Total No. of Questions : 10]

SEAT No. :

P3373

[Total No. of Pages : 2

[5253] - 501
T.E. (Civil) (End Sem.)
HYDROLOGY & WATER RESOURCE ENGINEERING
(2015 Pattern)

Time :2½ hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 and Q9 or Q10.***
2) ***Figures to right indicates full marks.***

Q1) a) Explain Application of Hydrology. **[5]**

b) State deltas for gram, maize, sugarcane, rice and cotton also explain methods to improve duty. **[5]**

OR

Q2) a) State the formula to calculate optimum number of rainguages. Explain the different terms in formula. **[5]**

b) Differentiate between sub-surface irrigation and sprinkler irrigation. **[5]**

Q3) a) Derive the formula to calculate discharge of a well in a confined aquifer. **[5]**

b) State various types of tube well. Explain Any one in detail. **[5]**

OR

Q4) a) Determine the capacity of reservoir from the following data. The CCA is 80000 hectares. Assume canal and reservoir losses as 5% and 10% respectively.

Crop	Base period (days)	Duty (hect/cumecs)	Intensity of irrigation (%)
Rice	120	1800	25
Wheat	150	2000	30
Sugarcane	320	2500	20

[6]

b) Explain the following. **[4]**

i) Aquifer ii) Aquiclude

iii) Specific Yield of an Aquifer iv) Porosity of soil

P.T.O.

Q5) a) The ordinate of 6 h unit hydrograph are given below: **[10]**

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of 6 h UH (m^3/s)	0	20	60	150	120	90	66	50	32	20	10	0

It two storms, each of 1- cm excess rainfall and 6 h duration occurs in succession, calculate the resulting hydrograph of flow. Assume base flow to be $10 m^3/s$.

b) What is unit Hydrograph? Draw a single peaked hydrograph showing its all components. Also state the uses of hydrograph. **[8]**

OR

Q6) a) What is S curve Hydrograph? Explain its construction with sketch. **[9]**

b) Explain Gumbels flood frequency analysis method. **[9]**

Q7) 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]**

OR

Q8) a) What are various reservoir losses? Explain various measures to control these losses. **[8]**

b) What is reservoir sedimentation? What is significance of trap efficiency? Explain with neat sketches. **[8]**

Q9) a) Write a short note on ancient system of water distribution which still exist in North Maharashtra. **[8]**

b) Explain Global Water Partnership (GWP). **[8]**

OR

Q10)a) What is water logging? Explain tile drain formule and also state formule for spacing of tile drain. **[8]**

b) Draw a neat sketch for lift irrigation scheme and state various components of lift irrigation scheme. Explain various design steps in lift irrigation system. **[8]**

Total No. of Questions : 12]

SEAT No. :

P3389

[Total No. of Pages : 3

[5253]-502

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

INFRASTRUCTURE ENGINEERING & CONSTRUCTION TECHNIQUES

(2015 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, Q9 or Q10 and Q11 or Q12.***
2) ***Neat diagram, must be drawn wherever necessary.***
3) ***Figures to the right side indicate full Marks.***
4) ***Assume, suitable data, if necessary.***

Q1) Explain Bus Rapid Transit System (BRTS) including its necessity and advantages. **[6]**

OR

Q2) Compare railway transportation with road transportation. **[6]**

Q3) a) Explain in brief advantages and disadvantages of concrete sleepers. **[4]**

b) Explain the Points and Crossing. Draw neat labeled diagram of turnout. **[4]**

OR

Q4) a) Define the following: **[4]**

i) Turnout;

ii) Tongue rail;

iii) Stock rail;

iv) Switch

b) Discuss in brief different methods to reduce the wear of rails. **[4]**

Q5) What are the various methods of dewatering system? Explain any one method with suitable sketch. **[6]**

P.T.O

OR

Q6) List various Dredging Systems. Explain any one with sketch. **[6]**

Q7) a) What do you understand by mucking? State various methods of mucking and explain any one in detail. **[6]**

b) Compare the advantages and disadvantages of tunnels with open cut. **[6]**

c) Write a short note on TBM. **[4]**

OR

Q8) a) Explain in detail NATM method of tunneling. **[6]**

b) What do you understand by the term drilling pattern? Explain the need for drilling pattern. **[6]**

Discuss the types of drilling pattern.

c) Write a short note on micro tunneling. **[4]**

Q9) a) Define harbor. State the requirements of good harbor. **[6]**

b) Explain in brief the following: **[6]**

i) Dry dock;

ii) Fenders;

iii) Jetties

c) Differentiate between wharves and quay. **[4]**

OR

Q10)a) Discuss in detail various methods of construction of breakwater wall. **[6]**

b) Draw the schematic diagram of harbor layout showing all components. **[6]**

c) Differentiate between natural and artificial harbor. **[4]**

Q11)a) A construction equipment on a work site costs Rs. 3,50,000 and has expected life of 5 years and salvage value of Rs. 40,000 at the end of useful life. Calculate yearly depreciation of the machine using **[6]**

i) straight line method and

ii) sum of year method.

b) What are the factors to be considered for calculation of output estimation of equipment? **[6]**

c) Write short note on: Preventive maintenance of equipment. **[6]**

OR

Q12)a) Construction machinery costs Rs 45,000. It's useful life is 5 years. The salvage value at the end of five years is Rs. 4,500. Estimate the yearly depreciation of the equipment using **[6]**

i) straight line method and

ii) double-declining balance method.

b) Write short note on: **[12]**

i) economic life of equipment;

ii) backhoe;

iii) dumpers

Total No. of Questions : 10]

SEAT No. :

P3955

[Total No. of Pages : 3

[5253] - 503
T.E. (Civil) (End Semester)
STRUCTURAL DESIGN - I
(2015 Pattern) (Semester - I)

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

Q1) a) State and Explain modes of failure in tension member with sketch. **[6]**

b) A single angle section 90 × 60 × 10 @ 11.0 kg/m is connected with gusset plate with 7 bolts of 20 mm diameter in one line at pitch of 50 mm and edge distance of 30 mm. Determine design tensile strength of the section for rupture of net section. (Assume the section is connected with longer leg and gauge distance = 50 mm) **[4]**

OR

Q2) a) A discontinuous strut of effective length 2.975 m consists of two unequal angles ISA 100 × 75 × 10 @ 13 kg/m and is connected to a 12 mm thick gusset plate by its longer leg on the opposite side of the gusset plate. Determine the strength of the member. **[5]**

b) Check the adequacy of an ISA 90 × 60 × 6 @ 8.9 kg/m to carry factored axial tensile load of 150 kN for yielding and rupture only. Assume angle is connected to 8 mm thick gusset plate by 4 numbers of M20 bolts.**[5]**

Q3) a) A 6 m long column is effectively held in position at both ends and restrained against rotation at one end. If an ISHB350 @ 67.4 kg/m is used, calculate design compressive strength. **[5]**

P.T.O.

b) An ISA 130 × 130 × 10 @ 19.7 kg/m used as a strut has the length between the intersections at each end as 3 m. If it is connected with gusset plate by one bolt at each end (assume fixed condition), then determine the equivalent slenderness ratio. **[5]**

OR

Q4) Design the gusseted base for a column ISHB 350 @ 66.1 kg/m supporting a factored axial compression of 1700 kN. Use M20 grade of concrete and gusset angle ISA 150 × 115 × 15 mm. **[10]**

Q5) Determine the design bending strength of ISLB350 @ 49.5 kg/m considering the beam to be **[16]**

a) laterally supported

b) laterally unsupported. The unsupported length of beam is 6 m.

OR

Q6) A conference hall 8 m × 18 m is provided with a 120 mm RC slab over rolled steel beams spaced 3 m c/c. A wearing coat of 100 mm thickness is provided over the roof. Design the beam section if. the compression flange of the beam is laterally supported throughout the span. Assuming unit weight of reinforced concrete and wearing coat are 25 kN/m^3 and 20 kN /m^3 respectively. Take Live load 3 kN/m^2. Assume self weight of beam 0.75 kN/m. **[16]**

Q7) a) Explain types of beam to beam and beam to column connections with suitable sketches. **[6]**

b) A beam ISMB 450 @ 72.4 kg/m transmit an end reaction of 120 kN to the column ISHB 300 @ 58.8 kg/m. Design seated bolted connection using M20 bolts of 4.6 grade. **[10]**

OR

Q8) Design suitable cross section for welded plate girder for an effective span of 30 m and carrying uniformly distributed load 30 kN/m including self weight. It is also loaded with two concentrated load of 150 kN acting at 10 m from either supports. The compression flange of the girder is laterally supported throughout the span. Also design connection between flange and web. Draw the design sketches. **[16]**

Q9) Determine the maximum wheel load, shear force and bending moment for the manually operated gantry girder as per the following data. Also check for fatigue strength. **[18]**

Weight of crane girder : l50 kN

Crane capacity : 180 kN

Weight of crab and motor : 50 kN

Span of crane girder : 15m

Minimum hook approach : 1.2 m

Span of gantry girder : 5m

Weight of rail : 0.25 kN/m

Crane operates : 225 days

Working hours : 9 am to 5 pm

Maximum no of trip per hour : 03

Design life : 50 years

Section modulus of cross section : 3765×10^3 mm^3

Shear area of cross section : 4560 mm^2

OR

Q10) Determine the design forces in the members L_0U_1, U_1L_1 and L_0L_1 of an Accessible truss as shown in Fig. 10. Assume design wind pressure is 1200 N/mm^2 and the c/c spacing of truss is 4m. Assume self weight of purlin is 100 N/m^2, self weight of bracing 80 N/m^2, Self weight of AC sheet 130 N/m^2 and rise of truss = 3 m. **[18]**

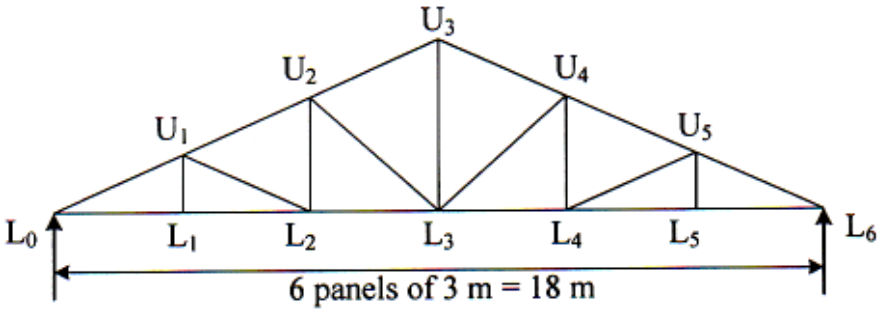


Fig. 10

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P3953

[Total No. of Pages : 3

[5253]-504

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

STRUCTURAL ANALYSIS - II

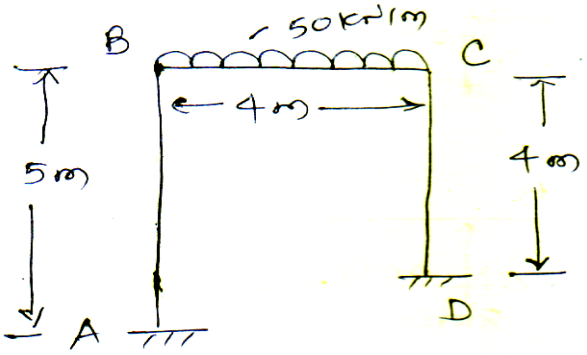
(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

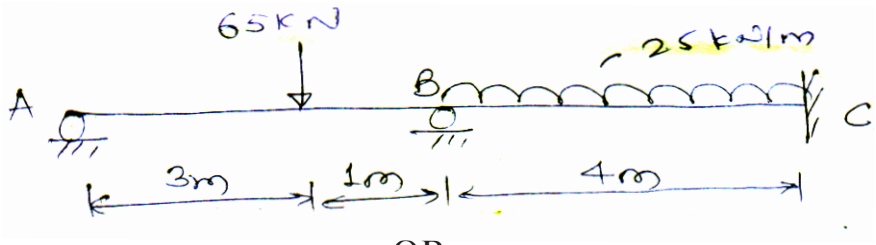
Instructions to the candidate :

1) *Answer questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Figures in bold to the right, indicate full marks.*
3) *If necessary, assume suitable data & indicate clearly.*
4) *Use of electronic calculator is allowed.*

Q1) a) Analyse the frame by slope deflection method and draw BMD. **[10]**

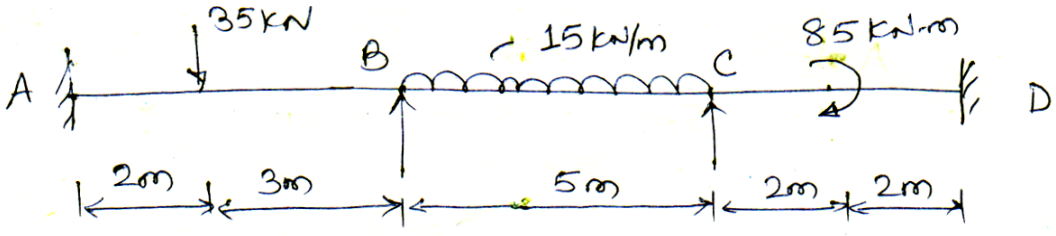


b) Analyse the continuous beam by flexibility method, Draw BMD. **[10]**



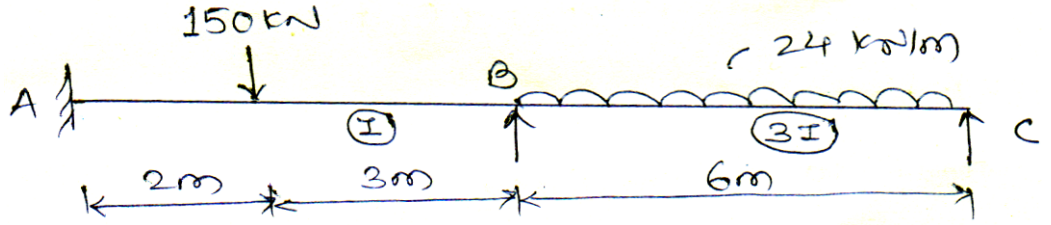
OR

Q2) a) Analyse the continuous beam by moment distribution method, Draw BMD **[10]**

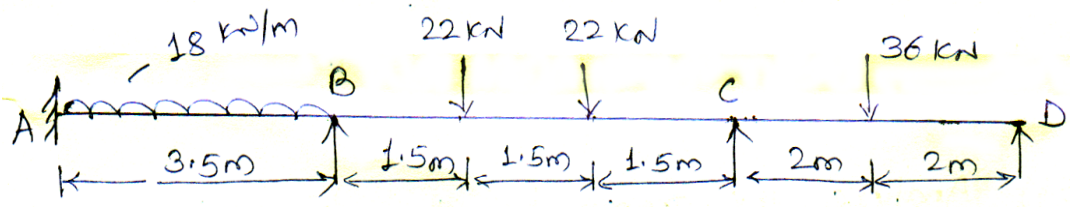


P.T.O.

b) Analyse continuous beam by slope deflection method, Draw BMD. **[10]**

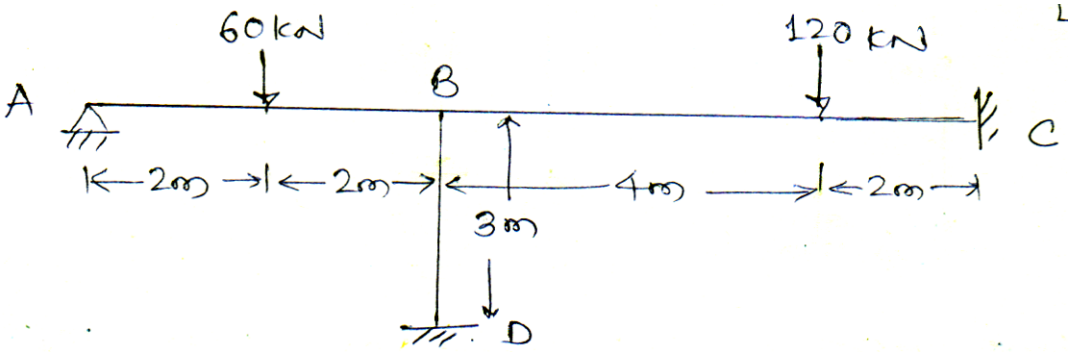


Q3) a) Analyse the continuous beam by stiffness matrix method, Draw BMD. **[16]**

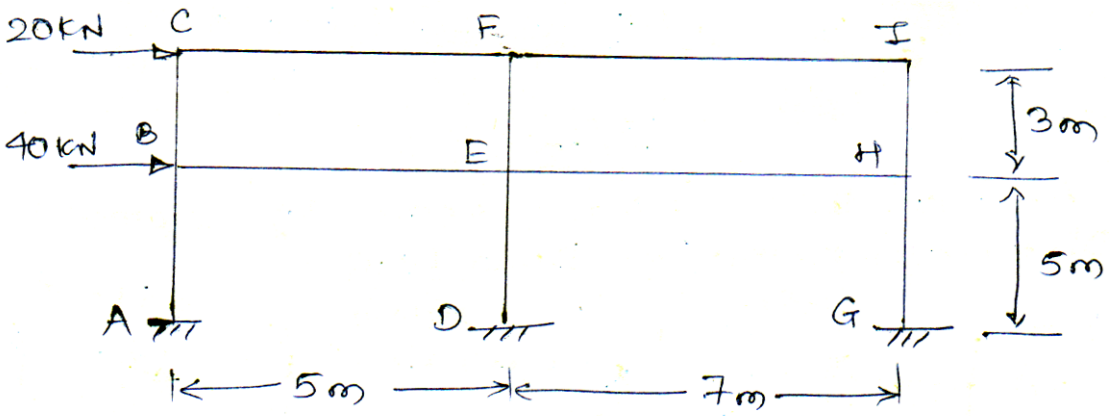


OR

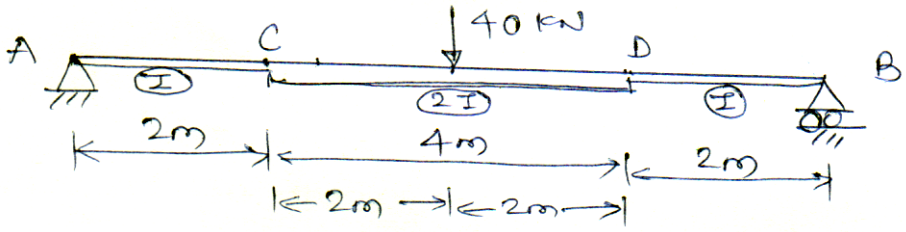
Q4) Analyse the frame by stiffness matrix method Draw BMD. **[16]**



Q5) a) Determine values of moment, shear and axial forces in members of the frame loaded and supported as shown using portal frame method draw BMD **[10]**



b) Determine deflection at the centre of beam using finite difference method. Take 5 nodes. **[8]**



OR

Q6) a) Analyse the frame given in Q5 (a) by cantilever method. Draw BMD. **[10]**

b) Determine maximum deflection for a cantilever Beam of 2m span, carrying concentrated load of 80kN at free end. Take 4 nodes. **[8]**

Q7) a) Explain principal of minimum potential energy. **[8]**

b) Derive expression for shape function for a two noded bar element taking natural co-ordinate. **[8]**

OR

Q8) a) Determine shape function for a CST element in terms of natural co-ordinate system. **[8]**

b) Explain plain stress & plain strain problem. **[8]**

Total No. of Questions : 12]

SEAT No. :

P2487

[Total No. of Pages : 3

[5253]-505

T.E. (Civil) (Theory)

FLUID MECHANICS - II

(2015 Pattern) (Semester - I)

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 non programmable electronic pocket calculator is allowed.***
4) ***Assume suitable data, if necessary.***
5) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.***

Q1) a) Explain in brief with neat sketch "Karman Vortex Trail". **[2]**

b) The following data is related to the flat plate moving in stationary air of a fluid mechanics laboratory :

i) Speed of the plate = 55 km/hour

ii) Size of the plate = (1 .65 × 1.65) m

iii) Density of Air = 1.16 Kg/m^3

iv) Coefficient of lift = 0.78

v) Coefficient of drag = 0.15

Find out : I) Lift force. II) Drag force. III) Resultant force, and IV) Power required to keep the plate in motion. **[6]**

OR

Q2) a) Define unsteady flow. Give any two practical examples of it. **[2]**

b) Explain the following terms with neat sketches : **[3 + 3 = 6]**

i) Surge Tank and its Function

ii) Water hammer

Q3) Derive the energy equation with usual notations for open channel flow. **[6]**

OR

Q4) a) Explain in brief with neat sketches the following terms : **[6]**

i) Specific Force Diagram

ii) Specific Energy Curve

P.T.O.

Q5) The following data is given for the irrigation channel of trapezoidal section:

a) Side slopes = 3H to 2V.

b) Q = 10.50 m^3/s,

c) Longitudinal slope = 1 in 5000 and

d) The channel is to be lined for which the value of friction coefficient in Manning's formula is n = 0.012.

Find the most economic section of the channel. **[6]**

OR

Q6) Derive the following expression for conjugate depths of hydraulic jump in rectangular channel. Also state the assumption made for it. **[6]**

$$\frac{y_1}{y_2} = \frac{1}{2}\left[-1+\sqrt{1+8Fr_2^2}\right]$$

Q7) a) A jet of water 80 mm diameter having a velocity of 20m/s, strikes normally a flat smooth plate.

Determine the thrust on the plate (i) if the plate at rest. (ii) if the plate is moving in the same direction as jet with a velocity of 6 m/s.

Also find the work done per second in each case and efficiency of the jet when the plate is moving. **[6]**

b) Derive the expression for minimum starting speed of centrifugal pump. **[6]**

c) A centrifugal pump with 1.25m diameter runs at 210 rpm and pumps 1 890 lit/sec. the average lift being 6.1 m. The angle which the vane makes at exit with the tangent to the impeller is 27° and the radial velocity of flow is 2.6 m/s. Determine the manometric efficiency and the least speed to start the pumping against the head of 6.1m, the inner diameter of the impeller being 0.6m. **[6]**

OR

Q8) a) Explain the following terms : **[6]**

i) Reciprocating pump

ii) Submersible pump

b) Explain in brief : i) Cavitation in centrifugal pump ii) Various Efficiencies of centrifugal pump. **[6]**

c) Derive expression for the "work done by the jet" in case of flat plate inclined and moving in the direction of jet. **[6]**

Q9) a) Explain in brief various elements of hydroelectric power plant with the neat sketch. **[8]**

b) A Pelton wheel is revolving at a speed of 191 r.p.m. and develops 5150.50 kW when working under a head of 221 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.47. Also find the speed. discharge and power when this turbine is working under a head of 141m. **[8]**

OR

Q10)a) Derive the following expression for the specific speed of hydraulic turbine. **[8]**

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

b) A Pelton wheel is to be designed for the following specifications :

Shaft Power = 11,772kW; Head = 380 meters;

Speed = 750 r.p.m; Overall efficiency = 86%:

and jet diameter is not to exceed one-sixth of the wheel diameter.

Determine: i) The wheel diameter. ii) The number of jet required. and iii) Diameter of the jet. Take coefficient of velocity = 0.985 and Speed ratio = 0.45 **[8]**

Q11)a) Derive the following form of GVF equation. **[6]**

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - \frac{Q^2 T}{gA^3}}.$$

b) Describe the procedure of GVF computation by "Standard Step Method". **[10]**

OR

Q12)a) Explain in brief the various types of water surface profiles. **[4]**

b) A Rectangular channel 8 m wide carries discharge of 11 m^3/s (Manning's n = 0.025. bed slope of 0.0016). Compute the length of back water profile created by a dam which backs up a depth 2 m immediately behind the dam by direct step method. Take at least 3 steps to compute the profile. **[12]**

● ● ●

Total No. of Questions : 10]

SEAT No. :

P2488

[Total No. of Pages : 4

[5253]-506

T.E. (Mechanical)

DESIGN OF MACHINE ELEMENT - I

(2015 Pattern) (End Semester)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer five questions from the following.***
2) ***Draw neat labeled diagrams wherever necessary.***
3) ***Figures to right indicate full marks.***
4) ***Use of electronic calculator is permitted.***
5) ***Use of Programmable calculator is not allowed.***
6) ***Assume suitable/standard data if necessary.***

Q1) a) Two rods, made of plain carbon steel 40C8 (S_{yt} = 380MPa), are to be connected by means of a cotter joint. The diameter of each rod is 70 mm and the cotter is made from steel plate of 15mm thickness. Calculate the dimensions of the socket end. Use Yield strength in compression = 2x tensile Yield strength, Yield strength in shear = 50% of Tensile Yield Strength and Factor of safety as 6. **[6]**

b) Define lever. Explain the terms for lever with neat sketch load, effort, load arm, effort arm, mechanical advantage and leverage. **[4]**

OR

Q2) a) Draw neat labeled sketch of protected type flange coupling. **[4]**

b) A rotating shaft 40mm in diameter, is made of steel FeE 580 (S_{yt}= 580MPa). It is subjected to a steady torsional moment of 250N-m and bending moment of 1250N- m. Calculate the factor of safety available based on (i) Maximum Principal Stress theory and (ii) Maximum Shear stress theory. **[6]**

Q3) a) It is required to design a square key for connecting a sprocket to a 40 mm diameter shaft. 25kW power at 720 rpm is transmitted from the shaft to the sprocket. The key is made from plain carbon steel 30C8 (S_{yt} = 400MPa) and the factor of safety is 4. Assume yield strength in tension and compression is equal. Calculate length of the key on the basis of shear strength and length of key on the basis of compressive strength. **[4]**

P.T.O.

b) A rotating bar made of steel 45C8 (Sut = 630 MPa) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 315 MPa. Calculate the fatigue strength of bar for a life of 90,000 cycles. Draw necessary SN curve and indicate all parameters. **[6]**

OR

Q4) a) Explain cumulative damage in fatigue with necessary Miner's Equation. **[4]**

b) A rigid flange coupling is required to transmit 20kW power at 720 rpm. The shafts and bolts are made of plain carbon steel 30C8 (Syt = 400 MPa) and the factor of safety is 4. The yield strength in compression is 1.5 times the yield strength in tension. Calculate (i) Diameter of shafts (ii) Flange dimensions and (iii) Diameter of bolts. **[6]**

Q5) a) 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 the screw collar are 50 mm and 20 mm respectively. The co efficient of thread friction and collar friction are 0.2 and 0.15 respectively. **[12]**

The screw rotates at 12 rpm. Assuming uniform wear conditions at the collar and allowable thread bearing pressure of 5.77 N/mm^2, find

i) Stresses in the screw.

ii) Torque required to rotate the screw.

iii) Required number of threads of nut in engagement with screw

iv) Power required.

b) Explain Re-circulating ball screw with neat sketch and applications. **[4]**

OR

Q6) a) Prove that for self-locking screw the efficiency is less than 50%. **[3]**

b) The differential screw jack comprising of two non rotating screws with a outside diameter 50 mm. The screw threads are square single start with coefficient of thread friction 0.15. Both the screws are right handed and the lower screw is fixed. The pitch of upper screw is 16 mm and for lower screw is 12 mm respectively. Determine **[13]**

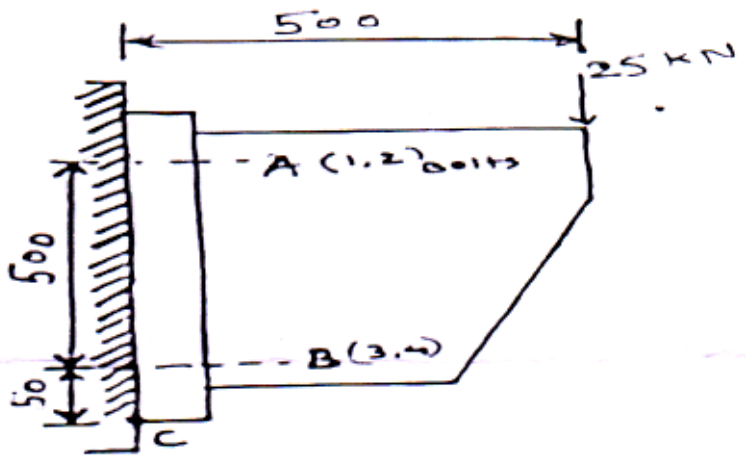
i) Efficiency of the screw jack.

ii) Load that can be lifted if the shear stress in the body of the screw is limited to 28 MPa.

Q7) a) i) What are the advantages of welded joints over a threaded joints. **[6]**

ii) state the various forms of screw thread

b) A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B as shown in figure. Assuming that the bracket is held against the wall and prevented from tipping about C by all four bolts and using allowable tensile stress in bolts as 35 N/mm^2, Determine the size of bolts on the basis of maximum principal stress theory. **[12]**



OR

Q8) a) A solid rectangular bar of cross section 80×50 mm is welded by 5 mm fillet weld on all side of flate plate, with axis perpendicular to flat plate. if permissible shear stress for weld is 75 N/mm^2, Determine the maximum torque that can be applied to the rectangular bar. **[13]**

b) Explain and Draw the neat sketch of Screw fasteners (any two) : **[5]**

i) Through bolt

ii) Tap bolt

iii) Set screw

Q9) a) Define following terms (any two) : **[4]**

i) Solid Length

ii) Spring Rate

iii) Spring Index

b) Design a Closed Coil helical Compression spring for a service ranging from 2250 N to 2750 N. The axial deflection of the spring for load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 Mpa and modulus of rigidity 84×10^3 KN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensional sketch of the spring showing details. Consider square and ground ends. **[12]**

OR

Q10)a) Determine the required number of coils and the allowable deflection in a helical spring made of 1.6 mm determine wire. Assume the spring index as 6 and permissible shear stress as 345 N/mm^2. The stiffness of spring is to be 1.2 N/mm Take G = 80 Gpa. Assume Square and Ground ends. **[8]**

b) i) Explain Leaf spring with neat sketch **[8]**

ii) What is meant by spring surge & explain its effect?

Total No. of Questions : 10]

SEAT No. :

P2489

[Total No. of Pages : 4

[5253]-507
T.E. (Mechanial)
HEAT TRANSFER
(2015 Pattern)

Time : 2.30 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Assume suitable data if necessary.***
2) ***Figure to the right indicate full marks.***
3) ***Use of scientific calculator is allowed.***

Q1) a) Derive three Dimensional general heat conduction equation in Cartesian co- ordinates for an isotropic material for unsteady state condition with uniform internal heat generation. **[7]**

b) What is unsteady state? Define internal temperature gradient. When it can be neglected? **[3]**

OR

Q2) a) An electric conductor of 10mm diameter insulated by PVC (k = 0.18 W/mK) is located in air at 30° C. The air has convective heat transfer coefficient of 7.8 W/m^2K. If the surface temperature of base conductor is 85° C, calculate- i) Current carrying capacity of conductor when 2 mm thick insulation is provided. Resistivity of conductor is $70 \times 10^{-8}\ \Omega$ m ii) Critical Insulation thickness iii) Maximum current carrying capacity iv) Percentage increase in current carrying capacity by providing critical insulation. **[7]**

b) What is insulated Boundary Condition? Explain with diagram. **[3]**

Q3) a) Explain time constant and response of thermocouple. **[4]**

b) What is Economical Thickness of Insulation? Explain with diagram. **[4]**

c) Explain different types of insulating materials. **[2]**

P.T.O.

OR

Q4) a) One end of a long rod 3 cm in diameter is inserted into a furnace with the outer end projecting into the outside air. Once the steady state is reached the temperature of the rod is measured at two points, 15 cm apart and found to be 140° C and 100° C, when the atmospheric air is at 30° C with convection coefficient of 20 W/m^2 K. Calculate the thermal conductivity of the rod material. **[7]**

b) Explain difference between fin efficiency and fin effectiveness. **[3]**

Q5) a) Explain the significance of following dimensionless Numbers : **[10]**

i) Prandtl Number

ii) Grashoff Number

iii) Reynold Number

iv) Nusselt Number

v) Biot Number

b) Explain with a neat sketch development of Hydrodynamic boundary layer and Thermal boundary layer assuming constant wall temperature, for fluid flow through a conduit. **[6]**

OR

Q6) a) A refrigerated truck on the high way is moving at a speed of 90 km/hr in a desert area where the air temperature is 70° C. The body of a truck can be summed as rectangular box 9 m long, 3 m wide and 2 m high.

Consider the boundary layer is turbulent over all the surfaces and temperature of the surface is 10°C. Neglect the heat transfer from front and back end of the truck, find- **[10]**

i) Heat transfer coefficient for this situation.

ii) Heat loss per hour from the surface.

Data : $\rho = 1.128 kg/m^3$, $C_p = 1.007$ kJ/kg.K,

ν (Kinematic Viscosity) $= 16.96 \times 10^{-6}$ m^2/sec, k = 0.027 W/mK

Use the following co relation -

$$\mathbf{N_u = 0.036\ R_e^{0.8.}\ Pr^{0.33}}$$

b) What is the difference between Forced Convection and natural Convection. **[6]**

Q7) a) Write a note on : **[6]**

i) Radiation Shape Factor

ii) Radiation Shield

b) Calculate all view factors for conical geometry shown in figure 1 Assume $F_{1-2} = 0.117$. **[10]**

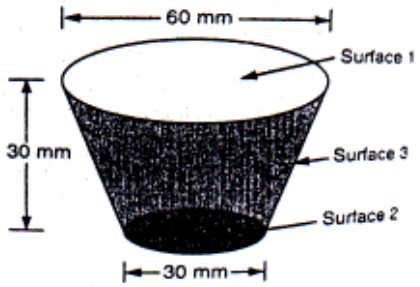


Figure 1

OR

Q8) a) Write the statements and mathematical expressions of the following laws in radiation heat transfer - **[10]**

i) Plank's law

ii) Wien's law

iii) Kirchoff's law

iv) Lambert's cosine rule

v) Stefan's boltzman's law

b) What is a gray body? How does it differ from a black body? What is a diffuse gray surface? **[6]**

Q9) a) Derive an expression for LMTD of counter flow heat exchanger. **[6]**

b) Compare Film wise and drop wise condensation. **[4]**

c) Water enters the tubs of a small single pass heat exchanger at 20°C and leaves at 40 °C on the shell side 25 Kg/min of steam condensed at 60 °C. Calculate the over all heat transfer coefficient and the required flow rate of water if the area of the exchanger is 12 m^2 (the latent heat of condensation of steam is 2358.7 kJ/kg.K at 60 °C) take specific heat of water as 4174 J/kg.K. **[8]**

OR

Q10)a) Explain the phenomenon of nucleate boiling. List the factors that affect nucleate boiling. **[4]**

b) Derive an expression for effectiveness of parallel flow heat exchanger. **[6]**

c) What is design and selection criteria for heat exchanger? **[4]**

d) What is Active cooling and Passive cooling methods? **[4]**

● ● ●

Total No. of Questions : 10]

SEAT No. :

P2490

[Total No. of Pages : 3

[5253]-508

T.E. (Mechanical/Automobile)

THEORY OF MACHINES - II

(2015 Pattern) (Semester - I)

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) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data, if necessary.***

Q1) a) Explain the term interference in connection with gear with sketch and the various methods used to avoid it. **[6]**

b) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. If addendum on each wheel is such that path of contact is maximum and interference is just avoided, find the path of contact, arc of contact and contact ratio. Also find the addenda for each wheel. **[7]**

OR

Q2) a) Two horizontal shafts are connected by a pair of spiral gears A and B. The angle between the shafts is 60°. A is driver and rotates 1.5 times as fast as B. A has 40 teeth with helix angle of 25°. The normal pitch is 10 mm. the driving torque applied at A is 30 Nm. Find the pitch circle diameter, the end thrust on each shaft neglecting friction taking normal pressure angle as 20°. **[7]**

b) A two start worm rotating at 800 rpm drives a 26 teeth worm gear. The worm has pitch diameter of 54 mm and a pitch of 18 mm. If the coefficient of friction is 0.06, find **[6]**

i) The helix angle of the worm

ii) Speed of gear.

iii) The centre distance

iv) The lead angle of maximum efficiency

v) Efficiency.

vi) Maximum efficiency.

P.T.O.

Q3) Explain the following terms with the help of a neat sketch : **[7]**

a) Compound and Reverted gear train.

b) Bevel epicyclic gear train.

OR

Q4) An epicyclic gear train is composed of a fixed annular wheel A having 150 teeth. Meshing with A is a wheel B, which drives wheel D through an idle wheel C, D being concentric with A. Wheels B and C are carried on an arm which revolves clockwise at 100 rpm about the axes of A and D. If wheel B and D have 25 and 40 teeth respectively, find the number of teeth on C and speed and sense of rotation of C. **[7]**

Q5) The following data relate to a cam operating an oscillating roller follower, min dia. of cam is 40 mm, dia. of roller is 12 mm, length of follower arm is 50 mm, distance of fulcrum center from cam center is 60 mm, angle of ascent is 120°, angle of decent is 90°, angle of dwell for the follower in the highest position is 60°, angle of oscillation of follower is 34°. Draw the profile of cam if follower lift with uniform acceleration and retardation, acceleration being 2/3 of retardation and decent take place with SHM. **[16]**

OR

Q6) a) What is cam jump phenomenon? Derive the expression for jump velocity for the eccentric cam operating flat face follower. **[10]**

b) What is polynomial curve cam? Derive an expression for displacement, velocity and acceleration for 2-3 polynomial D-R-D cam. **[6]**

Q7) a) Explain the following terms related to synthesis problem. **[4]**

i) Function generation

ii) Body guidance.

b) Design a four bar mechanism to generate the function $y = \sin x$, x varies from 0 to 90°. Angle of input link varies from 30° to 150° and angle of output link varies from 60° to 120°. Assume length for fixed link as a one unit. Use three precision positions from Chebyshev spacing. **[12]**

OR

Q8) a) Explain the following terms : **[6]**

i) Type synthesis.

ii) Number synthesis.

iii) Dimensional synthesis.

b) Synthesis a four bar mechanism using Freudenstein's equation to satisfy in one of its positions for the following specifications assuming fixed link length as 1 Unit; **[10]**

$\theta = 60°$	$\omega_\theta = 5$ rad/sec	$\alpha_\theta = 2$ rad/sec
$\Phi = 90°$	$\omega_\Phi = 2$ rad/sec	$\alpha_\Phi = 7$ rad/sec

Q9) a) Describe cone variators used to transmit the power between parallel, non-parallel and intersecting shaft axes. **[6]**

b) The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 r.p.m. clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot = 1855 m/hr). Calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12°. Find the maximum acceleration during pitching motion. **[12]**

OR

Q10)a) Discuss in brief continuously variable transmission. **[6]**

b) A rear engine automobile is travelling along a track of 100 meters mean radius. Each of the four road wheels has a moment of inertia of 2.5 kg-m^2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.2 kg-m^2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3:1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lies centrally with respect to the four wheels. **[12]**

Total No. of Questions : 10]

SEAT No. :

P2491

[Total No. of Pages : 4

[5253]-509

T.E. (Mechanical Engineering)

TURBO MACHINES

(2015 Pattern) (Semester - I)

Time : 2.5 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Use of non programmable scientific calculator is allowed.***
3) ***Assume data wherever necessary and mention it.***
4) ***Draw neat and suitable figures wherever necessary.***
5) ***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.***
6) ***Use of steam table is permitted.***

Q1) a) Show that the ratio of flow rate, Ql/Q2 = (1+cosθ) / (1–cosθ) for the impact of jet on stationary flat plate inclined at θ^0 to the direction of the horizontal jet. Where Q1 = upward directed flow rate and Q2 = downward directed flow rate. **[6]**

b) What is the difference between the impulse and reaction turbine? **[4]**

OR

Q2) a) Classify water turbines in brief. **[4]**

b) The mean bucket speed of a Pelton wheel is 40 m/s and the discharge is 1.2 m^3/sec. The head over the turbine is 385 m. The head loss due to friction in penstock is 9 m. The bucket deflects the jet through 165°. If the coefficient of velocity of nozzle is 0.9.Detemine i) Power developed by the turbine and ii) Hydraulic efficiency of turbine. Neglect bucket friction. **[6]**

Q3) a) Discuss main characteristics of the Pelton wheel. **[4]**

b) A Kaplan turbine runner has outer diameter of 4.5 m and the diameter of the hub is 2m. It is required to develop 20.6 MW when running at 150 rpm, under a head of 21m .Assuming hydraulic efficiency of 94% and overall efficiency of 88%. determine the runner vane angle at inlet and exit at the mean diameter of the vane. **[6]**

P.T.O.

OR

Q4) a) Write a short note on selection of turbines. **[4]**

b) Particulars of the reaction turbine are given below Head of the turbine is 180 m, Inlet diameter is 4.25 m, Outlet diameter is 2.75 m, Inlet vane angle is 120 deg., Velocity of flow at outlet is 16 m/s, hydraulic efficiency is 92 %, width of wheel is same at inlet and outlet, Discharge is radial at outlet calculate the speed of the turbine. **[6]**

Q5) a) Write a difference between throttle and nozzle governing used in steam turbines and explain with neat sketch of nozzle governing. **[8]**

b) Steam issues from the nozzles of an angle of 20 deg 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 3kg/s. **[8]**

OR

Q6) a) Discuss reheat factor with the help of T.S. diagram. **[6]**

b) Following data refer to the signle row of impulse steam turbine mean diameter of the blade ring = 1.lm, Speed = 3000rpm, Nozzle angle = 17 deg., ratio of blade velocity to the steam velocity = 0.45, blade friction factor = 0.82, Blade angle at exit is less by 3 deg to that at inlet, steam mass flow rate = 10.2 Kg/s. Draw a velocity diagram and find the following (i) Blade angles at inlet and outlet (ii) Tangential force (iii) Axial force (iv) Resultant force (v) Power developed. **[10]**

Q7) a) Explain with neat sketch any two types of impellers used in centrifugal pump. **[6]**

b) The impeller of the centrifugal pump has an outer diameter of 250mm and an effective area of the $0.017m^2$.The blades are bent backward so that the direction of outlet relative velocity makes an angle of 148 deg with the tangent drawn in the direction of impeller rotation. The diameters of suction and delivery pipes are 150mm and 100mm respectively. The pump delivers $0.031m^3/s$ at 1450 rpm when suction and delivery lifts are 4.6m and 18m respectively. The head losses in the suction and delivery pipes are 2m and 2.9m respectively. The motor driving the pump delivers 10KW.Assuming that water enters the pump without shock and whirl Determine (i) Manometric efficiency and (ii) The overall Efficiency of the pump. **[10]**

OR

Q8) a) Discuss the significance of the effect of outlet blade angle on performance of centrifugal pump. **[7]**

b) Three stage centrifugal pump has impellers 40cm diameter and 2cm wide at outlet. The vanes are curved back at the outlet at 45deg and reduce the circumferential area by 10%.Its Manometric efficiency is 90% and overall efficiency is 80%.Determine the head generated by the pump when running at 1000rpm.Delivering 50 LPS. What should be the shaft power and specific speed? **[6]**

c) Tests on a pump model indicate a Thomas cavitation factor is 0.1 .A homologous unit is installed at a location where atmospheric pressure is 0.91 bar and vapour pressure as 0.035 bar (abs) and is to pump water against a head of 25m.What is the maximum permissible suction lift/ head? Neglect frictional losses in the suction pipe. **[3]**

Q9) a) Explain flow processes through Axial flow compressor with h-S diagram for single stage. **[8]**

b) A centrifugal compressor running at 10000rpm delivers 660m^3/min of air. The air is compressed from 1bar and 20°C to a pressure ratio of 4 with an isentropic efficiency of 82%.Blades are radial at outlet of the impeller and flow velocity of 62m/s may be assumed throughout constant. The outer radius of the impeller is twice the inner and the slip factor may be assumed as 0.9.The blade area coefficient may be assumed 0.9 at outlet, Determine, (i) Final temperature of the air (ii) Theoretical power (iii) Impeller diameter at inlet and outlet. (iv) Bredth of the impeller at inlet (v) Impeller blade angle at inlet (vi) Diffuser blade angle at inlet. R=287 J/kgK, Cp = 1.005 KJ/kgK. **[10]**

OR

Q10)a) Explain surging and choking in axial flow compressor. **[6]**

b) Define (i) Flow coefficient and (ii) Blade loading Coefficient. **[2]**

c) A centrifugal compressor runs at 15000rpm with overall stagnation pressure ratio of 4. An ambient air conditions are 25°C and 1bar, vanes are radial slip factor is 0.96 and power input factor (work factor) is 1.04. Flow in the inlet section up to the impeller entry is isentropic and that in the impeller and diffuser is adiabatic there is no Prewhirl at axial entry to the impeller. Mechanical efficiency is 96% and the electric motor driving the compressor is 98% efficient. The stagnation pressure loss from impeller exit to diffuser exit is 0.1 bar isentropic efficiency of the impeller alone is 90% taking $\gamma = 1.4$, Cp= 1.005 KJ/kgK for air, Determine (i) Electrical energy consumed by electric motor per kg of air. (ii) Overall efficiency of the compressor (iii) Impeller tip diameter Draw a neat T-S diagram. **[10]**

Total No. of Questions : 9]

SEAT No. :

P2492

[Total No. of Pages : 2

[5253] - 510
TE (Mechanical Engg.)
End Semester
METROLOGY AND QUALITY CONTROL
(2015 Pattern)

Time :2½ hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Solve Q.No,1 or 2, Q.No.3or 4,Q,No.5or 6,Q.No.7or 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 construction & working of Micrometer with it's Applications **[5]**

b) Find the shaft & hole dimensions with tolerance for a **90H8e9** pair given the following data with standard notations - 90 mm lies in diameter step of 80 to 100 mm. Upper deviation for e shaft = -11D^0.41 , Tolerance unit, i = 0.45(D)^0.33 + 0.001D. lT8 = 25i & 1T9 = 40i **[5]**

OR

Q2) a) Explain Centre Line Average (CLA) & Root Mean Square (RMS) method of analyzing the surface trace **[5]**

b) Explain (any 1) - i) Gauge Repeatability & Reproducibility ii) LVDT Comparator **[5]**

Q3) a) Explain various types of Screw thread errors **[5]**

b) Write note on - Automatic Inspection Systems **[5]**

OR

Q4) a) Explain working of Gear Tooth Vernier Caliper **[6]**

b) Differentiate between Alignment Tests & Running tests **[4]**

Q5) a) Write a note on Cost of Quality & Value of Quality **[7]**

b) Explain Deming's PDCA cycle & Deming's 14 points **[9]**

OR

Q6) a) Enlist 7 Basic Quality Tools & explain any 2 from them **[9]**

b) Explain Concept of Controllability of Quality : Self Control **[7]**

Q7) a) Explain in detail : Operating Characteristics Curve showing Producer's Risk, Consumer's Risk, AQL, LTPD, Indifference Region **[8]**

b) Table below shows the number of defectives found in inspection of 10 lots of 100 magnets each **[8]**

Lot no.	1	2	3	4	5	6	7	8	9	10
No. of Defectives	3	2	5	2	1	4	4	13	4	3

(i) Determine the control limits for P chart and state whether the process is in control.

(ii) If the point that goes outside the control limits is analyzed and eliminated, what will be the values of new control limits?

OR

Q8) a) Write a note on Process Capability & explain the indices: Cp, Cpk & Ppk **[10]**

b) Calculate sample size & AOQ for Single Sampling Plan using following data - Probability of acceptance of 0.4% defectives in a lot = 0.558, Lot size = 10000, Acceptance number = 1, np' for sample = 1.5, Defectives found in the sample are not to be replaced. If defectives found in sample are to be replaced then what will be AOQ? **[6]**

Q9) Write detailed note on (Any 3) **[18]**

a) TPM ,

b) ISO / TS 16949 Quality Management System,

c) FMECA,

d) Kanban,

e) Six Sigma

f) Poka Yoke

Total No. of Questions : 12]

SEAT No. :

P2493

[Total No. of Pages : 4

[5253] - 511
T.E (Mechanical Sandwich) (Semester - I)
NUMERICAL METHODS AND OPTIMIZATION
(2015 Pattern)

Time :2½ hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8, Q9 or Q10, Q11 or Q12.***
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) The vander waals equation for real gases is given by, **[6]**

$\{p+(a/v^2)\}\ (v - b) = RT$

Where p = pressure = 1 kN/m^2, R = Gas constant = 0.082kJ/kg k, a = constant = 3.82, b = constant = 0.06, V = volume at pressure p and T = temperature. Find the volume at 300 K. Assume initial volume = 20 m^3 / kg. Solve the numerical upto 2 iteration.

OR

Q2) Determine using Half interval method, a root of equation cos (x) – 1.3 (x) = 0. **[6]**

Not more than 4 iterations are expected.

Q3) Solve the system of equation using Gauss elimination method. **[8]**

x - y + 4 z = 16

3x + 2y + z = 18

x + 4y – 2z = 12

Use partial pivoting.

P.T.O.

OR

Q4) Solve the system of equation using Gauss Seidel iterative method. **[8]**

$10x + y + z = 12$

$2x + 10y + z = 13$

$2x + 2y + 10z = 14$

Find the solution after 4 iterations.

Q5) Maximise, $Z = 3x + 2y$ subject to condition, **[6]**

$-2x + y <= 1$

$x <= 2$

$x + y <= 3$

$x, y >= 3$

Use graphical method.

OR

Q6) Write a short note on the any three following: **[6]**

a) Constrained optimization

b) Slack variable

c) Artificial variable

d) Genetic Algorithm

Q7) a) A steel plate of 750 mm* 750 mm has its two adjacent sides mainteined at 100 °C. While the two other sides are maintained at 0 °C. What will be the steady state temperature at interior points assuming a grid size of 250 mm. **[10]**

	T_4	T_3
	T_1	T_2

b) Give $\frac{dy}{dx} = \frac{y-x}{y+x}$ with inital condition y(0) = 1; Find y for x = 0.1 by Euler's method. Take n = 5. **[6]**

OR

Q8) a) Draw a flowchart for Runge - kutta fourth order method. **[8]**

b) Initial temperature within an isulated cylindrical metal rod of 4 cm length is given by, T = 50 (4-x), 0 < x < 4, where x is distance from one end in cm. Both the end are maintained at 0 °C. Find the temperature as a function of x and t ($0 \leq t \leq 1.5$) if the heat flow is governed by

$$\frac{\partial T}{\partial t} = \alpha \frac{\partial^{2T}}{\partial x^2}, \Delta x = 1, \Delta t = 0.25, \alpha = 2.$$ **[8]**

Q9) a) An experiment gave the following values:

v(ft/min)	350	400	500	600
t (min)	61	26	7	2.6

It is known that v and t are connected by the relation $v = at^b$. Find the best possible values of a and b. **[8]**

b) Kinematic viscosity of water (v) is related to temperature (T) in the following manner: **[8]**

T (°C)	0	4	8	12	16	20	24
$v*10^{-2}$, (cm^2/s)	1.7923	1.5676	1.3874	1.2396	1.1168	1.0105	0.9186

Use method of least square to fit the parabolic equation of the form $v = a + bT + cT^2$ for the data.

OR

Q10)a) Draw flow chart for lagrange's interpolation. **[6]**

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 by Newton's Difference method: **[10]**

Age	45	50	55	60	65
Premium	2871	2404	2083	1862	1712

Q11)a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using. **[10]**

i) Trapezoidal rule

ii) Simpson's 1/3rd rule

iii) Simpson's 3/8th rule

and compare the results with its actual value.

b) Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4}$ dx by Gaussian 3 - point formula. **[8]**

OR

Q12)a) Evaluate $\int_6^{14}\int_1^5 (x-y+1)\,dx.dy$ by using simpson's 1/3rd rule with number of strips for x and y equal to 4. **[10]**

b) Draw a flow chart by trapezoidal rule to find $\int_0^1 \sqrt{\sin(x)+\cos(x)}$ **[8]**

Total No. of Questions : 8]

SEAT No. :

P2494

[Total No. of Pages : 3

[5253] - 512
TE (Mechanical Sandwich)
(Semester - I)
MECHATRONICS
(2015 Pattern)

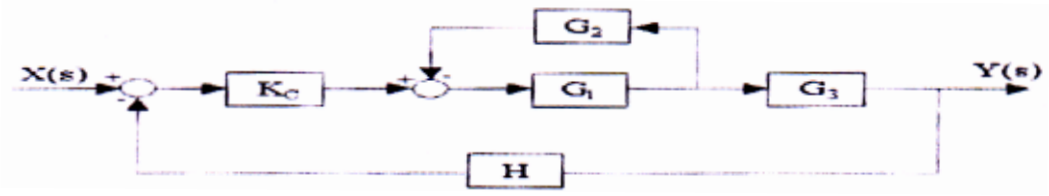
Time :2½ hours] *[Max. Marks :70*

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) ***Assume Suitable data if necessary***

Q1) a) Compare RTD & Thermocouple **[6]**

b) Find out overall transfer Function by using Block Diagramme Elimination Technique **[8]**



c) Discuss the selection criteria for DAQ **[6]**

OR

Q2) a) Explain the construction & working of optical encoder **[6]**

b) Enlist the application of Mechatronics & explain any one in detail with Block diagramme **[8]**

c) A 4-bit DAC has reference voltage of 0-10 volts . The binary input is 1110. Find the analog output voltage & resolution of converter **[6]**

Q3) a) Explain with block diagramme architecture of Programmable Logic Controller **[8]**

b) A conveyor is run by switching on or off a motor. We are positioning parts on the conveyor with an optical detector. When the optical sensor goes on, we want to wait 1.5 seconds, and then stop the conveyor. After a delay of 2 seconds the conveyor wil1 start again. We need to use a start and stop button - a light should be on when the system is active.**[10]**

P.T.O.

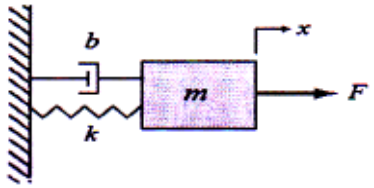
OR

Q4) a) Discuss the selection criteria for PLC. Explain Timers & Counters **[8]**

b) In a certain bank, each of three bank officers has a unique key to the vault. The bank rules require that two out of the three officers be present when the vault is opened. Draw the ladder diagram for a relay logic circuit that will unlatch the door and turn on the light when two of the three keys are inserted **[10]**

Q5) a) Explain the terms i) Hydraulic capacitance ii) Hydraulic Inertance **[8]**

b) For the mechanical system shown in fig. Assume M(mass) = 2kg, K(stiffness) = 2N/m & b (damping) = 0.5Ns/m. The displacement x of the mass m is measured from equilibrium position. In this system the external force f (t) is input & x is the output. Determine i) Transfer function ii) Identify location of poles & zeros. **[8]**



OR

Q6) a) Derive the mathematical equation for Thermal system. **[8]**

b) Write a short note on stability of system. Find the poles & zeros of the transfer function **[8]**

$G(s) = (s^2+3s+2)/(s+4)(s^2+6s+25)$ & sketch pole-zero plot.

Q7) a) Write a short note on PID tuning Methods **[6]**

b) Fig. shows as error time graph .Sketch the PID controller o/p w.r.t. time. Assume

Kp = 10, K=2& Kd=0.5 & Po=0 i.e. controller o/p is zero when error is zero. **[10]**

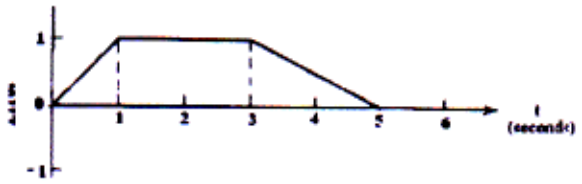


Figure 3

OR

Q8) a) Explain P+I controller with block diagramme, characteristic, advantage & Disadvantage and application. **[8]**

b) A feedback system has forward path T.F. G(s) = (s+2)/s(s+l)

Determine Rise time (Tr),Peak Time(Tp), Peak overshoot (Mp),settling time (Ts)& Delay Time (Td) for unit step input. **[8]**

Total No. of Questions : 10]

SEAT No. :

P2495

[Total No. of Pages : 4

[5253] - 513
T.E. (Mechanical Sandwich)
APPLIED COMPUTER AIDED ENGINEERING
(2015 Pattern)

Time :2½ hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer Q1or Q2,Q3or Q4,Q5 or Q6,Q7 or Q8,Q9 or Q1O***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data, if necessary***

Q1) What is the effect of following transformations on triangle ABC, where A(0,0), B(10,0) and C(0,8) ? Find concatenated transformation matrix, if transformations are performed as per following sequence.

i) Rotation through 45 degrees in anticlockwise direction.

ii) Translation through +5 and -8 units along the X and Y directions respectively.

iii) Rotation through 60 degrees in clockwise direction. **[10]**

OR

Q2) a) Explain different types of co-ordinate systems used in computer graphics. **[4]**

b) Write a short note on Bezier Curves. **[6]**

Q3) a) A line joints two points (3,4,6) and (5,7,1). Write:

i) Parametric equation of line

ii) Tangent vector of line

iii) Unit vector in direction of line **[6]**

b) Define automation. What are different strategies in automation? **[4]**

OR

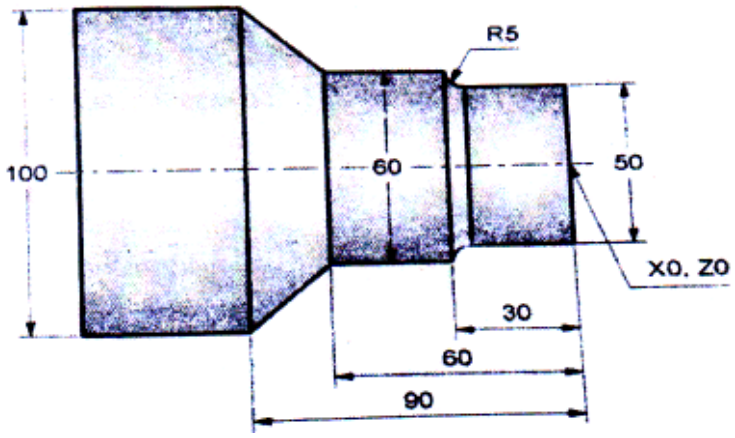
Q4) a) Compare solid modeling with wireframe modeling. **[4]**

b) Classify the various types of Grippers. Explain vacuum gripper. **[6]**

P.T.O.

Q5) a) Explain different types of tool motion control modes used in NC programming **[8]**

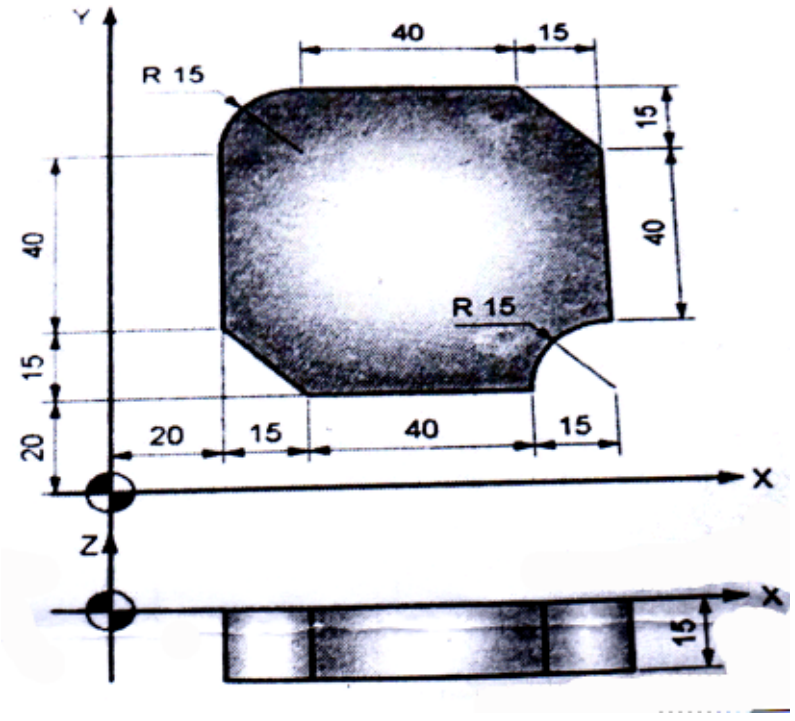
b) Write a CNC program to take a finish cut for the shape shown in figure. Assume suitable machining data, Use multiple stock removal cycle.**[10]**



OR

Q6) a) Explain Canned cycle for drilling and multiple stock removal in proper word address format. **[6]**

b) Develop a part program for the part shown in figure. The part is 15 mm thick. Use end mill cutter diameter 15 mm, cutting speed 700 r.p.m and feed rate of 100 mm/min. **[12]**



Q7) a) Explain Fused Deposition Modeling (FDM) process and enlist its advantages and limitations. **[8]**

b) What is Rapid Prototyping? Explain various RP systems. List its advantages and limitations. **[8]**

OR

Q8) a) Explain 3D Printing with neat sketch. List its advantages, limitations and applications. **[8]**

b) Explain Laminated Object Manufacturing (LOM) process. Enlist its advantages and limitations. **[8]**

Q9) a) Explain concept of shape function in 1D element **[4]**

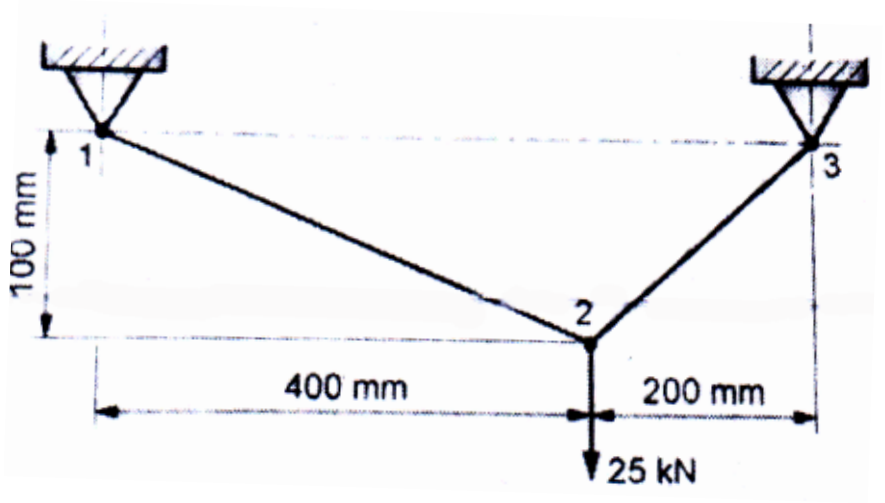
b) A plane truss, shown in figure is subjected to a downward vertical load at node 2. If the cross sectional area of both the element is $30mm^2$ and $E= 2.1 \times 10^5$ N/mm, **[12]**

determine:

i) The nodal displacement

ii) Stresses in each element

iii) Reaction force at support



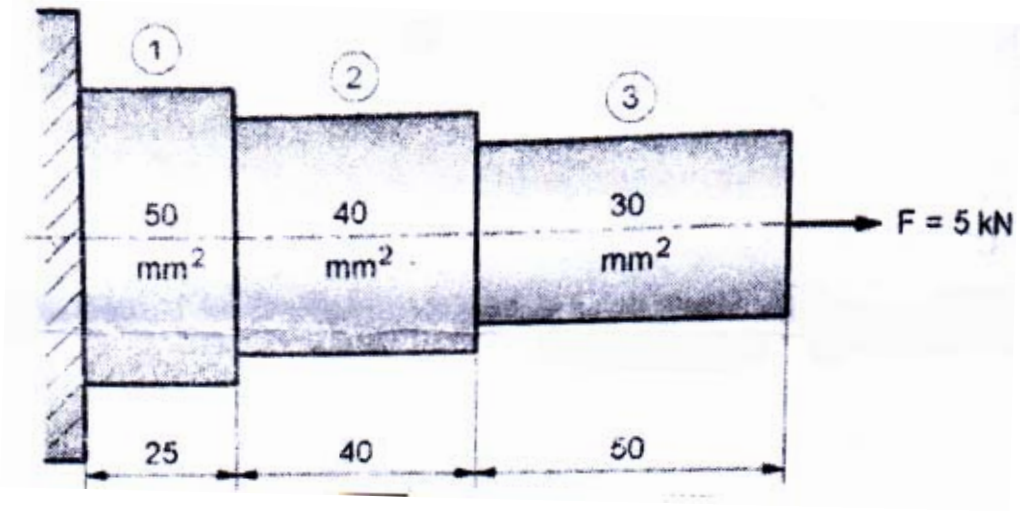
OR

Q10)a) A steeped bar, shown in figure, is subjected to an axial pull of 5 kN. If the material of bar is uniform and has modulus of elasticity of 200 GPa, determine: **[10]**

i) Nodal displacements

ii) Stresses in each element

iii) Reaction force at support



b) What is FEA? Explain basic steps in finite element modeling. **[6]**

Total No. of Questions : 10]

SEAT No. :

P3374

[Total No. of Pages : 3

[5253] - 514
T.E. (Mechanical Sandwich)
MACHINE DESIGN
(2015 Pattern) (Semester - I)

Time :3 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 the stress concentration causes and remedies? **[4]**

b) With neat sketch explain the Modified Goodman Approach? **[6]**

OR

Q2) Two rods are connected by Knuckle Joint. The axial force P acting in rod is 25 kN. The rod and pin are made of plain carbon steel 45C8 (Syt = 380 N/mm^2) and factor of safety is 2.5. The yield strength shear is 57.7% of yield strength in tension. Calculate **[10]**

a) Diameter of rod

b) Diameter of pin

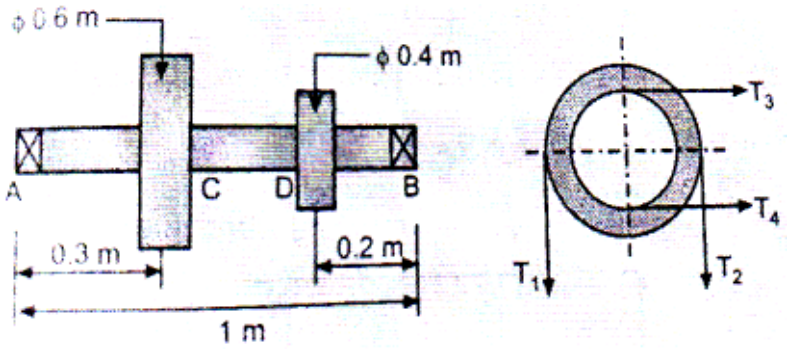
Q3) a) Explain self-locking and Overhauling of power screw. **[5]**

b) Explain in detail springs are in series and parallel. **[5]**

OR

Q4) A shaft is supported by two bearings placed 1m apart. A 600mm diameter pulley is mounted at a distance of 300mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400mm diameter is placed 200mm to the left of right hand bearing is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing stress of 42 MPa in shear for material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. **[10]**

P.T.O.



Q5) a) Explain different causes of gear tooth failure with remedial action **[4]**

b) The P.C.D of spur pinion and gear are 100mm and 300mm respectively. The pinion is made of plain carbon steel 40C8 (Sut= 600N/mm^2) while gear is made of Gr. C.I FG300. The pinion receives 5kW power at 500 rpm through its shaft. The service factor and factor of safety is 1.5 each. The face width of gear is ten times of module. If velocity factor accounts the dynamic load, calculate the module and the number of teeth on pinion and gear. Specify the surface hardness for a gear pair.(km=1 , 20° full depth involute system) **[12]**

OR

Q6) a) Explain the term effective load with reference of spur gear. How to estimate the effective load of spur gear tooth. **[6]**

b) Define formative or virtual number of teeth on a helical gear. Derive the expression used to obtain its value. **[6]**

c) What are the various forces acting on worm and worm gears? Explain in brief. **[4]**

Q7) a) Explain failure in rolling contact bearing with causes and remedial action. **[4]**

b) A ball bearing operates on work cycle consisting of three parts: a radial load of 3000N at 720 rpm for 30% of the cycle, a radial load of 7000N at 1440pm for 40% of the cycle and radial load of 5000N at 900rpm for remaining part of the cycle. The dynamic capacity of the bearing is 30700N. **[12]**

Calculate:

i) The rating life of bearing in hours.

ii) The average speed of rotation.

iii) The life of bearing with 95 % reliability.

OR

Q8) a) Derive the stribecks equation for rolling contact bearing. **[6]**

b) A ball bearing subjected to a radial load of 5 kN, is expected to have a life of 8000 hours at 1450 rpm with a reliability of 99 %. Calculate the dynamic load capacity of the bearing, so that it can be selected from manufacturer's catalogue based on reliability of 90 %. **[10]**

Q9) a) It is stated that the speed at which a belt should be run to transmit maximum power is that at which the maximum allowable tension is three times the centrifugal tension in the belt at that speed. Prove the statement. **[4]**

b) Explain the different types of stresses induced in the wire ropes. **[10]**

c) Explain the polygon effect in case of chain drives. **[4]**

OR

Q10)a) Explain the procedure to select the V- belt from manufacturer's catalogue. **[6]**

b) Two parallel shafts whose centre lines are 4.8 m apart, are connected by an open flat belt drive. The diameter of the larger pulley is 1 .5 m and that of smaller pulley 1 m. The initial tension in the belt when stationary is 3 kN. The mass of the belt is 1.5 kg / m length. The coefficient of friction between the belt and the pulley is 0.3. Taking centrifugal tension into account, calculate the power transmitted, when the smaller pulley rotates at 400 r.p.m. **[12]**

Total No. of Questions : 10]

SEAT No. :

P2496

[Total No. of Pages : 3

[5253] - 515
T.E (Automobile Engineering) (Semester - I)
DESIGN OF MACHINE ELEMENTS
(2015 Pattern)

Time :3 hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***A figure to the right indicates full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What are the factors to be considered while designing a machine element? **[6]**

b) Differentiate between rigid and flexible coupling. **[4]**

OR

Q2) a) A foot lever is 1m from the center of shaft to the point of application of 800N load, find

(i) diameter of shaft (ii) length of the key (iii) dimensions of rectangular arm of the foot lever at 60mm from the center of the shaft, assuming width of the arm as 3 times thickness. The allowable tensile strength may be taken as 73Mpa and allowable shear stress as 70Mpa, Width of key=l2mm and thickness of key=8mm. **[6]**

b) How do you classify keys? **[4]**

Q3) a) How do you classify shafts? **[2]**

b) A machine slide weighing 3 KN is elevated by a double start acme threaded screw at the rate of 0.84 m/min. If the coefficient of friction is 0.12, calculate the power to drive the slide. The end of the screw carries a thrust collar of 32 mm inside diameter and 58 mm outside diameter. Pitch of the screw thread is 7 mm and outside diameter is 44 mm. Take coefficient of friction for collar as 0.09 and allowable shear stress as 44.125 Mpa. Is it strong enough to sustain the load? **[8]**

P.T.O.

OR

Q4) a) Prove that square key is strong in shear and crushing. **[2]**

b) Derive an expression for torque required to raise the load in power screws. **[8]**

Q5) a) Write a short note on S-N diagram. **[6]**

b) A steel connecting rod is subjected to a reversed axial loading 180 KN. Determine the required diameter of rod using factor of safety 2. Take ultimate stress=363 Mpa, yield shear stress=216 Mpa, yield stress=470Mpa, fatigue stress concentration factor=1, correction factor=0.7, surface finish factor=1, size factor=0.89. **[10]**

OR

Q6) a) Derive soderberg equation. **[10]**

b) The brasses of an automobile engine connecting rod have worn so as to allow play which gives shock loading equivalent to a weight 6000 N falling through a height 0.2 mm. The connecting rod is 250 mm long and has a cross-sectional area 300 mm^2 Determine the maximum stress induced in connecting rod, resilience in tension or compression. Take E=200000Mpa. **[6]**

Q7) a) Derive Lewis equation for beam strength. **[6]**

b) A spur gear set to transmit 20 KW at 900rpm of pinion. The transmission ratio is 7/3:1. Take 20° FDI, Z_1=18, σ_d=l40Mpa for pinion and σ_d=55Mpa for gear. The diameter of the pinion is 105 mm. Design number of teeth, module, face width for strength only. **[12]**

$Y = \pi (0.154-0.912/Z)$, $C_V = 3.05/3.05+V$

OR

Q8) 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 α = 20°FDI, β = 45°. σ_d=193.2Mpa, BHN=250 for pinion and gear. Check only tangential tooth load. **[12]**

$Y = \pi (0.154-0.912/Z_e)$, $Cv = 5.55/5.55+V^{0.5}$

Q9) A worm gear drive is to connect two shafts to transmit 10 KW. The transmission ratio is 20:1 and worm shaft rotates at 1440 rpm. Design the gear set. Assume single start square thread. Take σ_d=207 Mpa, for worm and σ_d=82.4 Mpa, for worm wheel. Form factorY= π (0.154-0.912/Z). **[16]**

OR

Q10)2 shafts right angles to each other are connected by 20° full depth involute teeth bevel gears. 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 σ_d=233.4 Mpa, BHN=200 for pinion and σ_d=172.6 Mpa, BHN=150 for gear. Form factor Y= π (0.154-0.912/Ze), C_v =6.1/6.1+V **[16]**

Total No. of Questions : 10]

SEAT No. :

P3390

[Total No. of Pages : 2

[5253]-516

T.E. (Automobile Engineering) (Semester - I)

AUTOMOTIVE ELECTRICAL AND ELECTRONICS

(2015 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) ***Assume, suitable data, if necessary.***

Q1) a) Explain Multiplex Wiring System **[5]**

b) Write a short note on CAN bus. **[5]**

OR

Q2) a) Compare Lead Acid battery with alkaline battery. **[5]**

b) Explain working of electrical speedometer with neat diagram. **[5]**

Q3) a) Enlist the troubles of the ignition system which are likely to be encountered while running the vehicle and their remedies. **[6]**

b) Write a short note on battery performance. **[4]**

OR

Q4) a) Enlist different drive mechanisms of Starting motor. Explain any one of them. **[5]**

b) Explain any one method of spark advance. **[5]**

Q5) a) Classify the MAP sensors based on their working principles. Explain working of any one of them. **[10]**

b) List out the various sensors used for electronically controlling of the engine. Explain Knock Sensor with neat figure. **[8]**

OR

P.T.O

Q6) a) Enlist the types of exhaust gas oxygen sensors. Explain any one of them. **[8]**

b) Enlist the types of actuators used in engine. Explain working of any one solenoid based engine actuator. **[10]**

Q7) a) Why the air-fuel ratio is controlled closed to stoichiometric ratio in electronically controlled engine'? Why there is need to control the engine operation electronically? Justify your answer with neat figures and graphs. **[12]**

b) Enlist the components of fuel system. **[4]**

OR

Q8) a) Explain all Injection Strategies or Techniques used in SI Engine with neat figures. **[8]**

b) What is meant by closed loop control of engine'? When the engine control switches from open loop to closed loop? **[8]**

Q9) a) Explain Anti-lock Braking System in details with layout. **[8]**

b) Explain Tire pressure monitoring system in brief. **[8]**

OR

Q10)a) What is meant by adaptive cruise control? Explain in detail. **[8]**

b) Explain Supplementary Restrain System of Airbag with neat figures **[8]**

Total No. of Questions : 8]

SEAT No. :

P2497

[Total No. of Pages : 3

[5253]- 517

T.E. (Electronics Course) (Semester - I)

POWER ELECTRONICS & APPLICATIONS

(2015 Pattern)

Time : 2 ½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer the 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 different types of triggering methods used for SCR? Explain any one in detail? **[6]**

b) Draw and explain construction, modes of operation & V-I characteristic of TRIAC. **[8]**

c) Draw the circuit diagram & derive an expression for average o/p voltage and rms o/p voltage of 1- $\varnothing$ semi converter for RL-load? **[6]**

OR

Q2) a) Why SCR is called latching type device? Explain with the help of two-transistor analogy and derive an expression for anode current Ia? **[6]**

b) Draw the circuit diagram, waveforms and explain operation of 3-$\varnothing$ full converter for $\alpha = 60$. **[8]**

c) Write a short note on : i) Selenium diode ii) MOV **[6]**

Q3) a) Define Inverter? With neat circuit diagram and waveforms, explain 3$\varnothing$ full bridge inverter with R-load for 180° conduction mode. **[8]**

b) With the help of circuit diagram & waveforms, explain the operation of single phase full wave AC voltage controller for R-load using SCRs. **[8]**

P.T.O

OR

Q4) a) What is mean by Cross Conduction in inverters? How it can be avoided? **[4]**

b) What are the various performance parameters used for inverters **[6]**

c) Explain different switching techniques used for 1- $\varnothing$ inverters to produce quasi- square wave. **[6]**

Q5) a) The step-down chopper is with resistive load of R = 10Ω and i/p voltage 220V. When the chopper is on, its voltage drop is 2V and chopping frequency is 1kHz. If duty cycle is 50%, Determine i) Average output voltage ii) RMS output voltage iii) Chopping efficiency **[6]**

b) How Choppers are classified? Explain two quadrant and four quadrant choppers in detail. **[8]**

c) Write a short note on: SMPS **[4]**

OR

Q6) a) Explain the operation of step-up chopper. A step-up dc chopper has an i/p of 200V and o/p of 250V. The blocking period in each cycle of operation is 0.6×10^{-3} sec. find the period of conduction in each cycle. **[8]**

b) With the help of circuit diagram and waveforms, explain the operation of buck regulator. **[6]**

c) What are different control techniques used for DC choppers? Explain in detail. **[4]**

Q7) a) Write a short note on: UPS **[8]**

b) With the help of block diagram, explain the operation of Electronic lamp Ballast? **[8]**

OR

Q8) a) Write a short note on: HVDC transmission system. **[8]**

b) Explain use of power electronics in capacitor charging application in detail. **[8]**

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Total No. of Questions : 10]

SEAT No. :

P2498

[Total No. of Pages : 3

[5253]- 518

T.E. (Electronics Engg.)

INSTRUMENTATION SYSTEMS

(2015 Pattern) (Semester - I)

Time : 02 :30 Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer the 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 diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain the following terms with suitable diagrams: **[5]**

i) Linearity ii) Sensitivity

b) Define the term Relative Humidity. Explain with neat sketch working principle of any one type of humidity sensor. **[5]**

OR

Q2) a) Explain with neat block diagram working principle of Electronic Nose. **[5]**

b) Explain block diagram of generalized instrumentation system. **[5]**

Q3) a) Suggest a suitable non-contact type temperature sensor for measuring very high temperature in a metallurgical furnace. Also explain the working principle for the same. **[5]**

b) Explain working principle of hydrostatic pressure type of level measurement technique. **[5]**

OR

P.T.O

Q4) a) Describe with neat sketch transit time ultrasonic flow meter. **[5]**

b) Describe signal conditioning scheme for resistance temperature detector (RTD). **[5]**

Q5) a) Draw a neat sketch of capacitive accelerometer. Explain working principle of capacitive accelerometer. **[8]**

b) Draw a neat sketch of LVDT. Explain signal conditioning scheme for LVDT. **[8]**

OR

Q6) a) Write a short note on Charge Coupled Devices (CCD). **[8]**

b) Explain with neat sketch working principle of incremental optical encoder. **[8]**

Q7) a) Explain general architecture of SMART sensors. List its advantages. **[8]**

b) Explain i) MEMS magnetic field sensors and ii) PZT actuators **[8]**

OR

Q8) a) Write a short note on bulk micromachining for MEMS devices. **[8]**

b) Explain working principle of MEMS hot wire anemometer. **[8]**

Q9) a) Draw a pneumatic circuit symbol and explain with neat diagram working of poppet valve. **[6]**

b) Explain principle of operation of DC motor. State various types of D.C. motor. **[6]**

c) Draw control valve characteristics and explain the terms **[6]**

i) Quick Opening ii) Linear and

iii) Equal Percentage.

OR

Q10)a) A 5V control signal is to be used to turn ON and OFF a solenoid valve operating on 23OVAC. Explain a relay driver circuit which can be used for this application. **[6]**

b) Explain control of single acting cylinder using appropriate directional control valve. **[6]**

c) Explain the working of solenoid as an actuator. **[6]**

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Total No. of Questions : 10]

SEAT No. :

P2499

[Total No. of Pages : 4

[5253]- 519

T.E. (Electronics)

ELECTROMAGNETICS AND WAVE PROPAGATION

(2015 Pattern)

Time : 2 ½ 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 indicate full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***

Q1) a) Define Electric field Intensity $\overline{E}$. Derive the expression for the same using coulomb's law of force. **[4]**

b) The finite sheet $0 \le x \le 1, 0 \le y \le 1$ on the z = 0 plane has a charge density $\rho_s = xy(x^2 + y^2 + 25)^{\frac{3}{2}} nc/m^2$.

Find, **[6]**

i) The total charge on the sheet

ii) The electric field at (0, 0, 5)

OR

Q2) a) State and explain Gauss's law **[4]**

b) Derive boundary conditions for electric field at an interface between conductor and free space. **[6]**

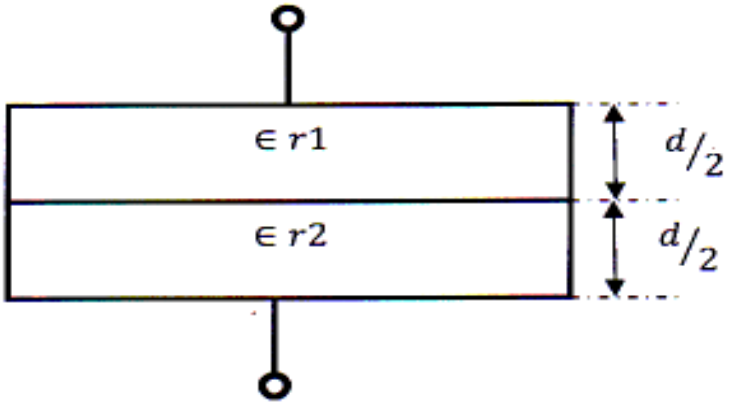
P.T.O

Q3) a) Derive expression of a capacitance for a parallel plate capacitor. **[6]**

b) Determine the capacitance of the capacitors in fig below, **[4]**

Consider

$\in r1=4, \in r2=6, d=5mm, s=30cm^2$



OR

Q4) a) State and derive Boit - Savart's law **[4]**

b) Using Ampere's circuital law find magnetic field intensity $(\bar{H})$ due to an infinite long straight current carrying conductor. **[6]**

Q5) a) Write Maxwell's equation in both differential and integral forms. **[10]**

b) A parallel plate capacitor with plate area of $5cm^2$ and plate separation of 3mm has a voltage $50\sin 10^3 t$ V applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\,\varepsilon_0$ **[4]**

c) State and explain Faraday Law **[4]**

OR

Q6) a) In free space,

$$\bar{E} = 20\cos(\omega t - 50x)\,\bar{a}y\ V/m$$ **[8]**

Calculate,

i) $\bar{J}d$

ii) $\bar{H}$

iii) ω

iv) $\bar{D}$

b) Derive expression for wave equation in perfect conducting medium. **[10]**

Q7) a) A plane wave propagating through a medium with $\varepsilon r = 8, \mu r = 2$ has

$$E = 0.5e^{-Z/3} \sin(10^8 t - \beta z)\ \bar{a}_x V / m$$

Determine.

i) β

ii) Intrinsic impedance

iii) Wave Velocity

iv) $\bar{H}$ field **[8]**

b) What is polarization? Explain circular and Elliptical Polarization with mathematical expression. **[8]**

OR

Q8) a) What is Electromagnetic Power? State and Explain Poynting Theorem. **[8]**

b) In free space ($Z \leq 0$), a plane wave with.

$$H_i = 10\cos(10^8 t - \beta Z)\ \bar{a}_x mA / m$$

is incident normally on a lossless medium $(\varepsilon = 2\varepsilon_0, \mu = 8\mu)$ in region $Z \geq 0$.

Determine the reflected wave $\bar{H}r, \overline{Er}$ and transmitted wave $\bar{H}t, \bar{E}t$. **[8]**

Q9) a) Explain Modes of propagation : Ground, sky and Space wave propagation. **[8]**

b) Explain : **[8]**

i) Virtual Height

ii) MUF

iii) Skip distance

iv) Multi-hop propagation

OR

Q10)a) Explain characteristics of wireless channel : **[8]**

i) Fading

ii) Multipath delay spread

iii) Coherence Bandwidth

iv) Coherence Time

b) Explain the fundamental equations for the free space propagation. **[8]**

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Total No. of Questions : 8] SEAT No. :

P4362

[Total No. of Pages : 2

[5253]-520

T.E. (Electronics Engineering)

MICROCONTROLLERS & APPLICATIONS

(2015 Pattern) (Semester - 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, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Explain different selection criteria of microcontrollers for embedded system applications. **[4]**

b) State different hardware development tools for embedded system applications and explain any two hardware development tools for embedded System applications. **[8]**

c) Draw interfacing of stepper motor with 8051 microcontroller. Write ALP to rotate stepper motor continuously in clockwise direction. **[8]**

OR

Q2) a) Draw & explain internal RAM organization of 8051 microcontroller. **[8]**

b) Draw interfacing diagram of seven segment display with 8051. Write ALP to display numbers from 0-9. **[8]**

c) Draw interfacing diagram of motion detector with 8051 microcontroller. Write ALP to switch on LED when motion is detected. **[4]**

Q3) a) Draw & explain PIC18FXXX microcontroller architecture. **[8]**

b) Explain memory organization of PIC18FXXX microcontroller. **[8]**

OR

Q4) a) What is addressing mode? Explain different addressing modes of PIC 18FXXX microcontroller with examples. **[8]**

b) What are various oscillator options? Explain configuration register with format and explain how different oscillator options can be selected. **[8]**

P.T.O.

Q5) a) Draw and explain port A structure of PIC18FXXX microcontroller. **[8]**

b) Draw interfacing diagram to interface 8 LED's to port B of PIC18FXXX Microcontroller. Write embedded C program to flash LED's with 1 ms delay. **[8]**

OR

Q6) a) Draw and explain the interrupt structure of PIC18FXXX microcontroller. **[8]**

b) Draw interfacing diagram and write an embedded C program to interface 16 × 2 LCD with PIC18FXXX microcontroller to display the message 'HELLO". **[8]**

Q7) a) Explain I2C serial communication protocol in detail. Compare SPI with I2C. **[10]**

b) Write embedded C program to convert equivalent analog data to digital using ADC of PIC18FXXX. Also draw the flowchart. Assume suitable data. **[8]**

OR

Q8) a) Explain the MSSP structure with I2C master mode. **[8]**

b With neat diagram explain Home protection system. Write embedded C program for the same. **[10]**

Total No. of Questions : 10]

SEAT No. :

P2500

[Total No. of Pages : 3

[5253]- 521

T.E. (Electronics Engineering)

DATA COMMUNICATION (Endsem)

(2015 Pattern)

Time : 02 :30 Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer the 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 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 the factors to be considered for selection of transmission media. What are major advantages of STP over UTP? **[6]**

b) We want to digitize the human voice varying from 300Hz to 4kHz obtain Nyquist Rate and bit rate if we use 8 bits per sample. **[4]**

OR

Q2) a) Explain various data transmission modes with suitable example. **[4]**

b) Consider a (7 , 4) block code of **[6]**

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

i) find the generator maxtrix (G)

ii) List all the code vectors.

P.T.O

Q3) a) Apply shannon fano coding procedure to find the coding efficiency for the following message ensemble.

$P_1 = 0.4, P_2 = 0.2, P_3 = 0.12, P_4 = 0.08, P_5 = 0.08, P_6 = 0.08, P_7 = 0.04.$
Take M = 2 **[6]**

b) Explain in detail stop and wait ARQ system. **[4]**

OR

Q4) a) Apply Huffman encoding to following message ensemble. Find efficiency.
$x = [x_1\ x_2\ x_3\ x_4\ x_5\ x_6\ x_7]$

p[x] = [0.3 0.2 0.2 0.15 0.1 0.05] **[6]**

b) Prove that, H (x,y) = H (x/y) + H (y)

H (x,y) = H (y/x) + H (x) **[4]**

Q5) a) Explain Delta modulation in detail with the help of transmitter and receiver. **[8]**

b) Draw and explain the waveforms for the bit sequence 10111010

i) Rz Unipolar ii) NRZ Polar

iii) AMI iv) Split phase manchester. **[8]**

OR

Q6) a) Explain DPCM in detail with the help of transmitter and receiver. **[8]**

b) Write a short note on quantization noise and non-uniform quantization. **[8]**

Q7) a) Explain QPSK transmitter and receiver with neat block diagram. **[8]**

b) Explain with the help of neat block diagram 16-bit QAM transmitter and receiver. **[8]**

OR

Q8) a) Explain many PSK in detail with the help of transmitter and receiver block diagram. **[8]**

b) Draw block diagram of DM and explain working of it in detail. **[8]**

Q9) a) Explain the working of DS-SS transmitter & receiver with neat block diagram . **[8]**

b) State and explain properties of PN sequence. **[6]**

c) Compare slow frequency hopping and fast frequency hopping **[4]**

OR

Q10)a) A slow FH/MFSK system has following parameters. **[6]**

Number of bits per MFSK symbol = 4

Number of MFSK symbol Per hop = 5

Calculate the processing gain of system.

b) Compare FDMA, TDMA & CDMA. **[6]**

c) Write a short note on CSMA **[6]**

Total No. of Questions : 8]

SEAT No. :

P2501

[Total No. of Pages : 3

[5253] - 522

T.E. (E & TC)

DIGITAL COMMUNICATION

(2015 Pattern)

Time : 2 ½ 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 electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is delta - sigma modulator? Draw its block diagram, what are its advantages? **[7]**

b) What is time division multiplexing? Explain how allocation of time slots in TDM depends on bit rate. **[7]**

c) What is a strictly stationary process? Explain . **[6]**

OR

Q2) a) A binary channel with 36 kbps bit rate is available for PCM voice transmission Find. **[6]**

i) Number of quantization levels.

ii) Number of bits per sample.

iii) Sampling frequency.

The voice signal is band limited to 3.4 kHz

b) What is bit synchronisation? Explain any one bit synchroniser. **[7]**

c) If a white Gaussian noise is passed through a ideal low pass filter find the autocorrelation function of the filtered noise. Assume passband amplitude response of filter H (f) = 1 and cufoff frequency W Hz. **[7]**

P.T.O

Q3) a) Explain likelihood ratio test (LRT). **[6]**

b) A received binary signal has amplitude ± 2V and bit durahon is T_b. The signal is corrupted by AWGN having power spectral density 10^{-4} volt^2/ Hz. If the signal is processed by integrate & dump filter, what will be required value of T_b so that error probability is less than or equal to10^{-4}. Given Q (3.71) = 10^{-4} **[7]**

c) State any one property of matched filter. **[3]**

OR

Q4) a) Derive the expression for signal - to - noise ratio of integrate - and - dump filter. **[8]**

b) Find impulse response of matched filter whose input is given by **[6]**

$$g(t) = A \sin\left(\frac{2\pi t}{T}\right);\ 0 \le t \le T$$

$$= \quad 0 \qquad ;\ \text{otherwise}$$

c) Draw the block diagram of correlation receiver for binary digital input signal . **[2]**

Q5) a) Explain the band - pass transmission model (Both transmitter & receiver) **[6]**

b) Binary data is transmitted using PSK at a rate 2 Mbps over RF link having bandwidth 2MHz, find signal power required at the receiver input so that error probability is not more than 10^{-4}. Given noise PSD $\frac{N_o}{2} = 10^{-10}$ Watt/ Hz and Q (3.71) = 10^{-4} **[6]**

c) Explain QPSK signal generation. **[6]**

OR

Q6) a) Explain M-ary PSK transmitter & receiver. **[6]**

b) Binary data is transmitted using M-ary PSK at a rate 2 Mbps over RF link having bandwidth 2MHz find signal power required at the receiver input so that bit error probability is less than 10^{-5}.

Given M = 16 and Noise PSD $\frac{N_o}{2}=10^{-8}$ Watt / Hz erf (3.1) = 0.99996

[8]

c) Explain coherent binary FSK signal generation. **[4]**

Q7) a) Draw the block diagram of spread spectrum digital communication and explain the various blocks. **[8]**

b) State and explain properties of PN sequence. **[6]**

c) What are advantages of FHSS. **[2]**

OR

Q8) a) Draw the block diagram of FHSS transmitter and receiver and explain the various blocks. **[8]**

b) The DSSS communication system has message bit duration (T_b) = 4.095 ms and chip duration (T_c) = 1 μsec. with $\frac{E_b}{N_o}=10$ for average error probability less than 10^{-5}. Calculate processing gain & Jamming margin. **[6]**

c) What are disadvantages of DSSS. **[2]**

Total No. of Questions : 10]

SEAT No. :

P4340

[Total No. of Pages : 3

[5253] - 523
T.E (E&TC) (End Semester)
DIGITAL SIGNAL PROCESSING
(2015 Pattern)

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) ***Your answers will be valued as a whole.***
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) An analog signal given as $x_a(t) = 15 \cos(1250\pi t) + 17 \cos(2170\pi t) + 33 \cos(4750\pi t)$ is converted into discrete time signal. Determine Nyquist sampling rate, Folding frequency, resulting discrete time signal $x(n)$ if sampling frequency is 625 Hz. Also write discrete time frequencies in radians. **[5]**

b) An LTI system is defined by difference equation $y(n) = y(n-1) + y(n-2) + x(n-1)$. Find system function H(z). Draw pole zero diagram. Find out h(n) for causal, non-causal systems, if not why? **[5]**

OR

Q2) a) Find the DFT of the sequence

$x(n) = 1 \quad$ for $0 \le n \le 2$

$= 0 \quad$ otherwise

for N = 4. Find |X(K)| and $\angle X(K)$ **[5]**

b) Explain the sampling theorem and advantages of Digital over Analog Signal Processing. **[5]**

Q3) a) State any four properties of Z transform. **[4]**

b) Compare circular convolution with linear convolution find the circular convolution of two finite duration sequences. **[6]**

$x_1(n) = \{1, -1, -2, 3, -1\}$ &

$x_2(n) = \{1, 2, 3\}$

OR

Q4) a) What is FFT? Explain Bit-reversal and In place computation concepts in FFT- algorithm. Show the 3-bit bit reversed sequence. **[5]**

b) Explain the concept of orthogonality. Check whether the functions given are orthogonal or not over an time interval [0,1], $f(t) = 1$; $x(t) = \sqrt{3}(1-2t)$. **[5]**

Q5) a) Design the second order low pass Digital Butterworth filter with cut off frequency of 1 KHz and sampling frequency 10,000 samples/sec by Bilinear transformation. **[9]**

b) Write the equation, Draw & compare the characteristics of Butterworth filter, Chebyshev filters and elliptic filter. **[9]**

OR

Q6) a) What is Bilinear transformation? Explain the properties of BLT. What is warping effect? How do you take care of it in design. **[9]**

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.

$y(n) + 0.1\, y(n-1) + 0.72\, y(n-2) = 0.7\, x(n) - 0.95\, x(n-2)$ **[9]**

Q7) a) Design an FIR filter having desired frequency response as given below using rectangular window

$$H_d(w)\begin{cases}1 & |w| \le \pi/4 \\ 0 & \pi/4 \le |w| \le \pi\end{cases} \quad \& \quad w(n) = \begin{cases}1 & |n| < 2 \\ 0 & \text{otherwise}\end{cases}$$

Find H(w). Does the filter is realizable. Justify your answer. What modification is required in $H_d(w)$ to make it realizable. **[10]**

b) Explain frequency sampling technique of FIR filter designing in detail. **[6]**

OR

Q8) a) Explain windowing technique of FIR filter design in detail. Also explain Gibb's phenomena and how it can be reduced. State different types of windows used with their window function. **[10]**

b) What is the meaning of linear phase. Prove that FIR filters are inherently stable. **[6]**

Q9) a) Speech signal is corrupted by low and high frequency noise. Explain in detail how DSP is used to remove noise with illustration. **[8]**

b) Explain the application of DSP in vibration signature analysis for defective gear teeth. **[8]**

OR

Q10)a) Explain speech coding and compression technique. How signal processing techniques are used in this. **[8]**

b) Explain how DSP is useful in Interference cancellation in ECG. **[8]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P2502

[Total No. of Pages : 3

[5253]-524

T.E. (E & TC)

ELECTROMAGNETICS

(2015 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answers 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) Derive an expression for electric field intensity $\bar{E}$ at a point ρ due to infinite line charge with uniform charge density ρ_L. **[6]**

b) State significance of poisson's and laplace's equations. Derive the expressions for the same **[6]**

c) In cylindrical co-ordinates a magnetic field is given by

$\bar{H} = (2\rho - \rho^2)\hat{a}_\phi$ A/m for $0 \leq \rho \leq 1$m.

i) Determine the current density as a function of ρ within the cylinder.

ii) Determine total current passing through surface Z = 0, $0 \leq \rho \leq 1$ in $\hat{a}_z$ direction. **[8]**

OR

Q2) a) If $\bar{D} = (2y^2 + z)\hat{a}_x + 4xy\hat{a}_g + x\hat{a}_z$ c/m^2. Find

i) Volume charge density at (–1, 0, 3)

ii) The flux through the cube defined by $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$.

iii) The total charge enclosed by the cube **[6]**

b) Derive an expression for capacitance of parallel plate capacitor. **[6]**

c) Derive boundary condition for the interface between two magnetic media of different permeabilities. **[8]**

P.T.O.

Q3) a) State poynting theorem. State significance of poynting vector. Derive an expression for time average poynting vector **[8]**

b) In free space $\bar{E} = 20.\ \cos(wt - 50x)\hat{a}_y$ v/m calculate

i) $\bar{J}d$ ii) $\bar{H}$ iii) w **[8]**

OR

Q4) a) State Maxwell's equations in point and integral form for **[8]**

i) Static electric and steady magnetic field.

ii) Time varging field.

b) State Faraday's law. Explain the terms transformer emf and motional emf. **[8]**

Q5) a) State primary and secondary constants of transmission line. Derive relationship between primary and secondary constants of transmission line **[8]**

b) The characteristic impedance of the uniform transmission line is 2040Ω at a frequency of 800 Hz. At this frequency the propagation constant is $0.054\ \underline{|87.9^\circ}$. Determine R, L, G, C, V and λ. **[10]**

OR

Q6) a) What is meant by dissipationless line? Derive an expression for input impedance of dissipationless line. **[8]**

b) A lossless transmission line with $Z_O = 50\Omega$ is 30m long and operates at 2MHz. The line is terminated with a load $Z_L = 60 + j40\Omega$. If u = 0.6 C on the line, using Smith chart find

i) Reflection coefficient

ii) Standing wave ratio

iii) Input impedance

iv) Position of V_{max} & V_{min} form load **[10]**

Q7) a) What is meant by polarization of the wave. State its types and explain any one in detail **[8]**

b) Explain the terms : **[8]**

i) Depth of penetration

. ii) Snell's law

OR

Q8) a) Explain how reflection of wave takes place by perfect conductor **[8]**

b) Calculate skin depth propagation constant and wave velocity *v* at a frequency of 1.6 MHz in Aluminium Where 6 = 32.8 Ms/m and $\mu_z = 1$. **[8]**

Total No. of Questions : 8]

SEAT No. :

P3375

[Total No. of Pages : 2

[5253] - 525
T.E. (E & TC) (Semester - I)
MICROCONTROLLER
(2015 Pattern)

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) Draw and explain the flag structure of 8051 with bank 2 selection. **[6]**

b) Draw an interfacing diagram of LED connected to port 2 and write an ALP to generate ring counter with highest delay generated using mode 0. **[7]**

c) Draw an interfacing diagram of DAC and write an ALP to generate triangular wave continuously. **[7]**

OR

Q2) a) Draw and explain the Interrupt structure of 8051 with vector address **[6]**

b) Write short note on hardware debugging tools **[7]**

c) Draw the functional diagram of DAS for display of the count from external source on LED and LCD according to the condition: when switch S1 is pressed count should be displayed on LED and when S2 on LCD, Make the provision when Count reaches to FF, ring the buzzer connected with opto-isolater and Lamp the bulb connected with relay. Draw flowchart.**[7]**

Q3) a) Draw and explain functional diagram of Timer 0 of PIC. Also differentiate between operating functions of timer 0, 1 and 2 of PIC **[8]**

b) Draw and explain the data memory organization of PIC 18FXXX with concept of bank selection. **[8]**

OR

Q4) a) State features of PIC, draw and explain the block schematic of PIC 18FXXX. **[8]**

b) Draw and explain the RESET functional diagram with causes. **[8]**

P.T.O.

Q5) a) Draw an interfacing diagram of LCD 16×2 with PIC18FXXXX and write an embedded C program to display 'GST' on line one and 'INDIA' at 5th position on second line **[8]**

b) Draw and explain the capture mode of CCP module. **[8]**

OR

Q6) a) Write a program for 2.5 KHz and 75 % duty cycle PWM generation with N=4. **[8]**

b) Draw and explain the port structure of PIC with different registers used in Programming. **[8]**

Q7) a) Explain the SPI mode of MSSP structure used for serial communication. **[8]**

b) State features of RTC and draw an interfacing diagram with PIC 18FXXXX, write an initialization program. **[10]**

OR

Q8) a) Explain the use of PIC-ADC module to interface the Temp sensor LM35 used for accepting the Temp and display on LED connected to port D, write an embedded C program. **[8]**

b) Design a PIC test board test board using LED, keypad, buzzer and relay connected to ports with control using keys and write a C program for testing with S1 pressed LED ON and S2 pressed relay and buzzer ON.**[10]**

Total No. of Questions : 8]

SEAT No. : ____

P2503

[Total No. of Pages : 3

[5253]-526

T.E. (E & TC)

MECHATRONICS

(2015 Pattern) (Semester - I)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answers any one Questions out of Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or 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) A tachometer generator, used to measure the speed of rotation of IC engines, has an ideal rating of 6 V per 1000 rpm, a range of 0 - 4000 rpm & an accuracy of +/ - 0.4% of full scale. If the output of the tachometer generator is 18 V, what is the ideal value of the speed? What are the minimum & maximum possible values of the speed? **[4]**

b) Write short notes on : **[8]**

i) MEMS

ii) Nano sensor

c) Draw a diagram of gear pump. Explain its construction & working principle. **[8]**

OR

Q2) a) As shown in Figure 1, a radio tuner is connected to the tuning knob through a 3:1 gear mesh. If the knob is turned 70 degree, how many degrees does the tuner rotate? **[4]**

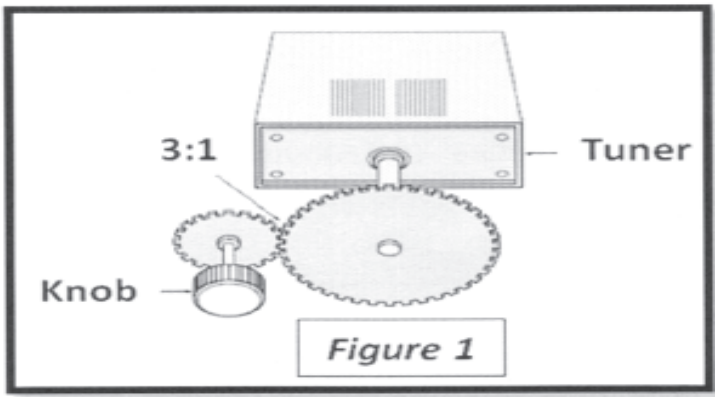

Figure 1

P.T.O.

b) Explain the working of gyroscope with a suitable sketch. **[8]**

c) Explain in details : **[8]**

i) Relief valve

ii) Centrifugal pump

Q3) a) Explain the following in details : **[10]**

i) Air filter & water trap

ii) Refrigerated dryer

b) Explain with a suitable sketch, how lubricator is used for lubrication. **[4]**

c) A pneumatic cylinder is required to move a 1000N load 150mm in 0.5s. What is the output power? **[4]**

OR

Q4) a) Write short notes on the following : **[10]**

i) Double acting cylinder

ii) Air receiver

b) Compare hydraulic & pneumatic systems in mechatronics applications. **[4]**

c) Explain the working of diaphragm compressor. **[4]**

Q5) a) What is relay? How is it useful in indirect switching of high voltage circuit? **[8]**

b) Explain power cables and signal cables. Where are they used in Mechatronics automation systems? **[8]**

OR

Q6) a) Explain the working of solenoid. **[6]**

b) Draw the symbol & explain the working of **[10]**

i) 4/2 directional control valve (DCV)

ii) 3/2 way spool valve.

Q7) a) Discuss the necessity of autopilot system for boat. Explain its construction & working with a suitable sketch. **[10]**

b) Write a short note on CNC machine. **[6]**

OR

Q8) a) Develop an engine management system. Explain its construction, working & applications with a suitable sketch. **[8]**

b) Explain anti-lock braking system (ABS) technology. What are its major components? **[8]**

Total No. of Questions : 10]

SEAT No. :

P3190

[Total No. of Pages : 3

[5253]- 527

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

ADVANCED MICROCONTROLLER AND ITS APPLICATIONS

(2015 Pattern)

Time : 2 ½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***All question are compulsory.***
2) ***Answers to the sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***

Q1) a) Write an instruction sequence in assembly language to add a data 0x0B to contents of memory location 0×200 and store the result in WREG. **[6]**

b) Draw the status register for the PlC microcontroller and Explain the function of Negative flag **[4]**

OR

Q2) a) Explain the following instructions : **[6]**

i) BTG f,b,a ii) MOVFF fs, fd

iii) MOVLW k

b) Explain the function of Bank select register. Write an instruction in assembly language which will select BANK 1. **[4]**

Q3) a) Explain various addressing modes used in PIC 18 microcontroller. **[6]**

b) Write a program in C language to load Timer 0 by a data FFAA H. **[4]**

OR

P.T.O

Q4) a) Write a program in C to configure the most significant 4 bits of Port D as input bits and the least significant 4 bits of the same port as output bits. **[6]**

b) Write a program in C language to load Timer 0 by a data 0x0l and start Timer 0. **[4]**

Q5) a) Using capture mode. write program in C language to measure the period of wave form fed to RC2 (CCP1) pin of Port C. Output the digital equivalent of the time period of wave form on Port B and Port D. Assume crystal frequency is 10MHz. Timer 1 without a pre scaler us used as a clock resource. **[8]**

b) Draw CCP1CON and list the steps involved in programming PIC microcontroller in Compare mode **[8]**

OR

Q6) a) Using compare mode. write program in C language to toggle the LED every 10 pulses. Use Timer 3 with 1:1 pre scaler as clock resource. **[8]**

b) Draw CCP1CON and list the steps involved in programming PIC microcontroller in PWM mode **[8]**

Q7) a) Explain the functions of following pins of LCD (l6x2) **[8]**

i) Register select (RS) ii) Read/Write (R/W)

iii) Enable (E) iv) VEE

b) Write a short note on interrupt structure of PIC 18 microcontroller **[9]**

OR

Q8) a) List the steps that must be taken in programming PIC 18 microcontroller to transfer character bytes serially. **[8]**

b) Using interrupt programming method write a program in C language to toggle an LED connected to Pin RB7 on occurrence of an interrupt INT0(Pin RB0). **[9]**

Q9) a) Explain in detail the functions of following flags related to onboard ADC of PIC microcontroller i) ADIF ii) Go/Done iii) ADFM iv) ADON **[8]**

b) Explain with a neat diagram, interfacing of DAC 0808 with PIC microcontroller and write a program in C language for generation of RAMP waveform using DAC interfaced with PIC microcontroller through Port B. Assume the crystal frequency to be 10MHz **[9]**

OR

Q10)a) With the help of a neat interfacing diagram explain how an electromagnetic relay can be controlled through PIC 18 microcontroller. **[8]**

b) With a neat interfacing diagram and explain temperature measurement using PIC 18 microcontroller **[9]**

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Total No. of Questions : 10]

SEAT No. :

P3956

[Total No. of Pages : 3

[5253] - 528
T.E. (Electrical) (End Semester)
ELECTRICAL MACHINES - II
(2015 Pattern)

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) ***Assume suitable data wherever necessary.***
3) ***Figures to the right in Bold indicate maximum marks.***
4) ***Use of non-programmable scientific calculator is permitted.***
5) ***Neat figures must be drawn wherever necessary.***

Q1) a) Compare salient pole type construction with non-salient pole type construction in case of three phase alternator. **[4]**

b) A three phase star connected, 1000KVA, 11000V alternator has rated current off 52.5A. The armature resistance per phase is 0.45Ω. The test results of the alternator is as given below : **[6]**

O.C. Test-Field Current =14.5A; Voltage between lines is 422V

S.C. Test-Field Current = 14.5A; Line Current = 52.5A.

Determine the full load voltage regulation of alternator at 0.8 power factor lagging.

OR

Q2) a) Define pitch factor. **[2]**

b) With a neat circuit diagram elaborate in detail procedure to determine the regulation of three phase alternator by m.m.f. method. **[8]**

Q3) a) A three phase 16 pole alternator has star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb of distributed winding and field is rotated at speed of 375rpm. Find the frequency of induced emf, phase voltage and line voltage. **[6]**

b) Define short circuit ration of alternator. Elaborate its significance. **[4]**

OR

P.T.O.

Q4) a) What are the necessary conditions of synchronizing two alternators in parallel? **[4]**

b) An alternator has direct axis synchronous reactance of 0.9 per unit and quadrature axis reactance of 0.55 per unit. Find per unit open circuit voltage for full load at lagging power factor of 0.8. **[6]**

Q5) a) With a neat diagram describe the construction and working of superconducting generator; also state its advantages. **[8]**

b) How speed of three phase induction motor varied by V/f method. **[8]**

OR

Q6) a) Draw complete slip-torque characteristics of three phase induction motor and explain working of three phase induction generator. **[8]**

b) With a neat figure describe construction and working of Linear Induction Motor. **[8]**

Q7) a) Describe the procedure to plot circle diagram of single phase uncompensated a.c. series. **[8]**

b) What are the problems experienced by d.c. series motor operated on a.c. supply. Elaborate the remedies for use on a.c. supply. **[8]**

OR

Q8) a) Describe with neat diagram how Universal motor works? Draw its operating characteristics. **[8]**

b) A Universal motor having resistance of 40Ω and inductance of 0.3H connected to 240V d.c. supply and loaded draws a current of 1A at 2000rpm. Find the speed and torque when the motor is connected to 240V, 50Hz a.c. supply and loaded to draw the same value of current when connected with d.c. supply. **[8]**

Q9) a) With neat diagrams explain double field revolving theory. Hence draw torque-speed characteristics of single phase induction motor. **[8]**

b) With a suitable diagram explain no load and blocked rotor test on single phase induction motor. How equivalent parameters are obtained from these tests. Draw equivalent circuits of motor under two test conditions. **[10]**

OR

Q10)a) With neat diagram explain construction and working of capacitor start capacitor run single phase induction motor. Draw it torque speed characteristics. **[8]**

b) A 220V, single phase induction motor gave the following test results : **[10]**

Blocked Rotor Test - 110V, 10A, 400W

No load Test- 220V, 4A, 100W

The stator winding resistance is 2Ω. Neglecting Ro find the parameters of equivalent circuit. Also find core, frictional and windage losses.

▽▽▽▽

Total No. of Questions : 10]

SEAT No. :

P2504

[Total No. of Pages : 2

[5253] - 529
T.E. (Electrical)
Power Electronics
(2015 Pattern) (End Sem.)

Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Solve Questions 1 or 2, Question 3 or 4, Question 5 or 6, Question 7 or 8, Question 9 or 10.***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) Elaborate effect of source inductance on the performance of single phase fully controlled converter. **[5]**

b) With neat constructional diagram explain working of GTO. **[5]**

OR

Q2) a) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers. **[5]**

b) Draw turn on characteristic of thyristor and define delay time and rise time. **[5]**

Q3) 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° and input ac voltage is 120V, 50Hz.**[5]**

b) Draw and explain output and transfer characteristics of MOSFET. **[5]**

OR

Q4) a) Compare MOSFET and IGBT. **[5]**

b) Write a short note on necessity of input filter. **[5]**

P.T.O.

Q5) 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° and 60°. **[8]**

b) Explain single phase ac regulator feeding inductive load. Draw output voltage waveform and derive equation for rms output 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 working of single phase full bridge voltage source inverter. Draw all waveforms. **[8]**

b) For single pulse width modulation with quasi square wave show that output voltage can be expressed as $V_0 = \sum_{n=1,3,5,....}^{\infty} \frac{4Vs}{n\pi} \sin\frac{n\pi}{2}$ sinnd sinnwt.Where Vs is source voltage and pulse width is 2d. **[8]**

OR

Q8) a) Explain sinusoidal pulse width modulation as used in PWM inverters. Write important features of the same. **[8]**

b) Explain with circuit diagram and waveforms, operation of single phase current source inverter. **[8]**

Q9) a) List different harmonic elimination techniques used in inverter. Explain any two methods in detail. **[8]**

b) Explain working of three phase six step voltage source inverter in 180° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

OR

Q10)a) Explain working of three phase six step voltage source inverter in 120° 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 cascaded multilevel converter. **[8]**

❖ ❖ ❖ ❖

Total No. of Questions : 8]

SEAT No. :

P3376

[Total No. of Pages : 2

[5253] - 530
T.E. (Electrical)
ELECTRICAL INSTALLATION MAINTENANCE & TESTING
(2015 Pattern)

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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Write the classification of AC Supply System. **[6]**

b) With neat sketch explain the single bus bar system with sectionalisation. **[6]**

c) Write short notes on following: **[8]**

i) Dielectric Absorption Ratio

ii) Thermography

OR

Q2) a) A single phase a.c. distributor AB of length 300 mt. has total impedance of $Z_{AB} = (0.2+j0.1)\ \Omega$ per km. With sending end at A , the distributor is loaded as under: **[8]**

i) at C, 200 mt. from A, 100A, at p.f 0.707 lag

ii) at B, 300 mt. from A , 200A, at p.f 0.8 lag

Load p.f are referred to far end B.

Calculate the total voltage drop in the distributor.

b) Explain Pipe Earthing with neat diagram. **[6]**

c) Explain insulation stressing Factors. **[6]**

Q3) a) Explain Failure modes of Transformer. **[6]**

b) Describe any one method of cable Fault Location. **[8]**

c) Explain Degree of Polymerization? **[4]**

OR

P.T.O.

Q4) a) Explain Motor Current Signature Analysis. **[6]**

b) Explain Dissolved Gas Analysis. **[8]**

c) Explain the IS/IEC standards for condition monitoring of transformer oil. **[4]**

Q5) a) Explain the Procedure of installation of Underground LT Service Line **[7]**

b) Explain how Schedule of Failure rate is made. **[4]**

c) How cable sizing is decided for particular application? Explain how Price Catalogue is referred for the same. **[5]**

OR

Q6) a) Explain the General Factors to be considered in estimation of HT/LT Lines. **[8]**

b) Describe how labour rates and schedule of rates are considered for estimating the data for laying of overhead lines. **[8]**

Q7) a) Explain the causes of Accidents. How they can be prevented? **[8]**

b) Write Down IE Act and Statutory Regulations for Electrical safety. **[8]**

OR

Q8) Write short notes on following: **[16]**

a) Contents of First Aid Box

b) Treatment for Electrical Shock

c) Danger Arising due to Failure of Insulation.

d) Objectives of Electrical Safety.

Total No. of Questions : 08]

SEAT No. : [ ]

P2505

[Total No. of Pages : 2

[5253] - 531
T.E. (Electrical)
Industrial & Technology Management
(2015 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.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) Define Management. What are the functions of management? **[7]**

b) State the critical factors in technology management. Explain these factors. **[6]**

c) Explain in brief following: **[7]**

i) TQM

ii) SIX SIGMA

OR

Q2) a) Differentiate between Partnership (Act 1934) & LLP (Limited Liability Partnership), (Act 2008). **[7]**

b) Explain in brief following : **[7]**

i) Industrial and Technology Management

ii) Ethics in technology management

c) What is Quality Management? State goalpost view of quality. **[6]**

Q3) a) Explain in brief following : **[10]**

i) Profit Maximization

ii) Wealth Maximization

iii) Return Maximization

b) What is Monopoly and explain Monopolistic competition. **[8]**

OR

P.T.O.

Q4) a) Explain in brief following : **[10]**

i) Market survey

ii) Market research

iii) Online Marketing

b) Write short note on Sources of Finance. **[8]**

Q5) a) What is Human Resource Planning? Explain process of HRP. **[6]**

b) Explain types of training and development methods. **[6]**

c) State the objectives and types of performance appraisal. **[4]**

OR

Q6) a) Differentiate between Recruitment & Selection. **[6]**

b) State group dynamics theories. What are different types of conflicts? **[6]**

c) Describe Mc Clelland's achievement theory of motivation. **[4]**

Q7) a) Explain the following: **[10]**

i) Design

ii) Patent

iii) Copyrights

b) Define Entrepreneur. Explain the different traits of Entrepreneur. **[6]**

OR

Q8) a) State Government policies and incentives for SSI. **[12]**

b) State the criteria for securing Patents. **[4]**

Total No. of Questions : 10]

SEAT No. :

P2506

[Total No. of Pages : 3

[5253] - 532

T.E. (Instrumentation & Control)

EMBEDDED SYSTEM DESIGN

(2015 Pattern) (Semester - 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, Q9 or Q10.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagram wherever necessary.***
4) ***Assume suitable data if necessary.***

Q1) a) Write a program to copy a block of 25 data bytes from the internal data memory at location 40H to external data memory at location 200H in 8051. **[6]**

b) Explain any four addressing modes giving examples of each mode. **[4]**

OR

Q2) a) With the help of port structure of 8051 explain why it is necessary to send logic one on port before performing read operation. **[6]**

b) Explain the role of the following pins of 8051 microcontroller. **[4]**

i) $\overline{\text{PSEN}}$ ii) TXD/ P3.1

iii) $\overline{\text{INT0}}$ / P3.3 iv) ALE

Q3) An application needs to transfer a message "PROCESSING" serially to a computer at a baud rate of 9600 from 8051. Draw the flowchart and write a program for the same in assembly or C. Explain all the SFRs required and show the calculations in detail. **[10]**

OR

Q4) a) With a neat sketch explain the interfacing of 8 bit parallel DAC to 8051. **[6]**

b) Draw and explain the bits of the PSW register of 8051. **[4]**

P.T.O.

Q5) Design a 8051 based temperature control system with temperature control within +/- 2°C of the given range of 35°C to 150°C. The system requirements are follows:

a) A 3 × 4 keys keyboard for setting temperature. **[3]**

b) A local 16 × 2 LCD display to display temperature values continuously. **[3]**

c) A relay to turn on and off the heater. **[3]**

d) RS232 communication interface to transmit the temperature value to a central computer at a baud rate of 9600. **[3]**

Explain the port pin assignment and calculations done. **[4]**

OR

Q6) a) With a neat diagram explain the interfacing of serial EEPROM to the 8051 microcontroller. **[8]**

b) With a neat diagram explain the interfacing of serial RTC to the 8051 microcontroller. **[8]**

Q7) a) Explain the File Registers of AVR microcontroller. What is the use of file registers? **[8]**

b) Explain the interrupts of AVR microcontroller with respect to following points: **[8]**

i) Number of interrupts

ii) Interrupt handling

iii) Interrupt Priority

OR

Q8) a) Where is the stack memory of AVR microcontroller located? Explain its use and operation. **[8]**

b) List the architectural features of AVR microcontroller. **[8]**

Q9) a) What is the function of UDR (USART I/O Data Register) and UBRR register in AVR microcontroller? How is transmission or reception complete indicated by AVR microcontroller during serial communication? Explain the general algorithm for establishing asynchronous serial communication at a specified baud rate. **[10]**

b) The ADCSRA register of AVR microcontroller is shown below. Explain the bits of this register. **[8]**

7	6	5	4	3	2	1	0	
ADEN	ADSC	ADATE	ADIF	ADIE	ADPS2	ADPS1	ADPS0	ADCSRA

OR

Q10) Write a program for AVR ATMega8535, in assembly or C to complement the port B after every 1 second. Assume internal clock of 1 MHZ. Explain the calculations in detail if any. Explain the configuration of all SFRs used. **[18]**

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Total No. of Questions : 10]

SEAT No. :

P2507

[Total No. of Pages : 2

[5253] - 533

T.E. (Instrumentation & Control)

Instrumental Methods for Chemical Analysis

(2015 Pattern) (Semester - I)

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 side indicate full marks.***
4) ***Assume Suitable data,if necessary.***

Q1) a) Compare Classical and Instrumental Method of Chemical Analysis in terms of Advantages and Disadvantages. **[4]**

b) Explain the principal and setup of Voltametry. **[6]**

OR

Q2) a) List out the Electrodes used in Electro analytical Methods. **[4]**

b) Distinguish between Coulometry and Potentiometry . **[6]**

Q3) a) Draw and explain the block diagram of Flame photometer. **[5]**

b) Explain with neat sketch single beam filter photometer. **[5]**

OR

Q4) a) State the Laws of Photometry. **[4]**

b) Write a note on : Inductively Coupled plasma. **[6]**

Q5) a) What is Fluorescence? Explain the working of double beam flouriometer. **[8]**

b) Draw and explain instrumentation of Fourier Transform Nuclear Magnetic Resonance spectroscopy(FT-NMR). **[8]**

OR

P.T.O.

Q6) a) What are the various types of Gas Analysers and Explain any one with neat sketch. **[8]**

b) Explain the Principle and working of Raman Spectrometer with the help of suitable block diagram. **[8]**

Q7) a) What is the working principle of Mass spectrometer? Explain with neat sketch Time of flight Mass analyser. **[8]**

b) Define the term Chromatography. Explain Gas chromatography with the help of suitable block diagram. **[8]**

OR

Q8) a) List out the detectors used in Mass Spectrometer(MS) and explain any one with neat sketch. **[8]**

b) Explain High Predominance Liquid chromatography with the help of suitable block diagram. **[8]**

Q9) a) Write a note on i) Electron spectroscopy for chemical analysis(ESCA). **[9]**

b) Draw and explain the Instrumentation for X-ray spectrometry. List of the application of Xray spectrometry. **[9]**

OR

Q10)a) State the Bragg's Law. Explain with the help of suitable block diagram X-ray diffractometer. **[9]**

b) What are the various types of Radiation detector? Explain any one with neat sketch. **[9]**

Total No. of Questions : 10]

SEAT No. :

P2508

[Total No. of Pages : 2

[5253] - 534
T.E. (Instrumentation & Control)
Control System Components
(2015 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

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

Q1) a) Draw the symbols and give applications of **[5]**

i) Limit switch ii) Pressure Switch
iii) Selector Switch iv) DIP Switch
v) Temperature Switch

b) List the advantages gained by the use of contactors instead of manually operated control equipments **[5]**

OR

Q2) a) Why is arc suppression needed in contactors. **[5]**

b) Explain opto-isolation as it applies to a solid state relay. **[5]**

Q3) a) Explain the purpose of motor protection. **[5]**

b) Describe the jogging operation of a motor. **[5]**

OR

Q4) a) With the help of electric wiring diagram, explain Direct-On-Line starter for 3 phase induction motor. **[5]**

b) Explain the reversing of 3 phase induction motor using push buttons. **[5]**

Q5) a) Compare pneumatics systems with electrical systems. **[5]**

b) Draw symbols of special double acting cylinders and give their application. **[5]**

c) Draw using standard symbols pneumatic circuit for reciprocating of double acting cylinder. **[6]**

P.T.O.

OR

Q6) a) Draw and explain pneumatic time delay valve. **[5]**

b) Draw and explain the principle of venturi in Oil Lubricator. **[5]**

c) Draw using standard symbols pneumatic circuit for sequential operation of two pneumatic cylinders. **[6]**

Q7) a) Draw and explain hydraulic power pack (hydraulic supply). **[8]**

b) Draw and explain using standard symbols hydraulic circuit for meter-in-circuit. **[8]**

OR

Q8) a) List different types of hydraulic pumps and explain any one type in detail. **[8]**

b) Draw and explain using standard symbols hydraulic circuit for sequencing of cylinders using hydraulic sequencing valve. **[8]**

Q9) a) Explain the need of circuit breakers, list different types of circuit breakers and explain the operating principle of any one type of circuit breaker. **[8]**

b) Explain with neat diagram, how synchros are used as error detector. **[10]**

OR

Q10)a) List different types of fuses and explain the terms Fusing current, Current rating of fuse element and Fusing Factor. **[8]**

b) Explain Hazardous Area Classification as per NEC standards and breifly describe protection methods. **[10]**

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Total No. of Questions : 10] **SEAT No. :**

P4363 **[Total No. of Pages : 3**

[5253]-535
T.E. (Instrumentation)
CONTROL SYSTEM DESIGN
(2015 Pattern)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsary.***
2) ***Neat diagrams 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) Design a phase lead compensator if the open loop transfer function is given by

$$G(s)H(s) = \frac{K}{(s(s+4))}$$

if % overshoot required is 15%, steady state error < = 0.15 rad., peak time t_p = 1.71sec. **[10]**

OR

Q2) a) If compensator transfer function is given by $G_c(s) = \frac{(22.5(s+3))}{(s+36)}$

design electronic compensator network. **[6]**

b) Compare lead and lag compensator (min 4 points). **[4]**

Q3) Find tuning parameters for P, PI, PID and write resulting equations for these configuraton if open loop process transfer function is given by

$$G(s) = \frac{5}{(s^2+2s+5)}.$$ **[10]**

OR

Q4) Open loop transfer function is given by $G(s) = \frac{5}{(s(s+3)(s+4))}$. Find gain and phase margin of give system. Determine suitable compensator requird if Kv = 20 Sec^{-1} phase margin 55°. **[10]**

P.T.O.

Q5) a) Design a PD controller for a open loop transfer function $G(s) = \dfrac{20}{(s(s+1)(2s+1))}$ so that PM=30° at w = 3 rad/sec. **[8]**

b) Design a PID controller for a system given by $G(s) = \dfrac{400}{(s(s+48.5))}$ so that peak overshoot will be less than 3% and settling time wil be less than 3 seconds. Also the seady state error for parabolic input should be less than 2%. **[8]**

OR

Q6) a) A unity feedback system has open loop transfer function $G(s) = \dfrac{5}{(s^2+2s+5)}$. Determin its natural frequency, damping ratio, and settling time. Now a PD control having transfer function $G_c(s)$=0.5+0.25 s is introduced in the control system. Calculate nautral frequency, damping ration and settling time of the system. **[8]**

b) Design a PD controller for unity feedback system having open loop transfer funciton $G(s) = \dfrac{10}{s(s+1)}$ so that phase margin will be 50 degree at 1.5 rad/sec. **[8]**

Q7) a) State matrix is given by $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -24 & -26 & -9 \end{bmatrix}$ determine state transition matirx by similiaraty transformation. **[10]**

b) The state space system is represented by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -4 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u, \; y = \begin{bmatrix} 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

determine whether system is controlable and observable or not. **[8]**

OR

Q8) a) If state matrix is given by $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -6 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u$ determine state transition matrix using Caley Hamilton Theorem. **[8]**

b) A system is given by following representation. Determin response of system if no input is applied and initial condition is given by $x_0=\begin{bmatrix}1\\ 2\end{bmatrix}$

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -3 & -4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u$$

$$y=\begin{bmatrix}1,1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$ **[10]**

Q9) Determine feedback gain matrix so that poles of given system should palced to

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -24 & -26 & -9\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$$

$$y=\begin{bmatrix}1 & 1 & 2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+4u$$

so that desired poles can be placed at –1,– 4, – 5. **[16]**

OR

Q10)Design a full state observer for a system given so that desired poles are –2,–4, –5

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -18 & -27 & -10\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u,\quad y=\begin{bmatrix}1 & 3 & 4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+6u$$ **[16]**

Total No. of Questions : 10]

SEAT No. :

P3377

[Total No. of Pages : 2

[5253]-536

T.E. (Instrumentation & Control Engineering)

INDUSTRIAL ORGANIZATION & MANAGEMENT

(2015 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, Q9 or Q10.***
2) ***Neat diagrams should be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) What do you mean by "Business Process Reengineering"? Give the general steps to be followed for it. **[5]**

b) What is SWOT analysis? How it is useful for expansion of the business? **[5]**

OR

Q2) a) Write a note on Environmental norms: ISO 14000. **[5]**

b) With appropriate diagram, explain Ishikawa diagram. **[5]**

Q3) a) Explain raw material handling and storage in a certain manufacturing industry. **[5]**

b) Draw BCG Matrix and explain it. **[5]**

OR

Q4) a) Derive the equation for EOQ. What are the assumptions made? **[6]**

b) Write a note on Quality Circle. **[4]**

Q5) Write short notes on : **[18]**

a) Job description and its uses.

b) Motivation & its need for the growth of the industry.

c) Leadership and its styles.

P.T.O.

OR

Q6) a) Write a note on Training, training needs and methods of training. **[9]**

b) Write a note on performance appraisal and its advantages. **[9]**

Q7) a) Explain capital structure and types of capital. **[8]**

b) What is capital budgeting? What are the different methods of capital budgeting? **[8]**

OR

Q8) a) Write in detail the function of money market and capital market. **[8]**

b) Write a note need and sources of finance. **[8]**

Q9) Write notes on : **[16]**

a) Management Information System

b) IT and e-business

OR

Q10)a) Write a note on 'Enterprise Resource Planning' as a modern tool. **[8]**

b) Explain with importance Business Ethics and Professional Ethics. **[8]**

Total No. of Questions : 8]

SEAT No. :

P2509

[Total No. of Pages : 3

[5253]-537

T.E. (Computer Engineering)

THEORY OF COMPUTATION

(2015 Patern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume Suitable data, if necessary.***

Q1) a) Construct DFA for language defined by $\Sigma = \{0,1\}$ where **[6]**

S = {strings ending with 0 always}

S = { strings representing odd binary numbers}

S = { strings over Σ^* with total number of 0's even}

b) Let $M = \{\{q_0, q_1\}, \{0,1\}, \delta, q_0, \{q_1\}\}$ be an NFA **[6]**

Where

$$\delta(q_0, 0) = \{q_0, q_1\}$$

$$\delta(q_0, 1) = \{q_1\}$$

$$\delta(q_0, 0) = \varnothing$$

$$\delta(q_1, 1) = \{q_0, q_1\}$$

Construct an equivalent DFA.

c) Write short notes on : **[8]**

i) Chomsky Normal Form

ii) Greibach Normal Form

OR

Q2) a) Design a FA which checks the divisibility by 4 for a decimal number. **[6]**

b) Construct a Moore and Mealy machine to generate 1's compliment of a given binary number. **[6]**

P.T.O.

c) Write CFGs for given CFLs : **[8]**

i) Languages containing the strings with equal number of a's and b's

ii) Languages containing the strings containing a's and b's with at least 2 a's

Q3) a) Define Turing Machine. Comment on language acceptance by Turing Machine. **[4]**

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

i) Universal Turing Machine

ii) Multi-tape Turing Machine

iii) Limitation of Turing Machine

c) Construct a Turing Machine to accept the language of even number of l's and even number 0's over $\Sigma = \{0,1\}$. **[8]**

OR

Q4) a) Explain the representation of TM. **[4]**

b) Design a Turing Machine to add two unary numbers. **[6]**

c) Construct TM for -

L = { all strings with equal no. of a's and b's}. **[8]**

Q5) a) Differentiate between FA and PDA. **[4]**

b) Construct NPDA that accepts the language generated by S= S+S | S*S | 4. **[6]**

c) Illustrate the working of Shift Reduce parser for id+id*id.

Consider the following grammar: **[6]**

$$E \rightarrow E + E \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow \{E\} \mid id$$

OR

Q6) a) What are the two different ways to define PDA acceptability? **[4]**

b) Construct PDA that accepts language generated by following

CFG : $S \rightarrow SS \mid (S) \mid (\ )$

c) Explain closure property of CFL with suitable example. **[6]**

Q7) a) What do you mean by NP- problems? Justify that Travelling Salesman problem is NP problem. **[8]**

b) Define Undecidability. Let $HALT_{TM}$ = { <M, w> where M is a TM and M halts on input w} Prove that $HALT_{TM}$ is undecidable. **[8]**

OR

Q8) a) Define and explain Recursive and Recursively enumerable languages. **[8]**

b) What is a Kruskals's Algorithm? How can we solve this problem using Turing Machine? **[8]**

Total No. of Questions : 10]

SEAT No. :

P2510

[Total No. of Pages : 4

[5253]-538

T.E. (Computer Engineering)

DATABASE MANAGEMENT SYSTEM

(2015 Pattern) (End Sem.)

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 indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Consider a database used to record the marks that students get in different exams of different course offerings.

Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the above database. **[5]**

b) For the database system to be usable, it must retrieve data efficiently. The need of efficiency has led designers to use complex data structures to represent data in the database. Developers hides this complexity from the database system users through several levels of abstraction. Explain those levels of abstraction in detail. **[5]**

OR

Q2) a) Construct an alternative E-R diagram for above requirements given in Q.1(a) that uses only a binary relationship between students and course-offerings. Make sure that only one relationship exists between a particular student and course-offering pair, yet you can represent the marks that a student gets in different exams of a course offering. **[5]**

b) Write PL/SQL trigger for following requirement : **[5]**

Event: Deletion of row from stud(roll_no, name, class) table.

Action: after deletion of values from stud table, values should be inserted into cancel_admission(roll_no, name) table.

Note: for every row to be deleted, action should be performed.

P.T.O.

Q3) a) Consider insurance database with following schema : **[5]**

person(driver-id, name, address)

car(license, model, year)

accident (report - no, date, location)

owns(driver-id,license)

participated(driver-id,car,report-no,damage-amount)

Write a query in SQL for following requirements (any 2) :

i) Find the total no. of people who owned cars that were involved in accidents in 2016.

ii) Retrieve the name of person whose address contains Pune.

iii) Find the name of persons having more than two cars.

b) Any database system to be good relational database system, codds have proposed 12 rules, explain any 2 rules proposed by codd with example.**[5]**

OR

Q4) a) What is normalization? What s the need of normalized database? **[5]**

b) The organization has decided to increase the salary of employees by 10% of existing salary, whose existing salary is less than Rs. 10000/- Write a PL/SQ block to update the salary as per above requirement, display an appropriate message based on the no. of rows affected by this update (using implicit cursor status variables). **[5]**

Q5) a) Consider the Transaction (T3), Transaction (T4) and Transaction (T6) are any hypothetical transactions working on data item Q. Schedule explaining the execution of T3, T4 and T6 are given below. Decide whether following schedule is conflict serializable or not? Justify your answer.**[9]**

T_3	T_4	T_6
read (Q)		
	Write (Q)	
Write (Q)		
		Write (Q)

b) Transaction during its execution should be in one of the different states at any point of time, explain the different states of transactions during its execution. **[8]**

OR

Q6) 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. **[9]**

b) A transaction may be waiting for more time for an Exclusive (X)lock on an item, while a sequence of other transactions request and are granted as Shared (S) lock on the same item. What is this problem? How it is solved by two phase lock protocol? **[8]**

Q7) a) Explain speed-up and scale-up parameters of parallel systems. What are the different factors limiting the speed-up and scae-up parameters. **[8]**

b) In both, Shared nothing parallel architecture and distributed system architecture resources are not shared, then how shared nothing parallel systems are different than distributed systems? Also explain in brief other parallel system architecture. **[9]**

OR

Q8) a) How two phase commit protocol to ensure the atomicity in distributed transaction, handles the following failures: **[8]**

i) Failure of participating site

ii) Failure of coordinator

iii) Failure due to network partition

b) For concurrency control in distributed transaction distributed lock manager approach is used, explain in detail different approaches for dealing with replication of data items in distributed lock manager approach. **[9]**

Q9) 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? **[8]**

b) List the different NOSQL data Models. Explain document store NOSQL data model with example. **[8]**

OR

Q10)a) Explain how NOSQL databases are different than relational databases? **[8]**

b) Write short note on Hadoop: HDFS, MapReduce. **[8]**

Total No. of Questions : 10]

SEAT No. : ____

P2511

[Total No. of Pages : 2

[5253] - 539
T.E. (Computer Engineering)
Software Engineering and Project Management
(2015 Pattern) (Semester - I)

Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Attempt questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q.7 or Q.8 and Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) What is the objective of Personal Software Process (PSP)? What are the activities of PSP model? **[5]**

b) What is agility? Explain about agile process model. **[5]**

OR

Q2) a) What are the Practitioner's myths? Discuss the reality of these myths. **[5]**

b) What are requirements engineering tasks? Explain in detail. **[5]**

Q3) a) What is meant by feasibility study? Give general process models of the requirement elicitation & analysis process. **[5]**

b) Explain layered architecture style with neat diagrams. **[5]**

OR

Q4) a) Explain guidelines of component level design. **[5]**

b) Explain the user interface design principles. **[5]**

Q5) a) What is the need for defining a software scope? What are the categories of software engineering resources? **[7]**

b) Compare software measurement and metric. State the measurement principles. **[6]**

c) Explain the reasons for software project failure. **[4]**

OR

P.T.O.

Q6) a) Explain COCOCMO Model for project estimation with suitable example. **[7]**

b) What is a task network in project scheduling? Explain with an example. **[6]**

c) Explain various factors considered while forming software teams. **[4]**

Q7) a) What is software SCM repository? Explain the features of tool set supporting SCM repository. **[6]**

b) In recent year, university has computerized its examination system by using various software applications. Find out Risk involved in implementation and administration you as software expert. Prepare RMMM Plan for the same. **[6]**

c) What is forward engineering? Compare with reverse engineering. **[4]**

OR

Q8) a) What are the elements that exist when an effective SCM system is implemented? Discuss each briefly. **[6]**

b) Explain various risk associated with software project. How they are managed? **[6]**

c) Explain Software Reengineering Process model in detail. **[4]**

Q9) a) Explain in detail, basis path testing as a white box testing technique with following details : **[9]**

i) Flow graph notation

ii) Cyclomatic complexity

iii) Test case derivation.

b) What do you understand by System Testing? What are the different kinds of system testing that are usually performed on large software testing. **[8]**

OR

Q10)a) Explain Defect Life Cycle in detail. **[7]**

b) How Top-down and Bottom-up integration is achieved? **[6]**

c) What is the difference between Testing and Debugging? **[4]**

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Total No. of Questions : 10]

SEAT No. :

P2512

[Total No. of Pages : 3

[5253] - 540
T.E. (Computer Engineering)
Information Systems and Engineering Economics
(2015 Pattern) (End Semester)

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, 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.***
5) ***Use of Scientific Calculator is permitted.***

Q1) a) Explain different challenges for the Information Systems manager. **[5]**

b) Explain DSS (Decision Support system) in detail. **[5]**

OR

Q2) a) List and explain characteristics of a Transaction Processing System. **[5]**

b) What is ICT and explain its role in rural development. **[5]**

Q3) a) What is metadata? Give its importance. **[5]**

b) What is outsourcing? Specify the benefits of outsourcing. **[5]**

OR

Q4) a) Explain the concept of Supply Chain Management. **[5]**

b) Explain Decision making with the help of an Management Information System. **[5]**

Q5) a) What Makes Economic Decisions different from other Design Decisions? **[8]**

b) Explain the following, **[8]**

i) time value of money
ii) earning power
iii) purchasing power
iv) Inflation

P.T.O.

OR

Q6) a) State and explain in short the four fundamental principles that are followed in any engineering economic decision? **[8]**

b) Explain the terms,, simple interest or compound interest with correct equations. Suppose you deposit Rs. 1,000 in a banks savings account that pays interest at a rate of 8%'per year. Assume that you don't withdraw the interest earned at the end of each period (year), but instead let it accumulate for 3 years. Depict all the returns calculations based on (i) simple interest and (ii) compound interest? **[8]**

Q7) a) List and explain the five main types of engineering economic decisions. **[8]**

b) Explain the following with proper examples, **[8]**

i) Economic Equivalence

ii) Cash Flows

OR

Q8) a) Explain Capital Expenses (Cap Ex) and Operating Expenses (Op Ex) with proper examples. **[8]**

b) Assume you borrowed Rs. 21,000 to finance your educational expenses for your remaining year of college. The loan has to be paid off over five years. The loan carries an interest rate of 6% per year and is to be repaid in equal annual installments over the next five years. Assume that the money was borrowed at the beginning of the year and that the first installment will be due a year later. Compute the amount of the annual repayment installments. Depict all the necessary cash-flows correctly. **[8]**

Q9) a) Explain various financial statements with their needs. **[8]**

b) What is the importance of having cash-flow statements? What points do they depict. **[10]**

OR

Q10)a) Explain various patterns of cash-flows with correct examples. What are Positive and Negative cash flows. **[8]**

b) What is Depreciation. **[10]**

A company ABC Ltd. purchased a machine costing Rs. 1000 on 1st January 2001. It had a useful life of three years over which it generated

annual sales of Rs. 800. ABC Ltd's annual costs during the three years were Rs. 300. Its income statement at the end of the three years looks as follows,

Income Statement	**2001**	**2002**	**2003**
Sales	800	800	800
Cost of Sales	(300)	(300)	(300)
Fixed Asset Cost	(1000)	-	-
Net Profit (Loss)	(500)	500	500

Instead of charging the entire cost of fixed asset at once, if ABC Ltd. depreciates the capital expenditure over its useful life, depict the corresponding Income Statement and Balance Sheet at the end of the three years.

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Total No. of Questions : 10]

SEAT No. :

P3954

[Total No. of Pages : 4

[5253] - 541
T.E. (Computer Engg.)
COMPUTER NETWORKS
(2015 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) ***Calculator is allowed.***
4) ***Assume Suitable data if necessary.***

Q1) a) Differentiate between OSI and TCP/IP reference model. **[4]**

b) Represent 101011100 using Manchester and differential Manchester line coding technique. **[4]**

c) Draw flowchart of CSMA/CA. **[2]**

OR

Q2) a) Explain in brief: FHSS and DSSS. **[6]**

b) Explain fiber optic modes of propagation. **[4]**

Q3) a) Explain control field of HDLC w.r.t I-frame, S-frame and U-frame. **[6]**

b) A slotted ALOHA network transmits 200-bit frames using a shared channel with a 200-kbps bandwidth. Find the throughput if the system (All stations together) produces **[4]**

i) 1000 frames per second

ii) 500 frames per second

OR

Q4) a) Explain selective repeat ARQ in detail. **[5]**

b) A bit stream 1001101 is transmitted using an hamming code. Show the actual bit string transmitted. Suppose 7^{th} bit from left is inverted during transmission, show that this error is detected and corrected at the receiver's end. **[5]**

P.T.O.

Q5) a) An organization is granted the block 130.34.12.64/26. The organization needs to have four subnets with equal number of addresses in each subnet. What are the subnet addresses and the range of addresses for each subnet? **[6]**

b) What are general techniques to improve quality of service ? Explain any one in detail. **[6]**

c) Draw and Explain IPV6 header. Explain the significance of extension header. **[6]**

OR

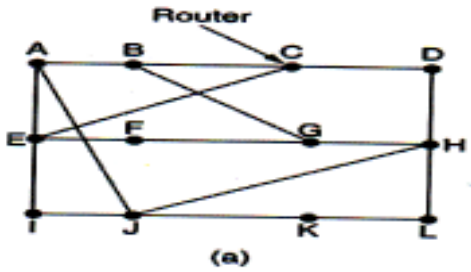
Q6) a) A host with IP address 130.23.3.20 and physical address B23455102210 has a packet to send to another host with IP address 130.23.43.25 and physical address A46EF45983AB. The two hosts are on the same Ethernet network. Show the ARP request and reply packets encapsulated in Ethernet frames. **[4]**

b) Write a short note on **[8]**

i) NAT

ii) ICMP

c) Explain Distance Vector Routing Algorithm? Consider topology given in fig.(a) and Vectors received from router J's four neighbors are given in fig (b). Calculate New routing table for router J using Distance Vector Routing Algorithm. **[6]**



(a)

To	A	I	H	K
A	0	24	20	21
B	12	36	31	28
C	25	18	19	36
D	40	27	8	24
E	14	7	30	22
F	23	20	19	40
G	18	31	6	31
H	17	20	0	19
I	21	0	14	22
J	9	11	7	10
K	24	22	22	0
L	29	33	9	9
	JA delay is 8	JI delay is 10	JH delay is 12	JK delay is 6

Vectors received from J's four neighbors

(b)

Q7) a) What causes Silly Window syndrome? How it is avoided? Explain. **[4]**

b) In a Stop-and-Wait system, the bandwidth of the line is 2 Mbps, and 1 bit takes 20 milliseconds to make a round trip. What is the bandwidth-delay product? If the system data packets are 2,000 bits in length, what is the utilization percentage of the link? **[4]**

c) For each of the following applications, determine whether TCP or UDP is used as the transport layer protocol and explain the reason(s) for your choice **[8]**

i) Watching a real time streamed video

ii) Web browsing

iii) A Voice over IP (VoIP) telephone conversation

iv) YouTube video

OR

Q8) a) What are the types of socket? Explain various socket primitives used in connection oriented client server approach. **[8]**

b) Explain UDP Header? Below is an Hexadecimal dump of an UDP datagram captured. **[8]**

e2 a7 00 0D 00 20 74 9e 0e ff 00 00 00 01 00 00 00 00 00 00 06 69 73 61 74 61 70 00 00 01 00 01

i) What is source port number?

ii) What is destination port number?

iii) What is total length of the user datagram?

iv) What is the length of the data?

v) Is packet directed from a client to server or vice versa?

Q9) a) What is the difference between persistent & non persistent HTTP? Explain HTTP request and reply message format. **[6]**

b) Write short notes on **[6]**

i) DHCP

ii) MIME

c) Explain DNS message format? **[4]**

OR

Q10)a) Explain FTP? Can we specify file transfer in a Web page? Explain with the help of suitable example. **[8]**

b) Browsers have a in-built caching mechanism for a better user experience. How do websites indicate if a web resource needs to be cached or not? Show HTTP messages in transit for both scenarios. **[8]**

▽▽▽▽

Total No. of Questions : 10]

SEAT No. :

P2513

[Total No. of Pages : 3

[5253]-542

T.E. (I.T.)

THEORY OF COMPUTATION

(2015 Patern)

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) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Design Moore machine for divisibility by 3 tester for binary number. **[6]**

b) Discuss Applications of FA & regular expressions. **[4]**

OR

Q2) a) Using Pumping lemma, Prove that $L = \{O^{i^2} / i \text{ is an integer, } i \geq 1\}$ is not-regular. **[6]**

b) Design Finite Automata to accept strings ending with 00 or 11. **[4]**

Q3) a) Simplify the following grammar **[5]**

$$S \rightarrow a \mid Xb \mid aYa$$

$$X \rightarrow Y \mid \in$$

$$Y \rightarrow b \mid X$$

b) Write an equivalent left-linear grammar for the right-linear grammar, which is defined as : **[5]**

$$S \rightarrow 0A \mid 1B$$

$$A \rightarrow 0C \mid 1A \mid 0$$

$$B \rightarrow 1B \mid 1A \mid 1$$

$$C \rightarrow 0 \mid 0A$$

P.T.O.

OR

Q4) a) Check whether or not the following grammar is ambiguous; if it is ambiguous, remove the ambiguity and write an equivalent unambiguous grammar. **[6]**

$$S \rightarrow aS \mid aSbS \mid \in$$

b) Write Short Note on Chomsky Hierarchy. **[4]**

Q5) a) Construct PDA that accepts language. **[8]**

$$L = \{ a^n b^m c^n \mid m, n \geq 1\}$$

b) Construct PDA to check for well formedness of paranthesis. Write ID for i) (( ) ( )) ii) (( )) **[8]**

OR

Q6) a) Construct Post Machine which accepts the string over $\Sigma = \{a, b\}$ containing odd length & the element at the centre as 'a'. **[8]**

Write simulation for the string abbabba

b) Convert the following CFG into CNF & construct PDA for the same. **[8]**

$$S \rightarrow 0A1 \mid 0BA$$

$$A \rightarrow S01|0$$

$$B \rightarrow 1B|1$$

Q7) a) Design a TM that multiplies two unary numbers. **[10]**

Write simulation for the strings.

11 & 111

b) Compare FA and TM. **[4]**

c) Define Recursive languages & Recursively enumerable languages with example **[4]**

OR

Q8) a) Design TM to find 2's complement. **[6]**

b) Construct a TM to compute **[10]**

$f(a, b) = a - b$ where $a > b$

$= 0$ where $a \leq b$

c) Explain Multitape TM **[2]**

Q9) a) Prove that, following are decidable languages **[10]**

i) $A_{CFG} = \left\{ \langle G, w \rangle \middle| \begin{array}{l} \text{where G is a CFG that} \\ \text{generates string w} \end{array} \right\}$

ii) $E_{CFG} = \left\{ \langle G, w \rangle \middle| \begin{array}{l} \text{where G is a CFG and} \\ L(G) = \phi \end{array} \right\}$

b) Write short note on NP completeness with examples. **[6]**

OR

Q10)a) Prove that, **[8]**

$HALT_M = \left\{ \langle M, w \rangle \middle| \begin{array}{l} \text{M is TM \& M halts} \\ \text{on input w} \end{array} \right\}$ is undecidable.

b) Write short notes on : **[8]**

i) PCP

ii) Measuring complexity

Total No. of Questions : 10]

SEAT No. :

P2514

[Total No. of Pages : 3

[5253] - 543
T.E. (Information Technology) (Semester - I)
Database Management Systems
(2015 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, Q9 or Q10.***
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 the fundamental operations in relational algebra with example. **[3]**

b) Explain different types of attributes of an entity with example. **[3]**

c) Draw and list different components of database system structure. **[4]**

OR

Q2) a) List E-R diagram symbols. & draw an E-R diagram for a hospital management system with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examination conducted. **[6]**

b) Consider the following database **[2]**
Student (RollNo, Name, Address)
Subject (Sub_code, Sub_name)
Marks (Roll_no, Sub_code, Marks)
Write following queries in SQL.
1. Find average marks of each student, along with the name of student

c) Differentiate between horizontal and vertical fragmentation. **[2]**

Q3) a) Explain various types of outer join operations with example. **[5]**

b) What is lossless decomposition? Suppose that we decompose the schema R=(A,B,C,D,E) into (A,B,C) and (A,D,E), show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds: A→BC CD → E B→D E → A. **[5]**

P.T.O.

OR

Q4) a) Explain embedded and dynamic SQL. **[5]**

b) Discuss various MYSQL data types **[5]**

Q5) a) Explain the CRUD operations in MongoDB with suitable example. **[4]**

b) What is fragment of relation? What are the main types of fragmentation? Why a fragmentation is useful concept in distributed database design? **[6]**

c) List down all the possible crash recovery methods. Explain shadow paging with proper example. **[8]**

OR

Q6) a) Explain Architecture of Parallel & Distributed Databases. **[6]**

b) Explain different database architectures. **[6]**

c) What is deadlock? Explain how deadlock detection and prevention is done. **[6]**

Q7) a) Explain the following terms in XML with examples : **[6]**

i) Documents ii) Elements

iii) Nested/sub elements iv) Attributes

v) Namespace vi) DTD

vii) Schema

b) What are the different data types in JSON? Discuss about JSON object and ARRAY in details. **[5]**

c) What is HDFS? Explain HBase data model and HBase region. **[5]**

OR

Q8) a) What is XML Schema? Give XML Schema for the following banking system: account (account_number, branch_name, balance) Customer(customer_number, customer_street, customer_city), Depositor(customer_number, account_number) **[6]**

b) What is concurrency control? Explain time stamp based concurrency control. **[6]**

c) Compare with suitable examples : **[4]**

i) RDBMS and XML

ii) JSON and XML

Q9) a) What is Data Warehouse? Explain Schemas in Data Warehouse. **[8]**

b) What is OLTP & OLAP? Explain different OLAP operations. **[8]**

OR

Q10)a) Write short note on: (any two) : **[8]**

i) SQLite database

ii) Machine learning for big Data

iii) Machine learning for BI.

b) What is KDD process? Explain KDD process in detail. **[8]**

Total No. of Questions : 10]

SEAT No. : ____

P2515

[Total No. of Pages : 2

[5253] - 544

T.E. (I.T.)

Software Engineering & Project Management

(2015 Pattern)

Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Solve any 1 out of Q1 or Q2 and.***
2) ***Solve any 1 out of Q3 or Q4 and.***
3,) ***Solve any 1 out of Q5 or Q6.***
4) ***Draw neat diagrams and assume suitable data wherever necessary.***
5) ***Figures to the right indicate full marks.***

Q1) a) Explain Software Process Framework. **[5]**

b) Explain prototyping model along with their relative merits and demerits. **[5]**

OR

Q2) a) Explain in brief requirement elicitation techniques. **[5]**

b) What are components of a use case diagram? Explain their usage with the help of an example. **[5]**

Q3) a) Explain in detail Requirement Engineering functions. **[5]**

b) Explain work breakdown structure with an example. **[5]**

OR

Q4) a) Explain with an diagram prioritizing software requirements based on Kano Analysis. **[5]**

b) What is meant by project scheduling? What is its importance? Explain reasons for cause of schedule conflicts. **[5]**

Q5) a) Explain in brief the SCRUM process with the help of diagram? **[10]**

b) Explain in brief Agile Manifesto. **[6]**

OR

P.T.O.

Q6) a) Explain in brief the agile practices of pair programming and test driven development? **[10]**

b) State and explain agility principles. **[6]**

Q7) a) Explain in brief risk mitigation, monitoring, and management? **[10]**

b) What is Software Quality Assurance? Explain various factors that affect Software Quality? **[6]**

OR

Q8) a) Explain in brief Ishikawa tools used for quality management? **[10]**

b) What are the common sources of risk in IT projects? **[6]**

Q9) a) Explain in detail ERP implementation life cycle. **[8]**

b) What are the different process trends in software engineering? **[6]**

c) What is meant by business process reengineering? **[4]**

OR

Q10)Write short note on : **[18]**

a) Test driven development.

b) Collaborative Development.

c) Software Configuration management tools.

Total No. of Questions : 10] SEAT No. :

P3957

[Total No. of Pages : 2

[5253]-545

T.E. (Information Technology) (Semester - I)

OPERATING SYSTEM

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Question 1 or 2, 3 or 4, 5 or 6, 7 or 8, 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 is a virtual machine? Explain the concept of virtualization. **[5]**

b) Write a shell program to check if a given string is palindrome or not. **[5]**

OR

Q2) a) State and explain multiprocessor thread scheduling approaches. **[5]**

b) How PCB helps in process state management? Explain the structure of PCB. **[5]**

Q3) a) Explain with definition, the concept of general and binary semaphore. **[5]**

b) Write a semaphore solution for dinning philosophers' problem. **[5]**

OR

Q4) a) Explain the following functions (along with parameters passed) with reference to semaphore programming in 'C' **[5]**

i) sem_post()

ii) sem_wait()

b) List the requirements of mutual exclusion. **[5]**

Q5) a) What are the common techniques for structuring the page table? Explain at least three of the techniques. **[10]**

b) For the following reference string. **[8]**

1,2,3,4,2,1,5,6,2,1,2,3,3,6

Count the number of page faults that occur with 3 frames using FIFO and LRU page replacement methods. Discuss the result.

P.T.O.

OR

Q6) a) Explain with the help of a neat diagram how TLB can be used to improve effective access time? **[10]**

b) Write a short note on: **[8]**

i) Buddy system

ii) Compaction

Q7) a) A disk drive has 200 cylinders, numbered 0-199. The drive is currently serving the request at cylinder 53. The queue of pending requests in FIFO order is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position what is the total distance that disk arm moves to satisfy all the pending requests for the following disk scheduling algorithms. **[12]**

i) FCFS

ii) SCAN

iii) C-LOOK

iv) SSTF

b) Explain in brief different I/O buffering techniques. **[4]**

OR

Q8) a) List and explain in brief I/O performing techniques (at least three). **[12]**

b) Define following terms **[4]**

i) Seek time

ii) Rotational latency

Q9) a) Describe the steps for adding new system call in the Linux Kernel. **[8]**

b) List and explain different inter-process communication mechanisms in Linux operating system. **[8]**

OR

Q10) Write short note on following: **[16]**

a) Memory management in Linux

b) Linux file system

c) Linux IPC mechanisms

d) Process management in Linux

Total No. of Questions : 10]

SEAT No. :

P2516

[Total No. of Pages : 3

[5253]-546

T.E. (IT)

HUMAN COMPUTER INTERACTON

(2015 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, 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) A software for handling meetings (diary or calendar) electronically needs to be developed. Identify any frequent task that will be performed on this system and specify its usability specifications assuming the new system will be a replacement of the old paper-based system. What assumptions you need to make about its user? **[5]**

b) Explain any 2 of the following HCI principles in brief. **[5]**

i) Know thy user

ii) Understand the task

iii) Reduce Memory Load

iv) Strive for Consistency

v) Prevent Errors/Reversal of Action

OR

Q2) a) Design and explain an experiment to investigate the decay aspect of human short-term memory. **[5]**

b) A semantic network is used in modeling the organization of knowledge in memory. Produce a semantic network to train memory for gaining knowledge about all living things. **[5]**

P.T.O.

Q3) a) How does making a call differs when using : **[5]**

i) Cell phone

ii) Smart phone?

Consider the kinds of user, type of activity and context of use

b) Negative affect can make it harder to do even easy tasks; positive affect can make it easier to do difficult tasks. What are implications of this for interaction design? **[5]**

OR

Q4) a) Suggest ideas for an interface which uses the properties of sound effectively? **[5]**

b) When systems are not designed to match the way people actually work, then users end up having to do 'work arounds'. Discuss. **[5]**

Q5) a) What is design? What is the golden rule of design? Illustrate the process of interaction design. **[8]**

b) A scenario is an idealized but detailed description of a specific instance of human-computer interaction (HCI). Scenarios specify how users carry out their tasks in a specified context. Write scenarios for purchasing an airline ticket.

Note- Generate scenarios to cover a wide range of situations, not just the most common ones. Include problem situations that will test the system concept, not just straightforward scenarios. **[8]**

OR

Q6) a) If the user has perfect knowledge of what they wanted (goal) and how the system worked (task) interaction becomes effective and satisfying. In designing navigation for a website page each screen needs to give the user enough knowledge of what to do to get closer to their goal. Discuss four important questions that drive a webpage navigation design for achieving the above motto. **[8]**

b) What is a prototype? Explain different types of rapid prototyping techniques. **[8]**

Q7) a) What is learnability, flexibility and robustness in context of usability? It has been suggested that consistency could be considered a major category of interactive principles, on the same level as learnability, flexibility and robustness. If this had been the case, discuss the principles that would appear in support of consistency? **[8]**

b) Explain Nielsen's ten heuristics. **[8]**

OR

Q8) a) Discuss Shneiderman's eight golden rules of interface design with suitable examples. **[8]**

b) Design an experiment to test whether adding color coding to an interface will improve accuracy. Identify your hypothesis, participant group, dependent and independent variables, experimental design, task and analysis approach. **[8]**

Q9) a) Goals are accomplished by methods consisting of operators which are identified by selection rules. Illustrate this for following goals

i) to delete a sentence in a graphical text editor.

ii) to close window in a graphical text editor. **[9]**

b) Discuss applications meant for computer - mediated communication. **[9]**

OR

Q10)a) Draw a state chart diagram of a machine that dispenses bottles on inserting coins. **[9]**

b) A hierarchical task analysis (HTA) provides an understanding of the tasks users need to perform to achieve certain goal. Perform HTA of the task - to cook food (rice). Illustrate using diagram. **[9]**

Total No. of Questions : 10]

SEAT No. :

P2517

[Total No. of Pages : 3

[5253]-547

T.E. (Chemical)

CHEMICAL ENGINEERING MATHEMATICS

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any Five questions.***
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) Explain Convergence and Divergence in case of Newton- Raphson method. **[10]**

OR

Q2) During a certain process the specific heat capacity of system is given by C = (0.4 + 0.004 T)kJ/kg°C. Find heat transferred when temperature changes from 25°C to 125°C, the mass of the gas is 3kg. Use the Trapezoidal rule with number of strips equal to 3. **[10]**

Q3) The velocity distribution of a fluid near a flat surface is given below :

x	0.1	0.3	0.6	0.8
y	0.72	1.81	2.73	3.47

x is the distance from the surface (mm) and v is the velocity (mm/ses). Use Langrage interpolation polynomial to obtain the velocity at x = 0.4. **[10]**

OR

P.T.O.

Q4) The Table below gives the temperature T (°C) and length *l* (mm) of heated rod. If $l = a_0T + a_1$, find the best values of a_0 and a_1. **[10]**

T	20	30	40	50	60	70
l	800.3	800.4	800.6	800.7	800.9	801.0

Q5) State the graphical interpretation of Eulers method. **[16]**

OR

Q6) The temperature of the slab at one end is 1000 °C. The ambient temperature is 45 °C. Heat flow from one end to other end of the slab is 20.4 kW for area of 1 m^2. The thermal conductivity of a slab is given by $K = 0.8 (1 + 0.025 T)$ where T is the temperature at the other end. If the thickness of slab is 40mm, find the temperature at the other end using Eulers method, take h = 0.01 mm. **[16]**

Q7) A non insulated metallic bar 1 m long is held in air which ia at temperature 20 °C. One end of the bar is maintained at 100°C while other is at 40°C. The temperature distribution along the length at steady state may be assumed to be $\frac{d^2T}{dX^2} + h(T_a - T) = 0$, where T is temperature in degree Celsius, X is the distance measured from hot end, Tais atmospheric temperature in °C and h = 0.01. Calculate the rod temperature at a distance 250, 500, 700mm from hot end.**[16]**

OR

Q8) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ for the following condition using explicit finite difference method at $x = 1$ and $x = 4$, $u = 0$ for all values of t at $t = 0$ $u = e^x + \cos x$ for $1 < x < 4$. Take dh = 1, dk = 0.1. Find all values of u for $t = 0$ to $t = 0.5$. **[16]**

Q9) a) What are the six steps of optimization. **[9]**

b) Explain scanning and bracketing procedure for optimization of unconstrained functions of one dimensional search. **[9]**

OR

Q10) A company is manufacturing two types of products A and B. Production is limited to 80 units of product A and 60 units of product B due to limited supply of raw material. Production of each of these products requires 5 units and 6 units of electronics components respectively. The electronic components are supplied by another manufacturer and the supply is limited to 600 units per day. The company has 160 employees i.e. the labour supply amounts to 160 man-days. The production of one unit of product A required 1 man-day of labour and one unit of product B requires 2 man-days of labour. Each unit of these products is sold in the market at a profit of Rs. 50/- and Rs 80/- respectively. Determine how many units of each product the company should produce to maximize profit. **[18]**

Total No. of Questions : 10] **SEAT No. :**

P3958 **[Total No. of Pages : 3**

[5253]-548
T.E. (Chemical) (Semester - I)
MASS TRANSFER - I (Theory)
(2015 Pattern)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1or 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 indicate full marks.***
4) ***Assume Suitable data, if necessary.***

Q1) A) Explain Moleculer Diffusion and Eddy Diffusion with Example. **[5]**

B) Write a short note on Choice of Separation Method, Support your answer with industrial example. **[5]**

OR

Q2) A) Explain Surface Renewal theory and penetration theory. **[6]**

B) What is interphase? Explain Concept of Resistance to Mass Transfer. **[4]**

Q3) A) Write short note on mass, heat and momentum transfer analogies. **[4]**

B) Explain Absorption & Stripping? What is significance of minimum liquid to gas ratio for absorption? **[6]**

OR

Q4) A) The diffusivity of gas - pair O_2–CCl_4 is determined by observing the steady state evaraporation of CCI4 (liquid) into a tube containing O_2. The entire system is held at constant temperature and pressure. Both the gases are assumed to be ideal and O_2 is stationery. The distance between the CCI4 (liquid) level and top of the liquid level is 0.171m. The total pressure on the system is $100.658*10^3$ N/m^2 (755 mm Hg) and the temperature is 273K. The vapour pressure of CCI4 is $4.399*10^3$ N/m^2 (33mm Hg) at that temperature. The cross sectional area of the tube is $0.082*10^{-3}$ m^2. After steady state is attained, $0.0208*10^{-6}$ m^3 of CCI4 (liquid) evaporated in a $36*10^3$ second period. What is the diffusivity of gas pair CCI4–O_2? Assume specific gravity of liquid CCI_4 as 1.59. **[6]**

b) Give the Selection Criteria for Selection of Solvent in Gas absorption operation. **[4]**

P.T.O.

Q5) A) Define following terms: **[10]**

i) Absolute humidity

ii) Wet bulb Temperature

iii) Enthalpy

iv) Humid volume

v) Percentage saturation humidity

B) Explain Mechanism and Working of Natural Cooling Tower. **[6]**

OR

Q6) A) Moist air at 310K has WBT of 300K. The latent heat of vaporization of water at 300K is 2440 kJ/kg, estimate the humidity of the air and the percentage relative humidity. The total pressure is l05 kPa and the vapor pressure of water vapor at 300K is 3.60 kPa and 6.33 kPa at

Psychrometric ratio hG/kY=1000J/kg K. **[6]**

B) A fresh air at 21.2 °C with partial pressure of water vapour is 0.0118 atm is blown at the rate of 214 m^3/hr, first through pre-heater and then adiabatically saturated in a spray chamber to 100% saturation and again reheated. This reheated air has humidity 0.024 kg. if it is assumed that fresh air, air leaving re-heater have same % humidity then find the temperature of pre-heater ,spray chamber and re-heater, also heat required for preheating and reheating. **[10]**

Q7) A) Give the Difference between Packed Column and Plate Column. **[4]**

B) Explain various Types of packing used in Packed Column. **[6]**

C) Explain venture scrubber and wetted wall for column gas-liquid contact. **[6]**

OR

Q8) A) Write a short note on: **[8]**

i) Spray Tower

ii) Bubble Column

B) Explain sparged vessel & mechanically agitated vessels with neat diagram. **[8]**

Q9) A) Give the Construction and working of Fludized bed Dryer. **[8]**

B) A batch of solid for which following table of data applies is to be dried from 25% to 6% moisture under conditions identitical to those for which data are tabulated the initial weight of wet solid is 300kg and drying surface is $1m^2/8kg$ of dry vapours. determine the time required for drying **[10]**

x	0.35	0.25	0.20	0.18	0.16	0.14	0.12	0.10	0.09	0.08	0.064
n	0.3	0.3	0.3	0.266	0.239	0.208	0.180	0.150	0.097	0.07	0.025

OR

Q10)A) Discuss rate of Drying Curve in Detail. **[6]**

B) Derive the equation for Total Time required for drying. **[6]**

C) A Certain Material was dried under constant drying condition and it was found that 2 hours are required to reduce the free moisture content from 20% to 10%. How much longer would be required to reduce free moisture content to 4%. Assume that no constant rate period is encountered. **[6]**

Total No. of Questions : 10]

SEAT No. :

P3378

[Total No. of Pages : 2

[5253]-549

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

INDUSTRIAL ORGANISATION AND MANAGEMENT

(2015 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, 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) Explain single ownership with advantages and disadvantages. **[6]**

b) Write a note on Personnel Management. **[4]**

OR

Q2) Explain with a neat sketch Line and Staff Organization along with Advantages. **[10]**

Q3) a) Write a note on Industrial disputes. **[6]**

b) Explain in detail Recruitment. **[4]**

OR

Q4) Explain various functions of Storekeeper. **[10]**

Q5) a) What is sales promotion? Explain sales promotion technique. **[8]**

b) What do you mean by pricing? Explain any two in detail. **[8]**

OR

Q6) a) Explain in detail Marketing Mix. **[8]**

b) What is Advertisng? Explain its importance in product selling. **[8]**

P.T.O.

Q7) a) Write Notes on : **[8]**

i) ISO

ii) Antidumping duty

b) Explain in detail the procedure to import equipment from foreign source. **[8]**

OR

Q8) a) Explain the Total Quality Management (TQM) of a process industry. **[8]**

b) Explain in detail various factors affecting international trade. **[8]**

Q9) Write short notes on : **[18]**

a) FERA and FEMA

b) Monopolies Restrictive Trade Practices (MRTP)

c) Flow Chart and Flow Diagram

OR

Q10)a) Explain the term Agreement in Contract Act. Explain the various types of Contract according to enforceability, formation and performance. **[12]**

b) Write note on MRTP. **[6]**

Total No. of Questions : 10]

SEAT No. :

P2518

[Total No. of Pages : 2

[5253]-550

T.E. (Chemical)

CHEMICAL PROCESS TECHNOLOGY

(2015 Pattern) (Semester - I)

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) a) Differentiate between Solvey Process and modified solvey process. **[5]**

b) Explain Production of common salt from sea water. **[5]**

OR

Q2) Discuss recovery of Mg salts from sea water. **[10]**

Q3) Explain production of single super phosphate and triple super phosphate. **[10]**

OR

Q4) Explain manufacturing of pulp by kraft process with its major engineering problems. **[10]**

Q5) a) What is hydrogenation of oil explain in detail. **[10]**

b) Explain cleaning action of soaps and detergents. **[6]**

OR

Q6) a) What is interesterification. **[6]**

b) Discuss Portland cement manufacturing. **[10]**

P.T.O.

Q7) a) Explain production of water gas. **[6]**

b) Explain isomerisation with proper example. **[6]**

c) Write note on alkylation. **[6]**

OR

Q8) a) Explain manufacturing of producer gas and its applications. **[6]**

b) Discuss catalytic cracking. **[6]**

c) Write note on pyrolysis. **[6]**

Q9) a) Explain manufacturing process of formaldehyde. **[8]**

b) Explain manufacturing of acetylene. **[8]**

OR

Q10)a) Explain production of phenol by cumeme process. **[8]**

b) Discuss manufacturing process for vinyl chloride from ethylene dichloride. **[8]**

Total No. of Questions : 8] SEAT No. :

P4364

[Total No. of Pages : 3

[5253]-551

T.E. (Chemical Engineering)

CHEMICAL ENGINEERING THERMODYNAMICS - II

(2015 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.7or 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) Describe chemical Potential as criteria for phase equilibria. **[6]**

b) Explain the concept of *Fugacity* and *Fugacity coefficient* for species in ideal solution. **[6]**

c) Assuming validity of Raoult's law, perform following calculations for Benzene (1)/ Toluene (2) : **[8]**

Given :

i) $x_1 = 0.33$, t = 100°C, find y_1 and P.

ii) $y_1 = 0.33$, t = 100°C, find x_1 and P.

Species	A	B	C
Benzene (1)	13.8594	2773.78	220.07
Toluene (2)	14.0098	3103.01	219.79

OR

Q2) a) Obtain the relation: $d(nG) = (nV)dP - (nS)dT + \sum \mu_i dn_i$ **[6]**

b) Determine the fugacity of steam at 623 K and 1000 kPa using enthalpy and entropy values provided here with. Assume that, steam behaves ideally at 101.3 kPa. **[6]**

Given:

At 1000 kPa and 623 K: H = 3159 kJ/kg; S = 7.3 kJ/kg. K

At 101.3 kPa and 623 K: H = 3176 kJ/kg; S = 8.38 kJ/kg. K

c) Derive the Gibbs/ Duhem equation. **[8]**

P.T.O.

Q3) a) Note the criteria for phase equilibria. **[8]**

b) Deduce the formulation: **[8]**

$$\varphi_i = \frac{\widehat{\varphi_l}}{\varphi_i^{sat}}$$

OR

Q4) a Draw and explain the three types of constant pressure liquid-liquid solubility diagram. **[8]**

b) Crystallization is a major separation process in chemical industry. Describe the solid-liquid equilibrium mechanism in this process. **[8]**

Q5) a) Describe the application of equilibrium criteria to Chemical reactions. **[8]**

b) Consider a system in which following reactions occur : **[8]**

$CH_4 + H_2O \rightarrow CO + 3\ H_2$

$CH_4 + 2\ H_2O \rightarrow CO_2 + 4\ H_2$

If Initially there are 6 mol of CH_4 and 9 mol of H_2O, determine expressions for mole fractions using reaction coordinates.

OR

Q6) a) With appropriate equations, explain the effect of temperature on the equilibrium constant. **[8]**

b) Deduce the relation: **[8]**

$$\Delta G^\circ = -RT\ In\ K$$

Q7) a) Acetic acid is esterified in the liquid phases with ethanol at 100°C and atmospheric pressure to produce ethyl acetate and water according to the reaction: **[10]**

$CH_3COOH_{(1)} + C_2H_5OH_{(1)} \rightarrow CH_3COOC_2H_{5(1)} + H_2O_{(1)}$

If initially there is one mole each of acetic acid and ethanol, estimate the mole fraction of ethyl acetate in the reaction mixture at equilibrium.

b) For gas phase and liquid phase reactions, explain the relation of equilibrium constant to composition. **[8]**

OR

Q8) Determine the number of degrees of freedom F for each of the following systems : **[18]**

a) A system of two miscible non reacting species which exists as an azeotrope in VLE

b) A system prepared by partially decomposing $CaCO_3$ into an evacuated space.

c) A system consisting of the gases CO, CO_2, H_2, H_2O, and CH_4 in chemical equilibrium.