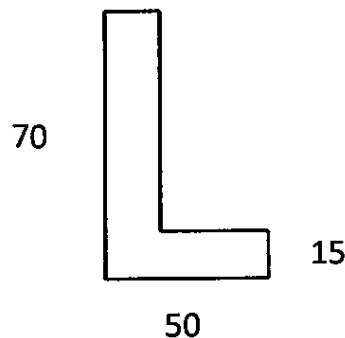
*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right side indicate full marks.*
- 3) Use of Calculator is allowed.*
- 4) Assume Suitable data if necessary.*

- Q1)** a) For following component, use genetic algorithm to maximize strip utilization for blanking operation. In Fig. all dimensions are in mm. Strip length is 1200 mm. Consider pitch and orientation of blank as variables. Assume suitable bounds for the variables. **[12]**



- b) Explain applications of neural networks in manufacturing automation. **[6]**

OR

- Q2)** a) Discuss the procedure to set up an optimization model for cooling system in injection moulding process. **[9]**
- b) Explain with suitable example the significance of hidden layer in neural networks. **[9]**

**P.T.O.**

- Q3) a)** A group technology cell has three machines and is used to process the family of four parts. The Table below lists production quantities ( $Q$ ), production time ( $T$ ) and machine fraction for each family member ( $f$ ). Assume non-operation times are all same at 30 min. per machine. [10]

Part	Machine 1			Machine 2		Machine 3	
	$Q$	$T$	$f$	$T$	$f$	$T$	$f$
1	1	3.0	0.2	4.5	0.3	2.25	0.15
2	1	2.0	0.2	4.0	0.4	3.0	0.3
3	1	5.0	0.25	4.0	0.2	3.0	0.15
4	1	4.0	0.3	1.333	0.1	2.667	0.2

Determine:

- Average hourly production rate for the cell
  - Utilization of each machine and average utilization of cell
  - Manufacturing lead time
- b) With suitable example explain ‘Bond Energy Algorithm’ applied to group technology. [7]

OR

- Q4) a)** Apply row and column masking algorithm for grouping of the parts (J) and machines (M) from the following part machine incidence matrix. [8]

	$J_1$	$J_2$	$J_3$	$J_4$	$J_5$	$J_6$	$J_7$	$J_8$
$M_1$	1		1			1		
$M_2$		1		1	1			
$M_3$				1		1	1	1
$M_4$		1		1	1	1		
$M_5$			1				1	1

- b) Explain various coding and classification schemes in group technology.[9]

**Q5) a)** Explain with suitable example how a Lee's algorithm is used for obstacle avoidance in robot path planning. [9]

b) A single link robot with rotary joint is moving smoothly following a cubic polynomial:  $\theta(t) = 15 + 20t^2 - 9t^3$  where,  $\theta(t)$  is angular displacement at any time  $t$  (in sec). Determine for this link the initial position, final position and time in which it will move from initial position to final position. [8]

OR

**Q6) a)** Explain the role of artificial intelligence in robot path planning. [9]

b) Write note on: Collisions free motion planning for robot manipulator. [8]

**Q7) a)** Explain with suitable example, an application of Adaptive boosting algorithm to flexible manufacturing system. [9]

b) Explain algorithms for automatic process planning of operation. [9]

OR

**Q8)** Write short notes on : [18]

a) Intelligent Tool Management system in FMS.

b) Route optimization algorithm for AS/RS.

c) Building blocks of FMS.

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P431**

**[6003]-528**

[Total No. of Pages : 2

**T.E. (Robotics & Automation)**

**ROBOT PROGRAMMING**

**(2019 Pattern) (Semester - II) (311508 (A))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Assume suitable data if necessary.
- 5) Use of Logarithmic Table, Slide rule in Electronic pocket calculator is allowed.

**Q1) a)** Differentiate between the command structure of VAL-I and VAL-II language in Robot Programming. [8]

b) Explain various program instructions used in VAL-II. [9]

OR

**Q2) a)** Develop a program using VAL II robot programming language for a PUMA 560 robot when setting output signal at 5<sup>th</sup> port of controller it unloads a cylindrical part of 10mm diameter, from Machine 1 positioned at point P1 with coordinates(100, 200, 0)mm and orientation(0, 90, 0)° and load the part on Machine2 positioned at P2 with coordinates (100, 200, 50)mm and orientation (0, 90, 0)°. The speed of robot motion is 40 in./s. However, because of safety precautions, the speed is reduced to 10 in./s while moving to a machine for an unloading or loading operation. [9]

b) Explain the following instruction in VAL-II with example: [8]

- i) LISTL
- ii) PCABORT
- iii) RENAME
- iv) DISABLE

**Q3) a)** Develop a program using RAPID robot programming language using RAPID procedure for pick and place operation from point P1(500, 500, 50)mm to P2(-500, 500, 50)mm such that it starts from *home* position and ends at *home* position. While executing the program the orientation of end effector remains same as (0, 90, 0)°. [9]

b) Define Motion Command. Explain at least four Move Motion Commands used in RAPID language. Explain with examples for each Motion Command. [9]

OR

**P.T.O.**

- Q4)** a) Explain the Position Instructions and Input/Signal Instructions in RAPID with the help of examples of programs. [9]  
b) Define Data types. Explain any four data type used in RAPID with the help of examples of programs. [9]

- Q5)** a) Explain the following instruction in AML with example: [9]  
i) ACCEL  
ii) WAITMOVE  
iii) SETTLE  
iv) QGOAL  
v) DEFIO  
vi) ENDMONITOR  
b) Explain the following code & output when executed in AML: [9]  
i) MONITOR (LED, 2, 0, 0, 1.5, 'passed');  
MOVE (ARM, fgoal, LED);  
ii) ATTN: SUBR;  
MOTPARMS: NEW STOPMOVE;  
WAITMOVE;  
BREAK (EOL, 'ATTENTION REQUESTED');  
APPLY ('AMOVE', MOTPARMS);  
END;  
iii) DMOVE (<4, 5, 6>, <30, -60, 90>);  
iv) SPEED (0.8)

OR

- Q6)** a) Define Sensor Instruction. Explain any four sensor instructions with examples used in AML. [9]  
b) Define Motion Control. Explain any four motion controls with examples used in AML. [9]

- Q7)** a) Define the concept of singularities. Explain the methods of detecting possible collision of robots and what are the features added to avoid it. [9]  
b) Write a short note on "Robot Economics". [8]

OR

- Q8)** a) Explain in detail about "Robot cycle time analysis". [9]  
b) Explain the "repeatability measurement of robot". [8]



[6003]-529

T.E. (Robotics and Automation)

ARTIFICIAL INTELLIGENCE FOR ROBOTICS

(2019 Pattern) (Semester - II) (311509-A)

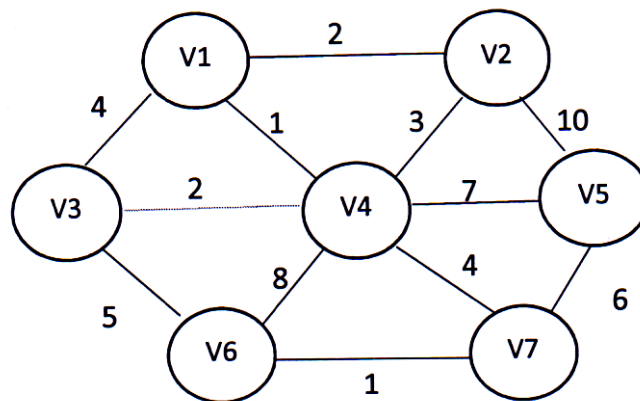
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figure to the right indicates full marks.
- 3) Use of calculator is allowed.
- 4) Assume suitable data if necessary.

Q1) a) Determine the minimum path length for following graph using greedy search method. [9]



- b) Using a simulated annealing algorithm to solve minimization problem, function value of 20 is updated to new value of 30 at temperature 55°C. What is the probability of accepting the new solution? [8]

OR

Q2) a) Ant colony optimization is used to solve a travelling salesmen problem with 5 stations. The distance matrix is given below. Considering starting station as A, what is the % probability that an ant will choose the path 1 to 3? Assume initial pheromone deposition level as 1. [10]

P.T.O.



	1	2	3	4	5
1	0	14	16	19	12
2	14	0	15	13	10
3	16	15	0	11	17
4	19	13	11	0	21
5	12	10	17	21	0

b) Explain the steps of real coded genetic algorithm. [7]

Q3) a) For the image and template shown in Figure, determine the correlation factor for translation (1, 1) using normalized cross correlation method.[10]

Template				y	Image				
8	1	8	x	2	2	6	5	1	
1	1	2		4	5	9	9	4	
4	8	3		7	8	1	9	3	
				9	1	1	3	8	
				5	4	9	6	9	
				1	6	4	8	5	

b) Determine the centroid of the grayscale image shown in Fig. below. [7]

		y		
0,0		1	2	3
1	2	2	0	3
2	1	1	1	4
3	2	2	1	3

OR

- Q4) a)** Determine the gradient of intensity of a pixel having intensity 2 in the image given below. Use Prewitt operator. [8]

5	8	4
6	2	3
4	6	1

- b) For a certain binary image, following data operates. Determine the compression ratio using run length encoding. [9]

Run	Bit Value	Length
1	1	12
2	0	18
3	1	7
4	0	17
5	1	10

- Q5) a)** Explain the application of any one metaheuristics algorithm for robot motion planning. [10]

- b) Write note on visibility graph method for robot path planning. [8]

OR

- Q6) a)** Explain route optimization for AS/RS systems. [8]

- b) With suitable examples explain the bug 0 and bug 1 strategies for obstacle avoidance in mobile robot navigation. [10]

- Q7) a)** Use A\* algorithm to determine the shortest path for an automated guided vehicle while moving from work station at (4, 6) to workstation at (1, 1) shown in Fig. below. The obstacles are in the form of tool storage racks at locations (3, 3), (1, 4) and (4, 2). [9]

(1,1)	(2,1)	(3,1)	(4,1)
(1,2)	(2,2)	(3,2)	(4,2)
(1,3)	(2,3)	(3,3)	(4,3)
(1,4)	(2,4)	(3,4)	(4,4)
(1,5)	(2,5)	(3,5)	(4,5)
(1,6)	(2,6)	(3,6)	(4,6)

- b) Write note on: Real time scheduling in flexible environment. [9]

OR

- Q8)** a) Explain with suitable example techniques for automatic tool path generation. [9]
- b) Write note on: Applications of artificial intelligent techniques in flexible manufacturing systems. [9]



[6003]-530

**T.E. (Robotics & Automation Engineering)**  
**FLEXIBLE MANUFACTURING SYSTEMS**  
**(2019 Pattern) (Semester - II) (311510 (A))**

Time : 2½ Hours]

[Max. Marks : 70

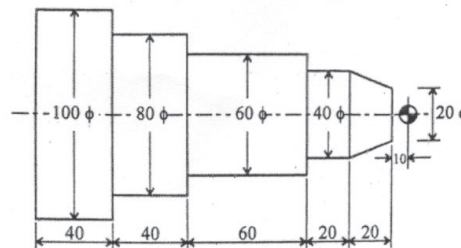
Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figure to the right indicates full marks.
- 3) Neat Diagram must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.

- Q1) a)** What are the basic components of the NC system and explain the function of each component? [9]
- b) Describe various G and M codes used in CNC machines. [9]

OR

- Q2) a)** Prepare part programming of following component [9]



All dimensions in mm.

- b) Discuss the several word functions in Numerical Control systems. Discuss the advantages of DNC over NC/CNC [9]
- Q3) a)** Explain with block diagram the main elements of CIM system. [9]
- b) Explain about computer aided process planning (CAPP) [8]

OR

P.T.O.

- Q4)** a) What is computer aided inspection (CAI) and how can we control quality with the help of CAI? [9]  
b) What is a material requirement planning? Explain the various inputs to the MRP system? [8]

- Q5)** a) What are the different types of material handling equipment? [9]  
b) What are the components of the AS/RS system? [9]

OR

- Q6)** a) Explain the working principle of a robot with the help of a neat sketch. Also describe the components. [9]  
b) What are different types of AGV Explain with their principle of working. [9]

- Q7)** a) What are the different types of tool strategies? Explain Each. [9]  
b) Explain the term Tool Monitoring and fault Detection. [8]

OR

- Q8)** a) What do you know about tool Management? Write note on tool Room Service and Tool Allocation. [9]  
b) Draw and explain block diagram offered detection in vibration. [8]

**\*\*\* END \*\*\***

Total No. of Questions : 8]

SEAT No. :

**P1414**

[Total No. of Pages : 2

**[6003]-531**

**T.E. (Robotics & Automation Engineering)**

**MICRO-ELECTRO-MECHANICAL SYSTEMS**

**(2019 Pattern) (Semester - II) (Elective - II) (311511 (A) - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of Logarithmic Table, Slide rule or Electronic pocket calculator is allowed.

**Q1) a)** What are piezo-resistive sensors? Explain the different piezo-resistive sensor materials. [8]

b) Briefly explain the applications of comb drive devices with respect to: [9]

i) Inertia Sensors

ii) Actuators

OR

**Q2) a)** Explain with a neat sketch of thermal resistors and thermal bimorph. Also, Explain the applications for each. [8]

b) Explain in brief with a neat sketch of parallel plate capacitors and comb drive devices along with their application. [9]

**Q3) a)** Write in brief one case study of MEMS in magnetic actuators. [9]

b) Write in brief one case study in piezoelectric sensors and actuators from a fabrication point of view. [9]

OR

**Q4) a)** Briefly explain the applications of parallel plate capacitors with respect to: [9]

i) Pressure Sensors

ii) Tactile Sensors

b) Explain with a neat sketch of magnetic actuators and micro-magnetic components. [9]

**P.T.O.**

- Q5) a)** Briefly explain PMMA and applications related to flow sensors. [8]  
**b)** Briefly explain SU-8 and the application of polymers related to pressure sensors. [9]

OR

- Q6) a)** What are polymers? Explain in brief LCP and PDMS with their applications. [8]  
**b)** Briefly explain polyimide and the application of polymers related to tactile sensors. [9]

- Q7) a)** With a neat sketch explain Wireless cameras and Voice transmissions. [9]  
**b)** Briefly explain the overview, history and application of Ultrasonic Distance ranging sensors. [9]

OR

- Q8) a)** Briefly explain the Blood pressure sensor and an Acceleration sensor with respect to overview, history and applications. [9]  
**b)** Briefly explain the overview, history, and application of Zigbee and Gyros. [9]



[6003]-532

**T.E. (Robotics and Automation Engineering)**

**HUMANOID ROBOTS**

**(2019 Pattern) (Semester-II) (Elective-II) (311511(A)-II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Give significance of angular momentum and the inertia tensor in humanoid robotics [8]

b) How can the dynamic equations of motion be derived for a humanoid robot in 3D analysis? Explain the steps involved in the derivation process.

A humanoid robot has two feet with contact points at (0,0) and (0.2,0) in a 2D plane. The robot's center of mass is located at (0.1,0.1). Calculate the net torque around the center of mass and determine if the robot is in balance. [10]

OR

**Q2) a)** What is the Zero Moment Point (ZMP) in humanoid robotics and why is it important in measuring stability? [8]

b) What is the significance of 2D analysis in humanoid robotics and how does it contribute to understanding robot behaviour?

A humanoid robot has a mass of 10kg. The inertia tensor of the robot's body is given as follows:  $I_{xx}=2\text{kgm}^2$ ,  $I_{yy}=3\text{kgm}^2$ ,  $I_{zz}=1\text{kg}\cdot\text{m}^2$  Calculate the total moment of inertia for the robot's body. [10]

**Q3) a)** How does the field of humanoid robotics contribute to the study and understanding of neuroscience? [8]

b) How can foveal vision be implemented in humanoid robots? What is cognitive human robotics and how does it integrate cognitive abilities in to robot systems? [9]

OR

*P. T. O*



- Q4)** a) Explain foveal vision and it's important for humanoid robots. [8]  
b) How can humanoid robots be used to emulate neuro-mechanisms and contribute to our understanding of brain function? [9]
- Q5)** a) What is multi-fingered grasping, and why is it important in robotics? Discuss some applications of multi-fingered grasping in robotics. [8]  
b) What is multi-arm object manipulation control? State the advantages of using multiple robot arms for object manipulation [9]

OR

- Q6)** a) What are the challenges in achieving effective multi-fingered grasping in robotics? [8]  
b) What are the challenges in controlling multiple robot arms for object manipulation? Explain the significance of cooperation between multiple humanoids in robotics. [9]

**Q7) Write short note on:** [18]

- a) Search and rescue humanoid robots
- b) Humanoids in sports
- c) Concept of AI

OR

**Q8) Write short note on:** [18]

- a) A.I. in Robotics
- b) Service robots
- c) Social Robotics



Total No. of Questions : 8]

SEAT No. :

P-1416

[Total No. Of Pages : 2

**[6003]-533**

**T.E. (Robotics and Automation)**

**MODELING AND SIMULATION**

**(2019 Pattern) (Semester-II) (Elective-II) (311511 A)-III**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Describe data collection phase of input modeling for simulation. [6]  
b) How a histogram works to display data? [6]  
c) Which methods are used for testing assumptions? [5]

OR

- Q2)** a) Describe Identification of the input data distribution of input modeling for simulation. [6]  
b) Describe Random Number Generation. [6]  
c) What is a Histogram? [5]
- Q3)** a) Explain generating continuous random variates like Weibull. [6]  
b) What is terminating simulation with regard to output analysis? [6]  
c) Explain generating continuous random variates like Uniform. [5]

OR

- Q4)** a) Explain generating continuous random variates like Normal [6]  
b) What is non-terminating simulation with regard to output analysis? [6]  
c) What is random variate generation? [5]

*P. T. O*

- Q5)** a) Write short note on reentrant manufacturing system. [6]  
b) How to Reduce Downtime in Manufacturing? [6]  
c) Which are sources of randomness in manufacturing system? [6]

OR

- Q6)** a) Illustrate how simulation can be used to improve the performance of a manufacturing system. [6]  
b) Which steps to be followed to do the simulation case study of manufacturing system? [6]  
c) Which are the important elements of automated material handling system? [6]
- Q7)** a) Which are the features to be considered while selecting simulation software? [6]  
b) What is SLAM? Which are applications of it? [6]  
c) Describe ARENA simulation software package. [6]

OR

- Q8)** a) Which features needed in programming most discrete-event simulation models? [6]  
b) What are the advantages of using a simulation package rather than a general-purpose programming language? [6]  
c) Describe classification of simulation software. [6]



Total No. of Questions : 8]

SEAT No. :

**P432**

[Total No. of Pages : 2

**[6003]-535**

**T.E. (Artificial Intelligence and Data Science)**

**COMPUTER NETWORKS**

**(2019 Pattern) (Semester-I) (317521)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate marks.
- 4) Assume suitable data, if necessary.

**Q1)** a) Differentiate between circuit switching, Packet switching, message Switching. [7]

b) Write short note on network address translation. [10]

OR

**Q2)** a) Explain the concept of class full and class less addressing. [7]

b) Compare routing protocols RIP, OSPF, BGP. [6]

c) Explain the concept of connection less and connection oriented protocol with example. [4]

**Q3)** a) Write short note on sockets and sockets programming. [10]

b) Explain different elements of transport protocol. [8]

OR

**Q4)** a) Explain RTP protocol in detail. [8]

b) Explain TCP handles error control and flow control. [10]

*P.T.O.*

- Q5)** a) Write short note on DNS. [7]  
b) Explain simple mail transfer protocol. [10]

OR

- Q6)** a) Explain POP Protocol. [8]  
b) Explain various FTP commands. [9]

- Q7)** a) Explain static and dynamic channel allocation. [9]  
b) Differentiate between Pure ALOHA and Slotted ALOHA. [9]

OR

- Q8)** a) Explain Binary Exponential Back off Algorithm. [10]  
b) Compare CSMA and WDMA. [8]



Total No. of Questions : 8]

SEAT No. :

**P433**

[Total No. of Pages : 2

**[6003]-536**

**T.E. (Artificial Intelligence and Data Science)**

**WEB TECHNOLOGY**

**(2019 Pattern) (Semester - I) (310252)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

**Q1) a)** Explain the following **[8]**

- i) XML namespace
- ii) HTTP session

b) What is servlet? Explain the session management technique in servlet.**[9]**

OR

**Q2) a)** Write a simple servlet program to display hello World. **[9]**

b) Explain DTD : Schema, elements, attributes. **[8]**

**Q3) a)** Write advantages of JSP over servlet and explain life cycle of JSP. **[8]**

b) Explain the strut architecture with neat diagram and also explain the benefits of struts. **[9]**

OR

**Q4) a)** Write a JSP program to demonstrate use of JSP Action tags. **[8]**

b) Write the benefits of web services and explain SOAP, REST and UDDI. **[9]**

**P.T.O.**

- Q5)** a) Explain the following with respects to Php [9]  
i) Session tracking  
ii) Function  
iii) Arrays.  
b) How does connectivity with mySQL work in Php. Explain with example. [9]

OR

- Q6)** a) Write a program to explain control statements in Php. [9]  
b) Explain the concepts of classes and pattern matching in Ruby. [9]
- Q7)** a) Explain scalar types and their operations in Ruby. [9]  
b) What is module? Differentiate classes and module [9]

OR

- Q8)** a) Explain rails with request and response in rail application. [9]  
b) What is EJB? Explain types of EJB. [9]



Total No. of Questions : 8]

SEAT No. :

P-434

[Total No. of Pages : 2

[6003]-537

**T.E. (Artificial Intelligence and Data Science)**

**ARTIFICIAL INTELLIGENCE**

**(2019 Pattern) (Semester - I) (310253)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt four questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume Suitable data if necessary.*

- Q1)** a) What are the issues that need to be addressed for solving CSP efficiently? Explain the Solutions to them. [9]
- b) Explain heuristic function that can be used in cutting off search in detail. [9]

OR

- Q2)** a) Explain Alpha-Beta Tree search and cutoff procedure in detail with an example. [9]
- b) Define constraints in CSPs. Explain any two types of Constrains in detail. [5]
- c) What are the limitations of Game search algorithms? [4]
- Q3)** a) What are the various approaches to knowledge representation? Explain in detail. [9]
- b) Detail the algorithm for deciding entailment in proposition logic. [8]

OR

- Q4)** a) Differentiate propositional logic with First order logic. List the Inference rules along with suitable examples for first order logic. [8]
- b) Explain Knowledge representation structures and compare them. [9]

**P.T.O.**



- Q5)** a) Explain Unification algorithm with suitable example. [9]  
b) What is knowledge engineering? Explain ontology of situation calculus. [9]

OR

- Q6)** a) Explain the forward chaining process and efficient forward chaining with example. State its usage. [8]  
b) What are the reasoning patterns in Propositional logic? Explain them in detail. [7]  
c) Write a note on: categories and objects. [3]

- Q7)** a) Explain time, schedules and resources in temporal domain with an example. [9]  
b) Discuss AI and its ethical concerns. Explain Limitations of AI. [8]

OR

- Q8)** a) Analyze various planning approaches in detail. [9]  
b) Explain AI Architecture with a suitable diagram. [8]



Total No. of Questions : 8]

SEAT No. :

P435

[Total No. of Pages : 2

[6003]-538

T.E. (AI & DS)

**EMBEDDED SYSTEMS AND SECURITY**

**(317522(A)) (Elective - I) (2019 Pattern) (Semester - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is the difference between Compiler and Cross Compiler? [6]
- b) Enlist the IDE's available for embedded system development. [6]
- c) Explain the firmware embedding process for OS based embedded products. [6]

OR

- Q2)** a) What are the different types of preprocessor directives available in embedded C? Explain them in detail. [6]
- b) With example, explain how the functions of port 0 pins can be selected. [6]
- c) What is the difference between In-System Programming (ISP) and In Application Programming IAP)? [6]

- Q3)** a) What is Process Life Cycle? [6]
- b) Explain the concept of Multithreading. What are the advantages of Multithreading? [6]
- c) Explain the different states of a task under MicroC/OS-II Kernel. [6]

OR

**P.T.O.**

- Q4)** a) Discuss the Preemptive scheduling algorithm. [6]  
b) What is Semaphore? Explain the different types of Semaphore. [6]  
c) Compare between Thread & Process. [6]

- Q5)** a) What is an embedded Linux? What are the advantages of it? [7]  
b) Explain the Linux Kernel Architecture. [10]

OR

- Q6)** a) What are the characteristics of Device Driver? [7]  
b) Explain the architecture of Embedded Linux System. [10]

- Q7)** a) Which are the security threats of the embedded system? [5]  
b) What are the effects of an attack on Embedded System? [6]  
c) Explain the counter measures to be used for prevention of attacks on Embedded System. [6]

OR

- Q8)** a) Explain the different types of attack. [5]  
b) What are the challenges in security of an Embedded System? [6]  
c) What are the Security requirements of an Embedded System? [6]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-436

[Total No. of Pages : 2

[6003]-540

T.E. (AI & DS) (Semester - I)

PATTERN RECOGNITION

(317522 (B)) (2019 Pattern) (Elective - I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q. 1 or Q. 2 , Q. 3 or Q. 4 , Q. 5 or Q. 6, Q. 7 or Q. 8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** a) Discuss the Elements of Formal Grammars. [9]

b) Explain the Chomsky Normal form with suitable example. [8]

OR

**Q2)** a) Give an Abstract View of Parsing Problem. [9]

b) Describe Blocks Word Description String Generation example as Pattern Description. [8]

**Q3)** a) Differentiate between Homomorphism and Isomorphism. [9]

b) Draw and Explain Grammatical Interface Model and its objectives. [8]

OR

**Q4)** a) Describe Clique finding algorithm with suitable example. [8]

b) Explain the Design and Selection of Similarity Measures. [9]

P.T.O.

- Q5)** a) Describe Characteristics of Neural Computing Applications. [9]  
b) Explain CAM & other Neural Memory Structure. [9]

OR

- Q6)** a) Describe with neat diagram Artificial Neuron Activation and Output Characteristics. [9]  
b) Explain the different reasons to adopt a Neural Computational Architecture. [9]

- Q7)** a) Draw & Explain structure of a Multiple Layer Feedforward Network.[9]  
b) Explain Summary of the Back Propagation learning Procedure with suitable diagram. [9]

OR

- Q8)** a) How the character classification is done with Pattern Associator? [9]  
b) Draw & explain how to train the feedforward network using Generalized delta Rule? [9]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-437

[Total No. of Pages : 2

[6003]-541

**T.E. (Artificial Intelligence and Data Science) (Semester - I)**

**HUMAN COMPUTER INTERFACE**

**(310245 (B)) (2019 Pattern) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn whenever necessary.
- 4) Make suitable assumption whenever necessary.

- Q1)** a) Explain what is mean by Human err in detail. [6]  
b) Elaborate Graphical User Interface in detail. [6]  
c) Explain web user interface in detail. [6]

OR

- Q2)** a) Explain usability Engineering with suitable example. [6]  
b) Write down about interactive design and prototyping using suitable example. [6]  
c) Write short note on: [6]  
i) Popularity of Graphics  
ii) Concept of Direct Manipulation

- Q3)** a) Explain analytic methods and model-based analysis. [6]  
b) Elaborate universal design principles in detail. [6]  
c) Explain cognitive walkthrough in detail. [5]

OR

- Q4)** a) Elaborate GOMS model. [6]  
b) Elaborate evaluation Framework using following point: [6]  
i) Paradigms and Techniques  
ii) DECIDE: A Framework to Guide Evaluation  
c) Discuss the concept of designing of diversity. [5]

**P.T.O.**

- Q5)** a) What is mean by ubiquitous computing? Which are the applications of it? Explain with suitable example. [6]
- b) Compare data integrity and data immunity. [6]
- c) Which are the social aspects of search? Explain. [6]

OR

- Q6)** a) Discuss about handling missing data using suitable example. [6]
- b) What is the significance of machine learning in HCI? Describe. [6]
- c) Explain sensor-based and context-aware interaction. [6]

- Q7)** a) Explain Mobile Navigation, Content and Control Idioms using appropriate. Example. [6]
- b) Discuss Drawers used in HCI system. Explain item-level drawers. [6]
- c) Describe the “Inter-app Integration”. [5]

OR

- Q8)** a) What is use of “multi-touch gestures”? Explain various multi-touch gestures used in mobile device. [6]
- b) Describe Tap-to-Reveal and Direct Manipulation. [6]
- c) Explain “Welcome and Help Screens”. [5]

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P438**

**[6003]-542**

[Total No. of Pages : 2

**T.E. (Artificial Intelligence and Data Science)**

**DATA SCIENCE**

**(2019 Pattern) (Semester - II) (317529)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Explain Data Analytics life cycle with the help of diagram. **[10]**

b) List different phases in data analytics life cycle and explain Model Building phase in detail. **[8]**

**OR**

**Q2) a)** What are different phases in data analytics life cycle? Explain Operationalize phase in detail. **[10]**

b) Explain Model building phase with its challenges. **[8]**

**Q3) a)** Explain association rules with example. **[4]**

b) Explain Python Libraries for Data Processing, Modeling and Data Visualization. **[10]**

c) Explain predictive, Descriptive, and Prescriptive data analysis. And also mention their difference. **[4]**

**OR**

**Q4) a)** Write a short notes on Global Innovation Social Network and Analysis. **[5]**

b) Explain the use of logistic function in logistic regression in detail. List and explain the Types of Logistic regression. **[10]**

c) Write short notes on ASM. **[3]**

**P.T.O.**



- Q5)** a) What is clustering? With suitable example explain the steps involved in k-means algorithm. [7]  
b) Discuss Holdout method and Random Sampling methods. [6]  
c) Write short note on [4]  
i) Confusion matrix  
ii) AUC- ROC curve

OR

- Q6)** a) What do you mean by text analysis? Why text analysis need to be done? Explain the following text analysis steps with suitable examples [11]  
i) Part of speech (POS) tagging  
ii) Lemmatization  
iii) Stemming  
b) Write short note on [6]  
i) Time series Analysis  
ii) TF- IDF.

- Q7)** a) What is data visualization? What are the different methods of data visualization explain in detail. [6]  
b) Explain in detail the Hadoop Ecosystem with suitable diagram. [11]

OR

- Q8)** a) Describe the Data visualization tool “Tableau”. Explain its applications in brief. [6]  
b) With a suitable example explain and draw a Box plot and explain its usages. [6]  
c) With a suitable example explain Histogram and explain its usages. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P439**

**[6003]-543**

**T.E. (Artificial Intelligence and Data Science)**

**CYBER SECURITY**

**(2019 Pattern) (Semester-II) (317530)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

- Q1)** a) Describe the Diffie-Hellman Key Exchange in detail. [6]  
b) Identify and explain the authentication methods. [6]  
c) Distinguish between Kerberos and X.509 authentication service. [5]

OR

- Q2)** a) What is Digital Signature Standard? Explain the DSS approach. [6]  
b) Explain the RSA algorithm in detail with the help of diagram. [6]  
c) Explain Message Digest algorithm in detail. [5]

- Q3)** a) Explore Secure Socket Layer Handshake protocol in detail. [6]  
b) What is VPN? Explain types of VPN. [6]  
c) Describe IPSec Protocol with its components and Security Services. [6]

OR

- Q4)** a) Distinguish between PGP and S/MIME. [6]  
b) Explain ISAKMP protocol of IPSec. [6]  
c) Identify Threats to web Security and figure out how any of two among listed are countered by particular feature of SSL. [6]

*P.T.O.*

- Q5)** a) Differentiate packet filtering router and stateful Inspection firewall. [6]  
b) What is trusted system? Explain in brief. [6]  
c) List limitations of Firewall. [5]

OR

- Q6)** a) Illustrate Screened subnet firewall Architecture. [6]  
b) List and Explain types of intrusion detection system (IDS) [6]  
c) Identify and explore any two-password management practice. [5]

- Q7)** a) Identify and explore the different types of Cyber stalker attacks. [6]  
b) Illustrate life cycle of cyber forensics? [6]  
c) List VoIP hacking types and explore any 3? What are the counter measures for it. [6]

OR

- Q8)** a) Who are cyber criminals? What are types of cyber crimes. [6]  
b) What is Botnet? How to protect from botnet? [6]  
c) Explain the terms: [6]  
i) Virus  
ii) Phishing  
iii) Spoofing  
iv) Phone phishing  
v) Internet pharming  
vi) Cyber Forensic



Total No. of Questions : 8]

SEAT No. :

**P440**

[Total No. of Pages : 2

**[6003]-544**

**T.E. (Artificial Intelligence and Data Science)**

**ARTIFICIAL NEURAL NETWORK**

**(2019 Pattern) (Semester - II) (317531)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** What is the Hopfield neural network? What is a state transition diagram for Hopfield Neural Network? Explain how to derive it in Hopfield model. **[8]**

b) Explain the concept of associative learning in artificial neural networks. How is it related to pattern recognition? **[6]**

c) Explain the architecture of Boltzmann machine. **[4]**

**OR**

**Q2) a)** Describe the Boltzmann machine and Boltzmann learning law. What are the limitations of the Boltzmann learning? **[8]**

b) Write a short note on **[10]**

i) Stochastic Network

ii) Simulated Annealing

**Q3) a)** Draw and explain Competitive learning Network. **[7]**

b) Describe the self-organization map (SOM) algorithm and explain how it can be used for feature mapping. **[6]**

c) Explain how ART can be used for character recognition task. **[4]**

**OR**

**Q4) a)** Explain briefly ART network. What are the features of ART network? **[7]**

b) Describe the components of a competitive learning neural network and explain how they contribute to the network function. **[6]**

c) What is vector quantization? How it is used for pattern clustering? **[4]**

**P.T.O.**

- Q5)** a) Explain the role of pooling layer in Convolution neural network. [8]  
b) Explain the concept of transfer learning and its importance in deep learning. [6]  
c) Explain Padding in neural network. [4]

OR

- Q6)** a) Explain Residual network in Convolution neural network. [8]  
b) Explain the concept of SoftMax regression and its significance in CNN models. [10]

- Q7)** a) Explain how ANN can be used for the recognition of printed characters. [7]  
b) Describe the Neocognitron model and its significance in the recognition of handwritten characters. [6]  
c) Explain example of pattern recognition in everyday life. [4]

OR

- Q8)** a) Discuss the application of ANN in pattern classification and recognition of Olympic game symbols. [7]  
b) Explain texture classification and segmentation in ANN. [6]  
c) Discuss the application of ANN in the recognition of consonant vowel (CV) segments. [4]



Total No. of Questions : 8]

SEAT No. :

P-441

[Total No. of Pages : 2

**[6003]-546**

**T.E. (Artificial Intelligence and Data Science)**

**ROBOTICS AND AUTOMATION**

**(2019 Pattern) (Semester - II) (317532(A)) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** a) What are Denavit Hartenberg parameter used for? How do we define DH parameter? [6]

b) What are the difference between forward and reverse Dynamic? [6]

c) What is Euler Lagrange equation of motion? Explain? [6]

OR

**Q2)** a) What are the difference between forward and reverse Kinematics? [6]

b) What is Newton Euler equation of motion, Explain? [6]

c) What is Jacobian in robotics? Explain? [6]

**Q3)** a) What are the different types of Grippers? Explain mechanical grippers with specification. [6]

b) Enlist what are the various process tools which can be used as a end effectors. Explain any one in detail. [6]

c) Explain Types of Power system in Robotics? [6]

OR

*P.T.O.*

- Q4)** a) Compare pneumatic & hydraulic grippers. [6]  
b) Which devices can be used as end effectors? How to achieve end effector interface. [6]  
c) Explain Types of Motion conversion in robotics? [6]

- Q5)** a) Explain, how do we integrate sensors and actuators? [6]  
b) What are the functions of adaptive control? Explain? [6]  
c) What are the types of PID control? Explain? [5]

OR

- Q6)** a) How Artificial Intelligence used in robotics, Explain? [6]  
b) Explain Open loop and close loop with example? [6]  
c) What is the architecture of Microcontroller in Embedded system. [5]

- Q7)** a) Classify different languages/methods used for robotics programming. Explain the structure of VAL language command along with example.[6]  
b) Explain any three basic commands in VAL-II with example. [5]  
c) Explain motion control, hand control, program control commands used in robotic programming with example. [5]

OR

- Q8)** a) Explain anyone of the following robotic application using VAL program.[6]  
i) Pick and place applications  
ii) Palletizing application using VAL  
b) Using VAL-II programming language explain simple pick and place application. [5]  
c) Explain WAIT, SIGNAL and DELAY command used in robotics for communication using simple application. [5]



Total No. of Questions : 8]

SEAT No. :

P-442

[Total No. of Pages : 2

**[6003]-547**

**T.E. (Artificial Intelligence and Data Science)**  
**NATURAL LANGUAGE PROCESSING (Elective - II)**  
**(2019 Pattern) (Semester - II) (317532(B))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Solve questions Q.1 or Q.2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1)** a) Explain Combinatory Categorical Grammar. **[8]**

b) List and Explain grammar rules for English. **[9]**

OR

**Q2)** a) Explain partial parsing with example. **[8]**

b) Discuss Advanced Methods in Transition-Based Parsing. **[9]**

**Q3)** a) Explain Word Sense Induction. **[8]**

b) Explain Features-based Algorithm for Semantic Role Labeling. **[9]**

OR

**Q4)** a) Explain Connotation Frames. **[8]**

b) Explain defining emotions with Plutchik wheel of emotion. **[9]**

*P.T.O.*



- Q5)** a) Explain need of Machine Translation (MT) with suitable example. Which are the problems of Machine Translation? [9]
- b) Write short note on :
- i) Knowledge based MT System [5]
  - ii) Encoder-decoder architecture [4]

OR

- Q6)** a) Explain Machine Translation (MT) approaches with suitable example. Describe Direct Machine Translation in detail. [9]
- b) Write short note on :
- i) Statistical Machine Translation (SMT). [5]
  - ii) Neural Machine Translation. [4]

- Q7)** a) Elaborate Information retrieval- Vector space Model in detail. [9]
- b) Write short note on : [9]
- i) Categorization.
  - ii) Summarization.
  - iii) Sentiment Analysis.

OR

- Q8)** a) Discuss Information Extraction using Sequence Labelling in detail. [9]
- b) Write short note on : [9]
- i) Named Entity Recognition.
  - ii) Analyzing text with NLTK.
  - iii) Chatbot using Dialogflow.



Total No. of Questions : 8]

SEAT No. :

P-443

[Total No. of Pages : 3

[6003]-548

**T.E. (Artificial Intelligence and Machine Learning)**

**DESIGN AND ANALYSIS OF ALGORITHM**

**(2019 Pattern) (Semester - I) (318541)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

- Q1)** a) What is Travelling salesman problem? Explain with example travelling salesman problem using Dynamic Programming. [8]
- b) Write an algorithm for Warshal's and Floyd's Algorithm. State it's time complexity. [6]
- c) Solve the following instance of the 0/1 knapsack problem by Dynamic Programming, Capacity  $W = 6$  [4]

Item	1	2	3
Weight	2	3	4
Profit	1	2	5

OR

- Q2)** a) Explain Dynamic Programming method. State Principle of optimality.[8]
- b) Explain optimal binary search tree with example. State difference between binary search tree and optimal binary search tree. Write the cost function for OBST. [10]
- Q3)** a) Write an algorithm for Knapsack problem using backtracking method.[7]
- b) Write an algorithm to find Sum of subset using backtracking. Explain with example. [6]
- c) Discuss graph coloring using backtracking with the help of example. [4]

OR

*P.T.O.*

- Q4)** a) Write an algorithm to find Hamiltonian path using backtracking method. [7]
- b) Explain the following terms : [6]
- i) State space tree
  - ii) Live node
  - iii) E-node
  - iv) Dead node
  - v) Implicit Constraints
  - vi) Solution State
- c) Draw state space tree for 4-Queen's problem. [4]

- Q5)** a) Write an algorithm for FIFO Branch and Bound. [8]
- b) Explain following term : [6]
- i) Branch and Bound
  - ii) LC Search
  - iii) FIFO Search
- c) Difference between backtracking and branch & bound. [4]

OR

- Q6)** a) Write an algorithm for LC Branch and Bound. [8]
- b) Find the solution of the following Travelling salesman problem using branch and bound method. [10]

$\infty$	20	30	10	11
15	$\infty$	16	4	2
3	5	$\infty$	2	4
19	6	18	$\infty$	3
16	4	7	16	$\infty$

- Q7)** a) Prove that Clique Decision problem is NP-complete. [7]  
b) Explain Vertex Cover Problem in detail. [6]  
c) Explain Pointer Doubling Algorithm. [4]

OR

- Q8)** a) Explain : NP-Hard, NP-Complete, Decision Problem, Polynomial Time algorithm and Deterministic-nondeterministic Algorithm. [7]  
b) Explain in detail Parallel Computing. [6]  
c) Differentiate between NP complete and NP Hard. [4]



Total No. of Questions : 8]

SEAT No. :

**P444**

[Total No. of Pages : 2

**[6003]-549**

**T.E. (Artificial Intelligence and Machine Learning)**

**IOT WITH ARTIFICIAL INTELLIGENCE**

**(2019 Pattern) (Semester-I) (318542)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right full indicate marks.*
- 4) *Assume suitable data, if neccessary.*

- Q1)** a) State and explain key advantages of IP suite of Internet of things. [8]
- b) Advantages and disadvantages of IEEE 802. 15.4 protocol. [6]
- c) Describe building blocks of constrained node networks. [4]

OR

- Q2)** a) What is SCADA software system? Explain working of SCADA software system. [8]
- b) Differentiate between IPV6 and IPV4 protocol. [6]
- c) Explain level 6 IOT system. [4]

- Q3)** a) List and explain any three IOT frameworks. [7]
- b) Write short note on Data Lake? [6]
- c) Explain Data integration platforms. [4]

OR

- Q4)** a) Describe authentication and authorization in detail. [7]
- b) State and describe unstructured data storage challenges. [6]
- c) Explain Cisco frameworks. [4]

**P.T.O.**

- Q5)** a) Explain everything as a service cloud service model (XAAS). [8]  
b) Short note on data in motion. [6]  
c) List advantages and disadvantages of unstructured data. [4]

OR

- Q6)** a) What are tools used in data analytics. [8]  
b) Explain data categorization for storage. [6]  
c) Explain key features of clouds to support IOT. [4]

- Q7)** a) State and describe different types of industrial automation. [7]  
b) Explain Amazon web service for IOT and its features. [6]  
c) Short note on IOT cloud platforms. [4]

OR

- Q8)** a) Explain working of commercial building automation using IOT. [7]  
b) What is the smart grids? Discuss how smart cities are adopting smart grid technology. [6]  
c) State and explain IOT data analytics application. [4]



Total No. of Questions : 8]

SEAT No. :

**P445**

[Total No. of Pages : 2

**[6003]-550**

**T.E. (Artificial Intelligence and Machine Learning)**

**WEB TECHNOLOGY**

**(2019 Pattern) (Semester - I) (318543)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain redux architecture in detail. [8]  
b) What are hooks? Explain different types of hooks. [6]  
c) Explain angular lifecycle. [4]

OR

- Q2)** a) What is data binding? What are the different types of data binding? [8]  
b) Explain mvc in web framework. State its advantages and disadvantages. [6]  
c) What is typescript? Explain variables in TS. [4]

- Q3)** a) What is Middleware in Express.js? What are the different types of Middleware? [7]  
b) What is the difference between Express.js and Node.js? [6]  
c) What are NoSQL databases? What are the different types of NoSQL databases? [4]

OR

- Q4)** a) How many types of API functions are available in Node.js? Explain with example. [7]  
b) What are the key differences between Angular.js and Node.js? [6]  
c) What is Mongoose ODM? Explain its advantages. [4]

**P.T.O.**

- Q5)** a) Explain any four form components in JQuery Mobile. [8]  
b) Explain any six JQuery methods to create animation effects. [6]  
c) Explain the following widgets in JQuery mobile: [4]  
i) FlipSwitch widget.  
ii) Footer widget

OR

- Q6)** a) Explain list in JQuery Mobile. How to divide list in JQuery mobile? [8]  
b) Explain multipage template JQuery mobile. [6]  
c) List all the roles in JQuery mobile. [4]

- Q7)** a) What is amazon VPC? Name all the components of amazon VPC and explain any four components of amazon VPC. [7]  
b) What is AWS storage service? List of the main storage services available on the AWS Cloud. [6]  
c) What is ELB? How does it work? [4]

OR

- Q8)** a) Explain the steps to deploy a web application on amazon EC2. [7]  
b) What is PUTTY? How to connect EC2 instance with PUTTY? [6]  
c) What are the important AWS Cloud Services? [4]

**\*\*\* END \*\*\***



Total No. of Questions : 8]

SEAT No. :

P-446

[Total No. of Pages : 2

[6003]-551

T.E. (AI & ML)

**MANAGEMENT AND ENTREPRENEURSHIP FOR IT  
INDUSTRY**

**(2019 Pattern) (Semester - I) (318544)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Write characteristics of Entrepreneurship and function of Entrepreneur. [6]
- b) Write about barriers to entrepreneurship. [6]
- c) Discuss the role of Entrepreneurs in economical development of country. [6]

OR

- Q2)** a) Explain stages of entrepreneurial process in detail. [6]
- b) Explain the types of Entrepreneurship in detail. [6]
- c) Define Entrepreneur. What are characteristic of an entrepreneur? [6]

- Q3)** a) What are the steps involved in formulation of project report. [6]
- b) With a brief explanation, explain CPM and PERT. [6]
- c) Explain the guidelines by planning commission for project report [5]

OR

- Q4)** a) What is ERP? Explain importance of ERP. [6]
- b) What is a project? Explain the required criteria in selecting a project.[6]
- c) Explain steps involve in report writing? [5]

**P.T.O.**

- Q5)** a) Explain about trademarks in IPR. [6]  
b) List the characteristics of small scale industries. [6]  
c) Explain steps involved in establishing micro and small enterprise. [6]

OR

- Q6)** a) Explain characteristics of small and micro industries. [6]  
b) Explain trademark, copy rights and patents. [6]  
c) Write short note on-i) MSME-DI 2)DIC 3) NISIC. [6]

- Q7)** a) What intellectual property rights in detail. [6]  
b) Explain Advantages and Disadvantages of IPR. [6]  
c) Explain Criticisms and Politics of Intellectual Property Rights. [5]

OR

- Q8)** a) Explain Economic analysis of Intellectual Property Rights. [6]  
b) Explain 1)WIPO 2)WTO [6]  
c) Discuss Need for Private Rights versus Public Interests. [5]



Total No. of Questions : 8]

SEAT No. :

P447

[Total No. of Pages : 2

[6003]-552

T.E. (Semester - I)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Robotics

(318545 (A)) (2019 Pattern) (Elective - I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

- Q1)** a) What are homogeneous coordinates and how are they used in robotics?[6]  
b) What are some common matrix operators used in robotics and how do they relate to transformation matrices? [6]  
c) Explain Denavit-Hartenberg matrix with its uses. [6]

OR

- Q2)** a) How can the forward solution be used to determine the position and orientation of a manipulator's end effector? [6]  
b) What is the inverse or back solution and how is it used to control a manipulator's motion? [6]  
c) What are techniques for obtaining the inverse solution? [6]

- Q3)** a) What are the different types of grippers used in robotics? [6]  
b) Write short note on force analysis for mechanical hydraulic systems?[6]  
c) What are the different types of end effectors? [5]

OR

- Q4)** a) What are tactile sensors? Explain their application. [6]  
b) Write short note on proximity and range sensors. [5]  
c) What are some miscellaneous sensors and sensor-based systems used in robotics and what are their applications? [6]

P.T.O.

- Q5)** a) What are some important hardware considerations when designing a computer system for a robot? [6]
- b) What are some of the computational elements used in robotic applications? [6]
- c) What are some important real-time considerations for robotic systems, and how are they addressed in computer design? [6]

OR

- Q6)** a) How is path planning used to optimize the movement of a robot? [6]
- b) What are some of the different programming languages used in robotics and what are their advantages and disadvantages? [6]
- c) How is artificial intelligence used in robot programming, and what are some of its applications in robotics? [6]

- Q7)** a) What are some common applications of robotics in material transfer and machine loading/unloading? [6]
- b) How is robotics used in processing operations such as welding and coating? [6]
- c) What are some of the different assembly and inspection tasks that robots are used for and what are some of their benefits and drawbacks? [5]

OR

- Q8)** a) What are some of the social and labor issues associated with the use of robotics? [6]
- b) What are some of the characteristics of future robot tasks? [5]
- c) What are some of the potential applications of robotics in hazardous and non-manufacturing environments? [6]

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Total No. of Questions : 8]

SEAT No. :

P448

[Total No. of Pages : 2

[6003]-553

**T.E. (Artificial Intelligence and Machine Learning)**

**PATTERN RECOGNITION**

**(318545 (B)) (2019 Pattern) (Semester - I) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

- Q1)** a) Explain Gaussian mixture models. [8]  
b) What is the difference between maximum likelihood and Bayes method.[6]  
c) Prove that the bayes classifier is equivalent to the minimum distance classifier,assuming that the feature vector is Gaussian. [4]

OR

- Q2)** a) Explain Nearest neighbor algorithm with example. [8]  
b) Explain Bayes Decision rule.Explain how it can be used for two class classification. [6]  
c) What is maximum entropy estimation. [4]

- Q3)** a) Explain stochastic approximation of LMS algorithm. [7]  
b) Explain least means square algorithm in detail. [6]  
c) Explain decision hyperplane. [4]

OR

- Q4)** a) Explain the perceptron learning algorithm in detail. [7]  
b) Explain sum of error estimate. [6]  
c) Explain any Linear discriminant based algorithm. [4]

**P.T.O.**

- Q5)** a) Describe the architecture and learning algorithm of back propagation network. [8]  
b) Explain K-means clustering algorithm. [6]  
c) Draw the model of single artificial neuron. [4]

OR

- Q6)** a) Explain two layer perceptron with algorithm. [8]  
b) Define the criterion functions used in clustering. [6]  
c) Explain the proximity measures. [4]

- Q7)** a) Explain following normal density function with formula [7]  
i) Univariate normal density.  
ii) Multivariate normal density  
b) Explain expectation maximization with the help of algorithm. [6]  
c) Explain linear discriminant function in detail. [4]

OR

- Q8)** a) Write a note on first order Hidden markov model. How the Hidden markov model different from markov model. [7]  
b) Define Classifier. Explain different types of classifiers. [6]  
c) Explain Bayesian parameter estimation. [4]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-449

[Total No. of Pages : 2

**[6003]-554**

**T.E. (Artificial Intelligence and Machine Learning)**

**INFORMATION SECURITY**

**(2019 Pattern) (Semester - I) (318545C) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

- Q1)** a) Explain in detail key management with suitable example. [6]
- b) Explain in detail Chinese reminder theorem. [6]
- c) Write a note on Diffie-Hellman key exchange. [6]

OR

- Q2)** a) Which are the different types of Cryptography. Explain Public Key Cryptography in detail. [6]
- b) Explain El Gamal algorithm in detail. [6]
- c) Write a note on Elliptic Curve Cryptography. [6]
- Q3)** a) Explain Hash Functions Based on Cipher Block Chaining in detail. [6]
- b) Explain in Web Security issues. [6]
- c) Write a short note on IP Security: IPsec. [5]

*P.T.O.*

OR

- Q4)** a) Write a note on Message Authentication functions. [6]  
b) Explain Secure Hash Algorithm (SHA) in detail. [6]  
c) Explain MD4 in detail. [5]

- Q5)** a) What are types of Firewall, and also explain Intrusion prevention system: Network based in detail. [6]  
b) Explain the concepts of trusted system & Trusted computing. [6]  
c) What do you mean by Multilevel Security. [6]

OR

- Q6)** a) Explain in detail Security for role based access control. [6]  
b) Write a note on Host based and network based Honeypot. [6]  
c) What do you mean by Flooding attacks. [6]

- Q7)** a) Explain in detail Indian IT Act. [6]  
b) Explain Cyber stalking in detail. [6]  
c) State & explain Information Security related to cybercrime. [5]

OR

- Q8)** a) State the classification of Cybercrimes. Write a note on cybercrime. [6]  
b) Write a note on The Indian IT Act-Challenges. [6]  
c) Write a note on Proxy servers. [5]





Total No. of Questions : 8]

SEAT No. :

P-450

[Total No. of Pages : 2

**[6003]-555**

**T.E. (Artificial Intelligence and Machine Learning)**

**BUSINESS INTELLIGENCE**

**(2019 Pattern) (Semester - I) (318545D) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1) a) Define the following tool with report to BI. [8]**

- i) Power BI
- ii) Tableau

**b) Explain what is business report? And its business reporting systems. [6]**

**c) State four perspective of BSC. [4]**

**OR**

**Q2) a) Define following term with report to BI. [8]**

- i) Key performance indicator
- ii) Balanced scored cards

**b) Explain with neat diagram types of charts and graphs with their specifications. [6]**

**c) What is the Roll of performance measurement dashboard in BI. [4]**

**P.T.O.**

- Q3)** a) State and explain with diagram, structure of mathematical models for decision support system? [7]  
b) Differentiate in-between descriptive analytics vs. predictive analytics vs. prescriptive analytics. [6]  
c) Define the term certainty, uncertainty and risk for decision support system. [4]

OR

- Q4)** a) Role of “What if analysis” and “Sensitivity analysis” in business intelligence. [7]  
b) Explain multi-criteria decision making with pair wise comparisons. [6]  
c) How mathematical programming optimization obtain in BI. [4]

- Q5)** a) Explain in detail the role of visual and business analytics in BI. [8]  
b) Describe ERP and business Intelligence. [6]  
c) State any four application of BI in banking. [4]

OR

- Q6)** a) State and explain business intelligence applications in fraud detection and retail industry. [8]  
b) Describe how different forms of Business Analytics are supported in practice. [6]  
c) Explain the concepts of Business Intelligence in Telecommunications.[4]

- Q7)** a) State and explain the critical success factors for implementing BI strategy. [7]  
b) State location based analytics for organization. [6]  
c) Explain emerging technologies in BI. [4]

OR

- Q8)** a) State and explain predicting the future with the help of data analysis. [7]  
b) Describe different types of advanced visualization reports. [6]  
c) Explain impact of analysis in organization. [4]



Total No. of Questions : 8]

SEAT No. :

**P451**

**[6003]-556**

[Total No. of Pages : 2

**T.E. (Artificial Intelligence and Machine Learning)  
MACHINE INTELLIGENCE FOR DATA SCIENCE  
(2019 Pattern) (Semester - II) (318552)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

- Q1)** a) What are the assumptions of linear regression? [6]  
b) How do you interpret linear regression coefficients. [6]  
c) What is difference between logistic regression and linear regression? [6]

OR

- Q2)** a) What is maximum likelihood estimation, and how does it relate to logistic regression? [6]  
b) How do you evaluate the performance of a logistic regression model, and what metrics are used? [6]  
c) How do you visualize the relationship between predictors and response in logistic regression. [6]

- Q3)** a) How does SVM work, and what are its strengths and limitations. [6]  
b) What are ensemble methods, and how can they improve classification accuracy? [6]  
c) What is bagging, and how does it reduce model variance? [5]

OR

- Q4)** a) What is boosting, and how does it reduce model bias? [6]  
b) What is random forest, and how does it use bagging and random feature selection? [5]  
c) What metrics are used to evaluate classification models? [6]

*P.T.O.*

- Q5)** a) What is a decision tree, and how does it partition the feature space? [6]  
b) What is entropy, and how is it used to construct decision trees? [6]  
c) What is random forest, and how does it combine multiple decision trees to improve accuracy? [6]

OR

- Q6)** a) What is boosting, and how does it iteratively adjust weights to improve accuracy? [6]  
b) What is XGBoost, and how does it improve on gradient boosting algorithms? [6]  
c) How do you evaluate decision tree or ensemble model performance, and what metrics are used? [6]

- Q7)** a) What is clustering, and how is it used in unsupervised learning? [6]  
b) What is k-means clustering, and how does it assign data points to clusters? [6]  
c) What is DBSCAN, and how does it identify clusters of varying shapes and densities? [5]

OR

- Q8)** a) What is hierarchical clustering, and how does it create a dendrogram to visualize cluster relationships? [6]  
b) What is agglomerative clustering, and how does it combine small clusters into larger ones? [5]  
c) What is divisive clustering, and how does it split larger clusters into smaller ones? [6]



Total No. of Questions : 8]

SEAT No. :

**P452**

[Total No. of Pages : 2

**[6003]-557**

**T.E. (Artificial Intelligence and Machine Learning)**

**DATA MINING AND WAREHOUSING**

**(2019 Pattern) (Semester-II) (318553)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Explain the k-means and DBSCAN clustering techniques with examples. **[8]**

b) Explain the concept of data, information, and knowledge in the context of BI. **[6]**

c) Explain the role of a data warehouse in BI systems. **[4]**

**OR**

**Q2) a)** Describe the design and implementation aspect of OLTP in the context of data mining and warehousing. **[8]**

b) Define Business Intelligence (BI) and its components. **[6]**

c) What are the business applications of BI? **[4]**

**Q3) a)** Explain the need for data warehousing in decision support systems. Discuss the characteristics of a data warehouse. **[7]**

b) Explain the three-tier data warehouse architecture. **[6]**

c) What are the trends in data warehousing? **[4]**

**OR**

**Q4) a)** Compare and contrast operational databases and data warehouses. Describe the components of a data warehouse. **[7]**

b) What is a data mart? Discuss its role in data warehousing. **[6]**

c) Describe the conceptual modeling of a data warehouse. **[4]**

**P.T.O.**

- Q5)** a) Explain the ETL process in data warehousing and its significance. [8]  
b) Write short note on data reduction strategies. [6]  
c) Describe applications of Data warehouse. [4]

OR

- Q6)** a) What are the techniques for discretization and concept hierarchy generation for numerical and categorical data in data warehousing? [8]  
b) Describe the role of metadata in data warehousing. [6]  
c) Give an overview of the data life cycle and its stages. [4]

- Q7)** a) Describe the different schemas used for representing multidimensional databases, including stars, snowflakes, and fact constellations. [7]  
b) What are OLAP operations in the multidimensional data model? [6]  
c) What is the difference between a fact table and a dimension table in a multidimensional database? [4]

OR

- Q8)** a) Compare and contrast the different types of OLAP tools, including ROLAP, MOLAP, and HOLAP. [7]  
b) Define the concept hierarchies in the context of a multidimensional data model. [6]  
c) Discuss the need for OLAP. [4]



Total No. of Questions : 8]

SEAT No. :

**P453**

[Total No. of Pages : 2

**[6003]-558**

**T.E. (Artificial Intelligence and Machine Learning)**

**ARTIFICIAL NEURAL NETWORKS**

**(2019 Pattern) (Semester - II) (318554)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

- Q1)** a) Explain the architecture of a multilayer perception (MLP). How it differs from a single-layer perception? [6]  
b) Explain in detail Error Back Propagation Algorithm. [6]  
c) Explain stochastic Gradient Descent with example. [6]

OR

- Q2)** a) Write Applications of Feed forward Neural Networks. [6]  
b) Explain how multilayer perception can be used in image classification tasks. [8]  
c) Explain Sigmoid Neurons with example. [4]

- Q3)** a) Describe the architecture of a recurrent neural network (RNN). What are some advantages and limitations of RNNs in sequence modeling tasks? [7]  
b) What are Hopfield networks and Boltzmann machines, and what are some applications of these models? [10]

OR

- Q4)** a) What is the Simulated Annealing. Write an algorithm for it. How it is useful in ANN. [7]  
b) Explain Pattern Storage Networks. [10]

- Q5)** a) Explain the components of competitive learning and how they are used to classify input patterns. Example with example. [8]  
b) Explain Semantic Networks in competitive learning. [6]  
c) Write an applications of Self-Organizing Maps. [4]

OR

- Q6)** a) Explain Feature Mapping Network and its role in pattern recognition. [10]  
b) Explain application of Adaptive Resonance Theory. [8]

**P.T.O.**

- Q7)** a) Describe the architecture of Deep Learning Networks, including input layer, hidden layers and output layer. Explain with example. [7]
- b) Explain with diagram Long short-term memory (LSTM) Networks. [10]

OR

- Q8)** a) Explain the challenges faced in training Deep Learning Networks, including overfitting vanishing gradients, and exploding gradients. [8]
- b) Explain convolutional networks (CNN). State it's application with examples. [9]





Total No. of Questions : 8]

SEAT No. :

P-454

[Total No. of Pages : 2

**[6003]-559**

**T.E. (Artificial Intelligence and Machine Learning)**

**INDUSTRIAL INTERNET OF THINGS**

**(2019 Pattern) (Semester - II) (318555(A)) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

- Q1)** a) Write a note on Interoperability in Smart Automation. [6]
- b) Explain in detail CPS-based manufacturing and Industries. [6]
- c) Explain Networking of IIoT in detail. [6]

OR

- Q2)** a) What is Enhancing Resiliency in Production Facilities? [6]
- b) How Integration of Knowledge is done in CMS? [6]
- c) Write a note on Communication in IIoT. [6]

- Q3)** a) What is Cyber Physical System Intelligence? [6]
- b) What are the advantages of using AI and Data Analytics in Manufacturing? [6]
- c) How is CPS used in machine tools? [5]

OR

*P.T.O.*

- Q4)** a) How can Machine Learning be applied in condition monitoring? [6]  
b) What are the challenges in implementing AI and Data Analytics in Manufacturing? [6]  
c) What is Big Data, and how is it used in IIoT? [5]

- Q5)** a) How do workers and CPS interact with each other? [6]  
b) What strategies can be used to support user intervention in CPS? [6]  
c) Write a note on Advance Manufacturing. [6]

OR

- Q6)** a) How can IIoT improve Human-Machine Interaction in the manufacturing sector? [6]  
b) How does Innovation Ecosystems support Human-Machine Interaction? [6]  
c) What are the challenges of evaluating the workforce in IIoT? [6]

- Q7)** a) What are the different applications of IIoT? Explain any one in detail.[6]  
b) How does Smart Metering work, and what are its benefits? [6]  
c) What is City Automation, and what are its advantages? [5]

OR

- Q8)** a) What are the real-life examples of IIoT in the Manufacturing sector, and how have they benefited the industry? [6]  
b) Write a note on e-Health Body Area Networks. [6]  
c) Explain Home Automation in detail. [5]



Total No. of Questions : 8]

SEAT No. :

P-455

[Total No. of Pages : 2

[6003]-560

**T.E. (Artificial Intelligence and Machine Learning)**

**BRAIN COMPUTER INTERFACE**

**(2019 Pattern) (Semester - II) (Elective - II) (318555(B))**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1)** a) Explain the Spike sorting Method? [6]

b) Write short note on Independent Component Analysis (ICA) [6]

c) What is Phase synchronization and coherence? [6]

OR

**Q2)** a) Write short note on frequency domain analysis. [6]

b) What is the Time domain analysis in BCI? Give example. [6]

c) Explain spatial filtering-principal component analysis (PCA) with example. [6]

**Q3)** a) Explain Binary classification in detail. [6]

b) Explain Ensemble classification in detail. [6]

c) Explain Support vector machines (SVM). [5]

OR

*P.T.O.*

- Q4)** a) Explain Graph theoretical functional connectivity analysis. [6]  
b) Determine Linear Regression and its applications. [5]  
c) Explain Perceptron's. [6]

- Q5)** a) What is Peak-to-valley amplitudes in the onset and offset FVEPs? [6]  
b) Discuss in brief Determination of gazed target. [6]  
c) Explain Availability of transient VEPs. [6]

OR

- Q6)** a) Explain Machine learning approach in BCI. [6]  
b) What is the Usability of Transient VEPs in BCIs- VEPs? [6]  
c) What are transient VEPs? Explain with an example. [6]

- Q7)** a) What are decoding and tracking arm (hand) position? [6]  
b) What is controlling prosthetic devices such as orthotic hands [6]  
c) What is the difference between Cursor and robotic control. [5]

OR

- Q8)** a) What is Noninvasive BCIs: P300 Mind Speller? [6]  
b) What is Emotion detection? Give applications. [5]  
c) Write short note on Ethics of Brain Computer Interfacing. [6]



Total No. of Questions : 8]

SEAT No. :

P-456

[Total No. of Pages : 2

[6003]-561

**T.E. (Artificial Intelligence and Machine Learning) (Semester - II)**

**AI FOR CYBER SECURITY**

**(2019 Pattern) (318555C) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** a) Explain different machine learning (ML) algorithms for botnet detection. [8]

b) Explain how to classify network attacks. [6]

c) Explain different approaches used to identify botnet topology. [4]

OR

**Q2)** a) Explain, different network anomaly detection techniques. [8]

b) Explain how to detect botnet topology and explain its types. [6]

c) Explain Random forest and SVM algorithm. [4]

**Q3)** a) Explain Fraud Prevention with Cloud AI Solutions and its benefits.[7]

b) Explain user authentication with keystroke recognition. [6]

c) Explain how to protect sensitive information and assets. [4]

OR

**Q4)** a) Explain leverage machine learning (ML) algorithms for fraud detection. [7]

b) Explain key elements of account reputation scoring. [6]

c) Explain Biometric authentication with facial recognition. [4]

**P.T.O.**

- Q5)** a) Explain the attacks against deep neural networks (DNNs) via model substitution. [8]
- b) Explain the main libraries and tools for developing adversarial examples. [6]
- c) Explain the fundamental concept of GAN. [4]

OR

- Q6)** a) What is intrusion detection systems. Explain GAN attacks used against IDS. [8]
- b) Explain the steps involved in model substitution. [6]
- c) Explain how to defend against adversarial attacks using facial recognition. [4]

- Q7)** a) What is cross validation. Explain its technique used for bias-variance trade-offs. [7]
- b) Explain how ROC curve is used to visualize the performance of binary classifier. [6]
- c) Explain how to manage algorithms' overfitting. [4]

OR

- Q8)** a) Explain the steps to be followed in preparation of raw data in Feature engineering. [7]
- b) Explain how to split sample data into training and test sets. [6]
- c) Explain bias-variance trade-offs with cross validation. [4]



Total No. of Questions : 8]

SEAT No. :

P-3627

[Total No. of Pages : 2

[6003]-562

**T.E. (AIML Engineering)**

**VIDEO ANALYTICS**

**(2019 Pattern) (Semester - II) (Elective - II) (318555D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Define Bayesian classifier? What are the different types of Bayesian classifiers? [6]

b) Write about Deep learning networks. [6]

c) Explain Neural networks. [6]

OR

**Q2)** a) Explain different types of deep neural networks. [6]

b) Explain fuzzy pattern classifier. [6]

c) Explain briefly a HMM based classifier. [6]

**Q3)** a) What is human action recognition using AI? [6]

b) With a brief explanation, explain human behavioral analysis. [6]

c) Explain Video analytics for security with example? [5]

OR

**Q4)** a) What is crowd analysis? Explain methods of crowd analysis. [6]

b) What is a perimeter security? Explain. [6]

c) Discuss prediction of crowd congestion. [5]

**P.T.O.**

- Q5)** a) Explain Video analytics for Business Intelligence. [6]  
b) What is driver assistance? Explain Lane departure warning (LDW). [6]  
c) Explain Customer behavior analysis with example. [6]

OR

- Q6)** a) Explain Traffic rule violation detection. [6]  
b) Explain purpose and methods of route planning. [6]  
c) Write short note on Traffic Monitoring and Assistance. [6]

- Q7)** a) What is Video Analysis Action Recognition? Explain applications of video action recognition [6]  
b) Explain scene understanding in deep learning. [6]  
c) What is meant by video rendering? Explain purpose of rendering a video. [5]

OR

- Q8)** a) What is meant by video rendering? Explain the process of rendering. [6]  
b) Explain the application of scene understanding. [6]  
c) Discuss Video Analysis Action Recognition. [5]





Total No. of Questions : 8]

SEAT No. :

**P-3151**

[Total No. of Pages : 2

**[6003]-563**

**T.E. (Honours in Artificial Intelligence and Machine Learning)**

**COMPUTATIONAL STATISTICS**

**(2019 Pattern) (Semester - I) (310301)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data, if necessary.

**Q1)** a) Consider the Confusion Matrix given below. Calculate Accuracy, Recall and Precision. **[9]**

Predicted class \ Actual class	CAT	Not CAT
CAT	150	10
Not CAT	20	100

b) State and explain in depth the typical analysis procedure used in statistical analysis. **[9]**

OR

**Q2)** a) What is T state? When to use T test? Describe different types of T test in detail. **[10]**

b) What is Sensitivity? Explain Types of Statistical Tests in depth. **[8]**

**Q3)** a) What are different feature scaling techniques? Explain Normalization and Standardization in depth. **[9]**

b) Differentiate between bias and variance. **[4]**

c) Elaborate the K fold validation method in depth. **[4]**

OR

**P.T.O.**

- Q4)** a) Differentiate between overfitting and Underfitting. State and explain different methods to avoid overfitting. [9]
- b) What is regularization? Explain the LASSO (Least Absolute Shrinkage and Selection Operator). Regularization Method. [8]

- Q5)** a) Explain in depth under-sampling and over re-sampling. [6]
- b) Define Outliers or Anomaly detection. What are different types of Anomaly? Explain different methods to detect Anomaly. [12]

OR

- Q6)** a) Describe Recursive Feature Elimination with example. [6]
- b) What is Dimensionality reduction? How PCA reduces dimensionality? [8]
- c) How does the Variance Thresholding is used for Robust Features Selection. [4]

- Q7)** a) Differentiate between linear and logistic regression. [8]
- b) Explain the Gradient Descent method. State and explain the difference between Batch and Stochastic gradient descent. [9]

OR

- Q8)** a) Describe the Monte Carlo Method in depth with its limitation. State the different real time applications of Monte Carlo Method. [9]
- b) What is Multilinear Regression? Explain with Multilinear Regression model in details. [8]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-457

[Total No. of Pages : 1

[6003]-564

**T.E. ( Honour in Cyber Security)**  
**INFORMATION AND CYBER SECURITY**  
**(2019 Pattern) (Semester - I) (310401)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2 , Q3 or Q4,Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of Scientific Calculator is permitted.*

- Q1)** a) Explain RSA algorithm step by step in detail with example. [9]  
b) What is Chinese remainder theorem? What is its implication in cryptography? Explain with example. [9]

OR

- Q2)** a) Explain Diffie Hellman in detail. Solve if  $p=7$ ,  $q=17$  using Diffie Hellman algorithm, select  $a=6$ ,  $b=4$ . [9]  
b) Explain operation of MD5 Message digest algorithm. [9]
- Q3)** a) What are the challenges in Social Engineering? Explain cyber stalking. [8]  
b) Describe different categories of cybercrime with example. [9]

OR

- Q4)** a) List the steps for risk identification and assessment in risk management for Information Security. [8]  
b) What are the objectives and pros and cons of Quantitative and Qualitative risk Assessment? [9]

*P.T.O.*

- Q5) a)** What services are provided by IPSec? Give difference between Transport mode and Tunnel mode. [9]
- b)** What protocols comprise SSL with neat diagram? What is the difference between SSL connection and SSL session? [9]

OR

- Q6) a)** What problem was Kerberos designed to address? Explain its working. [9]
- b)** Define firewall and explain following details about firewall. [9]
- i) Roles of firewall
  - ii) Design goal of firewall
  - iii) Different types of firewall
  - iv) Limitation of firewall

- Q7) a)** Define, list and explain different types of viruses. [8]
- b)** Explain Password Cracking and types of Password Cracking. [9]

OR

- Q8) a)** Explain Intrusion detection system with its types limitations and challenges. [8]
- b)** What is DoS and DDoS attack? Explain with suitable example. [9]



Total No. of Questions : 8]

SEAT No. :

P-458

[Total No. of Pages : 2

[6003]-565

T.E. (Semester - I)

Honors In Data Science

DATA SCIENCE AND VISUALIZATION

(2019 Pattern) (310501)

Time : 2½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) State and explain how Naive Bayes Theorem is used to solve classification problems. [6]
- b) What is the difference between regression and classification? Explain with example. [6]
- c) Write a note on (Any 3) [6]
- i) Partitioning Clustering
  - ii) Density-Based Clustering
  - iii) Distribution Model-Based Clustering.
  - iv) Hierarchical Clustering

OR

- Q2)** a) What is clustering? Explain K-means clustering algorithm. [6]
- b) Explain how simple linear regression is used for house price prediction. (Assume the suitable dataset). [6]
- c) Briefly explain evaluation of association rules. [6]

- Q3)** a) Write a note on the following. [9]
- i) Gini Index
  - ii) Information gain
  - iii) Entropy
- b) What is a neuron? Explain the architecture of artificial neurons. [8]

OR

P.T.O.

**Q4)** a) What is a decision tree? What are the advantages and disadvantages of a decision tree? [9]

b) What is a feedforward neural network? Explain with suitable example.[8]

**Q5)** a) What are the challenges related to data visualization. [6]

b) Explain dashboard design principles. [6]

c) What are the advance data visualization techniques? Explain any 2. [6]

OR

**Q6)** a) Write a note on 'Display media for dashboard'. [9]

b) Explain where and how bar-graphs, Scatterplots and histograms can be used to visualize the data. [9]

**Q7)** a) Explain entity-relationship (ER) Data modelling. [6]

b) List the disadvantages of multi-dimensional data model? [6]

c) Discuss the challenges of clustering High-dimensional data. [5]

OR

**Q8)** a) What are the key steps in data modelling process? Enlist and explain.[6]

b) Explain multidimensional data model with one example. [6]

c) What do you mean by Principal Component Analysis? Explain with example. [5]



Total No. of Questions : 8]

SEAT No. :

P-459

[Total No. of Pages : 2

[6003]-566

T.E.

(Honors in Internet of Things)

EMBEDDED SYSTEMS AND INTERNET OF THINGS

(2019 Pattern) (Semester-I) (310601)

Time : 2½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7, or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Use of Non-Programming scientific Calculator is allowed.

- Q1)** a) What are the active and passive types of sensors? Discuss and provide suitable examples. [6]
- b) Draw and describe the components of Raspberry Pi development board. [6]
- c) What is the need of interfacing of sensors with development boards? How is it done? [5]

OR

- Q2)** a) List and explain various features of the Arduino board in detail. [6]
- b) What are the analog digital types of sensors? Discuss and provide suitable example. [6]
- c) Explain the working of pressure sensor with neat block diagram. [5]

- Q3)** a) What is the need of Integrated Development Platform for application development? Explain with suitable example. [6]
- b) Describe any one open-source IDE for ES application development. [6]
- c) List the phases of SDLC. Explain SDLC requirements in detail. [5]

OR

- Q4)** a) What are the limitations of IDEs for ES applications? Discuss disadvantages of open source IDEs for ES applications. [5]

P.T.O.

- b) Explain Design, Components and Coding requirements of embedded systems applications? [6]
  - c) What are the testing and deployment requirements of embedded systems applications? [6]
- Q5)** a) Define Internet of Things (IoT). Enlist and explain its characteristics.[6]
- b) With the help of neat diagram, explain technical building blocks of IOT. [6]
  - c) Write a brief note on communication models of IOT and Communication APIs. [6]

OR

- Q6)** a) Draw and distinguish between physical design and logical design of IoT. [6]
- b) Enlist and explain issues and challenges of IOT. [6]
  - c) Explain IoT functional blocks in detail. [6]
- Q7)** a) Explain the usability of MQTT protocol for IoT applications. Comment on the QoS supported in MQTT. [6]
- b) Define Radio-Frequency Identification. Explain the role of Radio-Frequency Identification in Internet of Things. [6]
  - c) List different IoT enabling technologies which play a key-role and explain any one of them. [6]

OR

- Q8)** a) What is CoAP? How it is suitable for IoT applications? Discuss in detail. [6]
- b) Write a short note on AMQP protocol for IoT. [6]
  - c) Write a short note on “Zigbee” protocol. [6]





Total No. of Questions : 8]

SEAT No. :

P-460

[Total No. of Pages : 2

**[6003]-567**  
**T.E. (Honors)**  
**VIRTUAL REALITY (310701)**  
**(2019 Pattern) (Semester - I)**

*Time : 2½ Hours]*

*[Max. Marks :70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Explain in detail different geometric models? [9]  
b) What are axis angle representations of rotations? [8]

OR

- Q2)** a) Explain Implications for VR. [9]  
b) What is Orthographic projection and Perspective projection. [8]

- Q3)** a) What is Visual Perception? How to improve frame rates in Visual Perception. [6]  
b) Explain perception of motion in detail. [6]  
c) What is Rasterization? [6]

OR

- Q4)** a) Explain the structure of the Human Eye? [6]  
b) Explain Ray Tracing and Ray Casting. [12]

- Q5)** a) Explain the difference between tracking 2D and 3D orientation? [9]  
b) Explain Mismatched obstacles in VR. [8]

OR

**P.T.O.**

- Q6)** a) Explain motion in Real and virtual world. [9]  
b) What is tracking? Explain 3D tracking system. [8]

- Q7)** a) Write short on Auditory perception. [9]  
b) Explain with diagrams the physiology of human hearing. [9]

OR

- Q8)** a) Explain Locomotion and Manipulation for the interaction mechanism of virtual reality. [9]  
b) Explain Auditory rendering in detail. [9]



Total No. of Questions : 8]

SEAT No. :

P-461

[Total No. of Pages : 2

[6003]-568

**T.E. (Mechanical Engineering)**

**(Honors in Systems Engineering)**

**FOUNDATIONS OF SYSTEMS AND SYSTEMS ENGINEERING**

**(2019 Pattern) (Semester - I) (302041MJ)**

*Time : 2½ Hours]*

*[Max. Marks :70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7, or Q.8.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*

**Q1) a)** Describe Systems Science and demonstrate the interconnectedness among Systems Thinking, the General Systems Approach, and their application in Engineered Systems. **[9]**

b) Enumerate the various stages comprising the life cycle of a system, accompanied by an illustrative diagram. **[9]**

OR

**Q2) a)** Provide concise explanations on systems complexity and the concept of emergence within the field of System Engineering. **[9]**

b) Demonstrate the interconnection between the System of Internet (SOI), enabling systems, and the remaining systems present within the operational environment. **[9]**

**Q3) a)** Elaborate on the process of defining architecture, accompanied by an IPO diagram for visual representation. **[9]**

b) Enlist and provide an explanation of the different types of system architecture. **[8]**

OR

**P.T.O.**

- Q4)** a) Write short notes on Architectural views. [8]  
b) Briefly describe the development and traceability of architecture. [9]
- Q5)** a) Define MBSE (Model-Based systems Engineering) and illustrate the progression of MBSE over time. [9]  
b) Elaborate on the significance of System Modeling Language (SysML) and showcase its practical application in system modeling. [9]

OR

- Q6)** a) Illustrate the fundamental structure of SysML using a clear diagram while providing an accompanying explanation. [9]  
b) Provide concise explanations on the topics of modeling, simulation, and trade-off analysis. [9]
- Q7)** a) Illustrate the application of simulation modeling within the Systems Engineering (SE) lifecycle. [8]  
b) Provide brief explanations on the foundations of quantitative modeling. [9]

OR

- Q8)** a) Elaborate on the significance of modeling in the process of decision-making. [8]  
b) Provide concise explanations on System Dynamics Modeling. [9]



Total No. of Questions : 8]

SEAT No. :

P-462

[Total No. of Pages : 2

[6003]-569

T.E. (Semester - I)

Honors In Energy Management In Utility Systems

ENERGY MANAGEMENT

(2019 Pattern) (302021MJ)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.

**Q1)** a) Explain briefly schemes of BEE under energy conservation act-2001. [10]

b) What do you understand by designated consumers? [8]

OR

**Q2)** a) Discuss National Action Plan on Climate Change (NAPCC). [10]

b) How sustainable development is possible with energy efficiency programs? [8]

**Q3)** a) Explain ten steps methodology to carryout detailed energy audit.[10]

b) Define 'Energy management' and state the objectives of energy management. [7]

OR

**Q4)** a) List the different instruments used for energy audit along with their applications. [10]

b) What is need of Energy Audit? What are different types of Energy Audit? [7]

**Q5)** a) Write a note on Risk and sensitivity analysis. Discuss factors considered for sensitivity analysis. [10]

b) Explain simple payback period. What are the limitations of it? [8]

OR

P.T.O.

**Q6)** a) Annual savings after replacement of boiler for three years is Rs. 5,00,000, Rs. 5,50,000, Rs. 6,50,000. Total project cost is Rs 13.5 lakh. Considering cost of capital as 10%, what is the net present value of the proposal. [10]

b) Explain 'Internal Rate of Return' method of financial analysis with its advantages and disadvantages. [8]

**Q7)** a) Discuss Kyoto Protocol and role of developing countries in the implementation of protocol. [10]

b) Write short note on Carbon credits. [7]

OR

**Q8)** a) Explain in detail about Ozone Layer depletion process and its various effects. [10]

b) Discuss environmental impacts due to conventional energy use. [7]



Total No. of Questions : 8]

SEAT No. :

P-463

[Total No. of Pages : 2

[6003]-570

T.E. (Semester - I)

Honors In Electric Vehicles

E-VEHICLE TECHNOLOGY

(2019 Pattern) (302021MJ)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Draw the neat sketch wherever necessary.

- Q1)** a) Write a short note on li-ion battery with its working principal? [4]  
b) What are the different chemistries of li-ion batteries? Make its comparative analysis on basis of power, energy and lifespan? [8]  
c) Explain the advantages and disadvantages of li-ion batteries. [8]

OR

- Q2)** a) What are the Lithium ion battery charging precautions? [4]  
b) What is battery cell balancing? Explain the Issues and remedies for battery balancing. [8]  
c) What are the effects of overcharging and termination voltage accuracy on pack capacity of li-ion battery? Explain with suitable graph. [8]

- Q3)** a) Compare lead acid and li-ion batteries on basis of following parameters. [8]

- i) access and expensive
  - ii) energy efficiency
  - iii) temperature performance
  - iv) weight
  - v) life cycle
  - vi) energy density
  - vii) power density
  - viii) self discharge rate
- b) Explain lead acid batteries with advantages, disadvantages and applications. [8]

OR

P.T.O.

- Q4)** a) Explain Nickel-Metal Hydride Batteries with advantages, disadvantages and applications. [8]
- b) Explain Li-ion supercapaciter with advantages, disadvantages and applications. [8]

- Q5)** a) What do you mean by drive system in electric vehicles? Explain with its significance for manufacturers and drivers. [8]
- b) Write in short different types of motors used in electric vehicle? Differentiate between AC motors and DC motors. [8]

OR

- Q6)** a) What are the factors to be considered while Selection and sizing of the motor? [8]
- b) Explain different types of drives used in electric vehicle with neat sketches. [8]

- Q7)** a) Explain the significance of implementation of IOT in electric vehicle on basis of Intelligent transportation applications? [10]
- b) Write a short note on Recycling Technology of Waste Batteries? [8]

OR

- Q8)** a) Explain the Significance of IOT for modes of fast and efficient charging in electric vehicles. [8]
- b) Write a short note on Charging algorithms for fast and efficient charging? [10]





Total No. of Questions : 8]

SEAT No. :

P-464

[Total No. of Pages : 2

[6003]-571

T.E. (Semester - I)

Honors In 3D Printing

**ADDITIVE MANUFACTURING TECHNOLOGY**

**(2019 Pattern) (302011MJ)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Draw suitable Neat diagrams, whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Explain with neat sketch working principle and process parameters of Stereolithography (SLA) additive manufacturing technology. [10]
- b) List out benefits and drawbacks of Digital Light Processing (DLP).[8]

OR

- Q2)** a) Sketch and explain Continuous Liquid Interface Production (CLIP) additive manufacturing technology. [10]
- b) Write the advantages, disadvantages and applications of light-based photo curing technologies. [8]
- Q3)** a) Explain with neat sketch process mechanism and parameters of Electron-Beam Melting (EBM) process. [10]
- b) Enlist materials used in laser based melting additive manufacturing technologies and state their applications in various industries. [7]

OR

- Q4)** a) Explain with neat sketch process mechanism and parameters of Selective Laser Sintering (SLS) process. [10]
- b) What are the advantageous and limitations of Direct Metal Laser Sintering (DMLS). [7]

**P.T.O.**

- Q5) a)** Explain with neat sketch working principle and steps in manufacturing of parts using binder-jetting process. **[10]**
- b)** Differentiate between Directed Energy Deposition and Powder Bed Fusion technologies. **[8]**

OR

- Q6) a)** Explain with neat sketch working, materials used and applications of Electron Beam-based Directed Energy Deposition process. **[10]**
- b)** Write a short note on Multi-Jet Modeling 3D printing with its advantageous and disadvantages. **[8]**
- Q7) a)** What are the applications of additive manufacturing technology in aerospace and automotive industry? **[10]**
- b)** Explain the biomedical applications of additive manufacturing technology. **[7]**

OR

- Q8) a)** Explain the applications of additive manufacturing technology in fashion and jewellery industry. **[10]**
- b)** Explain the applications of additive manufacturing technology in Construction, Architectural sector. **[7]**



Total No. of Questions : 8]

SEAT No. :

P-465

[Total No. of Pages : 2

[6003]-572

T.E. (Honors)

ROBOTICS

Principles of Robotics - I

(2019 Pattern) (Semester - I) (304181HR)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Draw sketches where required.

- Q1)** a) Explain with neat sketch mechanical grippers. [6]  
b) State the factors in selection & Design of grippers. [6]  
c) Classify grippers based on various criteria. [6]

OR

- Q2)** a) State and explain various tools used as end effectors. [6]  
b) Explain with neat sketch tactile sensor gripper. [6]  
c) Explain with neat sketch vacuum grippers. [6]

- Q3)** a) Explain with neat sketch LVDT sensor. [6]  
b) Explain with neat sketch Piezo electric sensor. [5]  
c) Explain with neat sketch construction of range sensors. [6]

OR

- Q4)** a) Explain with neat sketch force sensors. [5]  
b) Explain working principles of capacitive sensors. [6]  
c) Explain with neat sketch touch sensors. [6]

P.T.O.

- Q5)** a) Enlist steps in forward kinematic analysis. [6]  
b) Explain with neat sketch D.H. parameter. [6]  
c) Define joint coordinates of a robot. [6]

OR

- Q6)** a) Write a short note on Jacobian transformation with one example. [6]  
b) Compare, illustrate & explain direct & inverse dynamics applicable to Robotics alongwith its applications. [6]  
c) A 2-DOF planar R-R- manipulator has  $L_1 = 120\text{mm}$ , &  $L_2 = 75\text{mm}$ . Determine joint angles using geometric approach. So that face end is located at (100,70). [6]
- Q7)** a) Explain various image processing techniques in robotics. [6]  
b) State & explain economic aspects in robotics. [5]  
c) What are the application of robots in industry. [6]

OR

- Q8)** a) What is robot safety. Explain 5 groups of humans that are at direct injury from robot. [8]  
b) Write notes on : any (2) [9]  
i) Agriculture  
ii) Home sector  
iii) Research & exploration



Total No. of Questions : 8]

SEAT No. :

P-466

[Total No. of Pages : 2

[6003]-573

T.E. (Semester - I)

Honors In Block Chain Technology

INTRODUCTION TO BLOCK CHAIN

(2019 Pattern) (304181HBCT)

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

**Q1)** a) What are the four core components of block chain? Explain in detail. [9]

b) Explain any one case study of block chain technology in detail. [9]

OR

**Q2)** a) Explain the different types of block chain structures. In detail. [9]

b) What is permission and permissionless blockchain? Explain permissionless block chain in detail. [9]

**Q3)** a) What are the major components in hyper ledger fabric? List and explain. [9]

b) Explain any one prominent application of blockchain in detail. [9]

OR

**Q4)** a) What is a bitcoin? Explain the bitcoin mechanism in blockchain. [9]

b) Explain the “smart contract” w.r.to hyper ledger in detail. [9]

**P.T.O.**

- Q5)** a) What is multichain in blockchain? Explain how it works. [9]  
b) Explain following w.r.to blockchain technology. [8]  
i) Ripple  
ii) Stellar

OR

- Q6)** a) What is API in blockchain? Explain in detail. [9]  
b) What are the two basic types of transactions in R3 corda? Explain. [8]
- Q7)** a) What is the importance of blockchain in election and voting system? Explain in detail. [9]  
b) Explain the supply chain management system w.r.to blockchain technology. [8]

OR

- Q8)** a) How the Blockchain is used in land Records? Explain in detail. [9]  
b) What is “Royalty Reward Program” in Blockchain technology? List its benefits. [8]



Total No. of Questions : 10]

SEAT No. :

P-467

[Total No. of Pages : 2

**[6003]-574**  
**T.E. (Semester - I)**  
**Honors In Metro Construction**  
**SURVEYING IN METRO CONSTRUCTION**  
**(2019 Pattern) (301301)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 Q.7 or Q.8 and Q.9 or Q.10.*
- 2) Neat diagram must be draw wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary and clearly state.*
- 5) Use of cell phone is prohibited in the examination hall.*

- Q1)** a) Explain Steps involved in Preliminary surveys. [7]  
b) Explain in brief the modern surveying techniques adopted for difficult terrain. [7]

OR

- Q2)** a) Explain in brief Criteria's for selection of Good Alignment for metro.[7]  
b) Explain Photogrammetry in modern surveying with its advantages.[7]

- Q3)** a) Explain the requirements of good track for metro. [7]  
b) Explain in brief stresses acting on rails of metro. [7]

OR

- Q4)** a) Explain in brief the term Track Modulus and its types. [7]  
b) Explain in brief photo-elastic Method. [7]

- Q5)** a) Explain the term Architectural design in Metro station. [7]  
b) Explain the functions of Main Building Areas for different Types of Metro Stations. [7]

OR

- Q6)** a) Explain the construction types of Metro station. [7]  
b) Explain the criteria are for selection of Site for a Metro Railway Station. [7]

**P.T.O.**

- Q7)** a) Explain various methods for 'Tunnel ventilation' [7]  
b) Explain maintenance of permanent way is important? [7]

OR

- Q8)** a) Enlist advantages and disadvantages of tunnels. [7]  
b) Why drainage is necessary in tunnel? Discuss various drainage systems for Tunnel. [7]

- Q9)** a) Enlist the various factors controlling the alignment of metro track. Explain any two in detail. [7]  
b) Write short note on 'Safety Precautions in tunneling'. [7]

OR

- Q10)** a) Explain the objectives in station planning of Metro Stations? [7]  
b) Explain different types of gradient used in metro construction. [7]





Total No. of Questions : 8]

SEAT No. :

P-468

[Total No. of Pages : 2

[6003]-575

T.E. (Civil)

**Honors In “Architecture And Town Planning”  
Urban Housing And Infrastructure Planning  
(2019 Pattern) (Semester - I) (301401)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagram must be draw wherever necessary.*
- 4) *Assume suitable data, if required.*

- Q1)** a) Describe the housing demand model. [6]  
b) Explain in detail objectives and function of housing board HUDCO.[6]  
c) What is the need of Housing Policies to fulfill demand of housing.[5]

OR

- Q2)** a) Elaborate the role of Cooperative Housing sectors. [6]  
b) Explain the strategy of Rural Housing Finance. [6]  
c) What are the advantages of Housing Finance Institutions (HFIs)? Write down the name of any four HFIs in India. [5]

- Q3)** a) Enlist types of urban infrastructure and explain any one in detail. [6]  
b) Write a note on “Financial aspect for water supply system”. [6]  
c) Which factors affect while planning of urban infrastructure. [5]

OR

- Q4)** a) How urban infrastructure change overall scenario of land as well as community. [6]  
b) What are the norms and financial strategy follow while planning of infrastructure activity. [6]  
c) Write a short note on area allocation for any two infrastructure activity as per URDPFI. [5]

**P.T.O.**

- Q5)** a) Explain the different components of storm water drainage system. [6]  
b) How to design water and drainage network to urban area. [6]  
c) What is the significance of urban services. [6]

OR

- Q6)** a) Explain in detail Municipal Solid Waste Management Plan. [6]  
b) Which are the techniques used to generate cost recovery from infrastructure. [6]  
c) Which are the components and appropriate technology required for planning of road network activity. [6]

- Q7)** a) Which factors to be considered while planning of city network scenario. [6]  
b) Write a note on “National Urban Sanitation Policy-2008”. [6]  
c) Explain in detail policies and norms of any one infrastructural network. [6]

OR

- Q8)** a) Write a note on “National Water Policy-2012”. [6]  
b) How infrastructure city network scenario affect on land use pattern of city. [6]  
c) Enlist different categories of green space and its norms as per URDPFI guidelines. [6]



Total No. of Questions : 8]

SEAT No. :

P-469

[Total No. of Pages : 2

[6003]-576

**T.E. (Printing Engineering)**  
**(Honor's in Advanced Packaging Technology)**  
**INTERNET OF THINGS**  
**(2019 Pattern) (Semester - I) (308211)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data, if required.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** a) Define sensors and Explain the working of any two types of sensors used in IOT application. [9]

b) Explain the LED interfacing using Arduino Board. [9]

OR

**Q2)** a) Define Actuator and Explain the working of any two types of actuator used in IOT application. [9]

b) Explain the servo-motor interfacing using Arduino Board [9]

**Q3)** a) Explain the Wi-Fi Communication system and explain the FHSS and DSSS technique used in WiFi. [8]

b) Explain the pinouts of ESP8266 [9]

OR

**Q4)** a) Explain what is web-server and mention the steps to be taken for posting the sensor data to the web-server. [8]

b) Explain the features and advantages of ESP 8266. [9]

**P.T.O.**

**Q5)** Describe the types and cloud services in detail for IOT applications [18]

OR

**Q6)** Describe the issues and challenges in IOT. [18]

**Q7)** Describe in detail about the industrial IOT and its applications. [17]

OR

**Q8)** Explain implementation of IOT in Printing industry. [17]



Total No. of Questions : 8]

SEAT No. :

**P470**

**[6003] - 577**

**[Total No. of Pages : 3**

**T.E. (Computer Engineering) (Honors)**  
**ARTIFICIAL INTELLIGENCE AND MACHINE**  
**(2019 Pattern) (Semester - II) (310303)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1) a)** Explain Unification algorithm with suitable example. **[9]**

b) What is knowledge representation in propositional logic. Compare propositional logic and predicate logic. **[8]**

OR

**Q2) a)** Represent the following sentences into formulas in predicate logic, **[9]**

- i) John likes all kinds of food.
- ii) Apples are food.
- iii) Chicken are food.
- iv) Anything anyone eats and isn't killed by is food.
- v) Bill eats peanuts and is still alive.
- vi) Sue eats everything Bill eats.

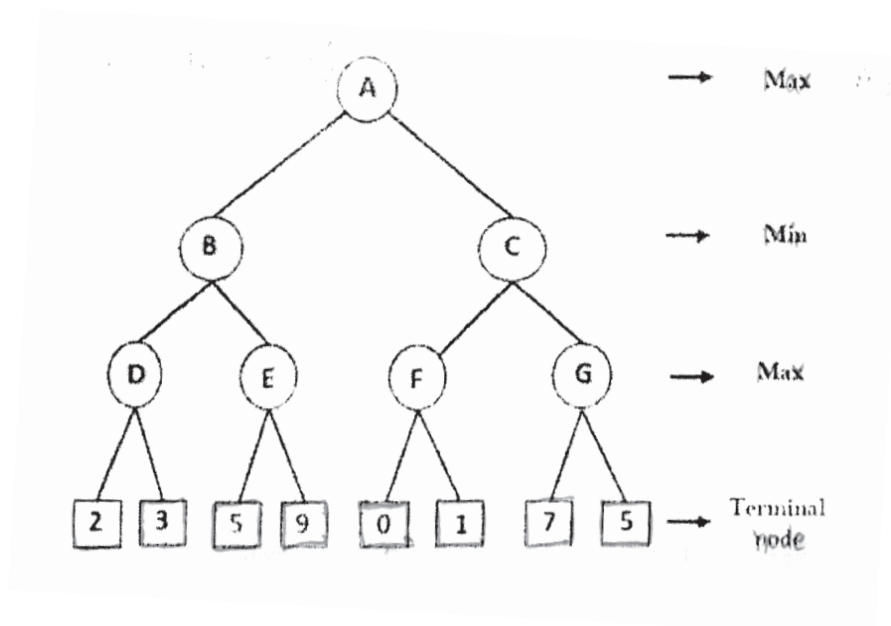
b) Explain various operators used in propositional logic for knowledge base building. **[8]**

**P.T.O.**

- Q3)** a) What is Artificial Neural Network? Give two applications of artificial neural networks in detail. [6]
- b) Explain how Decision Trees are used in Learning. [6]
- c) Explain how Support Vector Machines are used for classification with suitable example. [6]

OR

- Q4)** a) Explain [6]
- i) Supervised learning.
- ii) Unsupervised Learning.
- b) Explain the architecture of Artificial Neural Network. [6]
- c) With the help of an architecture diagram explain multilayer feed forward artificial neural network. [6]
- Q5)** a) Illustrate Mini-Max search for the tic-tac-toe game. [9]
- b) Solve given two player search tree using Alpha-beta pruning. [8]



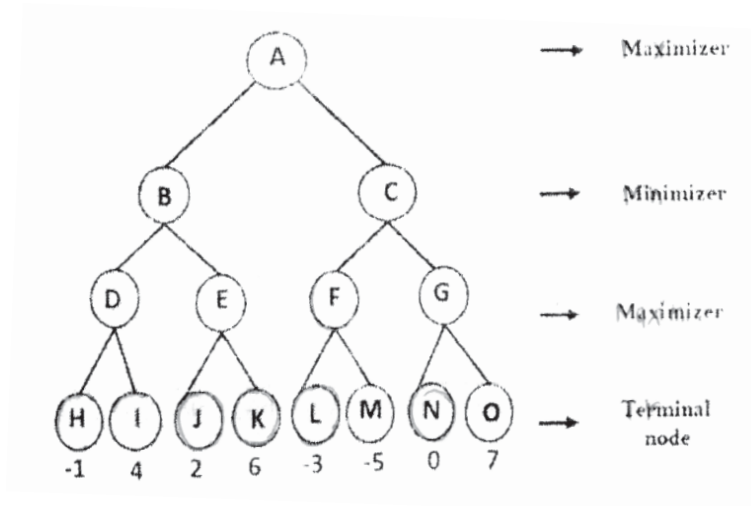
OR

**Q6) a)** Write a note on [9]

i) Types of Games in AI.

ii) State-of-the-art Game Programs.

**b)** Solve the given game tree using min max algorithm. [8]



**Q7) a)** Represent the architecture of an expert system. label the various components in the diagram and explain. [9]

**b)** What is NLP. Explain all five phases of NLP. [9]

OR

**Q8) a)** Explain the applications of Natural Language Processing. [9]

**b)** Explain forward chaining and backward chaining for a simple example.[9]



Total No. of Questions : 8]

SEAT No. :

**P471**

[Total No. of Pages : 2

**[6003]-578**  
**T.E. (Honors)**  
**CYBER SECURITY**  
**Enterprise Architecture and Components**  
**(2019 Pattern) (Semester - II) (310403)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt question Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Explain the following. **[9]**

- i) Business performance presentation services
  - ii) Embedded analytics
  - iii) Infrastructure security component
- b) List the components of information architecture. Explain information architecture in details along with its goals. **[9]**

OR

**Q2) a)** Describe component relationship diagram for enterprise information architecture (EIA) using various techniques from domains of enterprise application integration (EAI) and enterprise information integration (EII). **[9]**

- b) Describe internal and external components of information delivery channels. **[9]**

**Q3) a)** What is operational model? Explain various types of operational model level. **[9]**

- b) Discuss context of operational model design techniques. **[8]**

OR

**Q4) a)** What is service quality of MDM? Explain service quality in detail. **[9]**

- b) Explain standards used for operational model relationship diagram in brief. **[8]**

**P.T.O.**



**Q5)** a) Describe non-functional requirements and indicates their relevance in the metadata context. [9]

b) Explain metadata management component model with diagram. [9]

OR

**Q6)** a) What is metadata management? Describe metadata usage maturity levels. [9]

b) Describe subcomponents of the MDM services component. [9]

**Q7)** a) Describe enterprise security architecture in detail. [9]

b) Explain the TOGAF lifecycle and how TOGAF framework can be used to create the projects. [8]

OR

**Q8)** a) Explain SABSA lifecycle with example. [9]

b) Describe the principles of COBIT. [8]



Total No. of Questions : 8]

SEAT No. :

P-3662

[Total No. of Pages : 2

[6003]-579

T.E. (Computer Engineering) (Semester - II)

HONORS IN DATA SCIENCE

Statistics & Machine Learning

(2019 Pattern) (310503/310262)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of Scientific Calculator is permitted.

**Q1)** a) Write a short notes on : [9]

- i) Partial derivative
- ii) Multivariate calculus

b) What is the significance of chain rule in calculus? Explain chain rule with suitable Example. [9]

OR

**Q2)** a) Explain what it means for a function to be continuous and differentiable? [9]

b) What is the difference between Eigen value and Eigen vector? How do you find the Eigen value of a Eigen vector? [9]

**Q3)** a) List and Explain different types of machine learning. Explain any one model of machine learning? [9]

b) Difference between supervised and unsupervised learning? [8]

OR

**Q4)** a) What is machine learning? What are the Issues in Machine Learning?[9]

b) Draw and Explain Reinforcement Learning. Explain how does it work? [8]

P.T.O.

- Q5) a)** What are the different Types of Regression model? Explain any one regression type in brief with suitable example? [9]
- b) Explain cost function and gradient descent terms with respect to linear Regression algorithm? What is the significance of Initialization of weights? [9]

OR

- Q6) a)** What is the role of cross-validation in evaluating a regression model? [9]
- b) Explain the process of training a regression model using a dataset? [9]
- Q7) a)** What is Decision tree? What is the difference between a classification tree and a regression tree? [8]
- b) Explain with example hypothesis space search in decision tree learning? [9]

OR

- Q8) a)** What are the different types of Naive Bayes models, such as Gaussian, Multinomial, and Bernoulli? [8]
- b) What are advantages and disadvantages of NBmodel. What are various Applications of NBmodel? [9]



Total No. of Questions : 8]

SEAT No. :

**P472**

[Total No. of Pages : 2

**[6003]-580**

**T.E. (Computer Engineering) (Honors)**

**INTERNET OF THINGS**

**Internet of Things Architectures, Protocols and Systems Programming  
(2019 Pattern) (Semester - II) (310603)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Use of Non-Programmable scientific calculators is allowed.

- Q1)** a) Explain the difference between TCP and UDP Protocols? [6]  
b) Explain HTTP and CoAP in detail. [6]  
c) What are the responsibilities of transport layer in IoT? [5]

OR

- Q2)** a) Explain DCCP and SCTP protocol in detail. [6]  
b) Explain MQTT protocol architecture. [6]  
c) Explain transport layer security protocol? [5]

- Q3)** a) Explain IoT vulnerabilities and security challenges. [6]  
b) What are the misuse cases in IoT security? Explain. [6]  
c) Explain IoT Architecture with its layers? [6]

OR

- Q4)** a) Describe IoT security model. [6]  
b) Explain key elements in IoT security. [6]  
c) Explain the attacks in different layer of IoT. [6]

**P.T.O.**

- Q5)** a) Describe the components of Arduino. [6]  
b) Describe the role of Web/Cloud Services for IoT development. [6]  
c) Explain the use of APIs. [5]

OR

- Q6)** a) Describe the components of Raspberry Pi. [6]  
b) Explain essential features of web APIs. [6]  
c) Describe the components of Intel Galileo. [5]

- Q7)** a) Describe the role of IoT for Home Automation. [6]  
b) Describe the role of IoT for Agriculture applications. [6]  
c) Describe the role of IoT for Health and Lifestyle. [6]

OR

- Q8)** a) Describe role of IoT for Smart Cities development. [6]  
b) Describe the role of IoT for Industry. [6]  
c) Describe the role of IoT for Telecom/5G. [6]



Total No. of Questions : 8]

SEAT No. :

**P473**

[Total No. of Pages : 2

**[6003]-581**

**T.E. (Computer Engineering) (Honors)**  
**VIRTUAL REALITY AUGMENTED REALITY**  
**Augmented Reality**  
**(2019 Pattern) (Semester - II) (310703)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

- Q1)** a) Explain in detail role of Computer Vision in Augmented Reality. [9]  
b) Explain outdoor tracking in details. [8]

OR

- Q2)** a) Explain natural feature tracking by detection in augmented reality. [9]  
b) How pose estimation from Homography is done in marker tracking. Explain. [8]

- Q3)** a) Explain marker based tracking in details? [6]  
b) What are different types of markers? [6]  
c) What is scene generator? [6]

OR

- Q4)** a) Write note on: (Any 2) [6]  
i) Template markers  
ii) 2D barcode markers  
iii) Imperceptible markers  
b) When to use marker-based tracking. Explain. [6]  
c) How to select a marker type. Explain with respect to system requirement [6]

*P.T.O.*

- Q5)** a) Explain with diagram monitor based augmented reality display. [9]  
b) Explain different components of augmented reality. [8]

OR

- Q6)** a) Compare optical see-through and video see-through head mounted display. [9]  
b) Explain virtual retinal systems. [8]

- Q7)** a) Explain the working of SLAM technique. [9]  
b) What is mixed reality? Explain the different application of mixed reality.[9]

OR

- Q8)** a) Explain the difference between computer vision and mixed reality. [9]  
b) Explain parallel tracking and mapping (PTAM) in detail. [9]



Total No. of Questions : 8]

SEAT No. :

**P474**

[Total No. of Pages : 2

**[6003]-582**

**T.E. (Mechanical Engineering) (Honors)**  
**SYSTEMS ENGINEERING**  
**Model Based Systems Engineering**  
**(2019 Pattern) (Semester - II) (302043 MJ)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** List and explain the Behavioral features of a block. **[9]**

b) Differentiate between Diagram and Model with Example. **[9]**

OR

**Q2) a)** Write short notes on SysML diagrams. **[9]**

b) Describe the structural features of a block. **[9]**

**Q3) a)** Write short notes on MBSE Methodology. **[9]**

b) Explain the OOSEM approach with neat sketch. **[8]**

OR

**Q4) a)** Write down the difference between Modeling tool and diagramming tool. **[9]**

b) Write short notes on Requirements Interchange Format (ReqIF). **[8]**

**Q5) a)** Describe Process properties and problems associated with process. **[9]**

b) Explain in brief process library and process stakeholders. **[9]**

OR

**P.T.O.**



- Q6)** a) Explain V-model with an example. [9]  
b) Explain the frame work context view in brief. [9]

- Q7)** a) Explain the Typical properties of a requirement. [8]  
b) List and explain the main views of Approach to Context- based Requirements Engineering (ACRE) that are needed according to the framework with a neat sketch. [9]

OR

- Q8)** a) Write short notes on Requirement Validation. [8]  
b) Write short notes on the model-based requirements engineering ontology with a neat sketch. [9]



Total No. of Questions : 8]

SEAT No. :

**P 475**

[Total No. of Pages : 2

**[6003]-583**

**T.E. (Mechanical) (Honors)**

**ENERGY MANAGEMENT IN UTILITY SYSTEM**

**Energy Efficiency in Thermal Utilities**

**(2019 Pattern) (Semester - II) (302023 MJ)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right of each question indicate full marks.*
- 4) Assume suitable data wherever necessary and mention the same clearly.*

**Q1) a)** Explain working of mechanical float type trap with neat schematic diagram. **[10]**

b) What are the advantages of condensate system in process industry? **[8]**

OR

**Q2) a)** Write in detail about “flash steam recovery” from steam condensate. **[10]**

b) Explain why steam is used as a heat transfer medium. **[8]**

**Q3) a)** What is refractory? Discuss properties of the refractory used in furnace. **[10]**

b) Discuss factors on which furnace wall losses depends. **[7]**

OR

**Q4) a)** List applications of furnaces. Explain typical furnace with neat diagram. **[10]**

b) What is the role of insulation in furnace? Explain any five important properties of Ceramic Fibers used in furnaces. **[7]**

**Q5) a)** Explain the concept of cogeneration. Compare “Topping Cycle” and “Bottoming Cycle” with one example each and schematic diagram. **[10]**

b) List down all the Important Technical Parameters for Cogeneration plant. **[8]**

OR

**P.T.O.**

- Q6)** a) Explain steam turbine and gas turbine cogeneration system with schematic diagram. [10]  
b) Differentiate “Back Pressure Turbine” and “Extraction Condensing Turbine with suitable sketches. [8]

- Q7)** a) Explain the role of economizer in steam generation with schematic diagram. [10]  
b) What are the direct and indirect benefits of waste heat recovery? [7]

OR

- Q8)** a) Discuss waste heat recovery boilers? Explain the need and benefits?[10]  
b) What is a “heat pipe”? How does it work? [7]



Total No. of Questions : 8]

SEAT No. :

**P 476**

[Total No. of Pages : 2

**[6003]-584**

**T.E. (Mechanical/ Automobile) (Honors)**  
**ELECTRIC VEHICLES**  
**E-Vehicle System Design**  
**(2019 Pattern) (Semester - II) (302033 MJ)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw the neat sketch wherever necessary.*

- Q1)** a) Explain electronic breaking system with its features and benefits in electric vehicles? **[4]**
- b) Explain in short steel wheel and alloy wheels and Differentiate between steel wheel and alloy wheels on basis of, **[8]**
- i) Cost and durability
  - ii) Environmental working conditions
  - iii) Area of applications
  - iv) Effect on suspension system
- c) Explain the need for Capacitor Banks or Ultra Capacitors in regenerative breaking on electric vehicles. **[8]**

**OR**

- Q2)** a) List out various defects in tires? **[4]**
- b) Elaborate the factors affecting on following while design the vehicles?**[8]**
- i) Driver
  - ii) Environment
  - iii) Load
  - iv) Type of Vehicle
- c) What do you mean by traction motor? Explain its significance with neat sketch in electric vehicles? **[8]**

**P.T.O.**

- Q3) a)** Explain the following terms (any two) [8]
- i) The open differential
  - ii) Torsen Differential
  - iii) Active differential
  - iv) Welded/Spool Differential
- b) Explain the significance of transmission component system design in detail? Explain the role of case, a drive part and a shift control device in transmission system? [8]

OR

- Q4) a)** Classify different types of transmission system used in automobiles? Explain hybrid electric vehicle transmission in detail? [8]
- b) Explain the Influence of effective case depth on bending fatigue strength and shot peening strengthening and residual compressive stress on tooth surface? [8]

- Q5) a)** What do you mean by battery layout? Explain lead acid battery layout with neat sketch? [8]
- b) Explain Constructional details of cell design related to Batteries? [8]

OR

- Q6) a)** Explain the process of degradation modeling and analysis? [8]
- b) Explain Battery Compartment Design for Crashworthiness and Cooling? [8]

- Q7) a)** Explain Ergonomics based Roll-cage/Frame design with neat sketches? [10]
- b) Explain Structural Design aspect of Roll-cage/Body-Frame? [8]

OR

- Q8) a)** Explain the importance and process involved in Impact/Crash Analysis? [8]
- b) What do you mean by vehicle dynamics? Explain the components of vehicle dynamics with? [10]



Total No. of Questions : 8]

SEAT No. :

**P 477**

[Total No. of Pages : 2

**[6003]-585**

**T.E. (Mechanical Engineering) (Honors)**

**3D PRINTING**

**Design for Additive Manufacturing  
(2019 Pattern) (Semester - II) (302013 MJ)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1) a)** Explain distortion control methods in AM? Write a short note on Composition and phase transformation in process monitoring and control of Additive manufacturing. **[9]**

**b)** What are limitations of Additive Manufacturing? How the defects in the Additive Manufacturing can be rectified? **[9]**

**OR**

**Q2) a)** What is form fit function? Why they are important? Explain with the help of suitable example. **[8]**

**b)** Explain any two defects and its rectification in 3d printing. **[6]**

**c)** Write a short note on residual stresses in additive manufacturing. **[4]**

**Q3) a)** Write a short note on **[9]**

i) Support Material

ii) Sanding

iii) Hot isostatic processing

**b)** Write Classification and types of Slicing. Explain any one Slicing strategy in detail. **[8]**

**OR**

**P.T.O.**

- Q4)** a) What are different types of post processing methods for additive manufacturing? Explain support removal techniques with its advantages and disadvantages. [7]
- b) Explain Path Sequencing Strategy in detail. [6]
- c) Explain 3D slicing classification with suitable diagram. [4]

- Q5)** a) What are various AM CAD Data/file formats for Engineering and Non-Engineering Applications? What are the issues faced during 3D model Creation. [9]
- b) What are various Infill Structure techniques? How selection of Infill Structure technique affects Printed components? [9]

OR

- Q6)** a) Write a short note on [8]
- i) Finite Element Analysis (FEA)
- ii) Computation Fluid Dynamics (CFD)
- b) Explain any three-file format used in 3D printing. [6]
- c) Explain CAD specific and material specific ISO standards. [4]

- Q7)** a) Write a short note on Scanned Geometry Refinement. How repairing is done of scanned geometry? [8]
- b) How scanning is done in Reverse Engineering? What are 3D scanners? Write classification of Scanners. [9]

OR

- Q8)** a) What is reverse engineering? Describe application of reverse engineering in various fields. [8]
- b) Write a short note on “NURBS”. [5]
- c) Explain any two measuring devices in reverse engineering. [4]



Total No. of Questions : 8]

SEAT No. :

P-478

[Total No. Of Pages : 2

**[6003]-586**  
**T.E. (E & TC)**  
**HONORS IN ROBOTICS**  
**Robot Programming & Simulation**  
**(2019 Pattern) (Semester-II) (304183)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Figures to the right indicates full marks.*

- Q1)** a) Explain in detail robot language structure. Using VAL language, explain the structure of the program for a typical pick and place operation. [6]
- b) Explain any four VAL programming commands with example. [6]
- c) With schematic diagram, explain the robotic applications in welding industry. [6]

OR

- Q2)** a) Explain the four statements of VAL robot programming language. List the commands used in VAL programming and describe its functions.[6]
- b) Explain Wait, DELAY, SIGNAL commands with suitable examples. [6]
- c) List the commands used in VAL II programming and describe its functions. [6]

- Q3)** a) List and explain program control statement in AML [6]
- b) Explain manual and automatic mode of operation of industrial robot. [6]
- c) Explain the various Move master commands with example. [5]

OR

*P. T. O*



- Q4)** a) List and explain the sensor commands used in AML language with example. [6]
- b) Describe the elements and function used in AML robotic language. [5]
- c) Which syntax move master command language uses? List and explain different types of commands. [6]

- Q5)** a) What is robotic process automation? Explain with an example. [6]
- b) Describe use of Computer vision, Augmented Reality & Virtual Reality in robotics. [6]
- c) Discuss how collision detection works in robotics. [6]

OR

- Q6)** a) Write in brief about robot work planning. [6]
- b) Why is repeatability of robot is important explain in detail? [6]
- c) Describe in brief about robot studio online software. [6]
- Q7)** a) Explain basic steps in simulation with example. [6]
- b) Write in brief about Monte Carlo method of simulation. [6]
- c) Distinguish between hybrid and Analog model. [5]

OR

- Q8)** a) Write classification of simulation software [6]
- b) Write in brief about cobweb models continuous models. [6]
- c) Write in brief about distributed lag models. [5]



Total No. of Questions : 8]

SEAT No. :

P-479

[Total No. Of Pages : 2

**[6003]-587**

**T.E. (Electronics&Telecommunication)**

**(Honors)**

**Decentralize & Blockchain Technologies**

**(2019 Pattern) (Semester-II) (304183)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*

**Q1)** a) What is consensus algorithm? Explain any one type of consensus algorithm in detail. [6]

b) With the help of a neat sketch, define the Proof of Elapsed Time (PoET). [6]

c) Explain terms i) Proof of Activity ii) Proof of Burn. [6]

OR

**Q2)** a) Describe scaling process in Ethereum. [6]

b) Explain the terms i) Ethereum Clients ii) Ethereum Wallets [6]

c) What is the Difference Between Bitcoin and Ethereum Blockchain? [6]

**Q3)** a) What is Proof of stake? Narrate with example. [6]

b) What are hash functions and Hash puzzles? [6]

c) What are Blocks in a Blockchain? Enlist the disadvantages of Proof of work. [6]

OR

*P. T. O*

- Q4)** a) What Are the Real-World Use Cases of Ethereum? [6]  
b) Write short note on Smart Contract. [6]  
c) How are Ethereum keys generated? [6]

- Q5)** a) Express the selection process of Block-chain technology in detail. [8]  
b) What are the most important opportunities for deploying blockchain technology in business? Explain one in detail. [9]

OR

- Q6)** a) What are the factors to consider when choosing Blockchains? Explain two factors in detail. [8]  
b) What is the goal of blockchain? How does blockchain help in decision making? [9]
- Q7)** a) Explain how blockchain used in Medical record management system? [8]  
b) Why do we need Block-chain? Explain private Block-chain Network in detail. [9]

OR

- Q8)** a) How does IoT work with block-chain? Enlist Benefits of IoT and block-chain. [8]  
b) Write short note on future of Block-chain, along with one application. [9]



Total No. of Questions : 10]

SEAT No. :

P-480

[Total No. of Pages : 2

**[6003]-588**

**T.E. (Civil Engineering)**

**HONORS IN METRO CONSTRUCTION**

**Planning & Quantity Estimation for Metro Construction**

**(2019 Pattern) (Semester - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary and clearly state.*
- 5) Use of cell phone is prohibited in the examination hall.*
- 6) Use of electronic pocket calculator is allowed.*

- Q1)** a) Explain the objectives of Land Acquisition Act 2013? [7]  
b) Define the Procedure for land acquisition? [7]

OR

- Q2)** a) Explain 3G and 3H in land acquisition? [7]  
b) Explain the types of Land acquisition? [7]

- Q3)** a) Prepare detailed estimate of Elevated section (viaduct). [7]  
b) Explain the steps involved in construction of Underground section by Cut and Cover. [7]

OR

- Q4)** a) Prepare detailed estimate of Underground station (Civil work). [7]  
b) Explain the steps involved in construction of Elevated station (E&M work including lift and escalator). [7]

*P.T.O.*

- Q5)** a) Which factors are influencing the investment decision? [7]  
b) Enlist capital budgeting techniques and explain any 2 in brief. [7]

OR

- Q6)** a) Define the concept of cost of capital. State how you would determine the weighted average cost of capital of firm. [7]  
b) Explain the Risk identification techniques? [7]

- Q7)** a) Explain the Financial Support for PPPs in Infrastructure. [7]  
b) Explain types of contract documents used for construction. [7]

OR

- Q8)** a) Describe types of Construction Contract Specifications. [7]  
b) Explain cost of capital and its implications in budgeting decisions. [7]

- Q9)** a) Explain Impact of LARR Act, 2013 on infrastructure projects. [7]  
b) Define Changes proposed in the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill, 2015? [7]

OR

- Q10)** a) Explain the rules for land acquisition? [7]  
b) Explain the benefits of land acquisition? [7]



Total No. of Questions : 8]

SEAT No. :

P-481

[Total No. of Pages : 2

**[6003]-589**

**T.E. (Civil Engineering)**

**ARCHITECTURE AND TOWN PLANNING**

**Honors: Sustainable Architecture And Landscape Design**

**(2019 Pattern) (Semester - II) (301403)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain in detail any three benefits of Eco city. [6]
- b) Elaborate in detail various phases of development of water bodies. [6]
- c) What is green building? What concepts make green building, a sustainable building? [5]

OR

- Q2)** a) Write down the advantages of green belt and enlist the various factors which influence the design of green belt. [6]
- b) Write a note “smart city”. [6]
- c) Write a note on green residential cluster. [5]

- Q3)** a) Write a note on : Environmental factors in landscaping. [6]
- b) What is behavioral science in landscape design? Explain in detail. [6]
- c) Write a note on “Landscape suitability analysis”. [5]

OR

*P.T.O.*

- Q4)** a) Enlist various principles of landscape planning and explain any two in detail. [6]  
b) Explain any two types of subsurface drainage systems with neat sketch.[6]  
c) Write a note on “landscape assessment”. [5]

- Q5)** a) Draw a typical cross section of green roof. Also explain the function of each component. [7]  
b) Which are the main factors affecting landscaping? Explain in detail. [6]  
c) Write a note of “Impact of landscape on environment”. [5]

OR

- Q6)** a) What are different purposes and concerns of landscape? [6]  
b) Explain in detail the process of landscape planning. [6]  
c) Mention the components of landscape architecture and explain any one.[6]

- Q7)** a) Elaborate the concept of industrialized areas as landscape and treatment to be offered. [6]  
b) In what way landscape is developed in urban area? [6]  
c) Write a note on following : [6]  
Landscape treatment for water logged areas.

OR

- Q8)** a) Elaborate the means of improving landscape of existing road. [6]  
b) In what way landscape is developed in rural area? [6]  
c) Write a note on following: [6]  
i) Landscape treatment for coastal area.  
ii) Landscape treatment for desert area.



Total No. of Questions : 8]

SEAT No. :

P-3170

[Total No. of Pages : 2

[6003]-590

T.E. (Printing)

HONORS : SMART PACKAGING

(2019 Pattern) (Semester - II) (308213)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Neat diagrams must be drawn wherever necessary.

- Q1)** a) State the basic concepts of active and intelligent packaging. [7]  
b) What is interactive packaging? [10]

OR

- Q2)** a) What are advantages of smart packaging? [6]  
b) What is smart packaging? Describe in detail active packaging? [11]

- Q3)** a) Name five RFID application in daily life and describe the principle and functioning of anyone. [12]  
b) Name the three radio frequency bands which are used for RFID communication and frequencies used. [6]

OR

- Q4)** a) State the classification of RFID tags based on frequency, power source and chip. [6]  
b) State the different types of RFID tags available in the market. Briefly explain the utility of each type. [12]

P.T.O.



- Q5)** a) Explain the working principle of operation of NFC. Name the different modes of operations of NFC systems. [11]  
b) Briefly explain any three NFC applications. [6]

OR

- Q6)** a) Name the different modes of operations of NFC systems. [7]  
b) Name the different types of NFC tags. What are the advantages of NFC as compared to RFID systems? [10]

- Q7)** a) Give examples use of intelligent packaging in pharma packaging. [12]  
b) Describe any implementation stage of smart packaging in a pharma packaging industry. [6]

OR

- Q8)** a) Give an over view of smart packaging in the food industry. [6]  
b) Describe the stages of implementation for smart packaging for food packaging. [12]



Total No. of Questions : 10]

SEAT No. :

**P2806**

[Total No. of Pages : 2

**[6003]-601**

**T.E. (Civil)**

**HYDROLOGY AND WATER RESOURCES ENGINEERING**

**(2015 Pattern) (Semester-I) (301001)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagram must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** In a basin a 10 hrs storm rainfall gives the following depths. **[5]**

Rainfall (hr)	1	2	3	4	5	6	7	8	9	10
Depth of Water (cm)	2.0	2.75	6.5	4.0	9.5	5.0	8.2	10.0	5	1.5

The surface run off resulting from the above storm is equivalent to 22.5 cm of depth over the basin. Calculate average infiltration index for the basin.

b) Explain the different factors affecting evaporation of water from reservoir. **[5]**

**OR**

**Q2) a)** Explain Application of Hydrology. **[5]**

b) State deltas for gram, maize, sugarcane, rice and cotton also explain methods to improve duty. **[5]**

**Q3) a)** Determine the capacity of reservoir from the following. Data. The CCA is 80,000 hectares. Assume canal and reservoir losses as 5% and 10% respe. **[5]**

Crop	Baseperiod (days)	Duty (hect/cumecs)	Intensity of irrigation %
Rice	120	1800	25
Wheat	150	2000	30
Sugarcane	320	2500	20

b) Derive the formula to calculate discharge of a well in a confined aquifer. **[5]**

**OR**

**P.T.O.**

- Q4) a)** List various methods of assessing canal revenue. Explain volumetric basis method with merits & demerit. [5]
- b)** What is duty? State factors affecting & explain methods of improving duty. [5]

- Q5) a)** Define unit hydrograph. State factors affecting the unit hydrograph. Explain the components with the help of sketch. [8]
- b)** Given below are the observed flow from a storm of 6 hr duration on a stream with a drainage area of 316 sq. km. Assume a constant base flow of 17 cumecs. derive and plot a 6 hr duration unit hydrograph. [8]

Time (h)	0	6	12	18	24	30	36	42
Ordinate of 6 h UH (m <sup>3</sup> /s)	17	113.2	254.5	198	150	113.2	87.7	67.9

48	54	60	66	72
53.8	42.5	31.1	22.64	17

OR

- Q6) a)** What is S curve hydrography? Explain its components and construction with neat sketch. [8]
- b)** State various methods to estimate flood and explain Rational method in detail. [8]
- Q7) a)** Explain types of reservoirs and explain the points considered for selecting the site for a reservoir and state the investigations required for construction of reservoir. [8]
- b)** Explain the different steps involved in calculating the useful life of reservoir. [8]

OR

- Q8) a)** Explain how will you fix the capacity of the reservoir using annual inflow and Outflow. [8]
- b)** Explain fixation of reservoir capacity using elevation capacity curve and dependable yield. [8]
- Q9) a)** What is water logging? Explain tile drain formule and also state formula for spacing of tile drain. [8]
- b)** Explain different irrigation acts? [4]
- c)** Explain different methods of reclamation of water logged land. [6]

OR

- Q10) a)** Write a short note on ancient system of water distribution which still exist in North Maharashtra. [9]
- b)** Explain Global Water partnership (GWP). [9]



Total No. of Questions : 12]

SEAT No. :

P-2807

[Total No. Of Pages : 3

**[6003]-602**

**T.E. (Civil)**

**INFRASTRUCTURE ENGINEERING AND  
CONSTRUCTION TECHNIQUES  
(2015 Pattern) (Semester-I) (301002)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10 and Q11 or Q12.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1)** What are the key factors to consider when evaluating the feasibility of infrastructure projects? **[6]**

OR

**Q2)** How does the Bus Rapid Transit (BRT) system differ from traditional public transportation systems? **[6]**

**Q3) a)** Discuss the importance of alignment in railway tracks and the factors that influence it **[4]**

b) What are rail joints and what are the types commonly used in railway tracks? **[4]**

OR

**Q4) a)** Explain the concept of cant deficiency and cant excess in relation to railway curves. **[4]**

b) Differentiate between regular track maintenance and periodic track maintenance. **[4]**

*P. T. O*

- Q5)** a) Explain the Well Point system and its role in dewatering techniques. [4]  
b) Describe the process of electro osmosis and its application in dewatering. [4]

OR

- Q6)** a) Describe the construction methods used for diaphragm walls [4]  
b) How does mechanization improve construction site safety? [4]

- Q7)** a) Name Four types of tunnels commonly used in engineering projects. Explain any two with neat sketch. [6]  
b) Briefly describe the New Austrian Tunneling Method (NATM). [6]  
c) Define mucking in tunneling and explain its significance. [4]

OR

- Q8)** a) Describe the concept of trenchless tunneling. [6]  
b) What safety measures should be taken during tunneling operations? [6]  
c) Differentiate between pre-drainage and permanent drainage in tunneling. [4]

- Q9)** a) What are the key considerations when designing a marine railway? [6]  
b) Discuss the methods of construction for breakwater. [6]  
c) What is the purpose of docks and harbors? [4]

OR

- Q10)** a) Describe the construction process of a quay wall. [6]  
b) Compare the functions of wharves and jetties in port operations. [6]  
c) What factors should be considered when selecting a site for a harbor? [4]

- Q11)**a) Describe the working principle of a power shovel and its application in construction. [6]
- b) Describe the working principle of a clamshell and its typical applications. [6]
- c) What is the purpose of a dragline in construction projects? [4]

OR

- Q12)**a) Explain the difference between a crawler and a wheel-mounted excavator. [6]
- b) How can dumpers be classified based on their hauling capacity? [6]
- c) What safety precautions should be taken when operating construction equipment? [4]



Total No. of Questions : 10]

SEAT No. :

P-2808

[Total No. of Pages : 3

[6003]-603

T.E. (Civil)

**STRUCTURAL DESIGN - I**

**(2015 Pattern) (Semester - I) (301003)**

*Time : 3 Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10.*
- 2) Figures to the right side indicate full marks.*
- 3) Use of IS 456-2000 and non-programmable calculator is allowed.*
- 4) If necessary, assume suitable data and indicate clearly.*
- 5) Take Fe 410 grade of steel.*
- 6) Take ultimate stress in bolt,  $f = 400 \text{ N/mm}^2$ .*

**Q1)** a) State and explain modes of failure in tension members. [4]

b) Design a single angle discontinuous strut which carries factored load of 100 kN. Unsupported length of member is 3 m. [6]

OR

**Q2)** a) Differentiate between lacing and battening of built-up columns. [4]

b) Determine the tensile strength of the member of roof truss 2 ISA  $90 \times 90 \times 12 \text{ mm}$  connected to the 12 mm thick gusset plate using fillet weld. Length of weld on one side is 410mm and on opposite side is 175 mm. [6]

**Q3)** a) A 6 m long column is restrained in translation at both ends and restrained against rotation at one end. If ISHB 400 @ 77.4 kg/m is used, calculate design compressive strength of column. [5]

b) A column of 6 m length has to support factored load of 800 kN. The column is effectively held in position at one end and restrained against rotation at other end. Design column section using I-section. [5]

OR

**Q4)** Design a slab base for a column consisting of ISHB 400 @ 77.4 kg/m carrying axial factored load of 1100 kN. Use M20 grade of concrete. [10]

**P.T.O.**

**Q5)** A simply supported beam of span 4 m, carries udl of 60 kN/m including self-weight. Design the beam if compression flange is laterally restrained throughout the span. Apply usual check. **[16]**

OR

**Q6)** A simply supported beam of effective span 5 m carries factored udl 50 kN/m. The section is laterally unsupported throughout the span. Design the beam using I-section and apply usual checks. **[16]**

**Q7)** a) Explain types of beam to beam and beam to column connections with suitable sketches. **[5]**

b) Design a bolted framed connection for the factored beam end reaction 120 kN. The beam section is ISMB 250 @ 37.3 kg/m connected to the flange of the column section ISHB 200 @ 37.3kg/m. **[12]**

OR

**Q8)** A simply supported welded plate girder of an effective span of 20 m subjected to working udl of 60 kN/m throughout the span. Assume compression flange laterally supported throughout the span and design economical cross section for the plate girder along with welded connections. **[17]**

**Q9)** Design a gantry girder for following conditions- **[17]**

Span for gantry girder = 6.5 m

Span for crane girder = 16 m

Crane capacity = 250 kN

Weight of crane girder = 280 kN

Weight of trolley = 50 kN

Approach distance = 1 m

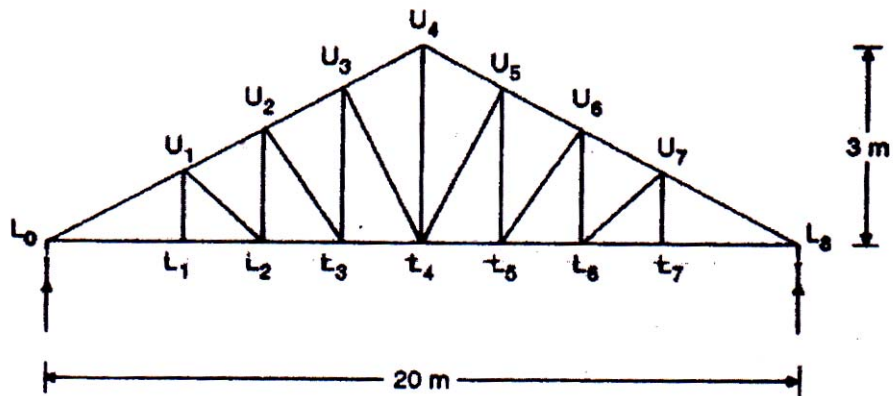
Wheel spacing = 3.5 m

Weight of rails can be assume as 0.3 kN/m

OR



**Q10)** Design members  $L_0-L_1$  and  $L_0-U_1$ , for the truss as shown in figure which is to be used for an industrial building situated at Mumbai and is covered with GI sheets. Assume  $P_z = 1000 \text{ kN/m}^2$ . [17]



[6003]-604

T.E. (Civil Engineering)

## STRUCTURAL ANALYSIS - II

(2015 Pattern) (301004) (Semester - I)

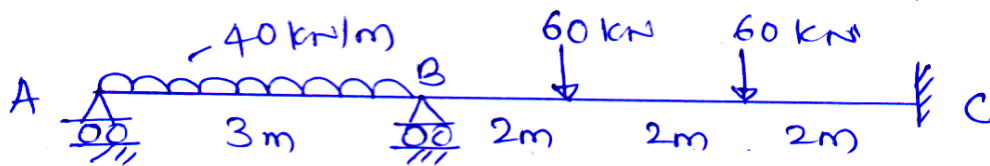
Time : 2½ Hours]

[Max. Marks : 70]

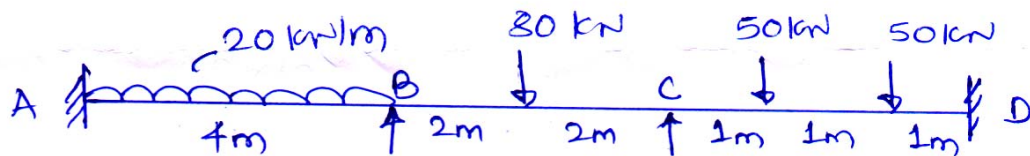
Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Use of non-programmable calculator is allowed.
- 3) Figures to the right indicate full marks.

Q1) a) Analyse the continuous beam by slope deflection method. Draw BMD. [10]

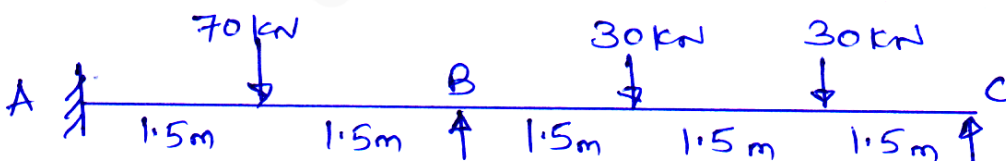


b) Analyse the continuous beam by moment distribution method. Draw BMD. [10]



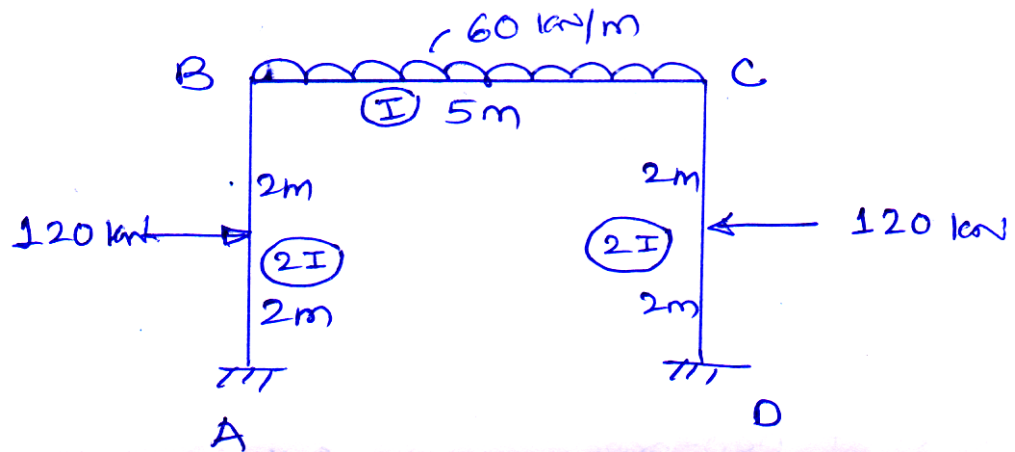
OR

Q2) a) Analyse the continuous beam by Flexibility matrix method. [10]



P.T.O.

b) Analyse the frame by moment distribution method. Draw BMD. [10]



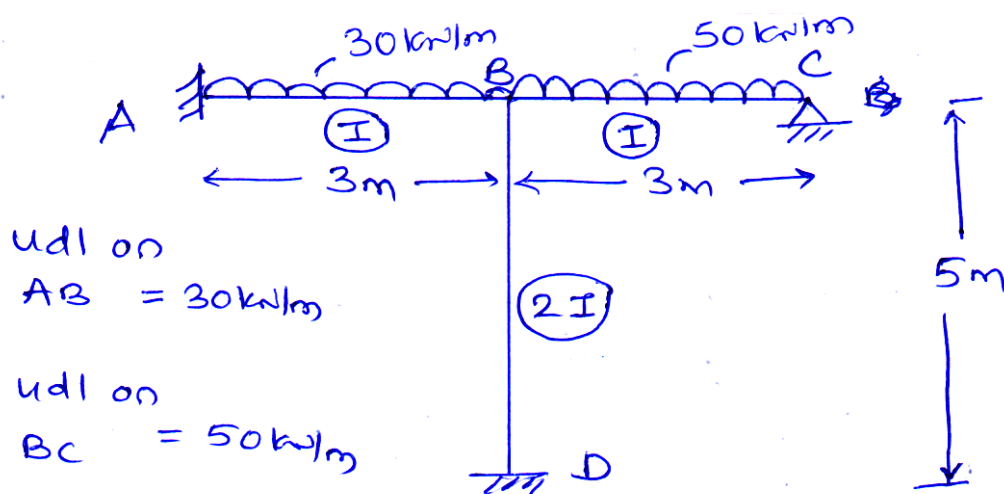
Q3) Analyse the continuous beam by stiffness matrix method. Draw SFD & BMD. [16]



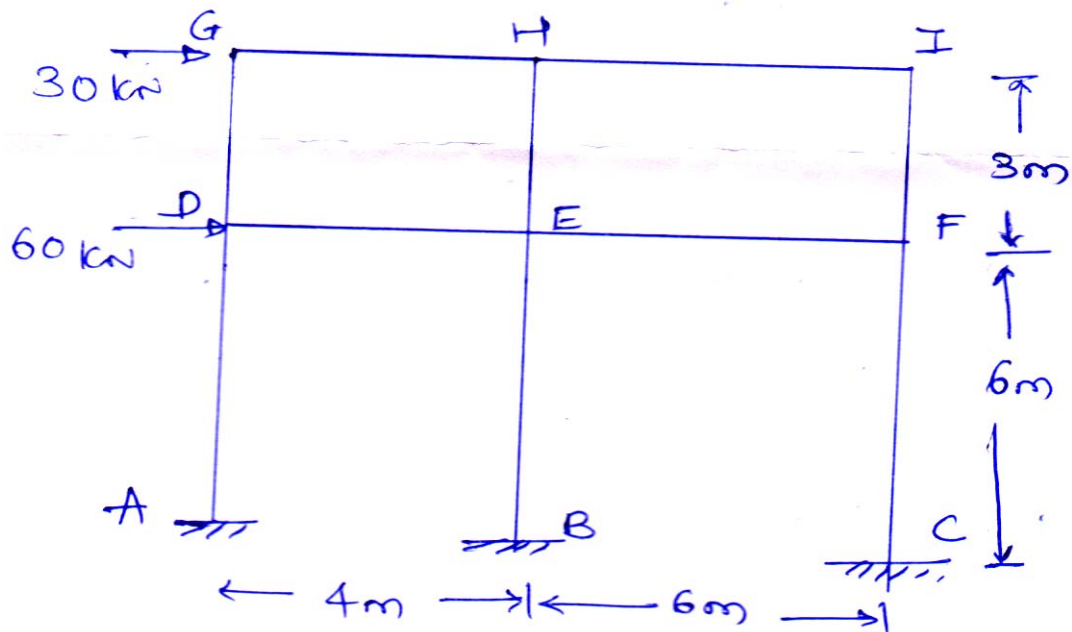
OR

Q4) Analyse the frame by stiffness matrix method. Take EI constant for Draw BMD. [16]

Beams



- Q5) a)** A cantilever beam of span 'L' carries a point load 'W' kN at the free end. Determine the deflection at free end. Take 5 nodes. [6]
- b)** Analyse the frame by portal method. Draw SFD & BMD. [12]



OR

- Q6) a)** A simply supported beam of span 6m carries uniformly distributed load of 100 kN/m on entire span. Determine maximum deflection using Finite difference method. Take 5 nodes. [6]
- b)** Analyse the frame shown for Q5b) using cantilever method. Draw SFD & BMD. [12]
- Q7) a)** Explain plain stress and plain strain problem. [8]
- b)** Explain following terms : [8]
- QST
  - Axisymmetric element
  - Shape function
  - Nodes

OR

- Q8) a)** Explain concept of Pascals Triangle and derive equation for minimum potential energy. [8]
- b)** Explain convergence criteria of FEM. [8]



Total No. of Questions : 8]

SEAT No. :

P-2810

[Total No. of Pages : 2

[6003]-605

**T.E. (Civil Engineering)**

**FLUID MECHANICS - II**

**(2015 Pattern) (Semester - I) (301005)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*

- Q1)** a) With a neat sketch write a note on Von-Karman's vortex trail. [6]  
b) Draw and discuss the specific energy curve. [6]  
c) For most economical rectangular channel section, prove that [6]  
i) Depth of flow is half the base width  
ii) Hydraulic radius is half the depth of flow

OR

- Q2)** a) Derive the condition for maximum discharge in a rectangular flow for given value of specific energy. [6]  
b) A rectangular channel has a width of 8 m and the discharge through it is 19 m<sup>3</sup>/s at a section where depth of flow is 1.5 m. Find the specific energy of flowing water, critical velocity, minimum specific energy and the type of flow. [6]  
c) Obtain an expression for time of emptying a hemispherical tank. [6]
- Q3)** a) Derive the equation for the force by jet of water on an inclined stationary plate. [8]  
b) A jet of water having velocity of 20 m/s strikes a curved plate which is moving with a velocity of 10 m/s. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves at an angle of 130° to the direction of motion of vane at the outlet. Calculate : [10]  
i) Vane angles so that water enters and leaves the vane without shock.  
ii) Work done per second per unit weight of water striking the vane per second.

**P.T.O.**

OR

- Q4)** a) With a neat sketch of centrifugal pump, describe the various components, heads and efficiencies in centrifugal pump. [8]
- b) For a head of 15m and speed of impeller 800 rpm, a centrifugal pump discharges 400 lit/sec. The inner and outer diameter of impeller are 200 and 400 mm respectively. The vanes are bent at  $40^\circ$  to the tangent at exit. The flow area remains  $0.06\text{m}^2$  from inlet to outlet. Calculate : [10]
- i) Manometric efficiency of pump
- ii) Vane angle at inlet

- Q5)** a) Classify the hydroelectric power plants based on various criteria. [7]
- b) For a pelton wheel, the head provided is 26m, the bucket speed is 8m/s and discharge is  $0.5\text{m}^3/\text{s}$ . if the bucket deflects through an angle of  $160^\circ$ , calculate the workdone by the jet per second on the runner and hydraulic efficiency. Assume coeff. of velocity = 0.98. [10]

OR

- Q6)** a) Classify the turbines based on various criteria. [7]
- b) Define a hydropower plant. Discuss in detail the classification of hydropower plants. [2 + 8]
- Q7)** a) With usual notations, derive the dynamic equation of Gradually Varied flow. [7]
- b) What are various methods to find the length of flow profile? Explain any one of them in detail. [2 + 8]

OR

- Q8)** a) Explain in detail various types of water surface profiles. [7]
- b) A rectangular channel 6m wide conveys a discharge of  $14\text{ m}^3/\text{s}$ . It has bed slope of 1 in 2000. If depth at a section is 2.6m, determine how far u/s or d/s of the section the depth would be within 10% of normal depth? Take 2 steps and assume  $n = 0.025$ . [10]



Total No. of Questions : 10]

SEAT No. :

**P2811**

**[6003]-606**

[Total No. of Pages : 3

**T.E. (Civil)**

**ADVANCED SURVEYING**

**(2015 Pattern) (Semester - II) (301007)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.No. 1 or Q. No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No.7 or Q.No.8, Q.No.9 or Q.No.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** The triangulation stations A and B 110 km apart are having elevations 422 m and 704 m respectively. The intervening peak C, 74 km from A has altitude of 477 m. Ascertain if A and B are intervisible. If necessary find the minimum height of scaffolding required at B, so that the line of sight has at least 3 m clearance anywhere along the patch. **[6]**

b) Explain the how the soundings are located by (i) two angles from the shore and (ii) intersecting ranges. **[4]**

OR

**Q2) a)** Explain the sources of errors in SBPS positioning. **[6]**

b) Explain how a shore line survey is conducted in hydrographic surveying. **[4]**

**Q3) a)** Define Remote Sensing and explain its classification. **[6]**

b) What do you mean by sounding? Explain how soundings are reduced and plotted. **[4]**

OR

**Q4) a)** What is GIS? Enlist and explain the functions of GIS. **[6]**

b) State different methods of locating soundings used in hydrographic surveying. Explain any one in detail. **[4]**

**Q5) a)** Explain laws of weight. **[5]**

b) Define: i) True value, ii) Most probable value and most probable error, iii) independent and conditioned quantity, and iv) weight. **[8]**

**P.T.O.**

- c) The angles of a spherical triangle PQR were observed as follows: [5]  
 $P = 87^{\circ} 14' 39''$  weight = 4  
 $Q = 39^{\circ} 40' 48''$  weight = 3  
 $R = 53^{\circ} 4' 55''$  weight = 2  
 Find the values of the adjusted spherical angles, if the spherical excess is known to be  $9''$ .

OR

- Q6)** a) Explain the process of adjustment in case of geodetic quadrilateral with no station at the intersection of diagonals. [5]  
 b) A surveyor carried out levelling operations of a closed traverse. [8]  
 ABCDA starting from A and found that,  
 B was 6.71 m above A  
 C was 5.59 m above B  
 D was 3.48 m above C  
 D was 13.72 m above A  
 The accuracy of all the four levelling operations is assumed to be equal.  
 Determine the probable heights of B, C and D by the method of correlates.  
 c) What do you mean by spherical excess? Explain the procedure of determining the sides of spherical triangle. [5]
- Q7)** a) Explain different elements used for visual interpretation of a photograph. [5]  
 b) Define: [5]  
 i) Isocentre  
 ii) Exposure Station  
 iii) Flying height and  
 iv) Tilt and tip  
 c) The scale of an aerial photograph is 1 cm = 160 m & the size of the photograph is 20 cm x 20 cm. If the longitudinal overlap is 65% and side overlap is 35%, determine the number of photographs required to cover an area of 232 sq. Km. [6]

OR

- Q8)** a) What are the different types of aerial photograph? Compare a map with aerial photograph. [5]  
 b) Explain the procedure of determining the difference in elevation by differential parallax. [5]  
 c) Derive an expression for the scale of a vertical photograph. Explain how the ground coordinates and the distances can be obtained from a vertical photograph. [6]



- Q9)** a) Explain the effect of curvature and refraction in Geodetic levelling. Derive an expression for the combined angular correction due to curvature and refraction. [8]
- b) Explain the procedure of marking the alignment of the tunnel on the surface of the ground and transferring the alignment underground. [8]

OR

- Q10)** a) Find the difference of elevation of two points A and B and the reduced level of B from the following data: [8]  
Horizontal distance between A to B = 6125.654 m  
Angle of depression from A to B =  $1^{\circ} 34' 32''$   
Height of signal at B = 4.265 m  
Height of instrument at A = 1.465 m
- b) Describe the procedure for determining centre line length of bridge and procedure for location of bridge piers while setting out a bridge. [8]



Total No. of Questions : 10]

SEAT No. :

P-2812

[Total No. of Pages : 3

[6003]-607

T.E. (Civil)

**PROJECT MANAGEMENT AND ENGINEERING  
ECONOMICS**

**(2015 Pattern) (Semester - II) (301008)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answers Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain Principles of Management. [5]

b) Explain Certified Project Management Professionals (PMP). [5]

OR

**Q2)** a) Explain in detail the features of PMBOOK in point of view of construction industry. [5]

b) Prepare the Work Breckdown Structure (WBS) for Bunglow. [5]

**Q3)** a) Write down the different Measures and Precautions takes on Site to prevent accidents. [5]

b) Draw the network diagram and make out critical path. [5]

Activity	Duration
1-2	3
1-3	3
1-4	6
2-4	5
2-5	7
3-4	3
4-5	5

*P.T.O.*

OR

- Q4)** a) What do you mean by ABC analysis and EOQ. [5]  
b) Explain Critical path and type of Floats in detail. [5]

- Q5)** a) Frame the CPM network for the data given in the table below and Also find: [10]  
i) Critical Path and Normal Duration of the project.  
ii) Calculate the normal cost and optimum cost. Assume the total cost of the project Rs. 11,000/- and initial cost Rs. 300/- per day.

Calculate the optimum duration.

Activity	Events		Duration (Days)		Slope of Cost curve in Rs./Day
	Preceeding	Succeeding	Normal	Crash	
A	10	30	7	3	100
B	10	20	9	7	60
C	30	50	4	1	150
D	20	50	5	3	250
E	20	40	3	1	20
F	50	60	6	4	332
G	40	60	2	1	1000

- b) Explain Resource Allocation, write steps in resource smoothening and leveling. [8]

OR

- Q6)** a) What do you know about EVA? How economic health of any project analyzed by using it? [6]  
b) Enlist the Project Management Software use in Construction Industry. Explain about MS Project / Primavera. [6]  
c) What do you mean by Resource optimization? Explain in detail. [6]

- Q7)** a) Draw Supply Curve and Demand Curve for any material and explain it in brief. [6]  
b) Explain Equity Shares and Debenture Capital concept in detail. [6]  
c) Elaborate law of substitution. [4]

OR

- Q8)** a) Explain the Simple and Compound Interest with example. [6]  
b) What are the factors affecting on Price Determination? [6]  
c) Explain the Law of Demand and Elasticity of Demand. [4]

- Q9)** a) Role of Project Management Consultants in Pre-tender and Post-tender process. [8]  
b) Cost of a project is Rs. 50,000/- has a cash flow of Rs. 22,000/- for a period of 5 Years. What is the NPV if the firm expect 14% per annum? Also state whether the project is feasible or not. [8]

OR

- Q10)** a) Write a short note on : [8]  
i) Pay Back Period  
ii) NPV  
b) A project cost Rs. 1,00,000. Its estimated life is 6 Years with an average annual cash flow of Rs. 40,000/-. Calculate IPR for the same. [8]



Total No. of Questions : 8]

SEAT No. :

P-2813

[Total No. of Pages : 2

[6003]-608

**T.E. (Civil Engineering)**

**FOUNDATION ENGINEERING**

**(2015 Pattern) (Semester - II) (301009)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of calculator is allowed in the examination.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain Seismic refraction method with neat sketch. [6]  
b) Write a note on 'floating foundations'. [7]  
c) Discuss the different causes of differential settlement. [7]

OR

- Q2)** a) Define disturbed sample & undisturbed sample. State the factors affecting the sample disturbance. [6]  
b) State Terzaghi's equation of bearing capacity for strip footing with meaning of each term & assumptions. [7]  
c) Write a note on laboratory consolidation test. [7]

- Q3)** a) Discuss the advantages of bored piles. [5]  
b) Explain in detail load carrying capacity of pile by pile load test. [6]  
c) A group of 9 piles with 3 piles in a row was driven in to soft clay extending from ground level to great depth. The diameter and length of piles were 0.3 m and 7m respectively. The cohesion of clay is 80 kN/m<sup>2</sup>. If the piles were spaced at 1m centre to centre, compute the allowable load on the pile group on the basis of shear failure criteria for a factor of safety of 2.5. Neglect bearing at the tip of piles. Take  $m = 0.6$  for shear mobilization around each pile. [7]

**P.T.O.**

OR

- Q4)** a) Explain the components of well foundations with neat sketch. [5]  
b) Write a note on pneumatic caisson with neat sketch. [6]  
c) Differentiate between open caisson and pneumatic caisson [7]

- Q5)** a) Write a note on vibro flotation technique of soil improvement with neat sketch. [5]  
b) Explain the different engineering problems associated with black cotton soil. [5]  
c) Explain : [6]  
i) Cantilever sheet pile  
ii) Anchored sheet pile

OR

- Q6)** a) Write a note on 'under reamed pile'. [5]  
b) Discuss the preloading technique with neat sketch. [5]  
c) Discuss any three types of cofferdams with neat sketch. [6]

- Q7)** a) Explain different liquefaction hazard mitigation methods. [5]  
b) Discuss the use of geosynthetics in road pavements. [5]  
c) Explain the use of geosynthetics for dam construction and slope stabilization. [6]

OR

- Q8)** a) Explain with neat sketch mechanism of reinforced soil. [5]  
b) Write the difference between Magnitude & Intensity of earthquake. [5]  
c) Differentiate between P wave and S wave. [6]



Total No. of Questions : 12]

SEAT No. :

P-2814

[Total No. of Pages : 5

[6003]-609

T.E. (Civil)

STRUCTURAL DESIGN - II

(2015 Pattern) (Semester - II) (301010)

*Time : 3 Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10 and Q.11 or Q.12.*
- 2) Figures to the right indicate full marks.*
- 3) IS 456-2000 and non programmable calculator are allowed in the examination.*
- 4) Neat diagrams must be drawn wherever necessary.*
- 5) Mere reproduction from IS Code as answer, will not be given full credit.*
- 6) If necessary assume suitable data and indicate clearly.*

**Q1)** Draw and explain stress-strain curves for concrete as per LSM. [5]

OR

**Q2)** Enlist various design philosophies/methods for design of RCC structures. Compare working stress method with limit state method. [5]

**Q3)** A beam of size 230mm × 412mm effective depth is simply supported over a span of 5m. The reinforcement consists of 4 bars of 16mm diameter at tension face. Find intensity of uniformly distributed load (including self-weight) that can be carried by beam. Use M25 & Fe415. [7]

OR

**Q4)** A rectangular, singly reinforced beam, 300mm wide and 465mm effective depth is used as a simply supported beam over an effective span of 4m. The reinforcement consists of 4 bars of 16mm diameter at tension face. Find the safe concentrated load (at midspan) in addition to its self weight. Use WSM with M25 concrete and Fe 415 steel. [7]

*P.T.O.*

**Q5)** Design cantilever slab using LSM approach for an effective span of 1.8m carrying live load of  $3.0 \text{ kN/m}^2$  and floor finish of  $1.5 \text{ kN/m}^2$ . Use M25 & Fe 500. Assume moderate exposure condition. Draw the details of the reinforcement. [8]

OR

**Q6)** A RC slab is to be provided for a passage measuring  $3.4\text{m} \times 7.5\text{m}$  with 230mm wide beams around all edges. Design the suitable slab assuming LL  $4 \text{ kN/m}^2$  and FF  $1.5 \text{ kN/m}^2$ . Use M25 and Fe500. Assume moderate exposure condition. Show details of the reinforcement. [8]

**Q7)** Design the second flight (midlanding level to first floor level) of a dog [16]

legged staircase of public building with the following data:

- a) Floor to floor height = 3.3m
- b) Rise = 150mm; Tread = 300mm; Width of flight = 1.2m
- c) Width of mid level landing = 1.2 m
- d) Width of floor level landing = 1.6m
- e) Width of supporting beams = 300mm
- f) Supporting beams are provided at the outer edges of both landings  
Material = M25, Fe 500
- g) Draw details of reinforcement. Use LSM approach.

OR

**Q8)** Design a simply supported two way slab of effective spans  $3.6\text{m} \times 5.6\text{m}$  effective carrying L.L. of  $3 \text{ kN/m}^2$  and F.F of  $1.5 \text{ kN/m}^2$ . Two adjacent edges of the slab are continuous. Use M20 and Fe415 for mild exposure condition. Draw the details of the reinforcement. [16]



**Q9)** Continuous RC beam ABCD of rectangular section is simply supported at A and D and continuous over support B and C. Span AB = 4.5m, BC = 4.0m and CD = 6.0m. The beam carries working dead load of 22 kN/m (including its self-weight) and working live load of 12 kN/m. The beam supports 120mm slab on one side. Calculate design moment for all spans and supports after 20% redistribution of moments. Design all spans and supports sections for flexure only. Draw the reinforcement details. Material- Concrete of grade M30, Fe 500 reinforcement. **[16]**

OR

**Q10)** Design a continuous beam ABCD for flexure and shear using IS Code method. AB=BC=CD=4.8m. The beam carries dead load of 22 kN/m (including its self-weight) and live load of 12 kN/m. Take material M25 and Fe 500. Show the reinforcement detail in longitudinal section and cross-section at continuous supports and at mid spans. Use LSM. **[16]**

**Q11)a)** Explain different parameters of interaction curves for the design of column. **[5]**

b) Design a uni-axial short column by limit state method with material M25 and Fe 500 to carry a working load of 900 kN, working moment of 80 kNm about major axis bisecting the depth of column. The unsupported length of column is 3.8m. The column is fixed at both the ends. Show detailed design calculations and reinforcement details. **[13]**

OR

**Q12)** Design a short axially loaded column and its isolated footing for carrying a working axial load of 1200 kN. The effective length of column is 3.2 m. Use M25 grade of concrete and Fe 415 grade of steel. SBC of soil is 300 kN/m<sup>2</sup>. **[18]**

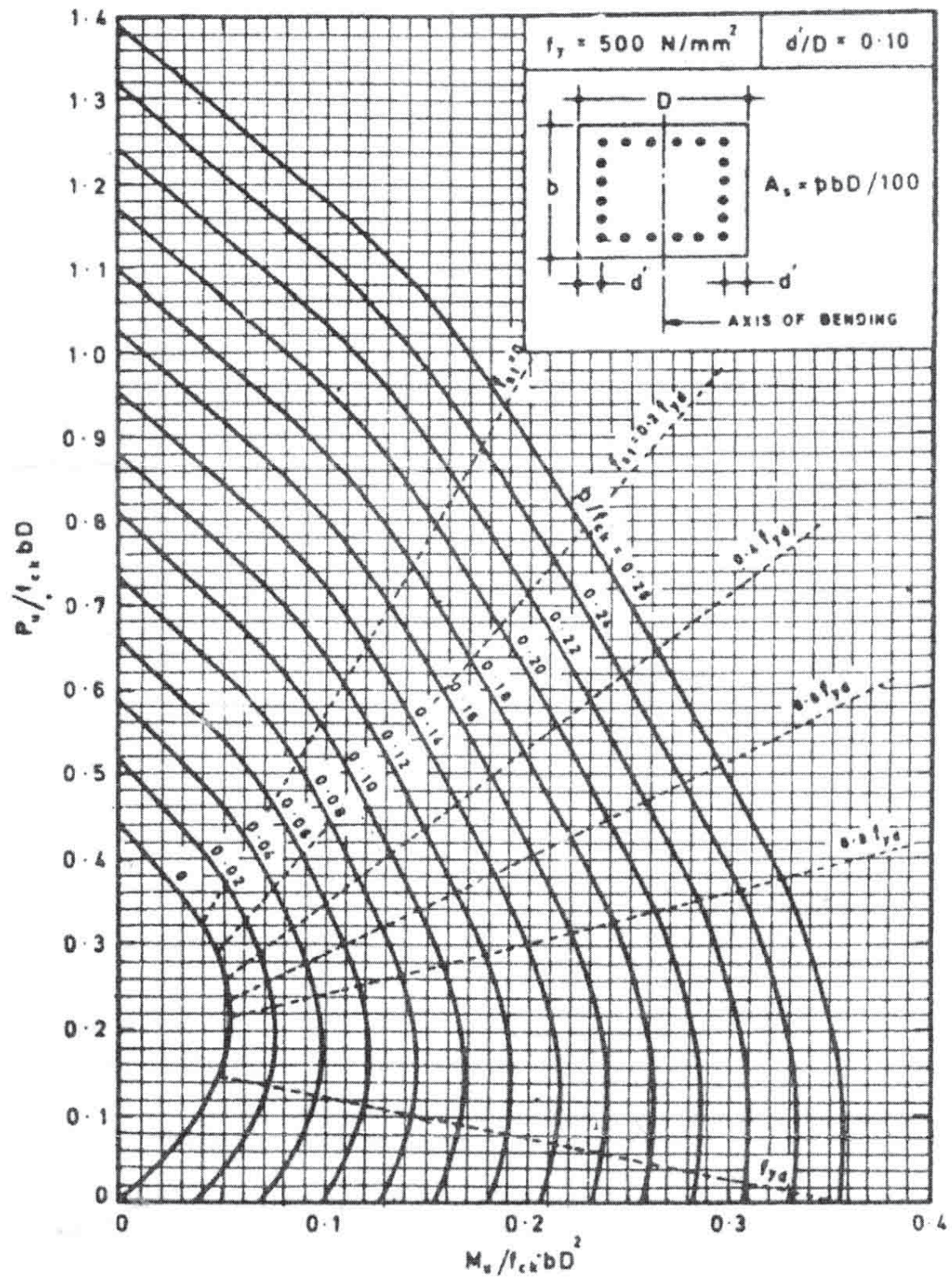


Chart No 1: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on all sides



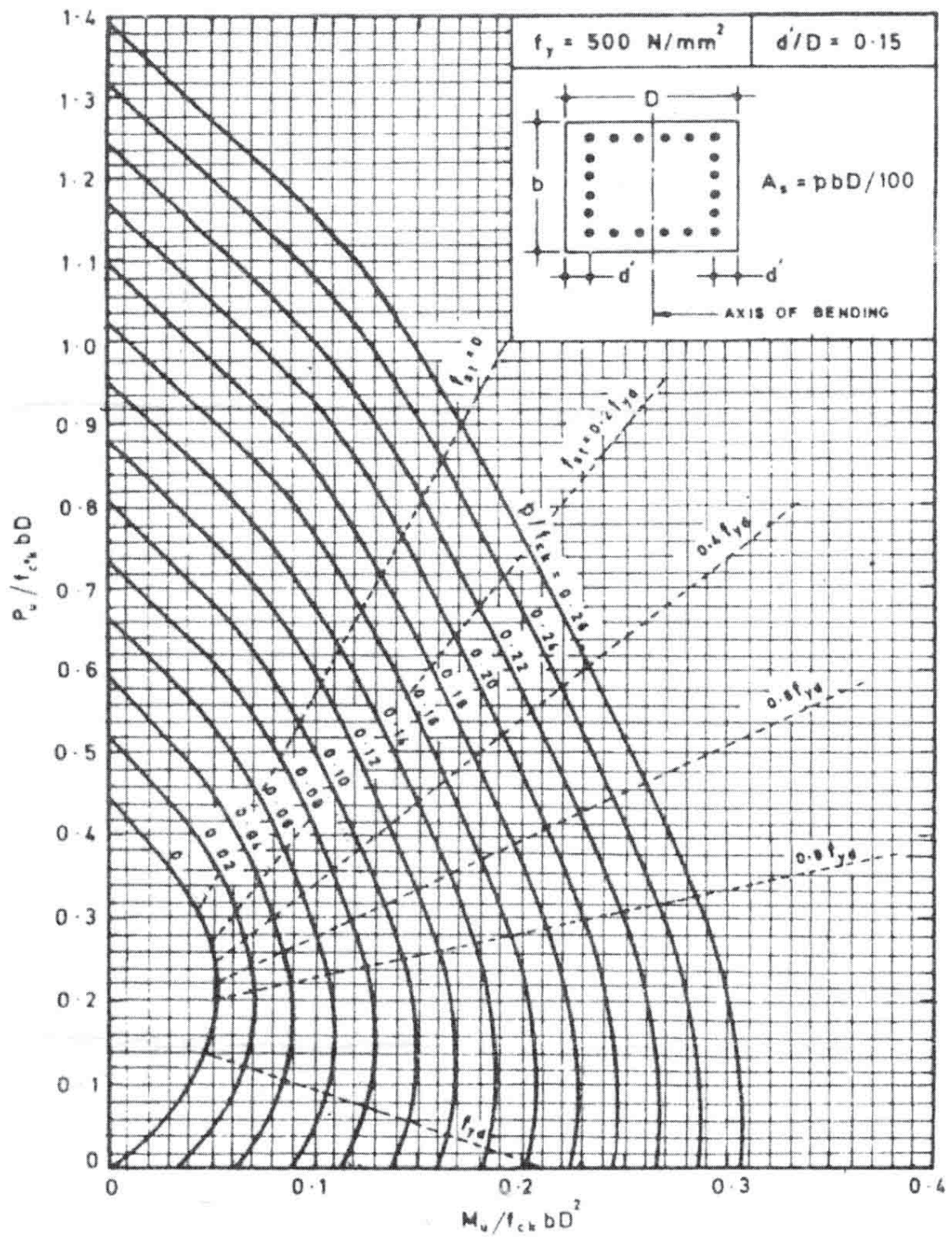


Chart No 2: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on all sides



Total No. of Questions : 10]

SEAT No. :

P-2815

[Total No. of Pages : 3

[6003]-610

T.E. (Civil)

**ENVIRONMENTAL ENGINEERING - I**

**(2015 Pattern) (Semester - II) (301011)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt any 7 question.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** What are the causes of air pollution. List five chronic health effect of air pollution. [5]

- b) Give note on followings : [2+3]
- i) Stable Atmosphere.
  - ii) Plume Behavior

**Q2) a)** What is water demand? List different water demand explain domestic water demand. [4]

- b) The population of 5 decades from 1930 to 1970 are given below in table. Find out the population after one, two and three decades beyond the last known decade, by using geometric increase method. [6]

Year	1930	1940	1950	1960	1970
Population	25000	28000	34000	42000	47000

**Q3) a)** Determine the surface area for settling tank for 0.5 m<sup>3</sup>/sec. flow using design overflow rate as 35 m<sup>3</sup>/m<sup>2</sup>/day. Also find the depth of tank if detention time is 95 min. Assume L/B = 4:1 and length of tank should not exceeds 100m. [6]

- b) Enlist the types of Aerators. And explain gravity type aerator. [4]

*P.T.O.*

- Q4) a)** Explain the following terms : [5]
- i) Coagulation.
  - ii) Sedimentation.
  - iii) Flocculation.
- b) With neat sketch explain the components of Rapid sand Filter and the step-by-step procedure of back washing. [5]
- Q5) a)** What is meant by Coagulation? Explain any one coagulant along with chemical reactions. [3]
- b) Discuss the followings : [3]
- i) Detention Period.
  - ii) Surface Loading.
- c) Explain how plain sedimentation is differing than sedimentation with coagulation. [4]
- Q6) a)** What are different factor affecting generation of solid waste. [5]
- b) Discuss in detail about Limes soda process and Ion exchange process. [5]
- Q7) a)** Explain in detail about Chlorine Ammonia treatment and state its demerits. [5]
- b) Explain about followings : [5]
- i) Sources of Fluorides.
  - ii) Electrodialysis.
- Q8) a)** Discuss the followings: [5]
- i) Break Point Chlorination.
  - ii) Methods of disinfection.
- b) With suitable sketch explain about Solar distillation technique. [5]

- Q9)** a) Tabulate the comparison of Continuous and intermittent system of water supply. [5]  
b) Explain any three methods of Rainwater harvesting. [5]

- Q10)** a) Discuss the following. [2+2+2]  
i) Pressure in distribution system.  
ii) Radial system of water distribution.  
iii) Water leakage detection techniques.  
b) Discuss the points on which total capacity of reservoir is depends.[4]



Total No. of Questions : 8]

SEAT No. :

**P2816**

**[6003]-626**

[Total No. of Pages : 2

**T.E. (Computer)**

**DESIGN & ANALYSIS OF ALGORITHMS**

**(2015 Pattern) (Semester - II) (310250)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right indicates full marks.

- Q1)** a) What are algorithms ? Explain algorithm as technology. [6]
- b) Explain the importance of tail recursion with suitable example. [6]
- c) Write short note on (any two) [8]
- a) Tabu search
  - b) Stimulated Annealing
  - c) Evolutionary computing

OR

- Q2)** a) Explain the concept of principle of Mathematical induction & prove the correctness of an algorithm to find factorial of a number. [6]
- b) State & explain stepwise refinement with a suitable example. [6]
- c) Draw & explain architecture of Artificial Neural Network. Explain the importance of weight, bias & target output. [8]
- Q3)** a) Explain asymptotic notations Big-O, Omega, Theta with example of each. [9]
- b) Whether Travelling Salesman Problem is NP Hard problem or Not? Justify [7]

OR

- Q4)** a) What is Greedy algorithm strategy ? Explain Greedy approach for finding shortest path in weighted graph. [8]
- b) Explain deterministic & non-deterministic algorithm with example. [8]

**P.T.O.**

- Q5)** a) Explain Tractable & non-tractable problems with example. [8]  
b) Explain amortized analysis. Find the amortized cost with respect to stack operations. [8]

OR

- Q6)** a) What is Embedded system? Explain embedded sorting algorithm. [8]  
b) State & explain fibonacci Heap in detail. Enlist its applications. [8]

- Q7)** a) Explain Naive string matching algorithm with its best, average & worst case complexity. [9]  
b) Explain multithreaded merge sort algorithm [9]

OR

- Q8)** a) Explain Rabin-karp string matching algorithm with example. [10]  
b) Explain Distributed Breadth first search algorithm. [8]





Total No. of Questions : 10]

SEAT No. :

P-2817

[Total No. Of Pages : 2

**[6003]-627**

**T.E. (Computer Engineering)**

**Systems Programming and Operating System  
(Semester-II) (2015 Pattern) (310251) (SP&OS)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, and Q9, or Q10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Which data structures are used by two pass assembler? Explain with example. **[6]**

b) What is a macro? Compare macro with function. **[4]**

OR

**Q2) a)** What is the need of DLL? Explain with example **[4]**

b) What is LEX? Explain its working. **[6]**

**Q3) a)** Which data structures are used by two pass macro preprocessor? Explain with example. **[5]**

b) Show two variants of specifying an intermediate code in assembler, Compare them. **[5]**

OR

**Q4) a)** Explain compile and Go loader scheme with example. **[5]**

b) What is a compiler? Explain any two phases of compiler with suitable diagram. **[5]**

*P. T. O*

- Q5)** a) Draw and explain process state transition diagram. [6]  
b) Differentiate between process and thread. [6]  
c) Explain Bankers Algorithm with an example. [6]

OR

- Q6)** a) What is process control block? Draw its structure and explain. [6]  
b) Explain the concept of context switching with the help of neat diagram. [6]  
c) What is a deadlock? State and explain the conditions for deadlock to occur. [6]
- Q7)** a) Explain segmentation with suitable example in brief. [6]  
b) Explain contiguous memory allocation with suitable example. [6]  
c) What is thrashing? Explain in brief. [4]

OR

- Q8)** a) Differentiate between internal and external fragmentation. [6]  
b) Explain demand paging with suitable diagram. [6]  
c) Write a short note on swapping. [4]
- Q9)** a) What is file system? Explain file system implementation in brief. [6]  
b) What is two level directory structure? Explain with suitable diagram. [6]  
c) Describe any one disk scheduling policy with an example. [4]

OR

- Q10)** a) What are the file access methods? Explain them in detail. [6]  
b) What is tree structured directory? Explain with suitable diagram. [6]  
c) Write a note on free space management. [4]



Total No. of Questions : 10]

SEAT No. :

P-2818

[Total No. of Pages : 2

[6003]-628

T.E. (Computer Engineering)

EMBEDDED SYSTEM & INTERNET OF THINGS

(2015 Pattern) (Semester - II) (310252)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer any five questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10.
- 2) Assume Suitable data wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Draw neat & labelled diagram wherever necessary.

**Q1)** a) Define IoT. What are the features of IoT system? [5]

b) What is Embedded system? Explain the block diagram of ES. [5]

OR

**Q2)** a) Explain the network layer protocol for IoT systems. [5]

b) Explain Rate monotonic scheduling algorithm. [5]

**Q3)** a) Draw and explain block diagram of an IoT device. [5]

b) Explain the IoT Level-4 with suitable diagram. [5]

OR

**Q4)** a) Explain the IoT Level-5 with suitable diagram. [3]

b) Discuss about the Four pillars of IOT with diagram. [4]

c) Explain the steps involved in the IoT system design methodology. [3]

**Q5)** a) Explain the Sensor Standards for Interoperability. [6]

b) Explain the Zigbee architecture with suitable diagram. [6]

c) Write a short note on 5A and 3I characteristics of IoT. [4]

OR

P.T.O.

- Q6)** a) Explain the KNX Protocol. [6]  
b) What are the different key elements of M2M architecture? [4]  
c) Why the security is important in IoT? Explain key elements of it. [6]

- Q7)** a) Write short note on WoT and Business Intelligence. [6]  
b) Explain unified multitier WOT Architecture in details. [6]  
c) Explain mobile cloud computing. [5]

OR

- Q8)** a) Explain SCADA Middleware Standards in brief. [6]  
b) Draw and explain RFID architecture. [6]  
c) Explain Cloud Middleware Architecture. [5]

- Q9)** a) Design Air Pollution Monitoring(APM), what are the different components required? Draw deployment design for this system. [6]  
b) Write short note on : [6]  
i) Amazon Kinesis  
ii) Xively Cloud for IoT  
c) Write the AutoBahn installation and setup steps. [5]

OR

- Q10)** a) Describe the use of Amazon EC2 for IoT. [5]  
b) Explain in brief Model, Template and View in Django architecture.[6]  
c) Design Smart Irrigation System (SIS) based on followings [6]  
i) Define process specification for SIS IoT system  
ii) Domain model of SIS IoT system  
iii) Information model of SIS IoT system  
iv) Controller service of SIS IoT system



Total No. of Questions : 10]

SEAT No. :

P-2819

[Total No. of Pages : 2

[6003]-629

T.E. (Computer Engineering)

SOFTWARE MODELLING AND DESING

(2015 Pattern) (Semester - II) (310253)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Figures to the right indicate full marks.

- Q1)** a) Define software design and give its importance. [5]  
b) Define component. Compare component and deployment diagram. [5]

OR

- Q2)** a) Explain 4+1 View Architecture of UML. [5]  
b) Draw Use Case diagram for Online Shoppe system. [5]

- Q3)** a) Explain join, fork and swimlane concept with activity diagram. [5]  
b) Define interface. Explain required and provided interface with example. [5]

OR

- Q4)** a) Explain with an example the difference between aggregation and composition. [5]  
b) Define interface. Explain required and provided interface with example. [5]

- Q5)** a) Explain Client Server architecture in detail. [8]  
b) Explain real time architecture with a suitable example. [8]

OR

P.T.O.

- Q6)** a) Explain object oriented architecture with a suitable example. [8]  
b) Explain broker pattern for service oriented architecture. [8]

- Q7)** a) What is the use of design pattern in modern software development? Explain categories of design pattern. [8]  
b) What is singleton pattern? Explain with suitable example. [8]

OR

- Q8)** a) Explain factory method with its intent, motivation and implementation with suitable example. [8]  
b) Explain iterator design pattern with suitable example. [8]

- Q9)** a) What is integration testing? Explain its type in detail. [6]  
b) What is performance testing? List few tools of performance testing. [6]  
c) Explain difference between verification & validation. [6]

OR

- Q10)** a) What is Cyclomatic Complexity? Explain with example. [6]  
b) Define test case? What is the importance test case? Give example. [6]  
c) Explain acceptance testing in detail. [6]



Total No. of Questions : 10]

SEAT No. :

P-2820

[Total No. of Pages : 2

**[6003]-630**  
**T.E. (Computer Engineering)**  
**WEB TECHNOLOGY**  
**(2015 Pattern) (Semester - II) (310254)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q.9 or 10.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) What do you mean by CSS? What are the different ways to create CSS?[5]  
b) Explain different data types available in JavaScript with Example. [5]

OR

- Q2)** a) Write at least any five Differences between HTML and HTML5. [5]  
b) What is JavaScript? How to create array and read elements in array in JavaScript. [5]

- Q3)** a) Discuss Servlet Lifecycle in detail. [5]  
b) Explain JSP scripting elements with examples. [5]

OR

- Q4)** a) Discuss use of DOM in JavaScript with suitable example. [5]  
b) What is the use of JSP Directives. Discuss different types of directives in detail. [5]

- Q5)** a) List and describe various features of PHP. [4]  
b) Write Short note on WML. [4]  
c) What is Associate arrays in PHP? Explain it with simple PHP code. [8]

OR

*P.T.O.*

- Q6)** a) List and Explain steps involved in connecting to MySQL with PHP. [8]  
b) What is AJAX? Explain working of AJAX with the help of diagram. [8]

- Q7)** a) Draw and explain neat diagram which depicts MVC to the struts architecture. [8]  
b) Discuss Different steps to create strut application in brief. [8]

OR

- Q8)** a) Write sample Angular JS application which can demonstrate use of different types of expressions. [8]  
b) Write short note on NodeJS. [4]  
c) Discuss actions in struts in brief. [4]

- Q9)** a) Draw and explain each tier of three tiers architecture using EJB. [8]  
b) Discuss. JNDI Lookup with an Example. [6]  
c) Write Short note on Content Management System. [4]

OR

- Q10)** a) What are the web services? Discuss SOAP and REST in detail. [10]  
b) What is use of EJB? Discuss Different types of EJB in detail. [8]







Total No. of Questions : 10]

SEAT No. :

**P2821**

**[6003]-632**

[Total No. of Pages : 2

**T.E. (Electrical)**

**ADVANCED MICROCONTROLLER AND ITS APPLICATIONS  
(2015 Pattern) (Semester - I) (303141)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 2) Figures to the right indicate full marks.

**Q1) a)** Explain status register in detail with help of example. **[6]**

b) Blink LEDs connected to RBI and RB4 using assembly language instructions. **[4]**

OR

**Q2) a)** Write an assembly language program to transfer 25H into first ten locations of Bank0. **[6]**

b) Explain following instruction with suitable example. **[4]**

i) BZ again

ii) CLRF f,a

**Q3) a)** Write a C program to generate delay of 5 milisecs. Using Timer0. Assume crystal frequency of 10MHz. **[6]**

b) Explain Integer and character data types in detail. **[4]**

OR

**Q4) a)** Explain T0CON register in detail. **[6]**

b) Write Assembly language program to perform addition of BCD numbers stored at 20H and 21H and store result to location 45H. **[4]**

**Q5) a)** Explain CCP1CON register in detail and also give its count, to have capture mode for every 16<sup>th</sup> rising edge. **[8]**

b) Explain speed control of DC Motor using PWM mode of CCP1. **[8]**

OR

**P.T.O.**

- Q6)** a) Write a C program to generate 2KHz PWM frequency at 25% duty cycle on CCP1 pin. [8]  
b) Discuss working of capture mode in detail with help of block diagram.[8]

- Q7)** a) Explain the process of receiving data serially with baud rate of 9600.[8]  
b) Explain TXSTA register in detail also Explain the role of SPBRG and calculate the count for 9600 baud rate for crystal frequency of 10MHz. [9]

OR

- Q8)** a) Explain the steps of timer interrupt programming. [8]  
b) Write C program to transmit character “NO” continuously at a baud rate of 9600 and crystal frequency of 10MHz. [9]

- Q9)** a) Explain ADCON0 and ADCON1 register in details. [8]  
b) Draw the interfacing diagram of opto-isolator and also explain its interfacing procedure. [9]

OR

- Q10)**a) Explain temperature measurement using LM35 and give the algorithm to transfer the result to 26H and 27H, lower byte to 26H and higher byte to 27H. [8]  
b) Explain interfacing of DAC with PIC 18f458 with the help of algorithm.[9]



Total No. of Questions : 10]

SEAT No. :

P-2822

[Total No. of Pages : 2

**[6003]-634**  
**T.E. (Electrical)**  
**POWER ELECTRONICS**  
**(2015 Pattern) (Semester - I) (303143)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q.9 or 10.*
- 2) Figures to the right indicate full marks.*

- Q1)** a) With neat constructional diagram explain working of GTO. [4]
- b) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers. [6]

OR

- Q2)** a) Explain the following ratings of the thyristor. [4]
- i) Latching current
  - ii) Holding current
- b) Compare MOSFET and IGBT. [6]

- Q3)** a) Explain R-C triggering circuit of thyristor. [4]
- b) A single phase full converter connected to 230V, 50Hz source is feeding a load  $R=10\Omega$  in series with a large inductance that make the load current ripple free. For firing angle of  $45^\circ$ , calculate rectification efficiency, FF and RF. [6]

OR

- Q4)** a) Draw and explain turn off characteristic of thyristor. [4]
- b) A single phase full converter with large inductance is fed by 230 V supply. Find average output voltage and reduction in output voltage due to overlap if  $\alpha=20^\circ$  and  $\mu = 3^\circ$ . [6]

*P.T.O.*

- Q5) a)** What is two stage ac voltage regulator? Draw neat diagram and explain its operation with output waveform for RL load. [8]
- b)** Explain working of three phase full converter with a firing angle of  $30^\circ$  & obtain expression for phase voltage & Line voltage. [8]

OR

- Q6) a)** With neat diagram explain four mode operation of a TRIAC. [8]
- b)** Draw and explain three phase semi converter feeding RL load with output wave forms. [8]

- Q7) a)** Explain with circuit diagram and waveforms, operation of single phase current source inverter. [8]
- b)** Explain single pulse width modulation used in PWM inverters. How harmonics are eliminated by adjusting width of pulse. [8]

OR

- Q8) a)** Explain working of single phase full bridge voltage source inverter. Draw all waveforms. [8]
- b)** Explain Sinusoidal Pulse width modulation with necessary waveforms. [8]

- Q9) a)** Explain working of three phase six step voltage source inverter in  $180^\circ$  mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. [10]
- b)** List different harmonic elimination techniques used in inverter. Explain any two methods in detail. [8]

OR

- Q10) a)** Explain working of three phase six step voltage source inverter in  $120^\circ$  mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. [10]
- b)** Draw neat diagram and explain flying capacitor multilevel inverter. [8]



Total No. of Questions : 10]

SEAT No. :

**P2823**

**[6003]-636**

[Total No. of Pages : 3

**T.E. (Electrical Engineering)**  
**POWER SYSTEM - II**  
**(2015 Pattern) (Semester - II) (303146)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Prove that active power at receiving end is given by **[7]**

$$P_R = \frac{|V_S||V_R|}{|B|} \cos(\beta - \delta) - \frac{|A|}{|B|} |V_R|^2 \cos(\beta - \alpha)$$

where  $\bar{V}_R = |V_R| \angle 0$ ,  $\bar{V}_S = |V_S| \angle \delta$ ,  $\bar{A} = |A| \angle \alpha$  and  $\bar{B} = |B| \angle \beta$

- b) What do you mean by “Right of Way” in transmission system? Compare this term in EHVAC and HVDC transmission system. **[3]**

OR

**Q2) a)** Show that per unit impedance of transformer on both sides are same. **[7]**

- b) State true or false with justification: **[3]**

“When HV transmission line is loaded with lagging load, the voltage regulation is negative.”

**Q3) a)** What are the advantages of EHVAC system? **[7]**

- b) What is surge impedance loading? Elaborate its significance of surge impedance loading **[3]**

OR

**P.T.O.**

- Q4) a)** Explain Ybus using bus incidence matrix. [7]
- b) Justify: “If 50% line capacitive series line compensation is connected in a transmission line, power transfer capability is increased twice compared to uncompensated line” [3]

- Q5) a)** The generating station at koyna power plant is rated at 11kV with short circuit capacity of 1000MVA. The generating station at Radhanagar is also rated at 11kV with short circuit capacity of 670MVA. If these two generating stations are connected with interconnector of reactance  $j0.4\Omega$ , calculate possible short circuit MVA at each station. Take 1000MVA as base (Hint: Short circuit MVA = Base MVA/reactance in pu, Take base MVA = 1000MVA and base kV = 11kV) [9]
- b) When and unloaded alternator is shorted at its terminal, draw oscillograph waveform of fault current and discuss about transient, sub transient and steady state period. [8]

OR

- Q6) a)** In case of three phase fault at the terminal of an unloaded alternator, prove that  $x_d'' < x_d' < x_d$  and  $I_f'' > I_f' > I_f$  with mathematical relation and diagram. (where  $I_f$  is fault current) [9]
- b) State whether following statements are true or false with justification [8]
- i) In case of three phase fault at the terminal of an unloaded alternator, the sub transient state current is less than transient & steady state current.
- ii) In case of three phase fault at the terminal of an unloaded alternator, the sub transient time constant is greater than transient and steady state time constant.

- Q7) a)** The potential difference to the neutral of a three phase, four wire systems are-36V,  $j48V$  and  $64V$  respectively. The currents in corresponding line wires are  $(-1 + j2)$  Amp,  $(-1 + j5)$  Amp and  $(-j3)$  Amp. Calculate negative sequence power. [9]
- b) Derive the equation of fault current in LL fault [8]

OR

- Q8)** a) Derive the equation of three phase power using symmetrical component. [9]  
b) In case of LLG fault, show that fault current [8]

$$I_f = \frac{-3E_{a1}Z_2}{Z_1Z_2 + Z_2Z_0 + Z_0Z_1}$$

- Q9)** a) Compare HVDC and EHVAC transmission system. [8]  
b) Write short note on “Constant current control in HVDC lines”. [8]

OR

- Q10)** a) Write short note on: [8]  
i) Monopolar HVDC link  
ii) Back to back HVDC link  
b) Draw the complete single line diagram of HVDC system showing all components and elaborate any three components in detail. [8]





Total No. of Questions : 8]

SEAT No. :

P-2824

[Total No. of Pages : 2

**[6003]-637**

**T.E. (Electrical)**

**CONTROL SYSTEM - I**

**(2015 Pattern) (Semester - II) (303147)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Use of non programmable calculator is allowed.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*

**Q1) a)** State and Explain Masons Gain formula. **[4]**

b) State and explain all time domain specifications of second order system. **[6]**

c) Sketch the complete root locus for open loop transfer

function.  $G(S) = \frac{K}{s(s+4)(s+10)}$  Determine, K marginal and frequency of oscillations. Comment on stability. **[10]**

OR

**Q2) a)** Clearly differentiate between open loop and closed loop control system. **[6]**

b) A unity feedback system is characterized by an open loop transfer function

$G(S) = \frac{K}{s(s+10)}$  Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine settling time, peak overshoot and peak time for a unit step input. **[8]**

c) Discuss steady state error for type '0', type '1' and type '2' system. **[6]**

*P.T.O.*

**Q3) a)** Sketch and explain polar plots type '0', '1' and '2' systems. [6]

**b)** Sketch polar plot for system with open loop transfer function as

$$G(S) = \frac{10}{s(s+1)(s+4)}$$

Obtain gain margin and phase margin. [10]

OR

**Q4) a)** Explain Nyquist stability criterion. [6]

**b)** For Unity feedback system  $G(S) = \frac{1}{s(s+2)(s+3)}$  plot Nyquist diagram.

Find GM and PM. [10]

**Q5) a)** Explain all frequency domain specifications. [6]

**b)** Sketch the bode plot and determine i) Gain cross-over frequency ii) Phase cross-over frequency iii) Gain Margin iv) Phase Margin. for the transfer

function  $G(S) = \frac{10}{s(1+0.4s)(1+0.1s)}$ . [12]

OR

**Q6) a)** Explain procedure to draw bode plot. [6]

**b)** Sketch bode plot for system with open loop transfer function as

$$G(S) = \frac{10}{s(1+0.1s)(1+0.001s)}$$

Comment on stability. [12]

**Q7) a)** Explain P, PI, PID controller with neat diagrams. [8]

**b)** Obtain the tuning of PID controller for a unity feedback system with

open loop transfer function as  $G(S) = \frac{1}{(s+1)(5s+1)(0.2s+1)}$  using

Ziegler Nichols method. [8]

OR

**Q8) a)** Write note on PID Controller tuning methods. [8]

**b)** Define and explain Lag and Lead compensator. [8]



Total No. of Questions : 10]

SEAT No. :

P-2825

[Total No. of Pages : 3

[6003]-638

T.E. (Electrical)

UTILIZATION OF ELECTRICAL ENERGY

(2015 Pattern) (Semester - II) (303148)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagram must be drawn wherever required.
- 3) Assume suitable data, if necessary.
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Figures to the right indicates full marks.

- Q1)** a) State the advantages of electric heating. [4]  
b) A 30 Kilo Watt, 3-phase, 400 V resistance oven is to employ Ni-Cr strip of 0.3 mm thickness. The heating elements are connected in delta, if the temperature of wire to be 1100°C and that of charge is 700°C. Determine length and width of wire. Take radiation efficiency 0.5, emissivity as 0.9 and specific resistance as  $1.03 \times 10^{-6} \Omega \text{m}$ . [6]

OR

- Q2)** a) State faraday's laws of electro deposition and explain the need for it.[4]  
b) What are the types of welding? Explain spot welding with neat diagram.[6]
- Q3)** a) Explain sodium vapour lamp construction & working with neat diagram.[4]  
b) Describe the construction and working of core type induction furnace.[6]

OR

- Q4)** a) Define following term, [4]  
i) Illumination  
ii) Depreciation factor  
iii) Candle power  
iv) Reflection
- b) A room size of 15×6 meter is to be illuminated by 20 number of 200 Watt each lamp. The MSCP of each lamp is 250. Take depreciation & utilization factor as 1.2 & 0.6 respectively. Find average illumination produced on the floor. [6]

P.T.O.

- Q5) a)** Draw the block diagram of electric locomotive and state the function of each component. [8]
- b)** Explain the functions of following equipment in traction substation. [8]
- i) Circuit Breaker
  - ii) Interrupter

OR

- Q6) a)** State and explain advantages of electric traction. [8]
- b)** Explain composite system for track electrification. [8]

- Q7) a)** Derive the expression for simplified quadrilateral speed time curve. [8]
- b)** An electric train uniformly accelerated at 6 km/hr/sec for 21 second on a level track, braked at 6km/hr/second. The free running period for the train is 10 minutes and stop time of 5 minutes. Draw speed time curve and calculate distance between stations, average speed and scheduled speed. [8]

OR

- Q8) a)** Define following terms and state it's unit [8]
- i) Specific energy consumption
  - ii) Tractive effort
  - iii) Coefficient of adhesion
  - iv) Dead weight
- b)** Derive the expression for simplified trapezoidal speed time curve.[8]

- Q9) a)** What is a transition explain shunt & bridge transition in detail. [6]
- b)** Explain suitability of D.C series motor for traction service. [4]
- c)** Two motors rated 1500 Volt have armature resistance of 0.2 Ohm each and take a current of 500A during starting. The starting time is 20 second. Find [8]
- i) Time duration of series and parallel operation
  - ii) Energy loss in controller of one motor
  - iii) Motor output
  - iv) Energy loss in armature of one motor
  - v) Total energy input
  - vi) Starting efficiency

OR

- Q10)** a) What are the desirable characteristics of motor used in traction? Explain. **[6]**
- b) Draw and explain block diagram of route relay interlock. **[6]**
- c) Explain following systems of colour light signalling, **[6]**
- i) Two aspect colour light signalling
  - ii) Three aspect colour light signalling
  - iii) Four aspect colour light signalling



Total No. of Questions : 8]

SEAT No. :

P-2826

[Total No. of Pages : 2

[6003]-639

T.E. (Electrical)

DESIGN OF ELECTRICAL MACHINES

(2015 Pattern) (Semester - II) (303149)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 .
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.

- Q1)** a) Explain the various types of windings used in a transformer (any two) [6]
- b) Explain the procedure to calculate the no load current in case of a three phase transformer. [6]
- c) Explain the various methods of cooling employed in a transformer. (any four) [8]

OR

- Q2)** a) Explain the various modes of heat dissipation. [6]
- b) Explain the specifications of three phase transformers as per IS 2026 (Part 1). [6]
- c) Derive the Output equation of a three phase transformer with usual notations. [8]

- Q3)** a) Derive the Output equation for three phase induction motor with usual notations. [8]
- b) Explain the constructional features of induction motor. [8]

OR

- Q4)** a) Define specific magnetic loading. Explain the factors to be considered for choice of specific magnetic loading. [8]
- b) Explain the design of any two types of AC windings. [8]

P.T.O.

- Q5)** a) Derive the equation for end ring current for the rotor of squirrel cage induction motor. [8]
- b) Discuss the various constraints in the selection of suitable combination of stator and rotor slots. [8]

OR

- Q6)** a) Explain the unbalanced magnetic pull and the various factors responsible for unbalanced magnetic pull. [8]
- b) A 11.2 KW, 415 v, 3 phase, 6 pole, 50 Hz, star connected squirrel cage induction motor has the following data number of stator slots = 54, number of rotor slots = 63, number of conductors per slot = 16, efficiency = 0.87, power factor = 0.82, current density = 6A/mm<sup>2</sup>. Find bar current, end ring current area of bar, area of end ring. Assume Rotor mmf as 85% of Stator mmf. Assume any other details if required. [8]

- Q7)** a) Explain the effects of ducts on calculation of magnetizing current. [6]
- b) Define and explain the continuous rating of electrical machine. [6]
- c) A 75 KW, 3300 V, 50 Hz, 8 pole, three phase, star connected Induction motor has magnetizing current equal to 35% of full load current. Find the stator turns per phase if the mmf required for flux density at 60° from the interpolar axis is 500 A. Assume the stator winding factor as 0.955. Efficiency = 0.94, power factor = 0.86. [6]

OR

- Q8)** a) Explain the procedure to calculate the no-load current for a three phase induction motor. [6]
- b) Write a short note on effect of saturation on the performance of three phase induction motor. [6]
- c) Explain the different types of leakage flux in an induction motor (any three). [6]



Total No. of Questions : 8]

SEAT No. :

**P2827**

[Total No. of Pages : 3

**[6003]-640**

**T.E. (Electrical Engineering)**  
**ENERGY AUDIT & MANAGEMENT**  
**(2015 Pattern) (Semester-II) (303150)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right indicate full marks.*
- 3) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) Assume suitable data, if necessary.*

**Q1)** Give salient features of Energy conservation Act.2003 **[6]**

OR

**Q2)** What are the short term and long term energy policies? **[6]**

**Q3)** What is necessity of energy policy? Discuss the format of energy policy. **[7]**

OR

**Q4)** With suitable example discuss force field analysis. What will the benefits of it? **[7]**

**Q5)** Discuss implementation of demand side management for Commercial consumers. What are the benefits of it for consumers? **[7]**

OR

**Q6)** Explain with suitable examples the role of tariff in energy management. **[7]**

**Q7) a)** What is data analysis? What are different ways to analyse data? What are the benefits of data analysis? **[9]**

**P.T.O.**



- b) In a steel rolling mill monthly production related energy consumption was 2.3 times the production and non-production related energy consumption was 20,500 kWh per month. In the month of June a series of energy conservation measures were implemented. Use CUMSUM technique to develop a table and calculate energy savings for the subsequent 6 months period from the data given below. Also plot CuSuM graph. [9]

Month	Production (kg)	Actual Energy Consumption (kWh)
Sept.	66,000	1,48,000
Oct.	70,000	1,53,000
Nov.	75,000	1,58,000
Dec.	78,000	1,64,000
Jan.	62,000	1,35,000
Feb.	73,000	1,55,000

OR

**Q8)** a) Discuss preliminary Audit. Also discuss phase III of audit. [9]

- b) Discuss least square method for data analysis. Also explain standard format for energy audit report. [9]

**Q9)** a) Explain selection criteria of DG sets. Also enlist common energy conservation tips in DGs. [8]

- b) Energy saving opportunities in boiler and auxiliaries. [8]

OR

**Q10)** a) Discuss energy conservation measures in pumping systems. [8]

- b) Explain the method for adequacy assessment for illumination system. What inferences can be drawn after assessment? [8]

- Q11)a)** The energy manager of company wants to replace 50 HP induction motor with energy efficient motor for energy saving. On the basis on following data calculate payback period for replacement of old motor with energy efficient motor. Take cost of Electricity is Rs. 7/K Wh. The demand charges Rs. 410/k VA per month. [8]

Description	Old motor	Energy efficiency Motors
Rating of machine	50HP	50 HP
Loading percentage	85%	85%
Operating hours per annum	6500	6500
Efficiency near full load	89%	93.5%
Power factor near full load	0.85 log	0.89 log
Capital cost	—	Rs. 3,50,000
Scrap value	Rs.50,000/-	—

- b) Explain financial appraisal criteria. [8]

OR

- Q12)a)** Calculate net present value for an investment of Rs. 5,00,000 for retrofit. The energy saving realised for five are Rs. 1,00,000, Rs. 75,000 Rs. 1,25,000, Rs. 2,00,000, and Rs. 2,50,000/- with discounting factor is 11% judge the economic feasibility of the project. [8]
- b) Explain with suitable example break even analysis. How it is different from others? [8]



Total No. of Questions : 8]

SEAT No. :

**P2828**

[Total No. of Pages : 2

**[6003]-651**  
**T.E. (E & TC)**  
**DIGITAL COMMUNICATION**  
**(2015 Pattern) (Semester -I) (304181)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) The Bandwidth of TV video plus audio signal is 4.5 MHZ. If the signal is connected to PCM bit stream with 1024 quantization levels, determine the number of bits/sec generated by the PCM system. Assume that the signal is sampled at the rate of 20% above nyquist rate. [8]
- b) Classify & Explain random processes [6]
- c) Draw & Explain multiplexing hierarchies [6]

OR

- Q2)** a) Draw the spectrum & waveform of following line code of given sequence 101100 [8]
- i) Polar RZ
- ii) Polar NRZ
- iii) Split phase manchester
- iv) AMI
- b) Compare PCM,DPCM,DM [6]
- c) Show that the RP  $x(t) = A \cos (\omega_c t + \theta)$  is wss here  $\theta$  uniformly distributed in the range of  $(-\pi, \pi)$  [6]

- Q3)** a) Explain integrate & Dump Receiver in details. [8]
- b) A received signal have amplitude  $\pm 2$  for a time T, signal is corrupted by white Gaussian noise having PSD  $10^{-10}$  W/Hz. If signal is processed by matched filter receiver what should be minimum time T during which signal must be sustained so that probability of error is not exceeding  $\phi(3.69) = 10^{-4}$  draw the o/p of matched filter also [8]

OR

**P.T.O.**

- Q4)** a) Write a Note on [8]  
 i) LRT  
 ii) Gram Schmidt Orthogonalization.  
 b) Derive equation of SNR of matched filter in presence of AWGN. [8]

- Q5)** a) Draw and explain the transmitter and receiver diagram of BPSK with appropriate mathematical equations also draw signal space diagram and PSD of the same. [8]  
 b) Binary data is transmitted using BPSK at a rate of 2Mbps over transmission link having bandwidth of 2 MHz, find signal power required at the receiver in put so that  $P_e$  is not more than  $10^{-4}$ . Given noise PSD  $N_0/2 = 10^{-10}$  Watts/Hertz and  $\phi(3.71) = 10^{-4}$  Compare BPSK and BFSK. [6]  
 c) Compare BPSK & BFSK [4]

OR

- Q6)** a) With neat block diagram discuss pass band transmission model and enlist various pass band modulation schemes. [8]  
 b) Discuss BFSK transmitter & receiver along with wave forms. [6]  
 c) Explain signal space diagram of QAM in details. [4]

- Q7)** a) Design 3 bit PN sequence & hence verify the properties [6]  
 b) Explain DSSS with neat block diagram & state its advantages [6]  
 c) Draw & explain block diagram of FHSS [4]

OR

- Q8)** a) The information bit duration in DS- BPSK spread spectrum communication system 4ms while chipping rate is 1 MHz. Assuming an average error probability of  $10^{-5}$  for proper detection of message signal. Calculate the jamming margin .  
 Given  $\phi(4.25) = 10^{-5}$ ,  $\phi(3.25) = 10^{-6}$  [6]  
 b) Define following. [6]  
 i) Processing gain  
 ii) Jamming Margin  
 iii) Probability of error  
 c) Compare slow FHSS and Fast FHSS wrt Frequency spectrums. [4]





Total No. of Questions : 10]

SEAT No. :

P-3159

[Total No. of Pages : 3

**[6003]-652**  
**T.E. (E&TC)**  
**DIGITAL SIGNAL PROCESSING**  
**(2015 Pattern) (Semester - I) (304182)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** State the advantages of DSP over ASP. **[6]**

b) Compute DFT of the following sequence **[4]**

$$x(n) = \{2 \ 1 \ 3 \ 4\}$$

OR

**Q2) a)** With the help of suitable diagram explain the sampling and reconstruction of the time domain signal. **[6]**

b) Compute the DCT of the following sequence **[4]**

$$x(n) = [0 \ 1 \ 2 \ 3]$$

**Q3) a)** Find linear convolution using overlap add method for following sequence  
 $X(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$   $h(n) = \{1, 2, 3\}$  **[6]**

b) Determine causal signal  $x(n)$  if its Z transform  $X(Z)$  is given by

$$X(Z) = \frac{1 + 3Z^{-1}}{1 + 3Z^{-1} + 2Z^{-2}} \quad \text{[4]}$$

OR

**Q4) a)** Compute N = 8 point FFT of the following sequence **[6]**

$$x(n) = [1, 2, 3, 4, 4, 3, 2, 1]$$

b) Show that the computational complexity is reduced in FFT as compared to DFT. **[4]**

*P.T.O.*

**Q5) a)** Design second order Butterworth filter with cut off frequency of 1 kHz and sampling frequency of  $10^4$  samples/sec. by using bilinear transformation method. [9]

b) Obtain direct form I and II, Cascade and parallel realization of system described by,  $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$  [8]

OR

**Q6) a)** Convert analog filter with transfer function [9]

$$H(S) = \frac{2}{(S+1)(S+2)}$$

into digital IIR filter using Impulse invariance technique. Use Sampling frequency as 5Hz.

b) With the help of suitable diagram show the mapping between analog and digital frequencies Explain in detail the “Frequency Warping Effect”. [8]

**Q7) a)** Design linear phase FIR low pass filter of length 7 with cutoff frequency 1rad/sec. Using rectangular window. [9]

b) Obtain linear phase realization of [8]

$$H(z) = 1 + \frac{z^{-1}}{4} + \frac{z^{-2}}{4} + z^{-3}$$

OR

**Q8) a)** Why FIR filters are called as inherently stable filters? With the help of suitable diagram. Explain Gibb’s phenomenon. [8]

b) The desired response of low pass filter is given as [9]

$$H_d(e^{j\omega}) = e^{-j3\omega} \quad \text{for } -3\pi/4 \leq \omega \leq 3\pi/4$$

$$0 \quad \text{for } 3\pi/4 \leq \omega \leq \pi$$

Determine  $H_d(e^{j\omega})$  for  $M = 7$  using hamming window

- Q9)** a) Explain in detail the interference cancellation in ECG signal using DSP.[8]  
b) Write a short note on: (4 marks each) [8]  
i) “Compact disc recording system”  
ii) “Speech coding and compression”

OR

- Q10)** a) With the help of block diagram explain vibration signature analysis for defective gear teeth. [8]  
b) Write a short note on [8]  
i) “Speech Noise reduction”  
ii) “Two band digital crossover”





Total No. of Questions : 8]

SEAT No. :

P-2829

[Total No. of Pages : 2

[6003]-653

**T.E. (Electronics and Telecommunication)**

**ELECTROMAGNETICS**

**(2015 Pattern) (Semester - I) (304183)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculator packet calculator and smith chart is allowed.*
- 5) Assume suitable data, if necessary.*

- Q1)** a) Derive the expression for electric field intensity  $E$  at a point  $P$  due to uniform charge distribution along an infinite straight line with uniform line charge density  $\rho_L$ . [8]
- b) Determine electric flux density at  $(4, 0, 3)$  if there is a point charge  $5 \text{ mC}$  at  $(4, 0, 0)$  and line charge  $5 \text{ mC/m}$  along the  $z$ -axis. [8]
- c) Derive the expression for capacitance of a parallel plate capacitor. [4]

OR

- Q2)** a) Derive the boundary condition at an interface between two magnetic media. [8]
- b) State and prove Gauss Theorem. [6]
- c) Derive expression for capacitance of spherical plate capacitor. [6]

- Q3)** a) State and prove Poynting theorem. Also explain significance of each term in it. [8]
- b) Derive the boundary condition at an interface between conductor and free space. [8]

OR

**P.T.O.**

- Q4)** a) State and explain Maxwell's equations for time varying field in point form and integral form for free space. [8]
- b) Explain the terms in detail : [8]
- i) Retarded potential
  - ii) Displacement current density

- Q5)** a) Derive relationship  $Z_0$  and  $\gamma$  in terms of primary constants. [8]
- b) A transmission line has a characteristic impedance of  $300 \Omega$  and terminated in a load  $(150 + j 150)\Omega$ . Find following using Smith chart. [8]
- i) VSWR
  - ii) Reflection Coefficient
  - iii) Input impedance at distance  $0.1\lambda$  from the load

OR

- Q6)** a) State and explain the primary constants and secondary constants of transmission line. [8]
- b) Explain the reflection coefficient and standing wave ratio for transmission line. Derive the relation between standing wave ratio and reflection coefficient. [8]

- Q7)** a) Derive from Maxwell's equations the wave equation in vector form for Electric Field Intensity in free space. [8]
- b) A 10 GHz plane wave travelling in free space as an amplitude  $E_x = 10 \text{ V/m}$ . Find  $V$ ,  $\lambda$ ,  $\beta$ ,  $\eta$  and amplitude of  $H$ . [10]

OR

- Q8)** a) Define and explain depth of penetration. Derive expression for depth of penetration for a good conductor. [10]
- b) Define polarization of uniform plane waves? Explain the types of same. [8]



Total No. of Questions : 8]

SEAT No. :

P-2830

[Total No. of Pages : 2

[6003]-654

T.E. (E & TC)

MICROCONTROLLERS

(2015 Pattern) (Semester - I) (304184)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of scientific calculator is allowed.

- Q1)** a) Explain register banks available in 8051? [6]  
b) Draw and explain port structure of 8051 microcontroller. [6]  
c) Explain the following instructions of 8051 with suitable example. [8]  
i) ADD A, R1  
ii) DIV AB  
iii) DA A  
iv) MVI R2, #12H

OR

- Q2)** a) Explain PSW register of 8051 with suitable example. [6]  
b) LEDs are interfaced to PORT P1 of 8051. Write a program to generate the delay using timer 1 without interrupt, for flashing the LEDs continuously. [6]  
c) Draw the Interface diagram to interface 16 × 2 LCD with 8051. Write an ASM program to display message “Welcome” on it. (8 bit mode) [8]

- Q3)** a) State peripheral features of PIC18F4xxx with its significance. [8]  
b) Which are the various oscillator options present in PIC microcontroller? Enlist and illustrate any four of them with neat diagrams. [8]

P.T.O.

OR

- Q4)** a) Develop an embedded C program to generate a square wave of 1KHz with Timer 0 on pin PORTD.2 (Assume 50% Duty cycle, no prescaler and XTAL = 10MHz) Compute the value to be loaded in the Timer register. [8]
- b) Write an embedded C program to blink the LEDs interfaced to PORTC using common anode Configuration. Write the delay () function using Timer 0 in 16 bit mode. [8]
- Q5)** a) Interface LED and button with PIC 18FXX microcontroller, illustrate the interfacing diagram, develop a C code such that when button is pressed LED should turn ON and when button is released LED should turn OFF. [8]
- b) Explain CCP1CON register. Find PR2 register value for 20% duty cycle, 1KHz PWM frequency. Set bit pattern of CCP1CON register accordingly. [8]

OR

- Q6)** a) Draw and explain block diagram of CCP module of PIC18F4xxx. [8]
- b) Write a program to create a 1KHz PWM frequency with 40% duty cycle on CCP1 pin of PIC18FXX. Crystal frequency of 10MHz, N=16. [8]
- Q7)** a) Enlist pins used of PIC18FXX used for 12C MSSP module. Explain 12C master mode. [8]
- b) A temperature of Furnace is monitored with LM35 connected to RA0 pin of PIC18FXX and display it on LCD connected to PORTD. Draw an interface diagram and embedded C program for same. [10]

OR

- Q8)** a) Draw and explain TXSTA register. Give the significance of TXIF in serial transmission. [8]
- b) Give the importance of SPBRG register. Compute the SPBRG value in Hex for following baud rate with Fosc = 4MHz. [10]
- i) 2400
- ii) 9600
- Write the formula used.



Total No. of Questions : 8]

SEAT No. :

P-2831

[Total No. of Pages : 2

[6003]-657

T.E. (E & TC) (Semester - II)

POWER ELECTRONICS

(2015 Pattern) (304186)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of Calculator is allowed.

- Q1)** a) Explain Dynamic characteristics of SCR for Ton & Toff using. Suitable waveform. [7]
- b) How Voltage & current capacity of SCR string will enhance. [3]
- c) Draw & explain about 180 degree mode of 3 phase inverter for balanced star R load. [10]

OR

- Q2)** a) For an SCR, gate cathode characteristics is given by  $V(q) = 1 + 10 I(q)$  gate source voltage is rectangular pulse of 12v with 18  $\mu$ sec duration for an average power dissipation of 0.4 W and a peak gate drive power of 6 w compute: The resistance to be connected in series with the SCR gate, The triggering frequency, The duty cycle of triggering pulse. [7]
- b) Draw and explain about the construction and VI characteristics of IGBT [6]
- c) Compare Single phase full converter & Semi converter with RL load with waveform. [7]
- Q3)** a) Compare Step down & Step up chopper state their applications. [8]
- b) A dc chopper is fed from 120 V dc. Its load voltage consists of rectangular pulses of duration 2 m sec in an overall cycle time of 5 msec. Calculate the average output voltage and ripple factor [8]

P.T.O.

OR

- Q4)** a) Explain working of SMPS, what are its advantages over linear power supply. [8]
- b) A single-phase half-wave ac voltage controller using one SCR in antiparallel with a diode feeds 1 kW, 200 V heater. For a firing angle of  $60^\circ$ , calculate the load power and input power factor. [8]
- Q5)** a) What is SLR half bridge DC-DC Converter, explain through ckt & wave form. [8]
- b) Explain the need & objectives of UPS, Draw block diagram. [8]

OR

- Q6)** a) Explain about Stepper motor drives with power and driver circuit. [8]
- b) Explain the advantages of Electronic ballast over conventional ballast, state its operation. [8]
- Q7)** a) What are speed control techniques of DC Motor? Explain single phase separately excited DC motor power circuit. [10]
- b) Draw & Explain about the thermal equivalent of Power device, Explain need of heat sink. [8]

OR

- Q8)** a) Draw & Explain about the working of Snubber circuit. [8]
- b) Explain the working of rechargeable LED lamp or panel with driver circuit and battery specifications. [10]



Total No. of Questions : 8]

SEAT No. :

**P2832**

**[6003]-658**

[Total No. of Pages : 2

**T.E. (E & TC)**

**INFORMATION THEORY, CODING AND COMMUNICATION  
NETWORKS**

**(2015 Pattern) (Semester - II) (304187)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Explain Golay Code and Interleaved code in detail. [7]  
b) Explain Shannon-Fano coding in detail. [7]  
c) Define and give example. [6]  
i) Hamming weight  
ii) Hamming distance  
iii) Code rate

OR

- Q2)** a) What do you mean by Channel Capacity? Explain Channel coding theorem in detail. [7]  
b) Define entropy and explain its properties in detail. [7]  
c) A discrete memory less source has 4 symbols  $x_1, x_2, x_3, x_4$  with probabilities 0.3, 0.2, 0.4 and 0.1 respectively. Construct Huffman code, calculate code efficiency and redundancy. [6]

- Q3)** a) Design (15,11) Rs code. Find code for message polynomial  $(x + 1)$ . Use primitive polynomial  $P(x) = x^4 + x + 1$ . [10]  
b) Define following terms related to convolutional codes with example. [8]  
i) Constraint length  
ii) Code rate  
iii)  $D_{free}$  (free length)  
iv) Generating function

OR

*P.T.O.*

- Q4)** a) Explain decoding of BCH codes and decoding of RS codes in detail. [10]  
b) For systematic rate 1/2 convolutional encoder with constraint length 2. parity bit is generated by mod-2 sum  $p = x + 1$ . [8]  
i) Draw the encoder  
ii) Draw state diagram, trellis diagram  
iii) Find out the output for message (1 0 1)

- Q5)** a) Draw & explain TCP/IP model. Explain functionality of each layer. [8]  
b) Compare coaxial cable, optical fiber and twisted pair cable. [8]

OR

- Q6)** a) Explain network design issues in detail. [8]  
b) Define network. Explain different types of network topologies. [8]

- Q7)** a) What is ARQ? Explain three types of ARQ in detail. [8]  
b) Give functions/services of DLL. Compare it with physical layer. [8]

OR

- Q8)** a) Explain different types of stations and data transfer modes of HDLC. [8]  
b) What is framing? Explain different types of framing methods. [8]





Total No. of Questions : 8]

SEAT No. :

P-2833

[Total No. of Pages : 2

[6003]-659

**T.E. (Electronics & Telecommunication)**

**BUSINESS MANAGEMENT**

**(2015 Pattern) (Semester - II) (304188)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 .*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) State the functions and characteristics of Management. [6]  
b) Draw and explain Ishikawa diagram with the help of example. [6]  
c) Explain the techniques of capital Budgeting. [8]

OR

- Q2)** a) Discuss briefly different levels of management. [6]  
b) Explain the 5S quality management standards. [6]  
c) Explain payback method of capital budgeting. [8]

- Q3)** a) State the objectives and benefits of training. [8]  
b) Write note on investment in training program. [8]

OR

- Q4)** a) Explain human resource information system. [8]  
b) What is human resource planning and state its objectives. [8]

- Q5)** a) Define entrepreneurship and state its characteristics. [8]  
b) What is business plan? What are the benefits of preparing business plan? [8]

OR

**P.T.O.**

- Q6)** a) Write note on Women Entrepreneurship. [8]  
b) State different government policies for business. [8]

- Q7)** a) What is marketing? Explain the need of marketing. [10]  
b) State the factors affecting consumer behavior. [8]

OR

- Q8)** a) Briefly explain any two methods of pricing. [10]  
b) Define customer relationship management. State its benefits and limitations. [8]



Total No. of Questions : 8]

SEAT No. :

P-2834

[Total No. of Pages : 2

**[6003]-660**  
**T.E. (E&TC)**  
**ADVANCED PROCESSORS**  
**(2015 Pattern) (Semester - II) (306189)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Figures to the right side indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) Neat diagrams must be drawn wherever necessary.*

- Q1) a)** Write embedded C program to flash LED connected at PORT 0.0 of LPC 2148. Draw necessary interfacing diagram. **[10]**
- b) Draw interfacing diagram of 4 × 4 keyboard matrix with LPC 2148 using Port φ & PORT 1. **[6]**
- c) List features of LPC 2148. **[4]**

OR

- Q2) a)** Interface 16 × 2 LCD with LPC2148. Draw flow chart to display "HELLO" On 1<sup>st</sup> line and "WORLD" on 2<sup>nd</sup> line of display. **[10]**
- b) Describe interrupt structure of LPC 2148. **[6]**
- c) Explain SPSR register. **[4]**

- Q3) a)** Explain GSM and GPS module interfacing using neat diagram. **[8]**
- b) Write an embedded C program to generate triangular wave with DAC using LPC2148. **[8]**

OR

- Q4) a)** Draw flow chart to display the sensed temperature by ADC on LCD using LPC 2148. Draw interfacing diagram. **[8]**
- b) Describe SD card. Write steps to initialize SDCard. **[8]**

*P.T.O.*

**Q5)** a) List features of TMS 320C67X processor. Write note on FIR, FFT of DSP processor. [8]

b) Describe data paths in C67X processor. [8]

OR

**Q6)** a) Differentiate between VLIW and SIMD architecture. [8]

b) Describe registers of C67X processor. [8]

**Q7)** a) Explain concept of pipeline operation in C67X processor. [8]

b) Describe interrupt structure of C67X processor. [10]

OR

**Q8)** a) Write note on internal memory of C67X processor. [8]

b) Explain with examples addressing modes of C67X processor. [10]



Total No. of Questions : 8]

SEAT No. :

**P2835**

[Total No. of Pages : 3

**[6003]-661**

**T.E. (Electronics & Telecommunication Engineering)**  
**SYSTEM PROGRAMMING & OPERATING SYSTEMS**  
**(2015 Pattern) (Semester-II) (304190)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right indicate full marks.*
- 3) Use of electronic pocket calculator is allowed.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Explain different assembly language statements with examples. [7]
- b) Enlist the different loading schemes and explain in brief compile and go loader. [7]
- c) Consider the following process where the arrival and burst time as shown below calculate average waiting time and turnaround time using FCFS algorithm. [6]

Process	Burst time	Arrival time
P1	6	0
P2	4	1
P3	7	3
P4	2	5

OR

- Q2)** a) In the analysis of a source program explain the significance and main functions of Lexical Analysis, Syntax Analysis and Semantic Analysis.[7]
- b) What is loader? Explain the significance and main functions of loader in system software. [7]

**P.T.O.**

- c) Consider the following process where the arrival and burst time as shown below. If the quantum slice time is 2 calculate average waiting time and turnaround time using round Robin algorithm. [6]

	Burst time	Arrival time
P1	05	0
P2	04	1
P3	02	2
P4	01	4

- Q3)** a) Write short note on Inter-Process Communication. [6]  
 b) State and Explain the conditions for deadlock. [6]  
 c) Write short note on Semaphore. [5]

OR

- Q4)** a) Explain producer consumer problem with solution. [7]  
 b) Explain Race condition with suitable example while handling two or more processes. [6]  
 c) Explain Ostrich algorithm. [4]

- Q5)** a) Consider the following page reference string. [5]  
 2,3,2,1,5,2,4,5,3,2,5,2  
 Number of page frames=3  
 Calculate page fault and page hit ratio using FIFO page replacement algorithm.  
 b) List the design issues of paging system and explain any two. [6]  
 c) Explain segmentation and its advantages. [6]

OR

- Q6)** a) What is paging? Explain concept of paging with TLB. [6]  
 Consider the following page reference string.  
 1,2,3,1,4,5,6,2,1,3,2,7,6,3,4,1,2,6  
 b) Number of page frames=6  
 Calculate page fault and page hit ratio using LRU page replacement algorithm. [5]

c) What are types of memory fragmentation? Differentiate them on following points. [6]

- i) Definition
- ii) Occurrence
- iii) Solution

**Q7)** a) Write a note on: [6]

- i) Directory structure in OS
- ii) File management system in OS

b) Explain DMA Concept in detail. [6]

c) Calculate average seek length with the help of FCFS disk scheduling algorithm for the following track sequence, 90, 58, 55, 39, 18, 150 current location of head is 55. [4]

OR

**Q8)** a) Write a short note on RAID disc. [6]

b) Enlist the various file operations. Explain access rights in file sharing. [6]

c) Explain file attributes. [4]



Total No. of Questions : 10]

SEAT No. :

P-3146

[Total No. of Pages : 2

[6003]-662

T.E. (IT)

THEORY OF COMPUTATION

(2015 Pattern) (Semester - I) (314441)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

- Q1)** a) Design a Mealy m/c for increment the given binary number by 1. [6]  
b) Give the differentiate between CFG and CFL. [4]

OR

- Q2)** a) Describe English language for following RE : [4]  
i)  $(a^*ab^*ab^*) + b^*$  ii)  $a^* + b^*c$   
b) Design a DFA for Language over the alphabet  $\Sigma = \{0,1\}$ , end with 00.[6]

- Q3)** a) Show that  $P=Q$ , where  $P=(1+011)^*$ ,  $Q=\epsilon+1^*(011)^*(1^*(011)^*)^*$ . [4]  
b) For the following CFG. Find regular expression and FA that define the same.

Language :  $S \rightarrow 0B \mid 1C$ ,  $C \rightarrow 0B \mid 0$ ,  $B \rightarrow 1C \mid 0$  [6]

OR

- Q4)** a) Give RE and FA for [5]

$L = L1 \cap L2$   $\Sigma = \{0,1\}$  where  $L1$  = All the string of even length

$L2$  = All the ending with 'aa'

- b) Show that the context free languages are closed under union, concatenation and kleen star. [5]

- Q5)** a) Design a PDA accepting by empty store / stack of the following language:[9]  
 $\{a^n b^n c^m d^m \mid m, n \geq 1\}$

- b) Let  $L = \{a^m b^{2n} \mid n, m \geq 1\}$  Construct i) CFG grammar accepting L, [8]  
ii) a PDA accepting L by empty state.

OR

P.T.O.



- Q6)** a) Construct a PDA equivalent to the following CFG : [9]  
 $S \rightarrow aAA, A \rightarrow aS \mid bS \mid a.$   
 b) Design a PDA accepting by empty store / stack of the following language: [7]  
 $\{a^m b^n \mid m > n \geq 1\}.$

- Q7)** a) Design a TM to recognize the language even no. 0's and 1's. [9]  
 b) Give the short note on following : [8]  
 i) Type of TM  
 ii) Halting problem of TM

OR

- Q8)** a) Construct a TM that can accept language  $\Sigma = \{0,1\},$   
 $L = WCW^R \mid (W \text{ is in } (a+b)^*)$  [9]  
 b) Give the short note on following : [8]  
 i) Church's Turing hypothesis  
 ii) UTM

- Q9)** a) Explain with an Example of Turing Reducibility? [8]  
 b) If L is Recursive language over  $\Sigma$ , show that [8]  
 $L(L \text{ is define as } \Sigma - L \text{ is also recursive.})$

OR

- Q10)** a) Explain the complexity class P, NP and differential between NP Complete and NP Hard. [8]  
 b) Show that PCP over  $|\Sigma| \geq 2$  is solve. [8]



Total No. of Questions : 10]

SEAT No. :

P-2836

[Total No. of Pages : 3

[6003]-668

**T.E. (Information Technology)**  
**SYSTEMS PROGRAMMING**  
**(2015 Pattern) (Semester - II) (314451)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) With syntax and example explain EQU and LTORG statements of assembly language. [4]

b) With neat diagram explain compile and go (assemble and go) loader scheme. What are the advantages and disadvantages of its? [6]

OR

**Q2)** a) What is language Processor? Explain two main activities of language Processing. [4]

b) Explain parameter passing methods used in macro definition. [6]

**Q3)** a) What is forward reference? Explain with suitable example. [2]

b) Define Macro, Macro definition. [2]

c) Obtain output of all phases of compiler for the following input string : [6]

$p = e * 10 + c$

OR

**Q4)** a) List out main functions of PASS I and Pass II of Two Pass Assembler. [2]

b) Explain the significance of transfer vector. [2]

c) Convert the following RE to DFA using direct method. [6]

$(a \mid b)^* aa \mid (a/b)^* bb$

**P.T.O.**

**Q5) a)** Construct Predictive Parser for the following Grammar and show the working of parser for the input string id1 + id2 \* id3. [10]

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid \text{id}$

b) Write a short note on YACC and YACC specification. [4]

c) What is Operator Precedent Grammar? Write Operator precedent grammar for arithmetic expression also construct operator precedence Relation table for it. [4]

OR

**Q6) a)** Consider following grammar [10]

$E \rightarrow E + E \mid E * E \mid E / E \mid (E) \mid \text{id}$

Perform Shift Reduce Parser for the string id1 + id2 \* id3. Also explain Shift-Reduce conflict & Reduce-Reduce conflict occurred during parsing of string.

b) Write a note on Predictive Parser ( LL1 Parser). [4]

c) What is bottom-up parsing? Compare SLR and CLR parsers. [4]

**Q7) a)** For the statement given below generate the Intermediate Code in the form of : [4]

i) Triple

ii) Quadruple

$A = -P * (-Q + R)$

b) Consider the following grammar. [6]

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow \text{id}$

Design dependency graph for the expression :  $4 * 7 + 3$

c) Generate three address code for [6]

for (i=0; i<=5; i++)

$x = y + z$

OR

**Q8)** a) Explain Storage Allocation Strategies with example. [8]

b) Convert the following production rules into semantic rules and show the annotated parse tree for the input **int a, b, c;** [8]

$S \rightarrow T L;$

$T \rightarrow \text{int}$

$T \rightarrow \text{float}$

$T \rightarrow \text{char}$

$L \rightarrow L1, \text{id}$

$L \rightarrow \text{id}$

**Q9)** a) With examples explain at least four machine independent code optimization techniques. [8]

b) Discuss the factors affecting target code generation. [8]

OR

**Q10)** a) Explain machine dependent code optimization techniques with suitable example. [8]

b) Discuss run time storage management of a code generator. [8]



Total No. of Questions : 10]

SEAT No. :

**P2837**

**[6003]-669**

[Total No. of Pages : 2

**T.E. (Information Technology)**  
**DESIGN AND ANALYSIS OF ALGORITHMS**  
**(2015 Pattern) (Semester - II) (314452)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain Contraposition with example. **[5]**  
b) Enumerate Control abstraction of Binary Search Algorithm. **[5]**

OR

- Q2)** a) Explain Asymtotic Analysis of Algorithms. **[5]**  
b) Differentiate Prim's and Kruskal's Algorithm. **[5]**

- Q3)** a) Construct Bellman Ford Algorithm. **[5]**  
b) What is Principle of Optimality? **[5]**

OR

- Q4)** a) Discuss Minimum Spanning Tree. **[5]**  
b) Solve the recurrence equation  $T(n) = T(n/2) + n$  **[5]**

- Q5)** a) Give Control abstraction of Knapsack Problem. What do you mean by feasible solution and optimal feasible solution? Explain. **[9]**  
b) What do you mean by Backtracking? What are implicit Rules for implementation of the same? Give outline of Backtracking Algorithm. **[2+2+4]**

OR

- Q6)** a) Solve by using sum of subset technique for inputs = {3,4,5,2} and sum = 9. Show all steps. **[9]**  
b) Explain chromatic number reference to Graph coloring technique with example. **[8]**

**P.T.O.**

**Q7) a)** Explain FIFO Branch and Bound. [5]

b) Find the shortest path for following TSP given distance in adjacency matrix using branch and bound technique. [12]

Nodes/Cities	1	2	3	4	5
1	$\infty$	20	30	10	11
2	15	$\infty$	30	10	11
3	3	5	$\infty$	2	4
4	19	6	18	$\infty$	3
5	16	4	7	16	$\infty$

OR

**Q8) a)** Distinguish between FIFO branch and bound and LC branch and bound with the help of an example. [9]

b) List the advantages and disadvantages of branch and bound method. [8]

**Q9) a)** What is 3-SAT Problem? Explain. [6]

b) Differentiate P, NP, NP-Complete and NP-Hard Problems with suitable diagram and examples. [10]

OR

**Q10)a)** What is Max-Clique Problem? Discuss steps to find max-clique. [8]

b) Discuss Parallel Algorithms. [8]



Total No. of Questions : 10]

SEAT No. :

P-2838

[Total No. of Pages : 2

[6003]-670

T.E. (Information Technology) (Semester - II)

CLOUD COMPUTING

(2015 Pattern) (314453)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 2) Neat Diagrams must be drawn wherever necessary.
- 3) Assume suitable data if necessary.

- Q1)** a) Explain advantages and disadvantages of Cloud Computing. [5]  
b) What are different Cloud Delivery Models? Compare it with diagrams. [5]

OR

- Q2)** a) Compare private cloud verses public cloud. [4]  
b) Write Short Notes On : [6]  
i) Multitenant Technology  
ii) Web Technology

- Q3)** a) Define Hypervisor. Explain and Differentiate its Types. [5]  
b) Draw and explain XEN architecture. [5]

OR

- Q4)** a) Write short note on: Open Cloud Consortium [OCC]. [4]  
b) Explain three types of virtualization. [6]

- Q5)** a) Explain virtualization attack in detail with suitable examples. [8]  
b) List and describe three different threat agents. [8]

OR

- Q6)** a) How are security policies and mechanisms used to counter threats?[8]  
b) Explain the concept and use of hardened virtual server image. [8]

P.T.O.

- Q7)** a) Explain architecture of NASA's Nebula Cloud. [8]  
b) Explain the concept of cloudlet. How is it different from cloud? [8]

OR

- Q8)** a) Explain the concept of cloud mashup with a suitable diagram. [8]  
b) Explain architecture of Facebook platform. [8]

- Q9)** a) What is a Docker? Explain docker deployment workflow. [9]  
b) Describe key issues related to energy efficiency in cloud computing. [9]

OR

**Q10)** Write short notes on :

- a) Jungle computing [6]  
b) Autonomic cloud engine [6]  
c) Multimedia Cloud [6]





Total No. of Questions : 10]

SEAT No. :

P-2839

[Total No. of Pages : 4

**[6003]-682**

**T.E. (Mechanical)**

**DESIGN OF MACHINE ELEMENTS - I**

**(2015 Pattern) (Semester - I) (302041)**

*Time : 3 Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10 from the following.*
- 2) *Draw neat labeled diagrams wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of non programmable electronic calculator is permitted.*
- 5) *Assume suitable/standard data if necessary.*

- Q1)** a) Explain the three basic types of standards used in a design office. [4]  
b) A transmission shaft of cold drawn steel ( $S_{ut} = 500 \text{ N/mm}^2$  and  $S_{yt} = 300 \text{ N/mm}^2$ ) is subjected to a fluctuating torque which varies from  $-100 \text{ N-m}$  to  $+400 \text{ N-m}$ . The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of the shaft. Assume the distortion energy theory of failure. Take  $K_a = 0.79$ ,  $K_b = 0.85$ . [6]

OR

- Q2)** a) Write a short note on Modified Goodman diagram. [4]  
b) State the theory of elastic failure on which ASME code is based. [6]

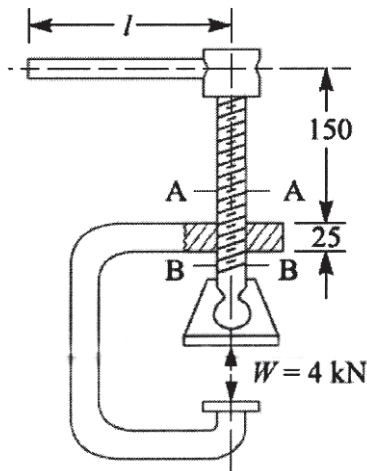
- Q3)** a) What is difference between splines and keys? [4]  
b) Design a rectangular key for a shaft of 50 mm diameter. Take shear stress 42 MPa. Compressive stress is 70 MPa. For key and shaft materials. [6]

OR

- Q4)** a) A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of  $250 \text{ N/mm}^2$ . The bar is made of steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ). Calculate the life of the bar for a reliability of 90%. Take  $K_a = 0.44$ ,  $K_b = 0.85$ ,  $K_c = 0.89$  [6]  
b) Explain briefly the various phases involved in the process of design of machine Elements? [4]

*P.T.O.*

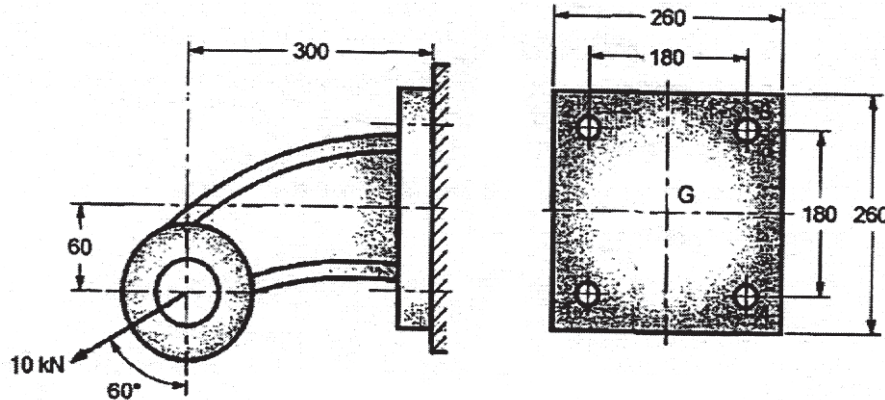
- Q5)** a) Prove that Efficiency of self locking square threads is less than 50% ? [6]
- b) A C-clamp, as shown in Fig., has trapezoidal threads of 12 mm outside diameter and 2 mm pitch, The coefficient of friction for screw threads is 0.12 and for the collar is 0.25. The mean radius of the collar is 6 mm. If the force exerted by the operator at the end of the handle is 80 N, find:
- The length of handle;
  - The maximum shear stress in the body of the screw and where does this exist; and
  - The bearing pressure on the threads.



OR

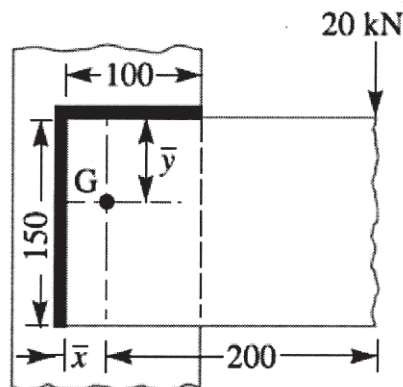
- b) A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of  $5.8 \text{ N/mm}^2$ , find:
- The torque required to rotate the screw;
  - The stress in the screw and Nut; and
  - The number of threads of nut in engagement with screw.
- [8]

- Q7) a)** Write a short note on 'bolts of uniform strength'. [8]
- b)** An off-set column is fixed to a steel column is as shown in figure by means of four bolts. The bracket is subjected to an inclined pull of 10 kN. Determine the diameter of bolts by assuming allowable tensile stress in bolt to be 150 N/mm<sup>2</sup>. [10]



OR

- Q8) a)** State the advantages and disadvantages of welded joints. Also explain types of welded joints. [8]
- b)** A bracket, as shown in Fig., carries a load of 10 kN. Find the size of the weld if the allowable shear stress is not to exceed 80 MPa. [10]



- Q9) a)** Draw a neat sketch of a multi leaf spring and show its essential parts. [6]
- b)** A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, find : i) Size of the spring wire, ii) Diameters of the spring, iii) Number of turns of the spring and iv) Free length of the spring. The compression of the spring at the maximum load is 30 mm. take  $G = 80 \text{ kN/mm}^2$ . [10]

OR

- Q10)** a) Explain Nipping of Leaf spring. [6]
- b) A safety valve of 60 mm diameter is to blow off at a pressure of  $1.2 \text{ N/mm}^2$ . It is held on its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. Take  $G = 80 \text{ kN/mm}^2$ . Calculate: i) Diameter of the spring wire, ii) Mean coil diameter, iii) Number of active turns and iv) Pitch of the coil. [10]



Total No. of Questions : 10]

SEAT No. :

**P2840**

**[6003]-683**

[Total No. of Pages : 3

**T.E. (Mechanical/Automobile)**

**HEAT TRANSFER**

**(2015 Pattern) (Semester - I) (302042)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right of each question indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, Mollier chart and calculator is allowed.*

- Q1)** a) State and explain Fourier's law of heat conduction. [5]  
b) Define fin efficiency. Identify the important parameters responsible for increase in fin efficiency. [5]

OR

- Q2)** a) Explain difference between fin efficiency and fin effectiveness. [5]  
b) A horizontal steel pipe having a diameter of 5 cm is maintained at a temperature of 50°C in a large room where the air and wall temperature are at 20°C. The surface emissivity of the steel may be taken as 0.8 and the convection heat transfer coefficient as 25 W/m<sup>2</sup>K. Calculate the total heat lost by the pipe per unit length. [5]

- Q3)** a) Explain the significance of Biot Number and Fourier Number. [5]  
b) Write three dimensional heat conduction equation in cylindrical coordinates and reduce it in one dimensional form. [5]

OR

- Q4)** a) Fins are more effective, when provided on surface for which film heat transfer coefficient is smaller. Explain [5]  
b) A stainless steel rod of outer diameter 3 cm originally at a temperature of 500°C is suddenly immersed in a liquid at 100°C for which the convective heat transfer coefficient is 100 W/m<sup>2</sup>K. For stainless steel  $k = 40 \text{ W/mK}$ ,  $\rho = 7800 \text{ kg/m}^3$ ,  $c = 460 \text{ J/kgK}$ , Determine the time required for the rod to reach a temperature of 150°C. [5]

**P.T.O.**

- Q5) a)** Explain the velocity and thermal boundary layer and its significance. [8]
- b)** Water is flowing at the rate of 50 kg/min through a tube of inner diameter 2.5cm. The inner surface of tube is maintained at 100°C. If the temperature of water increases from 25°C to 55°C, find length of tube required.  $Nu = 0.023 Re^{0.8} Pr^{0.4}$ , Properties of water:  $\rho = 977.8 \text{ kg/m}^3$ ,  $k = 0.6672 \text{ W/m}^\circ\text{C}$ ,  $\mu = 405 \times 10^{-6} \text{ Ns/m}^2$ ,  $C_p = 4.187 \text{ kJ/kg } ^\circ\text{C}$ . [8]

OR

- Q6) a) i)** Differentiate between forced convection and natural convection.[8]
- ii)** Give the characteristic dimension for following cases in Natural convection.
- 1) Vertical cylinder
  - 2) Horizontal cylinder
  - 3) horizontal plate
  - 4) Sphere
- b)** A horizontal flat circular metallic plate is kept on its flat surface on a terrace ground in sunlight. Radius of plate = 2 m. It attains a steady state temperature of 77°C. The ambient temperature is 27°C. Calculate the rate at which solar heat energy is received by the plate by means of convection only. Also calculate the rate of heat transfer per unit area of the plate.

Take characteristic length of plate = Surface area / Perimeter

For horizontal plate with hot surface up,

$$Nu = 0.13 (Gr Pr)^{1/3} \text{ for } Gr Pr < 2 \times 10^8.$$

$$Nu = 0.16 (Gr Pr)^{1/3} \text{ for } Gr Pr > 2 \times 10^8.$$

Use the following properties of air:

$$k = 0.0282 \text{ W/mK}, \nu = 18.23 \times 10^{-6} \text{ m}^2/\text{s}, Pr = 0.7025$$

- Q7) a)** Define and explain the solid angle in detail with sketch. [8]
- b)** Find out heat transfer rate due to radiation between two infinitely long parallel planes. One plane has emissivity of 0.4 and is maintained at 200°C. Other plane has emissivity of 0.2 and is maintained at 30°C. If a radiation shield ( $\varepsilon = 0.5$ ) is introduced between the two planes, find percentage reduction in heat transfer rate and steady state temperature of the shield. [8]

OR

**Q8) a)** Explain how electrical network can be applied to solve the radiation heat transfer problems. [8]

b) A pipe carrying steam having an outside diameter of 20 cm runs in a large room and is exposed to air at a temperature of 30°C. The pipe surface temperature is 400°C. Calculate loss of heat to the surroundings per meter length of pipe, due to thermal radiation. The emissivity of pipe surface is 0.8. What would be loss of heat due to radiation, if the pipe is enclosed in a 40 cm diameter brick conduit of emissivity 0.91? Find percentage change in heat transfer. [8]

**Q9) a)** Explain different regimes in pool boiling curve with neat sketch. [8]

b) Two fluids 'A' and 'B' exchange heat in a counter flow heat exchanger. Fluid 'A' enters at 420°C and has a mass flow rate of 1 kg/s. fluid 'B' enters at 20°C and has a mass flow rate of 1 kg/s. The effectiveness of heat exchanger is 75%. Determine Heat transfer rate and The exit temperature of fluid 'B'. Specific heat of fluid 'A' is 1 kJ/kgK and that of the fluid 'B' is 4kJ/kgK. [10]

OR

**Q10)a)** Derive an expression for LMTD for parallel flow heat exchanger. [8]

b) A chemical having a specific heat of 3.3 kJ/kg K flowing at the rate 20,000 kg/h enters a parallel flow heat exchanger at 120°C. The flow rate of cooling water is 50,000 kg/h with an inlet temperature of 20°C. The heat transfer area is 10 m<sup>2</sup> and overall heat transfer coefficient is 1200 W/m<sup>2</sup>°C. Taking specific heat of water as 4.186 kJ/kg K, find [10]

i) Effectiveness of the heat exchanger.

ii) Outlet temperature of water and chemical.



Total No. of Questions : 10]

SEAT No. :

**P2841**

[Total No. of Pages : 4

**[6003]-684**

**T.E. (Mechanical/Automobile Engg.)**

**THEORY OF MACHINES-II**

**(2015 Pattern) (Semester-I) (302043)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8. Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicates full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** A pinion having 30 teeth drives a gear having 80 teeth. The profile of gears is involute with  $20^\circ$  pressure angle, 10 mm module & 10 mm addendum. Find the length of path of contract, arc of contact and contact ratio. **[6]**

- b) Define: **[4]**
- i) Module
  - ii) Circular pitch
  - iii) Pressure angle
  - iv) Normal pressure angle

OR

**Q2) a)** A pair of parallel helical gears consist of a 25 teeth pinion meshing with 45 teeth gear. The helix angle is  $25^\circ$  & normal pressure angle is  $20^\circ$ . The normal module is 3mm. calculate: **[6]**

- i) Transverse module.
  - ii) Transverse pressure angle.
  - iii) Axial pitch
  - iv) Pitch circle diameter of pinion & Gear
- b) Define the term lead angle of worm & explain the significance. **[4]**

**P.T.O.**



- Q3) a)** In an epicyclic gear of the 'Sun & Planet' type shown in fig. 1 the PCD of the internally toothed ring is to be 224mm & module 4mm. When the ring D is stationary, the spider A which carries the three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable numbers of teeth for all wheels. [8]

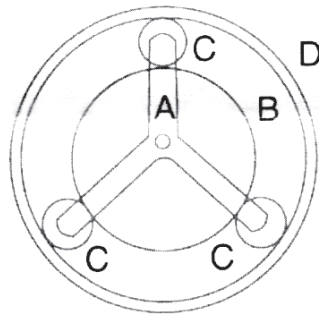


Fig. 1

- b) Write any four types of special Bevel Gears. [2]

OR

- Q4)** In epicyclic gear train as shown in fig.2 the driving gear A rotating in clockwise direction has 14teeth & fixed annular gear C has 100 teeh. The ratio of gear in gears E & D is 98:41. If 1.85kW is supplied to the geat A roatating at 1200 rpm. Find: [10]

- a) The Speed and direction of rotation of gear E.  
b) The fixing torque required at C, assuming 100% efficiency throughout & that all teeth have the same pitch.

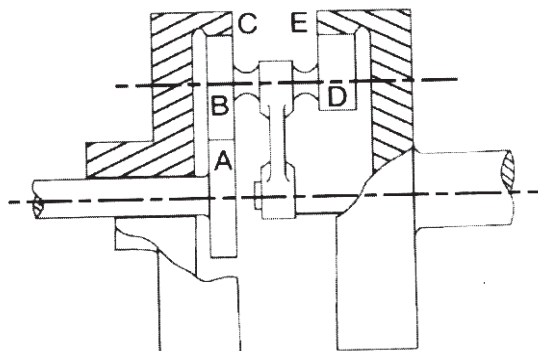


Fig.2

- Q5) a)** Derive an expression for displacement, velocity, acceleration & jerk 2-3 polynomial advanced cam & also sketch the curves. [10]
- b)** An eccentric plate circular cam of 160 mm diameter and eccentricity 40mm provides motion to a spring loaded follower of mass 2 kg whose axis is perpendicular to the axis of the cam & passes through its center. The spring has stiffness of 25 N/mm. it is found that at certain speed, the follower ceases contact with cam when it is rotated through  $110^\circ$  from its lower position. Determine this speed. If the initial compression of spring is 32mm, determine also the limiting speed of the cam to avoid jump. Ignore weight of follower. [6]

OR

- Q6)** The following data relate to a cam profile in which the follower is a flat faced follower moving with SHM during ascent & with uniform acceleration and retardation, acceleration being  $2/3^{\text{rd}}$  of retardation during descents. Minimum radius of cam=25 mm, lift=30mm, angle of ascent= $120^\circ$ . Angle of descent  $100^\circ$ , Angle of dwell between ascent & descent= $80^\circ$ . Speed of cam= 200 rpm. Draw the profile of cam & determine max. velocity & acceleration of the follower during outstroke & return stroke. [16]

- Q7) a)** Determine the chebyshev spacing for function  $y = x^{1.5}$  for the range  $0 \leq x \leq 3$  where three precision points are required. For these positions points. determine  $\theta_2, \theta_3$  &  $\Phi_2, \Phi_3$  if  $\Delta\theta=40^\circ$  &  $\Delta\Phi=90^\circ$ . [10]
- b)** A function varies from 0 to 8. Find the chebyshev spacing for four precision positions. [6]

OR

- Q8) a)** Design a four bar mechanism with input link coupler link & output link angles  $\theta$  &  $\Phi$  for 3 successive positions are given below: [10]

Position	1	2	3
$\theta$	$40^\circ$	$55^\circ$	$70^\circ$
$\Phi$	$50^\circ$	$60^\circ$	$75^\circ$

If the grounded link 30 mm, using Frudenstein's equation, find out length of other links to satisfy the given position conditions. Also draw the synthesized mechanism in its first position & comment on the mechanism obtained.

- b)** Derive an equation to evaluate kinematic coefficients for Synthesizing the four bar mechanism by using algebraic method. [6]

**Q9) a)** A ship propelled by a turbine rotor which has a mass of 5 tons of speed of 2100 rpm. The rotor has radius of gyration of 0.5m & rotates in clockwise direction when viewed from stern. Find the gyroscopic effects in following conditions.

- i) The ship sails at speed of 30 km/hr & steers to left in a curve having 60m radius.
- ii) The ship pitches  $6^\circ$  above &  $6^\circ$  below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is SHM & the periodic time is 20 sec.
- iii) The ship rolls & at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern.

Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case. **[14]**

- b) Write any 4 advantages of Stepless Drive. **[4]**

OR

**Q10)a)** A pair of locomotive driving wheels with the axle, have a MI. of  $180 \text{ kg-m}^2$ . The diameter of wheel treads is 1.8m & distance between wheel centers is 1.5m. When the locomotive is travelling on a level track at 95 km/h defective ballasting causes one wheel to fall 6mm & to rise again in total time of 0.1 sec. If the displacement of wheel takes place with SHM. Find: **[10]**

- i) The gyroscopic couple set
  - ii) The reaction between the wheel & rail due to this couple
- b) Draw & explain in detail working principle of any one type of CVT. **[8]**



Total No. of Questions : 10]

SEAT No. :

P-2842

[Total No. of Pages : 4

**[6003]-685**  
**T.E. (Mechanical Engineering)**  
**TURBO MACHINES**  
**(2015 Pattern) (Semester - I) (302044)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) Use of non-Programmable Scientific Calculator is allowed.*
- 3) Draw neat and suitable figure; wherever necessary.*
- 4) Figure to right indicate full marks.*
- 5) Use of steam table, Drawing sheet is permitted.*

**Q1) a)** A 75 mm diameter of jet of water having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at  $45^\circ$  to the axis of the jet. Find the normal force exerted by jet on the plate, work done and efficiency of the system? **[6]**

b) State the major components of a Turbomachine with their functions? **[4]**

OR

**Q2) a)** A jet of water moving with a velocity of 40 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of  $30^\circ$  with the direction of vane at inlet and leaves at an angle of  $90^\circ$  to the direction of vane at outlet. Determine vane angle at inlet and outlet so that water enters and leaves the vane without shock? **[6]**

b) Write a note on the losses in the turbomachines in details? **[4]**

**Q3) a)** Two jets strike the buckets of a Pelton wheel, which generates shaft power of 15450 kW. The diameter of each jet is given as 200 mm. If the net head on the turbine is 400 m, Find the overall efficiency of the turbine. Take  $C_v = 1.0$ . **[6]**

b) Define the term: Degree of reaction and explain the meaning of pure reaction and  $50^\circ$  reaction turbines. **[4]**

OR

*P.T.O.*

**Q4)** The following particulars refer to a stage of Parson's turbine comprising one ring of fixed blade and one blade of moving blades; Mean diameter of the blade ring = 70 cm, RPM=3000, steam velocity at exit from blade = 160 m/s, blade outlet angle =  $20^\circ$ , steam flow through blades = 7 kg/s. Draw the velocity diagram and find following : **[10]**

- i) Blade inlet angle,
- ii) Tangential force on the ring of a moving blade,
- iii) Power developed in a stage.

**Q5) a)** Derive an expression for diagram efficiency of single stage Impulse Turbine. Obtain the Condition for Maximum efficiency & its value. **[8]**

- b) In a single stage impulse turbine the mean diameter of the blade ring is 1 m and the rotational speed is 3000 rpm. The steam is issued from the nozzle at 300 m/sec and nozzle angle is  $20^\circ$ . The blades are equiangular. If the friction loss in the blade channel is 19% of the kinetic energy corresponds to relative velocity at the inlet to the blades. What is the power developed in the blading when the axial thrust on the blades is 98 N. Solve the problem graphically or analytically. **[8]**

OR

**Q6) a)** Enumerate the energy losses in steam turbine. **[6]**

- b) Steam issues from the nozzles of an angle of  $20^\circ$  at a velocity of 440 m/s, the friction factor is 0.9, for a single stage turbine designed for a maximum efficiency determine:
- i) Blade velocity
  - ii) Moving blade angles for equiangular blades
  - iii) Blade efficiency
  - iv) Stage efficiency if the nozzle efficiency is 93% & power developed for mass flow rate of 3 kg/s. **[10]**

**Q7) a)** Define the maximum suction lift. State the expression to calculate it. What factors affect its values? **[6]**

- b) Following data relates to centrifugal pump: Eye and rim diameter = 10 cm and 20 cm respectively, outer width = 1.25 cm, vane angle at outer rim =  $25^\circ$ , speed = 3000 rpm, constant flow velocity = 3 m/s, manometric efficiency = 78% and overall efficiency = 72%. Determine: **[10]**

- i) Inlet vane angle
- ii) Discharge
- iii) Manometric head and
- iv) Shaft Power
- v) Mechanical efficiency

OR

**Q8) a)** Derive an expression for rise in pressure through impeller of a centrifugal pump. **[6]**

- b) A centrifugal pump running at 900 rpm has an impeller diameter of 500mm and eye diameter of 300 mm. The blade angle at outlet is  $35^\circ$  with the tangent. Determine assuming zero whirl at inlet, the inlet blade angle, absolute velocity at outlet and its direction and the manometric head. The flow velocity is constant at 3m/s. **[10]**

**Q9) a)** Explain slip and Pre-whirl, Surging and choking in rotary compressor.**[8]**

- b) A centrifugal compressor running at 9000 rpm delivers  $600 \text{ m}^3/\text{min}$  of free air. The air is compressed from 1 bar and  $20^\circ\text{C}$  and delivered at 4 bar. The isentropic efficiency is 82%.The blades are radial at outlet and constant flow velocity is 62 m/s. The outer dia. of the impeller is twice the inner dia. and slip factor may be taken as 0.9. The blade area coefficient of 0.9 may be assumed at inlet. Calculate: **[10]**

- i) Temperature of air at outlet of impeller
- ii) Power required driving the compressor
- iii) Impeller diameters at inlet and outlet
- iv) Impeller blade angle at inlet
- v) Diffuser blade angle at inlet
- vi) Breadth of impeller at inlet

OR

**Q10)a)** Compare axial flow compressors and Centrifugal compressor on the following points: **[8]**

- i) Isentropic efficiency
  - ii) Pressure ratio per stage
  - iii) Range of operation within surging and chocking limits
  - iv) Effect of performance when working with contaminated fluids
  - v) Multi-staging limits
  - vi) Starting Torque
  - vii) Delivery Pressure
  - viii) Frontal area
- b) Explain pressure coefficient, flow coefficient and work input factor for axial flow compressors? **[10]**



Total No. of Questions : 9]

SEAT No. :

**P2843**

[Total No. of Pages : 2

**[6003]-686**

**T.E. (Mechanical/Automobile)**

**METROLOGY AND QUALITY CONTROL**

**(2015 Pattern) (Semester-I) (302045)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn whenever necessary.*
- 2) *Solve Q.No.1 or 2, Q.No.3 or 4, Q.No.5 or 6, Q.No.7 or 8. & Q.No.9.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of non-programmable calculator is allowed.*
- 5) *Figures to the right indicate full marks.*

- Q1)** a) Explain hole and shaft basis system with neat sketch. [5]  
b) Design Go and NOGO limit plug gauge for checking a hole having size 50 (+0.06,-0.00). Assume gauge maker's tolerance equal to 10% of work tolerance and wear allowance equal to 10 % of gauge maker's tolerance.[5]

OR

- Q2)** Differentiate between (any two) [10]  
a) Accuracy & Precision.  
b) Line and End standards.  
c) Systematic and random Error.

- Q3)** a) Write short note on Machine vision system. [5]  
b) List the various types of comparators and explain any one. [5]

OR

- Q4)** a) Define surface finish and explain various surface characteristics. [5]  
b) Explain automatic inspection system. [5]

- Q5)** a) Explain 7QC Tools. [7]  
b) Explain Juran's trilogy approach with diagram. [9]

OR

*P.T.O.*



- Q6)** a) Explain the concept of cost of quality & value of quality. [8]  
b) Define quality circle and list the objectives of quality circle. [8]

- Q7)** a) What are advantages of sampling inspection over 100% inspection? Explain the difference between single sampling and double sampling plan. [8]  
b) Discuss six sigma with suitable normal distribution curve. [8]

OR

- Q8)** a) A batch of 100 test specimens made of grey cast iron are tested on UTM, to determine the ultimate tensile strength of material. The results are tabulated as follows. [8]

Ultimate tensile Strength of material	Frequency
270	4
290	32
310	50
330	12
350	2

Calculate :

- i) Mean
  - ii) Variance
  - iii) Std. deviation
- b) What are the various elements of quality audit? [8]

- Q9)** Write note on (any 3) [18]

- a) Poka yoke
- b) DMAIC
- c) QFD
- d) TQM
- e) 5S
- f) JIT



Total No. of Questions : 10]

SEAT No. :

P-2844

[Total No. of Pages : 3

[6003]-687

T.E. (Mechanical)

REFRIGERATION AND AIR CONDITIONING

(2015 Pattern) (Semester - II) (302049)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q. 9 or 10.
- 2) Draw neat diagrams wherever necessary.
- 3) Use of scientific calculator, psychrometric chart is allowed.
- 4) Assume suitable data wherever necessary.
- 5) Figures to the right indicate full marks.

Q1) a) With a neat sketch explain the working of Ice plant. [4]

b) State desirable properties of refrigerants. [6]

OR

Q2) a) What is the significance of environment friendly refrigerant? [4]

b) A simple saturated vapour compression refrigeration system has a condensing temperature of 50°C and evaporating temperature of 0°C. The refrigeration capacity is 7 TR. The liquid leaving the condenser is saturated liquid and compression is isentropic. Determine:

- i) The mass of refrigerant in kg/s
- ii) Compressor power in kW
- iii) Heat rejected from the system and
- iv) COP of the system

Take enthalpy at the end of isentropic compression as 210 kJ/kg & Properties of Refrigerant is listed in the following table: [6]

T°C	P bar	$h_f$ kJ/kg	$h_g$ kJ/kg	$S_{fg}$ kJ/kgK	$S_g$ kJ/kgK
50	12.199	84.868	206.298	0.3034	0.6792
0	3.086	36.022	187.397	0.1418	0.6960

P.T.O.

- Q3)** a) Explain the concept of Carnot COP? [4]  
b) Explain refrigeration system with flash gas removal. [6]

OR

- Q4)** a) Explain Multi evaporator vapour compression refrigeration system. [4]  
b) State various applications of cryogenics. [6]

- Q5)** a) Explain the ASHRAE comfort chart showing the comfort zone for winter and summer season. [6]  
b) Explain the significance of various psychometric processes by drawing it on psychomotor chart. [10]

OR

- Q6)** a) Define RSHF, GSHF & ESHF. [6]  
b) Explain different methods of duct deign. [10]

- Q7)** a) Explain the working of Automatic Expansion Valve with a neat sketch.[8]  
b) Explain the working of different components used in air conditioning system. [8]

OR

- Q8)** a) Explain the working of Thermostatic Expansion Valve with a neat sketch. [8]  
b) Explain the concept of All-Air system with neat sketch. Also state the application of same. [8]

- Q9)** a) Explain the concept of Humidity and Smoke sensors. [8]  
b) What are the different pressure losses in the duct. Explain. [10]

OR

- Q10)** a) Classify the ducts on the basis of pressure and velocity of air in the duct. Also state any four factors which should be considered during design of duct. [8]  
b) Classify fans used in air conditioning system. Explain any one fan in detail. [10]



Total No. of Questions : 12]

SEAT No. :

**P2845**

**[6003]-688**

[Total No. of Pages : 4

**T.E. (Mechanical and Automobile Engineering)**  
**NUMERICAL METHODS AND OPTIMIZATION**  
**(2015 Pattern) (Semester - II) (302047)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q.9 or Q.10, and Q.11 or Q.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** If  $x = 0.4000$  is correct to 3 significant digits, then find maximum relative error. Also find absolute and relative error in the function  $f(x) = x + \sqrt{x}$  [6]

OR

**Q2)** Using Bisection method, find a root of the following equation at the end of sixth iteration.  $x^4 + 2x^3 - x - 1 = 0$  [6]

**Q3)** Solve the following equations using Gauss Elimination Method [6]

$$3x + 6y + z = 16$$

$$2x + 4y + 3z = 13$$

$$x + 3y + 2z = 9$$

OR

**Q4)** Solve the following equations using Gauss Jordan Method [6]

$$3x + 2y + 4z = 19$$

$$5x + 8y + z = 24$$

$$x + y + 10z = 33$$

**Q5)** Solve the following Linear Programming problem using Simplex Method [8]

$$\text{Maximize } Z = 1600x + 1500y$$

$$\text{Subject to } 5x + 4y \leq 500$$

$$15x + 16y \leq 1800$$

$$x \geq 0, y \geq 0$$

OR

**P.T.O.**

**Q6)** Solve the following Linear Programming problem using Simplex Method

$$\text{Minimize } Z = 24x + 40y \quad [8]$$

$$\text{Subject to } 3x + 2y \geq 5$$

$$x + 4y \geq 8$$

$$x + y \geq 4 \text{ where, } x \leq 0, y \leq 0$$

**Q7) a)** Draw a flowchart for Runge-Kutta 4<sup>th</sup> order method. [12]

b) Given

$$\frac{dy}{dx} = x - y^2 \text{ and } y(0) = 1$$

Find  $y(0.5)$  taking step size as 0.1

Using Runge-Kutta second order method.

OR

**Q8) a)** Given the differential equation [6]

$$\frac{dy}{dx} = \frac{x^2}{y^2 + 1}$$

with initial condition  $y = 0$  when  $x = 0$ , obtain  $y$  for  $x = 1.0$

taking step size as 0.25 using Euler's method.

b) A square plate ABCD  $3\text{m} \times 3\text{m}$  is insulated at two opposite edges AB and CD and the temperature at the surfaces AD and BC is maintained at  $100^\circ\text{C}$  and  $0^\circ\text{C}$  respectively till equilibrium condition is reached. Find the temperature distribution in the plate. Governing differential equation for variation of temperature in a 2 dimensional conducting media is [12]

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

and at the insulated surfaces  $\frac{\partial T}{\partial x} = 0$

- Q9) a)** Following data refers to the load lifted and corresponding force applied (effort) in a pulley system. If the load lifted and the effort required are related by equation [8]

$$\text{Effort} = a \times (\text{load lifted}) + b$$

Where, a and b are constants.

Load(KN)	10	15	20	25	30
Effort(KN)	0.750	0.935	1.100	1.200	1.300

Evaluate a and b by linear curve fitting.

- b)** Following data refers to equation of a best fit curve of the type [8]

$$y = a b^x$$

where, a and b are constants.

x	1	3	4	6	9
y	1.2	2.589	3.166	4.206	5.586

Find the values of constants a and b by fitting a curve through the above points.

OR

- Q10)a)** Following data relates to an experiment. [8]

X	0	1	2	3	4
y	1	5	25	100	250

Find the value of y at x = 3.5 using Newton Backward Interpolation.

- b)** The velocity distribution of a fluid near a flat surface is given as : [8]

X(m)	0.1	0.3	0.6	0.8
V(mm/sec)	0.72	1.81	2.73	3.47

x is the distance from surface (m) and V is the velocity (mm/sec). Find the velocity when distance from the surface is 0.4mm using, Divided difference method.

**Q11)a)** A curve is drawn to pass through points given in the table below [8]

x	1	1.5	2	2.5	3	3.5	4
y	2	2.4	2.7	2.8	3	2.6	2.1

Estimate the area bounded by the curve using,

- i) Trapezoidal Rule and
- ii) Simpson's 1/3<sup>rd</sup> Rule

**b)** Integrate the following given function by Simpson's 3/8<sup>th</sup> Rule [8]

x	0	2	4	6	7.5	9	10.5
y	1	13	34	73	299	341	468

OR

**Q12)a)** Find  $\int_2^4 (2x^2 + 1)dx$  by Gauss Legendre two point formula [8]

**b)** A function  $f(x,y)$  is described by the following data: [8]

x	1	1.25	1.5	1.75	2.0
y					
y = 1.0	3	3.8125	4.75	5.8125	7.0
y = 1.5	4.75	5.6875	6.75	7.9375	9.25
y = 2.0	7.0	8.0625	9.25	10.5625	12.0

Find the double integration of the function by Trapezoidal Rule.

The limits of x are 1.0 to 2.0 and limits of y are 1.0 to 2.0





Total No. of Questions : 10]

SEAT No. :

**P2846**

[Total No. of Pages : 2

**[6003]-689**

**T.E. (Mechanical/ Automobile)  
MANUFACTURING PROCESS-II  
(2015 Pattern) (Semester-II) (302051)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q.9 or Q.10
- 2) Figures to the right indicate full marks.
- 2) Assume suitable data necessary.

- Q1)** a) Differentiate between up-milling and down milling operations. [4]  
b) The tool life of high speed steel (HSS) tool and carbide tool have the same tool life of 60 minutes at a cutting speed of 75 m/min. the exponent of tool life in Taylor's equation "n" is 0.15 for HSS, while it is 0.2 for carbide tool. Compare tool life for the two tools at a speed of 90 m/min. [6]

OR

- Q2)** a) List types of chips and Explain the cutting conditions for chip type formation. [4]  
b) Calculate the Index Crank movement for 87 divisions by compound indexing methods. [6]  
Plate. No.1: 15, 16, 17, 18, 19, 20  
Plate. No. 2: 21, 23, 27, 29, 31 ,33  
Plate. No. 3: 37, 39, 41, 43, 47, 49

- Q3)** a) Explain standard marking system of grinding wheels. [4]  
b) Sketch Broach tool geometry and discuss main parts. [6]

OR

- Q4)** a) Differentiate between gang drilling and multispindle drilling machine. [4]  
b) With neat sketch explain any three milling operations. [6]

- Q5)** a) Explain the working set-up and principle of ECM in detail with neat sketch.[8]  
b) Discuss the need of non-conventional machining processes. Classify NCM processes based on type of energy source used. [8]

OR

*P.T.O.*

- Q6)** a) Draw a schematic diagram of electro-discharge machining set-up and explain its working principle. [8]  
 b) Explain LBM process principle with neat sketch. State its advantages, limitations and applications. [8]

- Q7)** a) Differentiate between absolute and incremental positioning system in CNC. [8]  
 b) Explain following codes : G90, G02, G63, G41, M05, M06, M11, M30. [8]

OR

- Q8)** a) Differentiate between NC, CNC, and DNC, with neat sketch. Discuss advantages of DNC. [8]  
 b) Explain the significance of each letter in following word address format with an example. [8]  
 N.....G.....X.....Y.....Z.....U..V...W.....F.....S.....T.....M.....

- Q9)** a) Differentiate between Jigs and Fixtures. [6]  
 b) Draw a drill jig for drilling hole of size 12 mm as shown in Fig. 1 below. Use appropriate locators, clamping devices and drill bushes. [12]

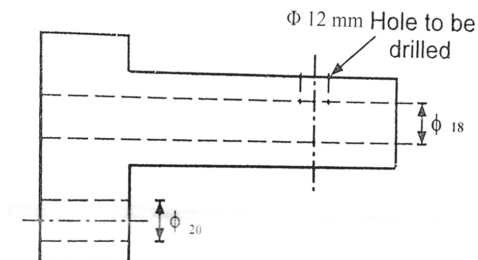


Fig. 1

OR

- Q10)** a) Explain design principles of Jigs and fixtures. [6]  
 b) List out main elements of jigs and fixtures. [6]  
 c) Apply 3-2-1 principle to a rectangular block and explain with sketch. [6]



Total No. of Questions : 10]

SEAT No. :

P-2847

[Total No. of Pages : 5

[6003]-690

T.E. (Mechanical) (Semester - II)

DESIGN OF MACHINE ELEMENT - II

(2015 Pattern) (302048)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer five questions from following.
- 2) Neat sketch must draw wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of electronics pocket calculator is allowed.
- 5) Use of programmable calculator is not permitted.
- 6) Assume suitable data if necessary.

Q1) a) Differentiate straight bevel gear and spiral bevel gear. [4]

- b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is  $20^\circ$ , while the helix angle is  $25^\circ$ . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively.

Calculate

- i) Beam strength
- ii) Wear strength

Use following data :  $Y = 0.484 - 2.87/Z'$ ,  $K = 0.16 \left( \frac{\text{BHN}}{100} \right)^2$  [6]

OR

Q2) A pair of spur gears with  $20^\circ$  full-depth involute teeth consists of a 20 teeth pinion meshing with a 40 teeth gear. The pinion is mounted on a crankshaft of 7.5 kW single cylinder diesel engine running at 1500 rpm. The driven shaft is connected to a two- stage compressor. Assume the service factor as 1.5. The pinion as well as the gear is made of steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$ ). The module and face width of the gears are 4 and 40 mm respectively. [10]

P.T.O.

- Using the velocity factor to account for the dynamic load, determine the factor of safety.
- If the factor of safety is two for pitting failure, recommend surface hardness for the gears. Use following data:

$$Y = 0.484 - 2.87/Z, \quad K = 0.16 \left( \frac{\text{BHN}}{100} \right)^2, \quad C_v = \frac{3}{3+v}$$

- Q3)** a) Explain the significance of helix angle on the performance of helix gears. [4]
- b) A single-row deep groove ball bearing is subjected to a pure radial force of 2950 N from a shaft that rotates at 600 rpm, The expected life  $L_{10h}$  of the bearing is 30000 hrs. The minimum acceptable diameter of the shaft is 40 mm. Select a suitable ball bearing for this application from following table. [6]

<i>Principal</i>			<i>Basic load</i>		<i>Designation</i>
<i>dimensions (mm)</i>			<i>ratings (N)</i>		
<i>d</i>	<i>D</i>	<i>B</i>	<i>C</i>	<i>C</i> <sub>0</sub>	
40	52	7	4160	3350	61808
	68	9	13300	7800	16008
	68	15	16800	9300	6008
	80	18	30700	16600	6208
	90	23	41000	22400	6308
	110	27	63700	36500	6408

OR

- Q4)** A pair of straight bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on the pinion and gear are 21 and 28 respectively. The pressure angle is  $20^\circ$ . The pinion shaft is connected to an electric motor developing 5kW rated power at 1440rpm. The service factor can be taken as 1.5. The pinion and the gear are made of steel ( $S_{ut} = 750 \text{ N/mm}^2$ ) and heat-treated to a surface hardness of 380 BHN. The gears are machined by a manufacturing process, which limits the error between the meshing teeth to  $10 \mu\text{m}$ . The module and face width are 4 mm and 20 mm respectively.

Determine the factor of safety against bending as well as against pitting failure. Use following data:  $Y = 0.484 - 2.87/Z$ ,  $K = 0.16 \left( \frac{\text{BHN}}{100} \right)^2$ ,

$$C_v = \frac{6}{6+V} \quad P_d = \frac{21V(C_{eb} + P_t)}{21V + \sqrt{(C_{eb} + P_t)}} \quad [10]$$

- Q5)** a) Write a short note on thermal consideration in worm gear. [6]  
 b) A pair of worm and worm wheel is designated as 3/60/10/6 The worm is transmitting 5 kW power at 1440 rpm to the worm wheel. The coefficient of friction is 0.1 and the normal pressure angle is 20°. Determine the components of the gear tooth force acting on the worm and the worm wheel. Also sketch the arrangement showing the component of tooth forces. [10]

OR

- Q6)** A pair of worm and worm wheel is designated as, 1/30/10/10 The input speed of the worm is 1200 rpm. The worm wheel is made of centrifugally cast, phosphor bronze and the worm made of case-hardened carbon steel 14C6. The coefficient of friction is 0.025. A worm gear box with an effective surface area of 1.5 m<sup>2</sup> is operating in still air with a heat transfer coefficient of 15 W/m<sup>2</sup>°C. The temperature rise of the lubricating oil above the atmospheric temperature is limited to 50°C. Determine the power transmitting capacity based on [16]

- a) Beam strength,  
 b) Wear strength and  
 c) Thermal considerations.

Use following data :

Speed factors for strength  $X_{b1} = 0.25$ ,  $X_{b2} = 0.48$ ,

Bending stress factors:  $S_{b1} = 28.2$ ,  $S_{b2} = 7$ ,

Speed factors for wear:  $X_{c1} = 0.112$ ,  $X_{c2} = 0.26$ ,

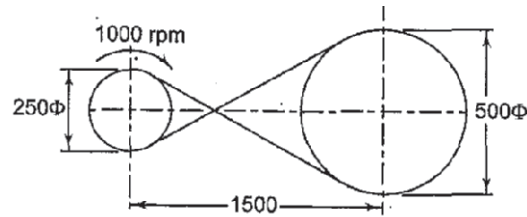
Surface stress factors :  $S_{c1} = 4.93$ ,  $S_{c2} = 1.55$

Zone factor  $Y_z = 1.143$

- Q7)** a) What is the polygonal action in roller chain? How will you reduce it? [6]  
 b) What are the advantages, disadvantages and applications of flat belt drive? [6]  
 c) The layout of a crossed leather belt drive transmitting 7.5 kW is shown in Fig. The mass of the belt is 0.55 kg per meter length and the coefficient of friction is 0.30. [6]

Calculate :

- (i) the belt tensions on the tight and loose sides, and
- (ii) the length of the belt



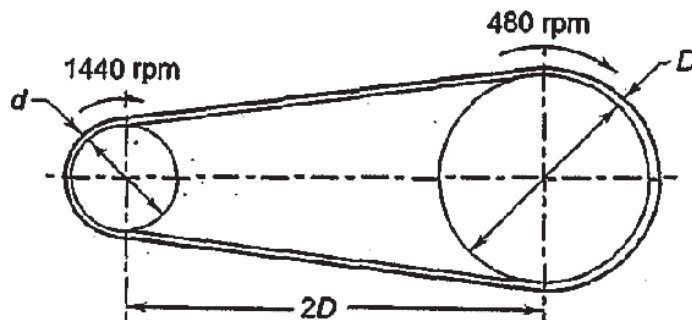
OR

**Q8) a)** What are the advantages disadvantages and applications of chain drives? [6]

- b) The layout of a leather belt drive transmitting 15 kW of power is shown in Fig. The center distance between the pulleys is twice the diameter of the bigger pulley. The belt should operate at a velocity of 20 m/s approximately and the stresses in the belt should not exceed 2.25 N/mm<sup>2</sup>. The density of leather is 0.95 g/cc, and the coefficient of friction is 0.35. The thickness of the belt is 5 mm. [12]

Calculate :

- i) The diameter of pulleys.
- ii) The length and width of the belt; and
- iii) The belt tensions



**Q9) a)** State desirable properties of a good bearing material [4]

b) State desirable properties of a good lubricant. [4]

c) Explain the parameters of bearing design, [8]

- i) Length to Diameter ratio,
- ii) Unit bearing Pressure,
- iii) Radial Clearance,
- iv) Minimum oil film thickness.

OR

- Q10)** a) Why is hydrodynamic journal bearing called 'self-acting' bearing? [6]  
 b) The following data is given for a 360° hydrodynamic bearing: [10]

Radial load = 3.2 kN

Journal speed = 1490 rpm

Journal diameter = 50 mm

Bearing length = 50mm

Radial clearance = 0.05 mm

Viscosity of lubricant = 25 cP

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate

- Coefficient of friction,
- Power lost in friction,
- Minimum oil film thickness,
- Flow requirement in 1 litres/min and
- Temperature rise.

**Table** Dimensionless performance parameters for full journal bearing with side flow

$\left(\frac{l}{d}\right)$	$\epsilon$	$\left(\frac{h_o}{c}\right)$	$S$	$\phi$	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{p}{p_{max.}}\right)$
1	0	1.0	$\infty$	(85)	$\infty$	$\pi$	0	–
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0



Total No. of Questions : 10]

SEAT No. :

**P2848**

[Total No. of Pages : 3

[6003]-691

**T.E. (Mechanical S/W)**

**MECHATRONICS**

**(2015 Pattern) (Semester-II) (302050)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

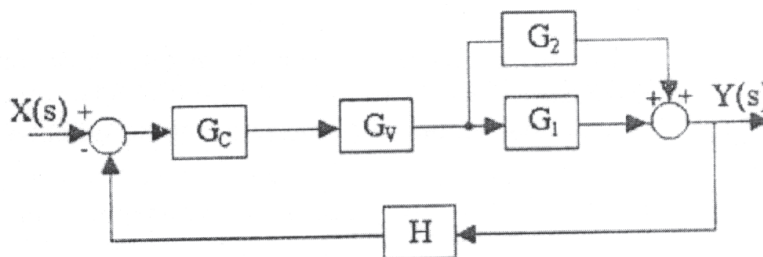
*Instructions to the candidates:*

- 1) Answer Q.No.1 or 2, Q.No.3 or 4, Q.No.5 or 6, Q.No.7 or 8. & Q.No.9. or Q.10.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams Must be drawn whenever necessary.
- 4) Make suitable assumption whenever necessary.

- Q1)** a) Using a suitable sketch, explain the working of capacitive proximity sensor.[6]  
b) Draw a block diagram of close loop control system and explain with example. [4]

OR

- Q2)** a) Define the following terms: [4]  
i) Sensitivity  
ii) Accuracy  
iii) Range  
iv) Resolution  
b) Obtain transfer function. [6]



- Q3)** a) Compare open loop and close loop control system. [4]  
b) With neat sketch, explain the working of 4-bit R-2R DAC. [6]

OR

*P.T.O.*



- Q4)** a) Explain any one of the Mechatronics system used as household appliance. [4]  
 b) What is Nyquist theorem? Explain sample & Hold Circuit? [6]

- Q5)** a) Discuss the role played by following elements in a PLC? [4]  
 i) Memory  
 ii) CPU  
 b) List and discuss, in brief, any six specification of PLC. [6]  
 c) Draw a ladder diagram for the following sequence. [6]  
 i) Turn the green ON for 25 seconds.  
 ii) Turn yellow on for 4 seconds.  
 iii) Turn red on for 30 seconds.

OR

- Q6)** a) Explain ladder diagram of logic AND Gate. [4]  
 b) In a certain bank each of three bank officers has a unique key to the vault. The bank rules requires requires that two out of the three officers be present when that vault is opened. Draw the ladder diagram for a relay logic circuit that will unlatch the door and turn on the light when the three keys are inserted. [6]  
 c) Give suitable example explain the working of timer and counter in a PLC. [6]

- Q7)** a) What is Routh stability criterion explain in detail? [4]  
 b) Explain transfer function-based modelling of translational mechanical system. [6]  
 c) Calculate and plot the poles and zeros for the system with transfer function  

$$G(s) = \frac{6(s+3)}{(s^2+2s+2)}$$
 comment on stability? [6]

OR

- Q8)** a) Explain building blocks of thermal and fluid system. [4]  
 b) For a system with characteristics equation [6]  

$$F(S)=S^4+3S^3+3S^2+2S+K=0$$
  
 Examine range of K for the stability.  
 c) Explain the term phase margin and Gain margin [6]
- Q9)** a) Explain the manual procedure for PID controller tuning with suitable examples. [6]  
 b) A Proportional controller is used to control temperature within 50°C to 130°C with a set point of 73.5°C. The set point is maintained with 50 % controller output. The offset error is corresponding to load change which causes 55% controller output. If the proportional gain is 2. Find the percentage controller output if the temperature is 61°C [6]  
 c) Explain PI control mode, stating its characteristics. [6]

OR

- Q10)** a) Explain derivative control mode. state its characteristics. [6]  
 b) In proportional controller, the gain is 4%. The Output voltage range is 0-10V. The input voltage span 4-12 V. Determine the value of gain. [6]  
 c) What is neutral zone in ON-OFF controller? Why its provided. [6]



Total No. of Questions : 10]

SEAT No. :

P-3144

[Total No. of Pages : 2

**[6003]-695**

**T.E. (Mechanical - Sandwich)**

**INDUSTRIAL ENGINEERING AND TECHNOLOGY  
MANAGEMENT (Self Study II)**

**(2015 Pattern) (Semester - II) (302067)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*
- 5) Use of calculator is allowed.*

**Q1) a) Explain types of organization. [6]**

**b) Explain Principles of Management. [4]**

**OR**

**Q2) a) Explain role of industrial engineer. [5]**

**b) Explain Different types of material handling equipment. [5]**

**Q3) a) Describe factors to be considered while finalizing plant location. [5]**

**b) Explain ABC analysis. [5]**

**OR**

**Q4) a) Write a short note on capacity planning. [5]**

**b) Explain moving average method. [5]**

**Q5) a) Describe with suitable examples; [8]**

**i) Operation process chart.**

**ii) Flow process chart.**

**b) Why allowances are considered in time study? What are various allowances to be considered? [8]**

**OR**

**Q6) a) Explain importance of ergonomics in the industry. [8]**

**b) Explain work sampling and write procedure for work sampling. [8]**

**P.T.O.**

- Q7)** a) Write short note on group technology. [6]  
 b) Explain in brief : [10]  
 i) Earliest start time and earliest finish time for an activity.  
 ii) Latest start time and latest finish time for an activity.  
 iii) Total float.  
 iv) Free float.

OR

- Q8)** a) Define process planning and write down steps in process planning. [6]  
 b) A Project schedule has following characteristics, construct the network diagram, calculate the earliest start time, Earliest finish time, Latest Start time, latest finish time and determine the critical path of the project also duration to complete the project. [10]

Activity	Time (days)
1 - 2	5
1 - 3	8
2 - 3	6
2 - 4	7
3 - 4	5
3 - 5	4
4 - 5	8

- Q9)** a) Write impact of technology on society and business. [8]  
 b) Explain process technology and product technology. [10]

OR

- Q10)** a) Explain Role of Government in technology development. [8]  
 b) Explain revolution and growth of technology. [10]



Total No. of Questions : 8]

SEAT No. :

P-482

[Total No. of Pages : 2

**[6003]-701**  
**T.E. (Information Technology)**  
**THEORY OF COMPUTATION**  
**(2019 Pattern) (Semester - I) (314441)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Eliminate useless symbols from the following grammar. **[6]**

$S \rightarrow aA \mid bB$

$A \rightarrow aA \mid a$

$B \rightarrow bB$

b) Prove that CFL's are closed under union, concatenation, Kleene's closure. **[6]**

c) What is an ambiguous grammar? Explain with a suitable example. **[6]**

OR

**Q2) a)** Convert the following CFG to Chomsky Normal Form (CNF) **[8]**

$S \rightarrow aAbB$

$A \rightarrow aA$

$B \rightarrow bB \mid b$

b) Construct NFA for the following left linear regular grammar. **[6]**

$S \rightarrow B1 \mid A0 \mid C0$

$B \rightarrow B1 \mid 1$

$A \rightarrow A1 \mid B1 \mid C0 \mid 0$

$C \rightarrow A0$

c) Write a note on Pumping lemma for CFL. **[4]**

*P.T.O.*

- Q3)** a) Design a Pushdown Automata for the language  $L = \{a^n b^{2n} \mid n > 0\}$ . [6]  
 b) Construct a PDA equivalent to the following CFG. [6]  
 $S \rightarrow 0BB$   
 $B \rightarrow 0S \mid 1S \mid 0$   
 c) Write a note on Post machine. [5]

OR

- Q4)** a) Design a Pushdown Automata which accepts only odd number of b's over  $\Sigma = \{a, b\}$ . Simulate PDA for the string "bbaba". [8]  
 b) Explain the acceptance by PDA [6]  
 i) By final state  
 ii) By empty stack  
 c) Define Push down Automata. [3]

- Q5)** a) Design a Turing machine to accept language  $L = \{a^n b^n c^n \mid n > 0\}$ . [7]  
 b) Write a short note on Post Correspondence problem. [5]  
 c) Differentiate between Push Down Automata and Turing Machine. [6]

OR

- Q6)** a) Explain Church Turing hypothesis. [3]  
 b) Design a Turing machine to add two unary numbers. [7]  
 c) Write a short notes on Universal Turing machine. [8]

- Q7)** a) Explain in detail Decidable problems concerning regular languages. [5]  
 b) Explain the satisfiability problem with an example. [6]  
 c) What is Polynomial time reduction? Explain it with a suitable example. [6]

OR

- Q8)** a) Show that for two recursive languages  $L_1$  and  $L_2$ ,  $L_1 \cup L_2$  is also recursive. [4]  
 b) What do you mean by NP-Complete problems? List the problems in this class and explain any one problem in detail. [7]  
 c) What do you mean by Mapping Reducibility? Explain it with an example. [6]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P483**

**[6003]-702**

**T.E. (Information Technology)**

**OPERATING SYSTEMS**

**(2019 Pattern) (Semester-I) (314442)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** a) What conditions are generally associated with readers-writers problem?  
Write its pseudo code. **[9]**

b) Describe resource allocation graph in detail. **[9]**

OR

**Q2)** a) Enlist different IPC techniques. Differentiate between named pipe and unnamed pipe with suitable example. **[9]**

b) What is Critical Section Problem? Give semaphore solution for producer-consumer problem. **[9]**

**Q3)** a) Consider six memory partitions of size 100 KB, 300 KB, 50 KB, 200 KB, 150 KB and 200 KB. These partitions need to be allocated to processes of sizes 200 KB, 100 KB, 50 KB in that order. Perform the allocation of processes using dynamic partitioning algorithms given below and comment on internal and external fragmentation- **[12]**

- i) First Fit Algorithm
- ii) Best Fit Algorithm
- iii) Worst Fit Algorithm

b) Explain Buddy system memory allocation with suitable example. **[5]**

OR

**P.T.O.**

- Q4)** a) Find the number of page faults for the reference string 6,5,1,2,5,3,5,4,2,3,6,3,2,1,2 using FIFO, LRU and optimal page replacement strategies. Consider frame size as 3. [12]
- b) Explain Belady's anomaly with suitable example. [5]

- Q5)** a) Assume a disk with 200 tracks and the disk request queue has random requests in it as follows: 55,58,39,18,90,160,150,38,184. Find the no of tracks traversed and average seek length if

- 1) SSTF
- 2) SCAN
- 3) C-SCAN

Is used and initially head is at track no 100. [12]

- b) What are typical operations that may be performed on a directory? [6]

OR

- Q6)** a) What is I/O buffering? Why I/O buffering is needed? State and explain different approaches of I/O buffering. [9]
- b) Explain with example any three disk scheduling criteria. [9]

- Q7)** a) List down the phases of a compiler. Explain with suitable example. [9]
- b) Explain macro call and macro expansion with suitable example. [8]

OR

- Q8)** a) Explain with example imperative statement, declarative statement, and assembly directive of assembly language programming? [9]
- b) What is system software explain any four system software in brief? [8]





Total No. of Questions: 8]

SEAT No. :

**P403**

**[6003]-703**

[Total No. of Pages : 4

**T.E. (I.T.)**

**MACHINE LEARNING**

**(2019 Pattern) (Semester-I) (314443)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

- Q1)** a) State and explain need of Regression analysis. [CO2, L2] [4]  
b) How gradient descent does helps to optimize linear regression model? [CO2, L2] [6]  
c) What are the different ways to prevent overfitting [CO2, L2] [8]

OR

- Q2)** a) What are different cost functions to access the performance of linear Regression model? In the given Dataset the outliers represent anomalies. Which cost function will be more suitable and why? [CO2, L3] [5]  
b) Define of Multivariate Regression and State advantages and disadvantages of Multivariate Regression. [CO2, L2] [5]

Consider the following data

	Prize in Rs	Amount Demanded
1	10	40
2	11	38
3	16	48
4	18	40
5	20	60

c)

- i) Find values  $\beta_0$  and  $\beta_1$  w.r.t. linear regression model which best fits given data.
  - ii) Interpret and explain equation of regression line.
  - iii) Estimate the likely demand when the price is Rs. 15.
- [CO2, L3] [8]

*P.T.O.*

- Q3) a)** Consider following data. Which feature will be selected as a root node? Use Information Gain. Played football is dependent feature. [CO4, L3] **[10]**

Outlook	Temperature	Humidity	Wind	Played football(yes/no)
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
Overcast	Cool	Normal	Strong	Yes
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes
Sunny	Mild	Normal	Strong	Yes
Overcast	Mild	High	Strong	Yes
Overcast	Hot	Normal	Weak	Yes
Rain	Mild	High	Strong	No

- b) Define and Explain following terms **[7]**
- i) Bayesian Network
  - ii) Advantages and disadvantages of Naïve Bayes Classifier [CO4, L2]

OR

- Q4) a)** For the given data set apply Naive Bayes Classifier and predict the Class for Type of family structure = Single Parent, Age group = Young, and Income status=Low [CO4, L3] **[10]**

Type of family structure	Age group	Income status	will they buy a car?
Nuclear	Young	Low	Yes
Extended	old	Low	No
Childless	Middle-aged	Low	No
Childless	Young	Medium	Yes
Single Parent	Middle-aged	Medium	Yes
Childless	Young	Low	No
Nuclear	Old	High	Yes
Nuclear	Middle-aged	Medium	Yes
Extended	Middle-aged	High	Yes
Single Parent	Old	Low	No

b) Define and explain following terms [7]

- i) Minority Class
- ii) Gini Index
- iii) Entropy
- iv) Information Gain [CO4, L2]

**Q5)** a) Find all association rules in the following database in the following database with minimum support = 2 and minimum confidence = 75% [CO5, L3] [10]

Transactions	Data Items
1	Bread, Milk, Diaper
2	Bread, Milk, Diaper, Coke
3	Diaper, Beer, Eggs
4	Bread, Milk, Coke

b) State & explain with appropriate example different types of linkage use in clustering. [CO5, L2] [8]

OR

**Q6)** a) Explain following Terms [8]

- i) Rule
  - ii) Support
  - iii) Lift
  - iv) Confidence
- [CO5, L2]

- b) Apply KNN on the Following data. Find class of person whose height is 170 cm and weight is 57 kg. Consider value  $K = 5$  and use Euclidian distance formula. [CO5, L3] [10]

Height (CM)	Weight (KG)	Class
167	51	Underweight
182	62	Normal
176	69	Normal
173	64	Normal
172	65	Normal
174	56	Underweight
169	58	Normal
173	57	Normal
170	55	Normal

- Q7)** a) With the help of suitable diagram explain Biological Neuron. [CO6, L3] [5]
- b) Explain the architecture of feed forward neural network. State its limitations. [CO6, 12] [7]
- c) What is deep learning? Explain different applications of deep learning [CO6, L1] [5]

OR

- Q8)** a) What is perceptron? Explain multilayer perceptron in detail. [CO6, L3] [5]
- b) Explain why we use non-linearity function? State and explain three types of neurons that add non-linearity in their computations [CO6, 12] [7]
- c) What is ANN? Explain McCulloch Pitts Neuron [CO6, L2] [5]



Total No. of Questions : 8]

SEAT No. :

**P484**

**[6003]-704**

**[Total No. of Pages : 2**

**T.E. (Information Technology)**  
**HUMAN COMPUTER INTERACTION INFORMATION**  
**TECHNOLOGY**  
**(2019 Pattern) (Semester - I) (314444)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answers : Q.1. or Q.2, Q.3 or Q.4,, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1) a)** What are User Profiles explain with example? **[8]**  
**b)** Hierarchical task analysis (HTA) is used to describe the interactions between a user & software system. Draw & explain HTA to online bus reservation system? **[9]**

OR

- Q2) a)** Explain Norman's 7 stage model with example. **[8]**  
**b)** Differentiate between Goals Vs Tasks. How does GOMS help in improving usability? Draw GOMS for CLOSE-WINDOW. **[9]**

- Q3) a)** Explain the principle of learnability and principle of flexibility with example. **[9]**  
**b)** i) Draw and explain Software design process. **[9]**  
ii) Explain the importance of User Focus from HCI perspective.

OR

- Q4) a)** What is Prototyping? Explain the low-fidelity and High-fidelity designs with example. **[9]**  
**b)** Consider any online food ordering system, draw model-view-controller (MVC) framework. Mention the necessary technology solutions available for each of MVC. **[9]**

- Q5) a)** Explain DECIDE framework with necessary diagram and an example of the same. **[8]**  
**b)** What are the goals of evaluation? Explain Cognitive walkthrough and heuristics evaluation technique in detail. **[9]**

OR

*P.T.O.*

- Q6)** a) Explain user interface management system (UIMS) in detail along with its architecture? [8]  
b) Write a short note on. [9]  
i) Toolkits  
ii) Usability testing

- Q7)** a) Explain [9]  
i) Augmented Reality  
ii) Virtual Reality along with real life examples of both.  
b) Discuss in the detail the Challenges faced by designer while designing interfaces for. [9]  
i) smart homes  
ii) smart devices

OR

- Q8)** a) Draw and explain Design thinking in detail for any suitable application.[9]  
b) In today's world finding things on the web has become easy. Discuss how multimodal interaction has enriched the experience. [9]



[6003]-705

T.E. (Information Technology)

DESIGN AND ANALYSIS OF ALGORITHM

(2019 Pattern) (Semester - I) (314445(A)) (Elective - I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

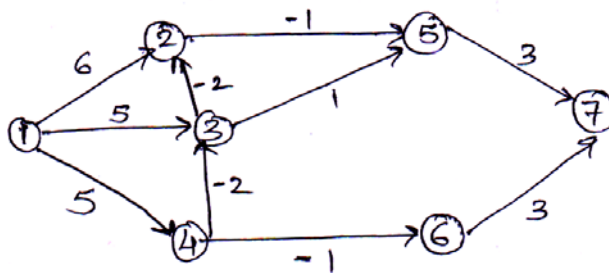
Q1) a) Explain the coin change making problem with suitable example. [9]

b) Solve the following instance of Knapsack problem by dynamic programming approach:

$n = 6$ ;  $M = 165$  and  $(p_1, p_2, p_3, p_4, p_5, p_6) = (w_1, w_2, w_3, w_4, w_5, w_6) = (100, 50, 20, 10, 7, 3)$ . [9]

OR

Q2) a) Use Bellman Ford algorithm for finding the shortest path for the graph.[9]



b) What is dynamic programming? Is this the optimization technique? What are the drawback of dynamic programming. [9]

P.T.O.

**Q3)** a) Explain 8-Queen problem and explain the following terms with respect to 8-Queens problem. [8]

i) State space tree

ii) Live node

iii) Static tree

iv) Solution state

v) Answer state

b) State the principal of backtracking and write backtracking algorithm for graph coloring [9]

OR

**Q4)** a) What is Backtracking? Write an algorithm for backtracking solution to the 0/1 knapsack problem. [8]

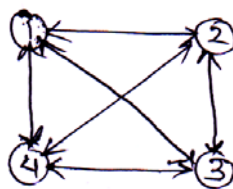
b) Let  $W = \{5, 10, 12, 13, 15, 18\}$  and  $M = 30$ . Find all possible subsets of  $W$  that sum to  $M$ . Draw the portion of state space tree. [9]

**Q5)** a) What is the difference between backtracking and branch & bound? Illustrate using the 0/1 knapsack problem. [9]

b) Write an algorithm for Least cost(LC) branch & bound. [9]

OR

**Q6)** What is traveling salesperson problem? Find solution to the following TSP using branch & bond. [18]

$$\begin{bmatrix} \infty & 10 & 15 & 20 \\ 5 & \infty & 9 & 10 \\ 6 & 13 & \infty & 12 \\ 8 & 8 & 9 & \infty \end{bmatrix}$$




**Q7)** a) Explain NP-Hard, NP-Complete, Decision problem & Polynomial time algorithm. [9]

b) Prove that clique problem is NP complete. [8]

OR

**Q8)** a) Prove that satisfiability problem is NP complete. [9]

b) Prove that vertex cover problem is NP complete. [8]



Total No. of Questions : 8]

SEAT No. :

P-486

[Total No. of Pages : 2

**[6003]-706**

**T.E. (Information Technology)**

**ADVANCED DATABASE & MANAGEMENT SYSTEM**

**(2019 Pattern) (Semester - I) (314445B) (Elective - I)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1)** a) Explain with example Four Types of No SQL Databases. Also explain Column-Oriented Database: Apache Cassandra. **[12]**

b) Explain Mongo DB NoSQL Database. **[6]**

OR

**Q2)** a) Explain NoSQL database Development Tool: MapReduce. Compare Relational and NoSQL databases. **[10]**

b) Explain NoSQL Programming Languages XML and JSON. **[8]**

**Q3)** a) What is Data warehouses? Explain characteristics and limitations of data Warehouse. **[8]**

b) Explain different OLAP Architectures. **[9]**

OR

**Q4)** a) Write a note on Decision support system. Explain with example views and Decision support. **[10]**

b) Define OLAP? Compare different OLAP Architecture. **[7]**

*P.T.O.*

- Q5)** a) What is KDD? Explain KDD seven step process with suitable diagram. **[10]**  
b) Explain predictive and descriptive algorithms in data mining. **[8]**

OR

- Q6)** a) Explain different issues in Data mining task. Explain Data Preprocessing Tasks in KDD Process. **[10]**  
b) Explain Pattern Evaluation and knowledge presentation steps in Data Mining. **[8]**

- Q7)** a) Compare Temporal, Spatial and Deductive Databases. **[5]**  
b) Write a note on : **[12]**  
i) Mobile databases  
ii) Multimedia databases

OR

- Q8)** a) Write a note on : **[10]**  
i) Geographical Information Systems (GIS)  
ii) Genome data management.  
b) Explain “Event-Condition- Action” model in Active Databases **[7]**



Total No. of Questions : 8]

SEAT No. :

P-487

[Total No. of Pages : 2

**[6003]-708**

**T.E. (I.T./A.I & D.S.)**

**DESIGN THINKING (Elective - I)**

**(2019 Pattern) (Semester - I) (314445C)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answers Q.1 or Q.2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

- Q1)** a) How might we..." question elaborate? Explain the template of HMV. [8]  
b) Explain the use of SCAMPER for Ideation. [9]

OR

- Q2)** a) How context mapping tools help us in design thinking? Which other tools support working with this tool? [6]  
b) Explain Brainstorming as an ideation technique? [6]  
c) What is a concept in design thinking? Explain using suitable example.[5]

- Q3)** a) What is prototype? Explain the different types of prototyping in detail.[9]  
b) What is dark horse prototype how to do it and when we need it. [9]

OR

- Q4)** a) Why is prototyping important? List different Prototyping techniques.[6]  
b) Why the prototype is needed and what are the advantages of using prototype in design thinking. [6]  
c) How to implement Critical Functional Prototype. [6]

*P.T.O.*

- Q5)** a) Discuss how 'Testing Sheet' will help designers to prepare the test sequence and document the test results. [8]  
b) What is Structured usability testing? Explain How it is carried out. [9]

OR

- Q6)** a) Discuss how 'Feedback Capture Grid' is used to test my prototyped ideas quickly and simply. [8]  
b) Explain How 'I like, I wish, I wonder' tool used in Phase Reflect. [9]
- Q7)** a) Discuss the case study "Reimagining the Trade Show Experience at IBM" in detail. [9]  
b) How "Social Networking at MeYou Health" is designed using design thinking tools? [9]

OR

- Q8)** a) Discuss the case study "Design Thinking in Healthcare with IDEO" in detail. [9]  
b) How Design Thinking transformed Airbnb? Explain. [9]



Total No. of Questions : 8]

SEAT No. :

P-488

[Total No. of Pages : 2

**[6003]-709**

**T.E. (Information Technology)**

**INTERNET OF THINGS (Elective - I)**

**(2019 Pattern) (Semester - I) (314445D)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Answers Q.1 or Q.2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) What is Bluetooth? Explain the following term of Bluetooth i) Piconet  
ii) Scatternet. **[9]**

b) Explain in detail the MQTT protocol. **[9]**

OR

**Q2)** a) Explain Bluetooth protocol architecture. **[9]**

b) What are the development reasons for AMQP? Explain the AMQP model with its main elements. **[9]**

**Q3)** a) Draw and explain the interfacing of the LED using Raspberry Pi with the program. **[8]**

b) Explain Arduino. What are the different features of Arduino? Discuss digital, analog, and power pins. **[9]**

OR

**Q4)** a) What is Raspberry Pi? Explain OS installation steps. **[8]**

b) Draw and explain the interfacing of the servo motor using Arduino Uno with the program. **[9]**

*P.T.O.*

**Q5)** a) What are different IoT systems vulnerable? Also, explain IoT security challenges. [8]

b) What is cloud computing? Explain elements of cloud computing. Also, explain the characteristics of cloud computing. [9]

OR

**Q6)** a) Explain the use and design of a RESTful web API. [8]

b) Explain the following key elements of IoT Security: Identity establishment, Access control, Data and message security. [9]

**Q7)** a) Write short note on : [9]

i) Home Automation.

ii) Indoor Air quality monitoring.

b) Explain following IoT Applications i) Structural Health Monitoring  
ii) Smart Parking iii) Smart Road. [9]

OR

**Q8)** a) Write short note on : [9]

i) Wearable Electronics.

ii) Smart Payments.

b) Explain how IoT is useful in environment - Weather Monitoring and Noise Pollution Monitoring. [9]



Total No. of Questions : 8]

SEAT No. :

**P489**

**[6003]-710**

[Total No. of Pages : 2

**T.E. (Information technology)**  
**COMPUTER NETWORK AND SECURITY**  
**(2019 Pattern) (Semester - II) (314451)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Explain MACAW protocol in details. [9]  
b) Explain with diagram Layered Architecture for Sensor Network. [9]

OR

- Q2)** a) Explain the issues in designing a routing protocol for Ad-hoc Wireless Network. [6]  
b) What are hidden station and exposed station problem in WLAN. [6]  
c) Explain different issues and Challenges in Designing a Sensor Network. [6]

OR

- Q3)** a) What is stream cipher? Explain encryption process using stream cipher with suitable example. [8]  
b) What is Cipher Block Chaining (CBC)? Explain the process of CBC with suitable diagram. [9]
- OR
- Q4)** a) Describe the following network security threats. [5]  
i) Unauthorized access  
ii) Distributed Denial of Service (DDoS) attacks  
b) Describe the following fundamental principles of Information security [6]  
i) Integrity  
ii) Authentication  
iii) Authorization and Access Control  
c) What is Cipher Feedback Mode (CFB) and Electronic Code book (ECB)? [6]

**P.T.O.**



**Q5) a)** Explain Data Encryption Standard Algorithm in detail with suitable diagram. [9]

b) Explain Diffie-Hellman key exchange algorithm. [9]

OR

**Q6) a)** Explain Private Key Management. [9]

b) Explain following terms. [9]

- i) PKIX Model
- ii) Digital Signature
- iii) Digital Certificate

**Q7) a)** Write a short note on Software attacks & hardware attacks with example. [8]

b) Explain the threats and vulnerabilities of the information security system. [9]

OR

**Q8) a)** Explain Layers of Cyber Security in detail. [8]

b) What is a man-in-the-middle attack (MIM)? Explain in detail. [9]



Total No. of Questions : 8]

SEAT No. :

**P490**

[Total No. of Pages : 2

**[6003]-711**

**T.E. (I.T.)**

**DATA SCIENCE AND BIG DATA ANALYTICS**

**(2019 Pattern) (Semester-II) (314452)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

**Q1) a)** Explain Google file system and its advantages. **[10]**

b) Explain Hadoop distributed file system **[8]**

OR

**Q2) a)** Why map reduce is required in Hadoop? Explain the stages involved in map reduce task with a suitable example? **[9]**

b) Describe the various types of NoSQL Databases with example and also compare them. **[9]**

**Q3) a)** Explain Mean, Mode and variance and standard deviation with suitable example. **[9]**

b) Draw and explain Architecture of HIVE **[8]**

OR

**Q4) a)** Explain Min-max scaling. For the following dataset carry out min-max Scaling, X=24, 28, 53, 30, 40, 18, 15, 21 **[9]**

b) What is data Wrangling? Why do you need it? explain data Wrangling methods? **[8]**

**Q5) a)** Explain any 4 Types of data visualization with example. **[9]**

b) Explain different data visualization tools. **[9]**

OR

**P.T.O.**

- Q6)** a) Explain data visualization with the help of example? What are the advantages of data visualization? [9]
- b) Explain Data Visualization with Tableau. [9]

- Q7)** a) Explain Big Data Analytics Challenges in brief. [9]
- b) Explain types of Mobile Analytics. [8]

OR

- Q8)** a) What is Porter's value chain analysis? Explain Porter's value chain analysis. [9]
- b) What is social media analytics? Explain the process of social media data analytics. [8]



Total No. of Questions : 8]

SEAT No. :

**P491**

**[6003]-712**

[Total No. of Pages : 2

**T.E.I.T.**

**WEB APPLICATION DEVELOPMENT  
(2019 Pattern) (Semester -II) (414464A)**

*Time :2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer four questions.*
- 2) *Figures to right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagram must be drawn wherever necessary.*

- Q1)** a) Explain MVC architecture with a suitable diagram. [6]  
b) List and explain different types of structural directives in Angular. [6]  
c) What way would you design simple application in typescript to demonstrate the use of modules? [6]

OR

- Q2)** a) List and explain the features of any three popular web frameworks. [6]  
b) How would you use the term typescript? Give the advantages and disadvantages of using it? [6]  
c) Explain any 2 Hooks in React JS with example. [6]

- Q3)** a) Write and explain a simple application using REST HTTP Method API in node JS. [6]  
b) Explain how to perform CRUD operations in a Node. JS application. Provide examples of CRUD implementation. [6]  
c) Write a short note on PM2 microservices. [5]

OR

- Q4)** a) What is template engine? How to create and use it using Express.JS?[6]  
b) List and explain the features of advanced MongoDB. [6]  
c) Explain the role of NPM (Node Package Manager) in Node.js development. [5]

**P.T.O.**

- Q5)** a) What is jQuery Mobile? Explain Mobile jQuery framework in detail. [6]  
b) Explain the mobile devices and desktop devices in detail ? [6]  
c) Write a code to create a header and footer in jQuery Mobile. [6]

OR

- Q6)** a) Explain any 3 events in jQuery Mobile with example? [6]  
b) Compare jQuery with jQuery Mobile. [6]  
c) Explain the concept of Mobile-First design in web development. Explain its significance and benefits in creating responsive and user-friendly websites. [6]
- Q7)** a) Explain the features and benefits of AWS Cloud. [6]  
b) What is S3 bucket and how to create a bucket? [6]  
c) Explain the different components of VPC? [5]

OR

- Q8)** a) What is PuTTY? How to connect EC2 instance with PuTTY? [6]  
b) Explain the process of deploying a website or web application on AWS. [6]  
c) What is Elastic Load Balancer and explain its working. [5]



Total No. of Questions : 8]

SEAT No. :

P-492

[Total No. of Pages : 3

[6003]-713

**T.E. (Information Technology) (Semester - II)**  
**ARTIFICIAL INTELLIGENCE (Elective-II)**  
**(2019 Pattern) (314454-A)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) What is knowledge representation in AI? List the various techniques of knowledge representation in AI. [6]
- b) What are the types of knowledge in AI and how it is categorized? [6]
- c) Differentiate between forward chaining and backward chaining. [6]

OR

- Q2)** a) What are the causes of uncertain knowledge in AI? What are the ways to solve the problems with uncertain knowledge? Give suitable examples. [8]
- b) Following are some statements, represent it in the form of nodes, arcs and relationship. [5]
- i) Jerry is a cat.
  - ii) Jerry is a mammal
  - iii) Jerry is owned by Priya.
  - iv) Jerry is brown colored.
  - v) All Mammals are animal.
- c) Following are statements, represent it in the form of frame representation.
- Peter is an engineer as a profession and his age is 25, he lives in city London and the country is England. [5]

**P.T.O.**

- Q3)** a) What are the stages in the lifecycle of a natural language processing (NLP) project? Draw neat diagram. [5]
- b) What is meant by data augmentation? What are some of the ways in which data augmentation can be done in NLP projects? [4]
- c) Describe how parsing is done in NLP? Write a note on Dependency parsing and semantic parsing. [8]

OR

- Q4)** a) List the components of natural language processing (NLP). [5]
- b) What are the steps to follow when building a text classification system? [7]
- c) What do you understand by semantic analysis? What are the techniques used for semantic analysis? [5]

- Q5)** a) Discuss the types of games in Game Theory? Give its features and examples. [4]
- b) What is the concept of Strategy in game theory? Write in short on Pure strategy, Optimal strategy and Mixed strategy. [6]
- c) Use MinMax Principle and Find the optimal plan for both the player. [8]

Player	Player B				
A		I	II	III	IV
	I	-2	0	0	5
	II	4	2	1	3
	III	-4	-3	0	-2
	IV	5	3	-4	2

OR

- Q6)** a) What is planning in AI? List the Components of Planning System. [8]
- b) What is Hierarchical planning in AI? Give suitable example. [4]
- c) What is meant by Alpha Beta pruning? List the Conditions for Alpha-beta pruning. [6]

- Q7)** a) What is the difference between deep learning, machine learning and AI? [8]
- b) Define Perceptron. Explain Multilayer Perceptron and Boltzmann Machine. [5]
- c) What is the difference between Epoch, Batch, and Iteration? [4]

OR

- Q8)** a) List the most used applications of Deep Learning. Elaborate any two. [9]
- b) What is TensorFlow? What are the three working components of TensorFlow Architecture? [8]





Total No. of Questions : 8]

SEAT No. :

P-493

[Total No. of Pages : 2

[6003]-714

**T.E. (Information Technology)**  
**CYBER SECURITY (Elective-II)**  
**(2019 Pattern) (Semester - II) (314454B)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Que 1 or Que 2, Que 3 or Que 4, Que 5 or Que 6, Que 7 or Que 8*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume Suitable data if necessary.*

- Q1)** a) List and explain the obstacles in collecting digital evidence. [6]  
b) Enumerate the guidelines for seizing digital evidence at the scene. [6]  
c) What are the different Email Protocols? How can email be used as evidence? [6]

OR

- Q2)** a) Explain the process of investigating e-mail crimes and violations. [6]  
b) List and explain the challenges in cyber forensics. [6]  
c) List any three types of web attacks. How these web attacks are investigated? [6]

- Q3)** a) What is Digital Forensics? Explain in details. [6]  
b) What are the 5 phases of digital forensics? Explain. [6]  
c) What is mean by Digital Evidence? Explain its Characteristics? [5]

OR

- Q4)** a) Explain with diagram Digital Forensic Model. [6]  
b) List and explain principles of Forensics Audio and Video Analysis.[6]  
c) Explain the preservation of digital evidences. [5]

**P.T.O.**

- Q5)** a) What is Phishing? Explain Phishing attack in detail. [6]  
b) What are the various social engineering attacks? Explain any one in detail. [6]  
c) Explain about Insider Threats attacks. [6]

OR

- Q6)** a) Explain Social Engineering Targets and Defense Strategies. [6]  
b) What are the types of computers based social engineering attacks? [6]  
c) Explain Attack Spiral Model, [6]

- Q7)** a) What are positive aspects and weak areas of ITA 2000? [6]  
b) What is mean by Security Audit? Explain its steps. [6]  
c) Explain in details Intellectual Property Rights in Cyberspace. [5]

OR

- Q8)** a) Explain cyber terrorism and provision under the IT Act. [6]  
b) What are various offenses in IT Act? Explain in short. [6]  
c) Explain what is mean by E-Commerce and E-Governance. [5]



Total No. of Questions : 8]

SEAT No. :

P-494

[Total No. of Pages : 2

[6003]-715

**T.E. (Information Technology)**

**CLOUD COMPUTING**

**(2019 Pattern) (Semester - II) (314454C) (Elective - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 .*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) What are the common standards supported by open cloud Consortium. [8]
- b) Explain the significance of Azure SQL. [6]
- c) Difference between on demand instances and spot instance in Amazon cloud. [4]

OR

- Q2)** a) Explain the architecture of Google App Engine with neat diagram. [8]
- b) Describe various standards for Messaging over cloud platform. [6]
- c) Explain the significance of Open Cloud Test-bed. [4]

- Q3)** a) Describe google file system architecture with neat diagram. [8]
- b) Explain the features and advantages of Dynamo DB. Explain how it is different than RDBMS. [9]

OR

- Q4)** a) Describe Hadoop Distributed File System with neat diagram. [8]
- b) What are different types of disasters and how the disaster recovery is done on cloud platform. [9]

**P.T.O.**

- Q5)** a) Explain the architecture of Internet of Things? List down the enabling technologies used in IoT. [9]  
b) Explain important features of ZigBee Technology. [9]

OR

- Q6)** a) Explain any one innovative Applications of the Internet of Things. [9]  
b) Draw an architecture of RFID along with an application. [9]

- Q7)** a) Enlist an important features of Cloud TV. Describe the use of cloud-based smart fabrics and paints. [9]  
b) Draw an architecture of Mobile Cloud Computing and explain in details. [8]

OR

- Q8)** a) Explain the Docker architecture with neat diagram. [9]  
b) Write short note on : [8]  
i) Energy Aware Cloud Computing  
ii) Jungle Computing



Total No. of Questions : 8]

SEAT No. :

P-495

[Total No. of Pages : 2

[6003]-716

T.E. (I.T)

Software Modeling and Design

(2019 Pattern) (Semester-II) (314454D) (Elective-II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 .
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Draw Activity Diagram using Swim lanes for given scenario.  
“A popular e-commerce website application serves customers to purchase items. Customer can select item by using ‘search item’ facility and add it in the cart. The cart total is calculated, and customer can pay bill by using various payment methods.” [8]
- b) Explain state diagram? Draw and discuss notations used for State Machine, Triggers and Ports, Transitions and conditions, Initial and Final State. [9]

OR

- Q2)** a) Consider typical scenarios of College’s Library Management System, Identify events performed by different users for the system, and Draw Sequence Diagram. [8]
- b) What is interaction and behavior modeling? list different diagram used for this modeling? Draw components used in 2 diagrams. [9]
- Q3)** a) Discuss what is object relational system ? How it is used in designing table class mapping. [9]
- b) Bank offers credit card and debit card to the account holders. Consider different activities to be performed by card holder and draw Class diagram with association. Map Class to tables. Draw schema diagram. [9]

OR

P.T.O.

- Q4)** a) Draw Component and Deployment Diagram for Car rental system. [6]
- b) Explain OCL with example. [6]
- c) What are the points one should consider while designing the Access Layer Classes [6]

- Q5)** a) How pure fabrication can solve issues related to high cohesion and low coupling? Explain with the help of Sales man as the scenario. [8]
- b) Explain Façade Behavioral Patterns. Write in detail any 2 Façade Behavioral Patterns. [9]

OR

- Q6)** a) Apply strategy design pattern to the following and draw the class diagram. A company has many employees. Each employee has a name and a performance index in the range of 1 to 5. When the index is 2 the increment is 10 percent of the previous year salary, 3 the increment is 15 percent of the previous year salary, 4 the increment is 20 percent of the previous year salary. Indicate roll of each class in the class diagram. [8]
- b) Explain GOF design patterns. [9]

- Q7)** a) What is real time software architecture? Explain the important characteristics of real time software architecture. [9]
- b) What is component based architecture? State different ways of representing component. [9]

OR

- Q8)** a) Describe Quality attributes in architecture design. [8]
- b) Explain dynamic view of software architecture with the help of example. [6]
- c) Explain the important characteristics of real time software architecture. [4]

