[5255] -1001

M.E. (Civil)

(Construction & Management)

Application of Statistical Methods in Construction

(2017 Course)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

1) *Attempt Q.1 or Q. 2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

2) *Neat diagram must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary and clearly state.*

5) *Use of cell phone is prohibited in the examination hall.*

6) *Use of electronic pocket calculator is allowed.*

Q1) a) Define Probability and state its rules? **[4]**

b) What do you mean by sampling and what are the various types of sampling. **[5]**

OR

Q2) a) In a bolt factory machines M_1, M_2, M_3 manufactures respectively 25,35 and 40 per cent of the total. Of their output 5, 4 and 2 per cent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured in the machine M_2? **[5]**

b) What is the use of standard deviation in Quality Control of concreting?**[4]**

Q3) a) A die was thrown 9000 times and of these 3220 yielded a 3 or 4. Is this consistent with the hypothesis that the die was unbiased? **[4]**

b) Explain the regression analysis with suitable example with respect to construction industry. **[5]**

P.T.O.

Q4) a) Write note on Analysis of variance one way and Two way classification.**[5]**

b) If $r_{12} = 0.98$, $r_{13} = 0.94$, $r_{23} = 0.92$, find the partial correlation coefficient between x_2 and x_3, when x_1 is held constant. **[4]**

Q5) a) What is simulation explain with suitable example and what is significance of random numbers? **[8]**

b) Explain with example : **[8]**

   i) Nunally model

   ii) Failure cost Profile

<div align="center">OR</div>

Q6) a) Explain Griffi's model with example from construction industry. Also explain the concept of Downtime cost of equipment. **[8]**

b) What is Simulation and explain any two in detail with software used for it. **[8]**

Q7) a) Explain **[8]**

   i) Sensitivity analysis

   ii) Role of mathematical model in construction management.

b) What is Use of Simulation in risk identification and mitigation explain with suitable example. **[8]**

<div align="center">OR</div>

Q8) a) What is EOQ? Derive the formula for EOQ. **[8]**

b) Explain ABC analysis with suitable example. **[8]**

<div align="center">♦♦♦♦</div>

Total No. of Questions : 8]

SEAT No. :

P4274

[Total No. of Pages : 3

[5255] -1002

M.E. (Civil - Construction & Management)
Management and Project Planning in Construction
(2017 Pattern)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　　　*[Max. Marks :50*

Instructions to the candidates:

1) *Attempt Q.1 or Q. 2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

2) *Neat diagram must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary and clearly state.*

5) *Use of cell phone is prohibited in the examination hall.*

6) *Use of electronic pocket calculator is allowed.*

Q1) a) Write a short note on : Fayol's 14 principles of management. **[4]**

b) What is Precedence network analysis? **[5]**

<div align="center">OR</div>

Q2) a) Explain project life cycle phases in construction of tunnels. **[5]**

b) Write a brief note on 'Repetitive Project Modelling'. **[4]**

P.T.O.

Q3) a)   The table below gives activities and their duration.   **[4]**

Activity	Duration (days)
1-2	7
1-3	5
2-4	11
3-4	4
3-5	5
4-5	7
4-6	2
5-6	9

   i)   Draw network, Calculate project duration and highlight critical path.

   ii) Calculate EST, EFT, LST and LFT for the activities.

   b)   What are the work - study applications in civil engineering.   **[5]**

OR

Q4) a)   Write a short note on : Site mobilisation techniques.   **[5]**

   b)   What is method study? Explain various symbols used in it.   **[4]**

Q5) a)   Explain in detail safety measures and safety policies to be adopted in construction industry.   **[8]**

   b)   Write a short note on :

   i)   Causes of accidents on various sites.   **[4]**

   ii) Minimum wages act.   **[4]**

OR

Q6) a)   Explain in brief : Workman Compensation Act.   **[8]**

   b)   Write a short note on :

   i)   Hazard identification and control techniques.   **[4]**

   ii) Personal protective equipments.   **[4]**

Q7) a) Explain importance of incentives in enhancing workers performance in construction industry. **[8]**

b) Write a short note on :

   i) Applications of fuzzy logic in Civil Engineering. **[4]**

   ii) BIM in construction **[4]**

OR

Q8) a) Explain artificial intelligence technique in brief and their application in construction. **[8]**

b) Write a short note on :

   i) Applications of genetic algorithms in Civil Engineering **[4]**

   ii) Methods of job evaluation (any two) **[4]**

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[5255] -1003

M.E. (Civil - Construction and Management)
CONSTRUCTION TECHNOLOGY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

1) *Attempt Q. 1 or Q. 2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Assume suitable data, if necessary and clearly state.*
5) *Use of cell phone is prohibited in the examination hall.*
6) *Use of electronic pocket calculator is allowed.*

Q1) a) What is vibro - compaction method of soil compaction? Explain any one in detail. **[4]**

b) List out the types of grouting. Explain permeation grouting in details with soil suitability. **[5]**

OR

Q2) a) Explain the NATM method of tunneling in detail. Focus on suitability of NATM. **[5]**

b) State objectives of the dewatering system. Explain Electroosmosis dewatering method. **[4]**

Q3) a) Explain Table - formwork system, states its advantages over conventional shuttering system. **[4]**

b) What is Precast - Pre stressed pile? Explain a typical square pile section with diagram and its construction. **[5]**

OR

Q4) a) What are the qualities of ingredients in self compacting concrete? How does it affect on quality of self compacting concrete? **[5]**

b) Explain the methods of support during pile driving with diagram. **[4]**

P.T.O.

Q5) a) Explain method of construction of diaphragm wall. **[4]**

b) State advantages of sheet piles and construction of sheet pile. **[4]**

c) Suggest the suitable type of cofferdam with reasons, explain its sequence of construction for following condition : **[8]**

- Construction of pier in sea shore land

- Excavation depth : 12 m

- Water level : 4 m from bed

- Soil condition : saturated

OR

Q6) a) Draw a neat & clean diagram of coffer dam showing load imposed on it. Explain any two loads in detail. **[8]**

b) Explain components of coffer dam with diagram. **[4]**

c) Explain types of coffer dam & state its advantages. **[4]**

Q7) a) List out types of caissons, explain floating caissons in detail. **[4]**

b) Explain pneumatic caissons in details. **[4]**

c) Focus on constructional sequence of caissons in details. **[8]**

OR

Q8) a) What is caisson? State its functions & applications. Explain factors considered in design of caissons. **[8]**

b) What is founding & sealing in caissons? Explain in detail with advantages. **[4]**

c) Which factors are considered in geotechnical investigation of caisson construction? State importance of each factor. **[4]**

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[5255] -1004

M.E. (Civil - Construction & Management)
TQM IN CONSTRUCTION
(2017 Pattern) (Credit System) (Revised)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

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

Q1) a) Elaborate - Juran's Triology for implementation of TQM.   **[4]**

b) With neat sketch, explain in detail - Fishbone Diagram.   **[5]**

OR

Q2) a) Differentiate between :   **[5]**

    i)   QA & QC

    ii) TQM & TQC

b) Explain the following quality control tools with neat sketch :   **[4]**

    i)   Pareto diagram

    ii) Histogram

Q3) a) Design checklist required for carrying out column concreting activity.**[4]**

b) Detailed out the different secrets to establishing a successful quality circle programme.   **[5]**

OR

P.T.O.

Q4) a) Briefly explain with neat sketch, Project Rework Reduction Tool (PRRT)**[5]**

b) What are the different Managerial competencies necessary for achieving quality in High Rise Building Construction. **[4]**

Q5) a) Discuss in detail the different principles of ISO 9001. **[8]**

b) Elaborate the certification process for ISO 9001 in detail. **[8]**

OR

Q6) a) Briefly illustrate the Eight clauses of ISO 9001. **[8]**

b) Define - ISO. What are the benefits of ISO in quality management. Explain the different ISO 9000 series. **[8]**

Q7) a) Detailed out the different barriers that are encountering while TQM Implementation. **[8]**

b) Describe Any 8 common Construction defects & remedial measures to avoid it. **[8]**

OR

Q8) a) Write a self explanatory note on - Quality Audit in Infrastructural projects. **[8]**

b) What do you mean by QFD. Explain the benefits of QFD. Explain in detail the QFD process. **[8]**

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[5255] -1006

M.E. (Civil - Structures) (Semester - I)
STRUCTURAL DYNAMICS
(2017 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

1) *Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6 and Q.7 or Q.8.*

2) *Figures to the right indicate full marks.*

3) *If necessary, assume suitable data and indicate clearly.*

4) *Use of electronic pocket calculator is allowed.*

Q1) a) A piston of mass $m = 4.53$ kg is traveling in a tube with a velocity of $v = 15.24$ m/s and engages a spring and damper as shown in Fig. 1 Determine the maximum displacement of the piston after engaging the spring and damper. How many seconds does it take? Consider $k = 35$ N/mm and $c = 0.175$ Ns/mm. **[4]**
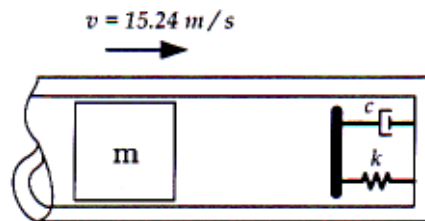

Fig. 1

b) A machine of 100 kg mass is supported on springs of total stiffness 700 KN/m and has an unbalanced rotating element, which results in a disturbing force of 350 N at a speed of 3,000 rpm. Assuming a damping factor of 0.20, determine

i) its amplitude of motion due to the unbalance.

ii) the transmissibility, and

iii) the transmitted force. **[5]**

OR

P.T.O.

Q2) a) A cantilever beam carries a mass M at the free end as shown in Fig. 2. A mass m falls from a height h onto the mass M and adheres to it without rebounding. Determine the resulting transverse vibration of the beam. **[4]**


Fig. 2

b) A mass m is suspended from a spring of stiffness 4,000 N/m and is subjected to a harmonic force having an amplitude of 100 N and a frequency of 5 Hz. The amplitude of the forced motion of the mass is observed to be 20 mm. Find the value of m. **[5]**

Q3) a) A large rotating machine causes the floor of a factory to oscillate sinusoidally. A punch press is to be mounted on the same floor. The displacement of the floor at the point where the punch press is to be mounted is measured to be $y(t) = 0.1\sin\omega t$. Calculate the maximum force transmitted to the punch press at resonance if the machine is mounted on a rubber fitting of stiffness, $k = 40,000$ N/m, damping $c = 900$ N s/m, and mass $m = 3,000$ kg. **[4]**

b) What is the difference between explicit and implicit integration methods? **[5]**

OR

Q4) a) Obtain the time response for an undamped spring - mass system subjected to the excitation shown in Fig. 3. **[4]**
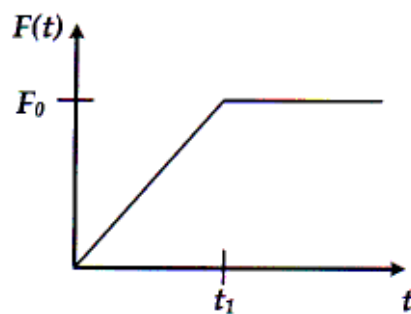
Fig. 3

b) Explain piece - wise acceleration method. **[5]**

Q5) a) Explain mass coupling, velocity coupling and elastic coupling with a suitable example. **[8]**

b) Determine the natural frequencies for the system shown in Fig. 4. Let $m_1 = m$ and $m_2 = 2m$ and $k_1 = k_2 = k_3 = k$ **[8]**
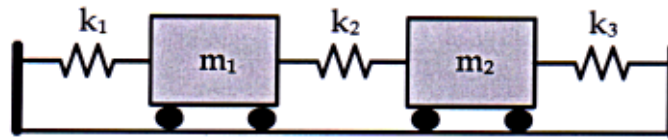

Fig. 4

OR

Q6) a) Two subway cars shown in Fig. 5 have 2,000 kg mass each and are connected by a coupler. The coupler can be modeled as a spring of stiffness $k = 2,80,000$ N/m. Write the equation of motion and calculate the natural frequencies and normalized mode shapes. **[8]**
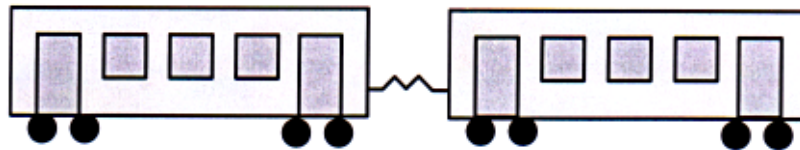

Fig. 5

b) Determine the eigen values and eigen vectors of a vibrating system for

which $[m] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $[k] = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}$. **[8]**

Q7) a) Determine the natural frequencies and the free - vibration solution of a bar fixed at one end and free at the other end. **[8]**

b) Determine the natural frequencies of vibration of a uniform beam fixed at $x = 0$ and simply supported at $x = L$. **[8]**

<div align="center">OR</div>

Q8) a) Obtain the maximum potential energy, kinetic energy and Rayleigh s quotient by Rayleigh's method. **[8]**

b) What is the main difference in the nature of the frequency equations of a discrete system and a continuous system. **[8]**

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[5255] -1008

M.E. (Civil Engg. - Structures) (End Semester)
Numerical Methods in Structural Engineering
## (2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*
Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary and clearly state.*

5) *Use of cell phone is prohibited in the examination hall.*

6) *Use of electronic pocket calculator is allowed.*

Q1) a) Using Stiffness Member Approach, find the rotations at the supports;**[4]**
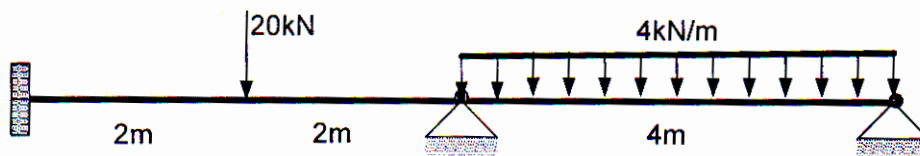
Fig.1a. Problem#1(a)

b) Solve the equations below, using Gauss - Seidel method. (Use 4 - iterations only)   **[5]**

$$2x_1 - x_2 = 1$$
$$-x_1 + 3x_2 - x_3 = 8$$
$$-x_2 + 2x_3 = -5$$

OR

P.T.O.

Q2) a) Clearly state the comparison between force and displacement methods. Explain in brief how these methods are used in solving structural engineering problems? **[5]**

b) What are linear system's/equations? Explain its significance, and its uses in Structural Engineering? **[4]**

Q3) a) Consider the Ordinary Differential Equation (ODE); x' = –5x with initial condition $x(0) = 1$. If the equation is solved using a step size of $h = 0.5$ then ; **[4]**

i) Is Euler's method stable for this ODE using this step size? Why?

ii) Is implicit backward Euler method stable for this ODE using this step size? Why?

b) Use the data in the Table - A to find the integral between $x = 1.0$ and 1.8, using the Simpson's 1/3 rule with $h = 0.4$ and then with $h = 0.2$. If the answer obtained using Romberg integral method is 1.767340; then find the order of error in Simpson's 1/3 rule. **[5]**

Table - A

x	1.0	1.2	1.4	1.6	1.8
$f(x)$	1.54	1.81	2.15	2.58	3.11

OR

Q4) a) Using Runge - Kutta method of order four, find *y* at *x* = 1.1 and 1.2 by solving ; **[5]**

$$y' = x^2 + y^2 \mid y(1) = 2.3$$

b) For the following quadrature rules :

i) Trapezoidal rule

ii) Simpson's 1/3 rule

iii) Simpson's 3/8 rule

iv) Gaussian quadrature (n nodes)

What are the degree of interpolation polynomial used to approximate an integral function? Explain in short with suitable sketches. **[4]**

Q5) a) Explain with suitable sketches and examples the importance and use of finite difference methods in structural engineering.
Present the Bi - Harmonic finite difference net for a plate simply supported at its edges. Explain how the boundary conditions are incorporated. **[8]**

b) A simply supported uniform plate of length "2a" and width "a", supports a trapezoidal load varying from '0.5w' at one small edge to 'w' at the opposite small edge, as shown in the sketch below. Estimate the deflection at the various nodal points, using a grid interval of $h = a/2$, using finite difference method. **[8]**
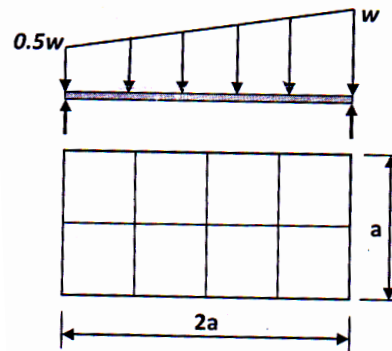
Fig.5b. Problem#5(b)

OR

Q6) a) A fixed beam of variable flexural rigidity supports a concentrated load "W" as shown in sketch below. Estimate the deflection under the load considering three equal sub - intervals of the beam, if the left hand support sinks by 8 mm. Use finite difference method. **[8]**
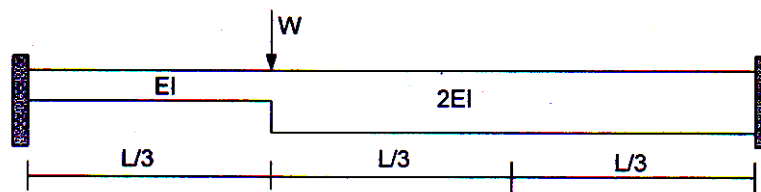
Fig.6a. Problem#6(a)

b) Estimate the lowest buckling load of a uniform pin ended column of length "L" and flexural rigidity "EI" using three intervals. The central one third portion of the column has twice the flexural rigidity as compared to other portions. Use finite difference formula. **[8]**

Q7) a) Information related to a straight line is shown in Table - B. Develop a First Order Model to fit his data set using Least Square technique. Draw the straight line. **[8]**

Table - B

X	1	2	3	4	5	6	7
Y	0.5	2.5	2	4	3.5	6	5.5

b) Explain Regression Analysis with suitable examples. Clearly state the Objectives, Use / Importance, and Procedure of a typical Regression Analysis in Structural Engineering. **[8].**

OR

Q8) a) What is a spline interpolation function? What is its use? Explain the various types of spline interpolation functions. **[8]**

b) Describe various types of errors encountered in numerical computations. Explain the importance of finding errors. **[8]**

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[5255]-1009

M.E. (Civil) (Hydraulics Engineering)
FLUID MECHANICS
(2017 Pattern)

Time :3 Hours]   **[Max. Marks : 50**

Instructions to the candidates:
1) *Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q.5 or Q. 6 and Q. 7 or Q. 8.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figure to the right indicates full marks.*
4) *Assume suitable data, if necessary and clearly state.*
5) *Use of cell phone is prohibited in the examination hall.*
6) *Use of electronic pocket calculator is allowed.*

Q1) a)   Explain Velocity potential function, Stream function Show that equipotential and streamline meet orthogonally.   **[4]**

b)   A source of strength 10 m^2/s located at (-1, 0) is combined with a sink of strength 14 m^2/s located at (1,0). Find the stream function and velocity potential.   **[5]**

<div align="center">OR</div>

Q2) a)   Derive 3- D continuity equation in cylindrical polar coordinate system.**[5]**

b)   Derive stream function and potential function for a source and superposition of source and sink.   **[4]**

Q3) a)   Glycerin (μ = 1.5 PaS and ρ = 1260 kg/m^3) flows at a velocity of 5 m/s in a 10 cm diameter pipe. Estimate (i) the boundary shear stress in the pipe due to the flow (ii) head loss in a length of 12 m of pipe.   **[4]**

b)   Derive Boundary Layer equations starting with Navier-Stokes' equations.
                                                                                     [5]

<div align="center">OR</div>

Q4) a)   Derive equation for velocity distribution for flow between parallel plates with both plates stationary starting with Navier-Stokes' equations.   **[5]**

<div align="right">*P.T.O.*</div>

b) A thin plate is moving in still atmosphere at a velocity of 4.5 m/s. The length of the plate is 0.7 m and width 0.6 m. Find (i) The thickness of boundary layer at the end of the plate (ii) Drag force on both sides of the plate Take density and kinematic viscosity of air as 1.24 kg/m^3 and 0.15 stokes respectively. **[4]**

Q5) a) Derive equation for shear stress for turbulent flow between parallel plates both at rest with turbulent flow starting with Reynolds equation. **[8]**

b) Water at 20°C is flowing through a Hydrodynamically smooth pipe of diameter 20 cm at the rate of 80 lit/s. The average height of roughness projections on the pipe surface is 0.2 mm. Determine the (i) friction factor (ii) shear stress at the pipe surface (iii) shear velocity (iv) maximum velocity. The density and kinematic viscosity of water at 20°C are 1000 kg/m^3 and 1×10^{-6} m^2/s respectively. **[8]**

OR

Q6) a) Prove that fluctuating component of velocity satisfies the continuity equation. **[8]**

b) Derive Reynolds' equations of motion. **[8]**

Q7) a) Discuss Isothermal and adiabatic processes. Derive equations for work done by a gas in expanding in adiabatic process. **[8]**

b) Derive Rankine-Hugoniet equation for normal shock wave. **[8]**

OR

Q8) a) Derive relation between pressure and bulk modulus of elasticity for both isothermal and adiabatic processes. **[8]**

b) Derive energy equation for compressible flow. **[8]**

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[5255]-1010

M.E. Civil (Hydraulics Enginering)
IRRIGATION & DRAINAGE ENGINEERING
(2017 Pattern)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q.5 or Q. 6 and Q. 7 or Q. 8.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figure to the right indicates full marks.*
4) *Assume suitable data, if necessary and clearly state.*
5) *Use of cell phone is prohibited in the examination hall.*
6) *Use of electronic pocket calculator is allowed.*

Q1) a) Explain the factors affecting the choice of irrigation methods.   **[6]**

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

i) Irrigation efficiencies for economical use of water,

ii) Assessment water charges,

Q2) a) Illustrate the classification of irrigation methods.   **[6]**

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

i) Factors governing consumptive use of water

ii) Multi-crop irrigation scheduling

Q3) a) Explain operations and maintenance of drip assembly.   **[6]**

b) Describe the components of sprinkler irrigation systems.   **[8]**

Q4) a) Describe in brief the following :   **[8]**

i) Elements of lift Irrigation schemes

ii) Operation and maintenance of drip irrigation system

b) Explain sprinkler system considering the following points : **[6]**

    i) Criteria for system layout

    ii) Selection of sprinkler and its spacing

    iii) Discharge capacity of the pump

    iv) Hydraulic design of sprinkler head

    v) Main and

    vi) Lateral pipe sizes

Q5) a) Explain how human activities accelerate soil erosion? Also illustrate the various soil conservation techniques, what factors would you consider to apply specific techniques for specific cause? **[6]**

b) Illustrate the following **[6]**

    i) Classification of salts affecting the soils and their characteristics

    ii) Leaching and salinity control.

Q6) a) Explain following : **[6]**

    i) Salt accumulation in soil water

    ii) Water and wind erosion

b) Explain in detail the various soil conservation techniques to avoid soil erosion. **[6]**

Q7) a) Explain the following : **[6]**

    i) Transient designs of surface drainage systems

    ii) Drainage by wells

b) Describe water logging of agricultural lands and its reclamation. **[6]**

Q8) a) Illustrate the following : **[6]**

    i) Need and purpose of drainage

    ii) Difference between surface and sub-surface drainage systems.

b) What are the reasons of soil erosion and what the measures of its conservation. **[6]**

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[5255] - 1011

M.E. (Civil - Hydraulics)
PLANNING AND MANAGEMENT OF WATER RESOURCES
(2017 Pattern) (Semester - I)

Time :3 hours]   *[Max. Marks :50*

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)   Assume suitable data if necessary.

    5)   Use of calculators is allowed

Q1) a)   Write a short note on- Excess Water management.   **[4]**

    b)   Explain the constraints for water resources development.   **[5]**

<div align="center">OR</div>

Q2) a)   Write a short note on- Drought management.   **[4]**

    b)   Explain spatial and temporal scales for planning and management of water resources.   **[5]**

Q3) a)   Write a short note on - reservoir sedimentation.   **[4]**

    b)   Explain - construction and maintenance of artificial wells.   **[5]**

<div align="center">OR</div>

Q4) a)   Explain - general approach for capacity estimation of an impounding reservoir.   **[5]**

    b)   Describe the role of conjunctive use in water resources management.**[4]**

Q5) a) Determine the optimal diameter of a pumping main for the following data: **[8]**

Design period = 30 yrs; discharge = 4 ML/D at present, increasing to 8 ML/D at 30 yr; length of the pumping main = 5,000 m; static lift = 30 m; Hazen William coefficient of the pipe = 120 at present, reducing to 100 at 30 yr; hours of pumping in a day = 16 hr; combined efficiency = 60 %; energy charges = Rs 3/kWh; and interest rate 8 %. Assume minor losses as 10 % of the frictional head loss.

  Available pipe sizes and their unit cost shown in parentheses are: 200 mm

(1,092 Rs/m); 250 mm (1,432 Rs/m); 300 mm (1,813 Rs/m); 350 mm

(2,260 Rs/m); 400 mm (2,730 Rs/m); 450 mm (3,267 Rs/m); 500 mm

(3,810 Rs/m); 600 mm (5,016 Rs/m); and 700 mm (6,553 Rs/m).

 b) Explain how to compute water demand for: **[8]**

  i) community water use

  ii) agricultural water use

  iii) industrial water use

<div align="center">OR</div>

Q6) a) Write a short note on - cost allocation in multipurpose projects. **[6]**

 b) Five industries A, B, C, D, and E combine together and plan their own water supply scheme consisting of a reservoir R and a pipe network, shown in Fig. 6b. The details of the scheme are as follows: **[10]**

  i) Cost of dam, land acquisition head works, etc, Rs. 80 million.

  ii) Annual maintenance cost at the dame site Rs. 200,000.

  iii) Initial cost of the pipeline, water requirements of the various industries, etc. are given as in the following Table.
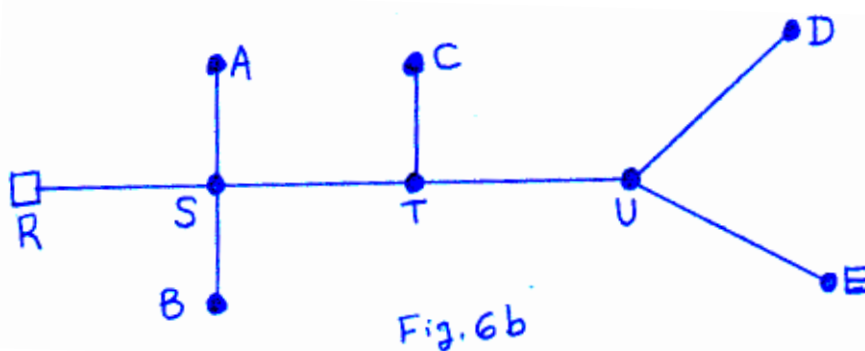

Fig.6b

Table: Water requirement and pipe network data.

Industry	Annual water use (million m³)	Pipeline	Length (km)	Initial cost (Rs/km)	Yearly OMR cost (Rs. /Km)
(1)	(2)	(3)	(4)	(5)	(6)
A	6	RS	4	5,000,000	40,000
B	4	SA	6	2,000,000	15,000
C	3	SB	3	1,500,000	12,000
D	7	ST	5	3,000,000	17,000
E	5	TC	4	1,200,000	10,000
-	-	TU	4	2,000,000	16,000
-	-	UD	5	1,800,000	18,000
-	-	UE	6	1,500,000	20,000

In the above Table S,T, and U are junction points without any outflow. The costs per km. are for the pipelines of the network, as given in Col. 3. If the acceptable rate of return is 5% and the period of analysis is 50 years; using the proportional use of facilities method, estimate the share of each industry in each cost and the cost per cubic meter of water delivered to each industry.

Q7) a) Which of the following plan is more economical at 6.5 % interest rate?**[8]**

	Plan A	Plan B
Cost of equipment (Rs.)	51,000	36,000
Annual O & M cost	2,200	2,600
Salvage value	7,000	6,000
Service life	30 years	15 years

Compare the two alternate plans by

i) equivalent annual cost, and

ii) present worth methods.

b) Explain following discounting factors: **[8]**

    i)   Single payment factors.

    ii)   uniform annual series factors.

    iii) uniform gradient - series factors.

<center>OR</center>

Q8) a) A farmer takes a loan of Rs. 50,000 from a bank to purchase a pump costing Rs. 50,000. The life of the pump is 10 years and the salvage value is zero. If the bank charges 10 % rate of interest:

    i)   Find equal yearly installments the farmer will have to pay to repay the loan in 10 years.

    ii)   Give the year wise statement of the installment contribution towards payment of interest and repayment of the loan.

Find all answers if the salvage value of the pump, at the end of its life of 10 years, is Rs. 10, 000; and the bank agrees to receive this amount at the end of the loan repayment period and accordingly reduce the yearly installment. **[8]**

b) Write a short note on:

    i)   appraisal criteria,

    ii)   inter - basin transfer of water **[8]**

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[5255] -1012
M.E. (Civil - Hydraulics)
DAM ENGINEERING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

    1)   *Attempt any five questions.*

    2)   *Figures to right indicate full marks.*

    3)   *Assume suitable data, if necessary.*

Q1) a)   Explain with a neat sketch 'Middle third Rule' in Granila dam safety analysis. **[5]**

    b)   Derive the equation for principal slicts at toe & heel for gravity dam for full condition. **[5]**

Q2) a)   Explain 2 dimensional method for analysis of gravity dam. **[5]**

    b)   Write advantages of colgrout masonry dam over other techniques. Give two examples of dams constructed by colgrout. **[5]**

Q3) a)   Explain with a neat sketch 'classification of arch dams'. **[5]**

    b)   Derive minimum thickness of rib of arch dam. **[5]**

Q4) a)   Explain rock fill dam components with a neat sketch. **[5]**

    b)   State advantages and disadvantages of Buttress dam. **[5]**

Q5) a)   Explain 'slip cricle method' for stability analysis of slope in earthen dam. **[5]**

    b)   Explain with a examples causes of failures of easthen dam. **[5]**

Q6) a) Explain design steps of Ogee spillway. **[5]**

b) Explain with a neat sketch suit ability of radial gates over spillway. **[5]**

Q7) a) Write a function of following : **[5]**

i) Pneumatic piezometer.

ii) Inclinometer

iii) Pendulum

iv) Vibrating nire settlement cell

v) Embedmust strain guage

b) Explain objective of dam safely and instrumentation. **[5]**

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[5255] -1014

M.E. (Civil - Geotechnical Engg.)
GROUND IMPROVEMENT TECHNIQUES
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*
Instructions to the candidates:

1) Figures to the right indicate full marks.

2) Use of scientific calculator is allowed.

3) Assume suitable data, if necessary clearly mentioning the same.

4) Draw neat figures wherever necessary.

5) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 & Q.7 or Q.8

Q1) a) Write short note on atomic bonds in clays.   **[4]**

    b) Explain granular stabilisation.   **[5]**

                                OR

Q2) a) Explain characteristics of any clay mineral.   **[5]**

    b) Describe chemical stabilisation.   **[4]**

Q3) a) What are the factors influencing cement stabilisation?   **[4]**

    b) Describe vibro compaction technique.   **[5]**

                                OR

Q4) a) Explain effectiveness of lime treatment.   **[5]**

    b) Write short note on electro - osmosis.   **[4]**

Q5) a) How is bearing capacity of lime group determined.   **[8]**

    b) Describe quality control and applications for lime columns. **[8]**

                                OR

Q6) a)   Discuss design criteria of lime column foundations.   **[8]**

b)   Explain the steps involved in design of sand drains.   **[8]**

Q7) a)   Describe hydrofracture and compaction grouting.   **[8]**

b)   How is testing and quality control excercised for grouting as per IS code?   **[8]**

OR

Q8) a)   How is soil grouting program designed?   **[8]**

b)   Write short notes on permeation grouting and jet grouting.   **[8]**

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[5255]-1015

M.E. (Civil) (Geotechnical Engineering)
ROCK MECHANICS
(2017 Pattern) (Semester - I)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
  1)   Answer any 5 questions from the 8 questions.
  2)   Figures to the right indicate full marks
  3)   Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator and steam tables is allowed.
  4)   Assume suitable data if necessary.
  5)   Neat diagrams must be drawn wherever necessary.

Q1) a)   Explain the importance of rock mechanics in dry underground excavations.   **[5]**

 b)   Enlist the index properties of rock and explain the rock quality designation.   **[5]**

Q2) a)   If a rock has permeability of 1 milliDarcy, how much water will flow through it per unit time and area under a gradient of unity? Take temperature of water as 20° C.   **[5]**

 b)   Write a note on rock anchoring technique.   **[5]**

Q3) a)   What are the methods for measuring absolute state of stress in rocks?**[4]**

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

 i)   Flat Jack method

 ii)   Overcoring

Q4) a) Explain the influence of time on rock deformation. Also explain the creep in rock. **[6]**

b) Write a note on Structural discontinuities in rock masses. **[4]**

Q5) a) Explain the failure propagation of jointed rocks? **[5]**

b) Explain the Griffith's theory of fracture initiation in rock masses. **[5]**

Q6) a) Explain the principal of limit equilibrium method for the analysis of rock structure. **[5]**

b) Explain the rock parameters required for the analysis of underground structures. **[5]**

Q7) a) Write a note on deep foundation in rock. **[5]**

b) What are the modes of failure of a footing on rock? **[5]**

Q8) a) Enlist the rock parameters required for the analysis of underground structures. **[5]**

b) Explain the kinematic analysis of rock slopes. **[5]**

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[5255] -1016

M.E. (Civil - Geotechnical Engg.)
GEO - ENVIRONMENTAL ENGINEERING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*
Instructions to the candidates:
   1)   *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
   2)   *Neat diagram must be drawn wherever necessary.*
   3)   *Figure to the right indicates full marks.*
   4)   *Assume suitable data, if necessary and clearly state.*
   5)   *Use of cell phone is prohibited in the examination hall.*
   6)   *Use of electronic pocket calculator is allowed.*

Q1) a)   State the different characteristics of solid waste and describe any one.**[4]**

      b)   Discuss "Laboratory and field evolution of permeability".   **[5]**

<div align="center">OR</div>

Q2) a)   What are the different sources and effect of sub - surface contamination? Explain them.   **[5]**

      b)   What is de - watering? Explain the design aspects of de - watering.   **[4]**

Q3) a)   What is Leachate? Explain how it is collected.   **[4]**

      b)   Describe different types of barrier materials used in land fill.   **[5]**
<div align="center">OR</div>

Q4) a)   Explain any five methods of composting used in India.   **[5]**

      b)   State the design aspects which are considered in waste disposal in landfill.**[4]**

Q5) a)   Write detail note on "Geotechnical reuse of solid waste".   **[8]**

      b)   What is "Demolition of waste"? Explain.   **[8]**

OR

Q6) a) Explain the different engineering properties of solid waste. **[8]**

b) Write detail note on "Re - clamation of old solid waste dumps". **[8]**

Q7) a) With the help of sketches, explain the "Single and Double lined landfill". **[8]**

b) Write the application of Geo - synthetics in waste disposal design. **[8]**

OR

Q8) a) Explain the different steps considered in land fill construction. **[8]**

b) Discuss "Construction quality control and performance monitoring" in land fill. **[8]**

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[5255] - 1017
M.E. Civil (Environmental Engineering)
ENVIRONMENTAL LEGISLATION AND MANAGEMENT SYSTEM
(2017 Pattern)

Time :3 hours]   *[Max. Marks :50*

Instructions to the candidates:

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

Q1) a) Explain concept of absolute liability with an example. **[4]**

b) Write penalties for violation of consent conditions in Air (P & CP) Act 1981. **[5]**

OR

Q2) a) Write objective and advantages of ISO 14001- Environmental Management Systems (EMS) standard. **[4]**

b) Write provisions for closure/directions in apprehended pollution situation in Water (P & CP) Act 1974. **[5]**

Q3) a) Explain role of central government in environment protection with a case study. **[4]**

b) Write the procedure of environmental audit and its significance with respect to environmental protection. **[5]**

OR

Q4) a) Explain coastal zone regulations for siting of industry. **[4]**

b) Explain any one case study of supreme court judgments in landmark cases. **[5]**

Q5) a) Write important powers and functions of the MPC board under both the water act. **[8]**

b) Write and explain provision about collection, transportation and disposal of Hazardous waste mentioned in Bio-Medical Waste (M & H) Rules, 2016. **[8]**

OR

Q6) a) Explain role of SPCB in implementation of various notifications issued by Central Govt. under Environment (Protection) Act, 1986. **[8]**

b) Write and explain the notifications issued by Govt. of Maharashtra for the protection and improvement of environment. **[8]**

Q7) a) Explain role of NGO in Nature Conservation. **[8]**

b) Explain Hazardous Waste rules with respect to occupier and authorization. **[8]**

OR

Q8) a) Explain the procedure of public hearing for obtaining Environmental Clearance. **[8]**

b) Write responsibilities of generators and role of Pollution Control Boards in hazardous waste management. **[8]**

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[5255] -1018
M.E. (Civil) (Environmental Engg.)
Environmental Chemistry & Micro Biology
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figure to the right indicate full marks.*
4) *Assume suitable data, if necessary and clearly state.*
5) *Use of cell phone is prohibited in the examination hall.*
6) *Use of electronic pocket calculator is allowed.*

Q1) a) Briefly explain oxidation - reduction equations. **[4]**

    b) State the effects of temperature & solar radiation on the air pollutants.**[5]**

OR

Q2) a) Give classification of detergents and explain each in detail. **[5]**

    b) Enumerate the chemical properties of air pollutants. **[4]**

Q3) a) Discuss the general effects of carcinogenic compounds. **[4]**

    b) What do you understand by microbial decomposition. **[5]**

OR

Q4) a) Discuss the problems due to pesticides. **[5]**

    b) State the effects of human exposure to Lead and its compounds. **[4]**

Q5) a) Explain microbial cell structure with sketch. **[8]**

    b) Explain difference between Gas and liquid Chromatography. **[8]**

OR

Q6) a) With suitable examples explain enzymes and their metabolic reactions.**[8]**

b) Discuss principles flame photometry & fluorometry with neat sketches.**[8]**

Q7) a) Explain the measurements and isolation of microorganism. **[8]**

b) What do you understand by industrial Microbiology? **[8]**

OR

Q8) a) What are the biological processes of wastewater treatment? **[8]**

b) Discuss the techniques of enumeration of microorganism. **[8]**

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[5255]-1019

M.E. (Civil - Environmental Engineering)
PHYSICO CHEMICAL PROCESSES FOR WATER AND WASTE WATER TREATMENT
(2017 Pattern) (Credit System)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
 1) *Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q.5 or Q. 6 and Q. 7 or Q. 8.*
 2) *Neat diagram must be drawn wherever necessary.*
 3) *Figure to the right indicates full marks.*
 4) *Assume suitable data, if necessary and clearly state.*
 5) *Use of electronic pocket calculator is allowed.*

Q1) a) Compare ideal and non-ideal reactors. **[4]**

 b) Discusses with neat sketches Orthokinetic and perikinetic flocculation.
 [5]

OR

Q2) a) Discuss how the rate parameters in CMF reactors are determined. **[4]**

 b) Explain the concept of stability of colloids in wastewater. **[5]**

Q3) Derive an expression for settling velocity of a discrete particle governed by Stoke's law. Determine the dimensions, power requirement, paddle configuration and rotational speed for a flocculator that treats 25MLD of raw water. Take optimum value of G x t as 48,000. **[9]**

OR

Q4) Discuss Mass transport processes and the Mass-Balance Principle used in wastewater Treatment. **[9]**

Q5) a) What is Oxygen Demand? Clarify various Oxygen Demands in wastewater treatment. **[10]**

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

   i) MLSS

   ii) Return sludge

   iii) MCRT

   iv) Dilution factor

OR

Q6) a) Discuss various reactions taking place due to inter particle bridging with polymer. **[10]**

b) Differentiate between Sludge and Solids also explain sludge Bulking.**[6]**

Q7) a) Answer the following with respect to rapid sand filter : **[8]**

   i) Effective size of filter media

   ii) Cleaning of the filter

b) What is necessarily of disinfection? List various disinfectants used in wastewater treatment. Discuss the factors affecting the efficiency of disinfection. **[8]**

OR

Q8) a) Discuss various types of adsorption isotherm with equations and meaning of each term in the equation. **[8]**

b) Discuss the important properties of Cellulose acetate membranes also mention meaning of term solute rejection. **[8]**

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[5255] -1020

M.E. (Civil - Environmental Engineering)
ENVIRONMENTAL SANITATION
(2017 Course) (Semester - I)

Time : 3 Hours]   *[Max. Marks :50*

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

Q1) Discuss the role of Micro - organisms in communicable diseases. **[6]**

Q2) Discuss the role and effects of insecticides used in Insects and Rodent control. **[6]**

Q3) Give short note on **[3 + 3 = 6]**

   a)   Industrial sanitation.

   b)   Industrial Hygiene

Q4) Differentiate between the followings. **[3 + 3 = 6]**

   a)   Emergency Sanitation

   b)   Rural Sanitation

Q5) Enlist and Discuss the Systems of Plumbing. **[6]**

Q6) Discuss in details the Principles of Plumbing. **[6]**

Q7) Define the following terminology used in building drainage (Any Two)**[2 × 4 = 8]**
   a)   Bedding
   b)   Benching
   c)   Trade Effluent

Q8) Discuss the Preliminary Data required for Design drainage system for a building.**[6]**

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[5255] -1022

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

WATER RESOURCES & ENVIRONMENTAL ENGG.
ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*
Instructions to the candidates:

   1)   *Attempt any five questions.*

   2)   *Assume suitable data if necessary.*

   3)   *Use of calculator is allowed.*

   4)   *Figures to the right indicate full marks.*

Q1) a)   State the stability of atmosphere for the following data.
         Temp. of air at ground = 30°C, Temp of air at 200 m height = 20°C
         If a balloon is release from a ground after 1 hour reach to height of 100
         m at that time temperature of 22°C.   **[5]**

     b)   A high volume sampler is run for 30 min @ 20 m^3/min air. Initial weight
         of filter paper is 5 gm after 30 min weight of filter paper is 10 gm what is
         concentration of dust particle in microgram/m^3.   **[5]**

Q2) a)   Design multi cyclone chamber for flue gas of 10 m^3/sec. Assume all the
         necessary data.   **[5]**

     b)   A fabric filter must process 3 m^3/s of fluegas. Design the bag house filter
         with air to cloth ratio of 5 m^3/min/m^2. Determine no. of bags and physical
         arrangement. Take dia of each bag as 210 mm.   **[5]**

Q3) a)   Explain working of adsorption process in details.   **[5]**

b) A gas has density of 1.9 kg/m³ at a pressure of 1 bar and with temperature of 35°C. A mass of 0.95 kg of the gas requires a heat transfer of 305 KJ to raise the temperature from 20°C to 305°C while pressure remain constant.

Determine **[5]**

i) Characteristic gas constant.

ii) Cp of gas and Cv of gas.

Q4) a) Two cum sample of air was found to contain 70 μg/cm of SO_2. The temperature and pressure were 25 degree celsius and 101.193 kPa when the air sample was taken. What was the SO_2 concentration in ppm. **[4]**

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

i) AAS

ii) Gas chromatograph (GC)

Q5) a) Explain the principal and working of trickling filter. **[4]**

b) Design a septic tank for a hostel housing IBO persons. Also design soil absorbing system for the disposal of septic tank efficiency. Assuming percolation rate as 15 min/cm. **[6]**

Q6) a) Explain Gaussian plume model and plume behaviour. **[4]**

b) Air flow with velocity 30 m/s passes through cyclone separator. The diameter of cyclone is 4 m and air temperator 105 degree celsius. Determine particle removal efficiency. Given : density of PM is 1.4 g/cum and diameter of PM is 12 μm. **[6]**

Q7) a) What is Bio - kinetic coefficient? How to determine it in lab? **[6]**

b) Explain MPN (Moond's expression), plate count and membrane filter techniques. **[4]**

Q8) Explain the following **[10]**

a) Ion exchange process

b) Flame photometer

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[5255]-1024
M.E. Civil (WREE)
ADVANCED WATER TREATMENT
(2017 Pattern)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q.5 or Q. 6 and Q. 7 or Q. 8.
    2) Neat diagram must be drawn wherever necessary.
    3) Figure to the right indicates full marks.
    4) Assume suitable data, if necessary and clearly state.
    5) Use of cell phone is prohibited in the examination hall.
    6) Use of electronic pocket calculator is allowed.

Q1) a) Draw a flow diagram of a public water supply scheme and explain each component. **[4]**

    b) Draw a neat sketch of a rapid sand gravity filter and show various components. **[5]**

OR

Q2) a) Prove that theoretically, the surface loading (Q/A) and not the depth is a measure of effective removal of particles in a sedimentation tank. **[5]**

    b) Write a short note on Pressure filter with a neat sketch. **[4]**

Q3) a) What are the different types of adsorption? Explain any one. **[4]**

    b) Write a short note on Pipe Networks. **[5]**

OR

Q4) a) Write a short note on zeolite process. **[5]**

    b) Comment on selection of pipe materials. **[4]**

Q5) a) What are the types of aquifers? Explain unconfined aquifer with a neat sketch. **[8]**

b) Differentiate between shallow dug wells and deep dug wells. How are dug wells constructed? **[8]**

OR

Q6) a) What are the general problems of contamination of groundwater? How to prevent it? **[8]**

b) What is a role of groundwater in hydrological cycle? Draw a neat sketch of hydrological cycle. **[8]**

Q7) a) Explain procedure of Electro dialysis with a neat sketch. **[8]**

b) Write principles and applications of Nano filtration. **[8]**

OR

Q8) a) Explain procedure of reverse osmosis with a neat sketch. **[8]**

b) Write principles and applications of Microfiltration. **[8]**

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[5255] -1025
M.E. (Mechanical)
ADVANCED MATHEMATICS
(Design Engineering / CAD - CAM/Auto Mobile)
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*
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 non programmable electronic pocket calculator is allowed.*

    5)   *Assume suitable data, if necessary.*

Q1) a) Find an orthonormal basis for the Euclidean space R^3, by applying Gram - Schmidt's method to the following vectors $(1, -1, 1)$, $(2, 1, 0)$ and $(-1, -1, 1)$ **[5]**

    b) If $w = \phi + i\psi$ represents a complex potential for an electrostatic field which is analytic, if the potential function ϕ is given by $\phi = x^3 - 3xy^2$ then find the stream function ψ. **[5]**

Q2) a) Evaluate $\oint_C \dfrac{\cos \pi z^2}{(z-1)(z-2)}\, dz$ where C is the circle $|z| = 3$. **[5]**

    b) Find the Laplace transform of the periodic function, whose definition in one period is, **[5]**

$$f(t) = \begin{cases} 1 \text{ when } 0 < t < \dfrac{a}{2} \\ -1 \text{ when } \dfrac{a}{2} < t < a \end{cases}$$

Q3) a) Solve the initial value problem in mechanical system given by

$$\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = e^{-3t} \text{ and}$$

$$y(0) = 0, y'(0) = 0 \qquad \text{[5]}$$
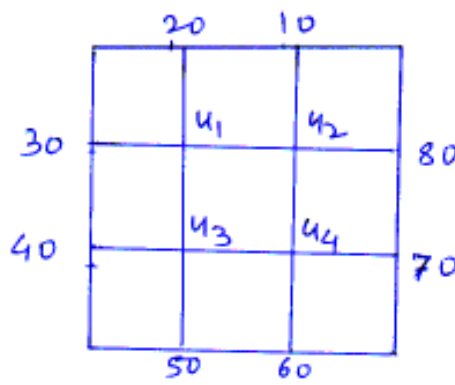
b) Solve the following differential equation by series method. **[5]**

$$\frac{d^2y}{dx^2} + xy = 0$$

Q4) a) Find the largest eigen value and corresponding eigen vector of the matrix by power method where

$$A = \begin{bmatrix} -2 & 5 & 4 \\ 5 & 6 & 5 \\ 4 & 6 & -2 \end{bmatrix} \text{ taking } X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \qquad \text{[5]}$$

b) Solve the boundary value problem $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ for the given square shown below. **[5]**

Q5) a) Given $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$; $u(0,t) = u(5,t) = 0$, $u(x,0) = x^2(25 - x^2)$; Find the values of f for x and t, with $h = 1$, using Bendre's schmidt method. **[5]**

b) Using Galerkin's method, obtain an approximate solution of the boundary value problem of a mass spring systems given by $y'' + y = x^2$, $0 < x < 1$, $y(0) = y(1) = 0$. **[5]**

Q6) a) Find the extremal of functional $\int_0^1 \left[xy' + (y')^2 \right] dx$, $y(0) = 0$ & $y(1) = 1$. **[5]**

   **b)** Solve the system of equations by least square method **[5]**

   $x - 3y = 1$, $2x - 3y = 2$, $4x + 3y = -2$

Q7) a) Find the image of the triangular region bounded by $x = 0, y = 0, x + y = 1$ under the transformation $w = z^2$. **[5]**

   b) Find the fourier Transform of the triangular pulse given by **[5]**

$$f(t) = \begin{cases} A\left(1 - \dfrac{|t|}{a}\right); & |t| \le a \\ 0 ; & \text{otherwise} \end{cases}$$

Q8) a) For the system shown in the figure below if $m_1 = 1$, $m_2 = 3$, $k_1 = 1$, $k_2 = 3$, $k_3 = 3$, assuming there is no friction, find the natural frequencies of the system and corresponding normal modes of vibration using matrix method. **[5]**
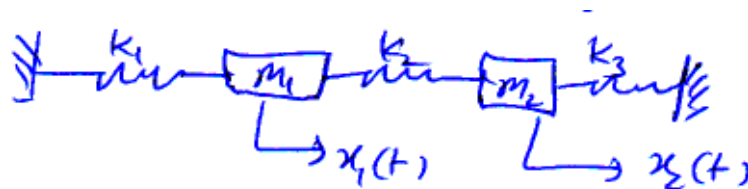
   b) Solve the boundary value problem $u_{tt} = u_{xx}$ with conditions $u(0, t) = u(1, t) = 0$, $u_t(x, 0) = 0$ and $u(x,0) = \dfrac{1}{2} x(1 - x)$. Find the solution upto $t = 0.4$ by using $h = k = 0.1$ **[5]**

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[5255]-1026

M.E. (Mechanical - Design Engineering)

MATERIAL SCIENCE AND MECHANICAL BEHAVIOR OF MATERIALS

(2017 Pattern) (Semester - I)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer any five questions.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and stream table is allowed.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data, if necessary.*

Q1) a) What do you mean by monoclinic, orthotropic, transversely isotropic and isotropic materials? Explain with the help of compliance matrix. **[5]**

   b) Calculate the elements of the stiffness and compliance matrices of a graphite epoxy unidirectional ply. The engineering constants are given as $E_1 = 148 \times 10^9 \ N/m^2$, $E_2 = 9.65 \times 10^9 \ N/m^2$, $G_{12} = 4.55 \times 10^9 N/m^2$, $v_{12} = 0.3$ and $v_{23} = 0.6$. **[5]**

Q2) A body is loaded under stresses. $\sigma_x = 150 MPa$, $\sigma_y = 60 MPa$, $\tau_{xy} = 20 MPa$, $\sigma_z = \tau_{yz} = \tau_{zx} = 0$. Find the three principal stresses, sketch the three-dimensional Mohr's circle diagram for this stress state, and find the largest shear stress in the body. **[10]**

Q3) a) A tensile specimen with a 12 mm initial diameter and 50 mm gage length reaches maximum load at 90 kN and fractures at 70 kN. The minimum diameter at fracture is 10 mm. Determine the engineering stress at maximum load and the true fracture stress. **[4]**

   b) Explain Bridgman correction and Bauschinger effect. Is it desirable phenomenon? Justify. **[6]**

Q4) a) Explain isotropic and kinematic hardening models with neat sketch. **[5]**

b) Explain yield criteria and yield surface for ductile materials. **[5]**

Q5) a) Write a note on plastic rigid body. **[4]**

b) Find shake down region for a circular rod of radius a with a tensile force P and a twisting moment M. **[6]**

Q6) a) The amplitude of a vibrating member decreases so that the amplitude on the 100th cycle is 13% of the amplitude on the 1st cycle. Determine natural decay. **[5]**

b) A piece of metal is subjected to a cyclic stress of 80 MPa. If the phase angle $\delta = 0.1°$ and no heat is transferred to the surroundings, what will be the temperature rise after 100,000 cycles? Data : $E = 80$ *GPa*, C = 800 *J/kg*K, and $\rho = 4.2$ *Mg*/m³. **[5]**

Q7) What is viscoelasticity? Explain Maxwell Model, Voigt Model and Maxwell-Voigt Model for rheological properties of viscoelastic material with neat sketch. **[10]**

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[5255] - 1027

M.E. (Mechanical - Design Engineering)
ADVANCED STRESS ANALYSIS
(2017 Pattern)

Time :3 hours]   *[Max. Marks :50*

Instructions to the candidates:

    1)   *Answer any FIVE questions*

    2)   *Neat diagram must be drawn wherever necessary*

    3)   *Figures to the right indicate full marks.*

    4)   *Use of scientific calculators is allowed.*

    5)   *Assume suitable data if necessary*

Q1) The Airys stress function for the stress distribution under knife edge on the boundary of an infinite solid is given in polar-coordinates by $\phi = \dfrac{P.r}{\pi}\theta.Sin\theta$, where P is the uniformly distributed load per unit length of the edge. Hence, prove that the resultant of forces integrated along any semi-circle around the edge is equal to P. If radius of side semicircle is 20 mm and applied load is 1000 N per unit length, find values of σ_r, σ_θ, $\tau_{r\theta}$ at an angle of 45° w. r. t. vertical axis. **[10]**

Q2) Show that $\phi = \dfrac{q}{8c^3}\left[y^3 \left(x^2 + \dfrac{2}{5}c^2 - \dfrac{1}{5}y^2 \right) + x^2(2c^2 - 3c^2 y) \right]$ is a stress function,and find what problem it solves when applied to region included in $y = \pm c$,x = 0,on the side 'x' positive. **[10]**

Q3) A thin rectangular section of bar with thickness 't' and width 'b' subjected to torque T'. Obtain an appropriate stress function and angle of twist for the section. Determine maximum shear stress and angle of twist of section for 700 Nm torque. Section parameters are b = 90mm, t =10mm and modulus of rigidity G = 80 × 10³ N/mm². **[10]**

P.T.O.

Q4) a) Explain membrane analogy used to analyses the torsion problems. Derive relation between lateral displacement of membrane and Prandtl's stress function. **[5]**

b) Derive an expression for condition of maximum bending moment for the beam carrying moving loads. **[5]**

Q5) Two semi-circular disks are made of steel shown in Fig.l (a) ($E_1 = E_2 = 200$ GPa and $v_1 = v_2 = 0.29$).The redii of curvature of the two surfaces at the point of contact are $R_1 = 60$ mm, $R'_1 = 130$mm, $R_2 = 80$ mm, $R'_2 = 200$ mm. The angle $\propto$ between the planes of minimum curvature is $\pi/3$ rad. If the load P= 4.50 kN, determine the maximum principal (Hertz) stress and maximum shear stress. Refer Fig. I (b) for determination of various coefficients. **[10]**
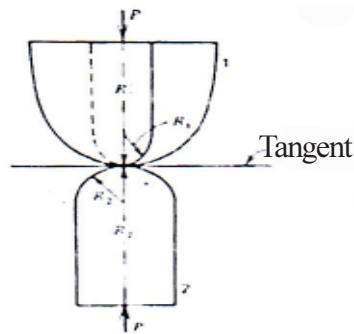

Fig.1 (a)   Two semi-circular disks
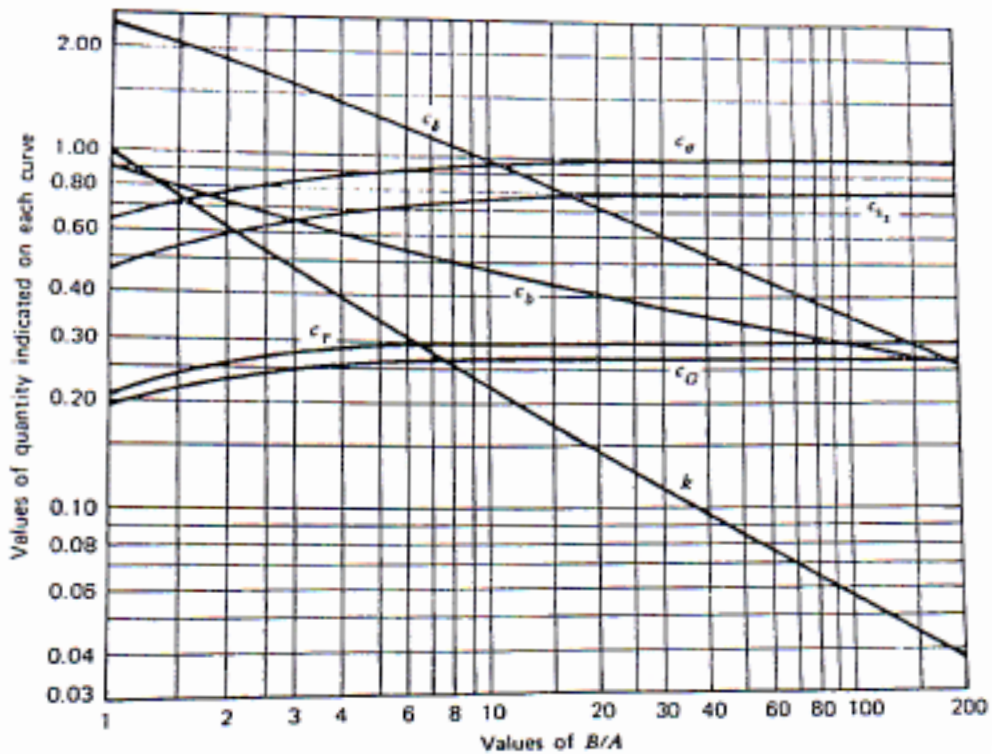
Fig.1(b)   Stress and deflection coefficients for two bodies in contact at a point.

Q6) Derive an expression and locate the shear center for the beam cross section shown in Fig.2 .The walls of the cross section have constant thickness t = 2.5 mm. **[10]**
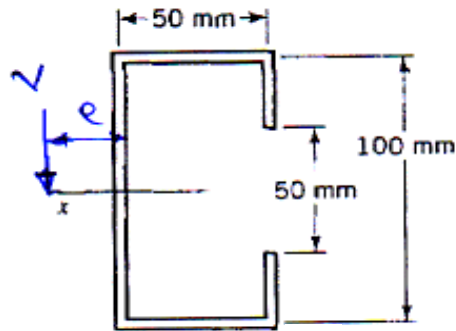
Fig.2 Q.6

Q7) a) Describe the construction and working of a circular polariscope. **[5]**

b) For three elements rectangular rosette the strain observations made with gauges mounted on steel specimen are;

$\epsilon_A = 400 \times 10^{-6}$; $\epsilon_B = -200 \times 10^{-6}$, and $\epsilon_C = 200 \times 10^{-6}$. Find the principal strains, principal stresses and their directions.

Assume E = 207 000N/mm² and μ = 0.29 **[5]**

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[5255]-1028

M. E. (Mechanical Engineering) (Semester - I)
(Heat Power/Design/CAD CAM/Energy/Automotive/Mechatronics)
RESEARCH METHODOLOGY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer any five questions.*
2) *Neat Diagrams should be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Explain Significance of Research. **[5]**

    b) Explain Criteria of Good Research. **[5]**

Q2) a) Explain Feasibility studies of research problem. **[5]**

    b) What is Hypothesis development and Characteristics of Hypothesis?**[5]**

Q3) a) Write a note on : **[5]**

      i) Qualitative research

      ii) Quantitative research

    b) Explain ANOVA with suitable example. **[5]**

Q4) a) Explain the Meaning of variable, Selection of variables. **[5]**

    b) Explain Steps in Setting up a computer model to predict performance of experimental system. **[5]**

P.T.O.

Q5) a) Explain the role of DSP in data collection in noisy environment. **[5]**

b) Explain Regression analysis, Curve fitting and Developing Correlation.**[5]**

Q6) a) Describe error analysis and methods to reduce errors in research process.**[5]**

b) Describe the outline and structure of research report. **[5]**

Q7) a) Explain dissemination of research findings and different steps and precautions while writing research report. **[5]**

b) Explain selection of suitable journal for publishing research work. **[5]**

Q8) a) Explain importance of literature survey during research works. **[5]**

b) Explain Ethics and check for Plagiarism of the research article. **[5]**

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[5255]-1029

M.E. (Mech. - Energy & Heat Power Engg.)
ADVANCED MATHEMATICS & NUMERICAL METHODS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

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 electronic pocket calculator is allowed.*

    5)   *Assume suitable data, if necessary.*

Q1) a)   Using Regula Falsi method find the real root of $f(x) = e^x - 4x = 0$ correct to three decimal places.   **[5]**

     b)   Fit a second degree parabola to the following equation.   **[5]**

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

Q2) a)   Solve the following equations using the LU decomposition :   **[5]**

$2x + 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

     b)   Find Y at X = 9 from the following data using Newton Divided Difference formula.   **[5]**

X	5	7	11	13	17
Y	150	392	1452	2366	5202

P.T.O.

Q3) a) Obtain the cubic spline of the following data : **[5]**

X	0	1	2	3
Y	2	-6	-8	2

b) Evaluate the integral $\int_0^{0.5} \left(\dfrac{x}{\sin x} \right) dx$ using Romberg's method, correct to 3 decimal places. **[5]**

Q4) a) Find integration of $e^x \cos(x)-2x$ in limits 0 to 1 by using 3 point Gauss-Legendre method. **[5]**

b) Determine the largest eigen value and the corresponding eigen vector of the following matrix using Power method. **[5]**

$$\begin{array}{rrr} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{array}$$

Q5) a) Use the Given's method to reduce the symmetric matrix. **[5]**

$$\begin{array}{rrr} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{array}$$

to tri-diagonal form

b) Use Range-Kutta method to solve y'=x+y, y(0)=1, for x=0.1, Take h=0.1. **[5]**

Q6) a) Use Adam-Bashforth formula to find y(0.4) for the equation **[5]**

$\dfrac{dy}{dx} = \dfrac{1}{2} xy$ using the data

x	0	0.1	0.2	0.3
y	1	1.0025	1.0101	1.0228

b) Solve the Laplace Equation **[5]**

Solve $\dfrac{\partial^2 T}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ for the grid shown in figure. Find the temperatures

T1, T2, T3 and T4
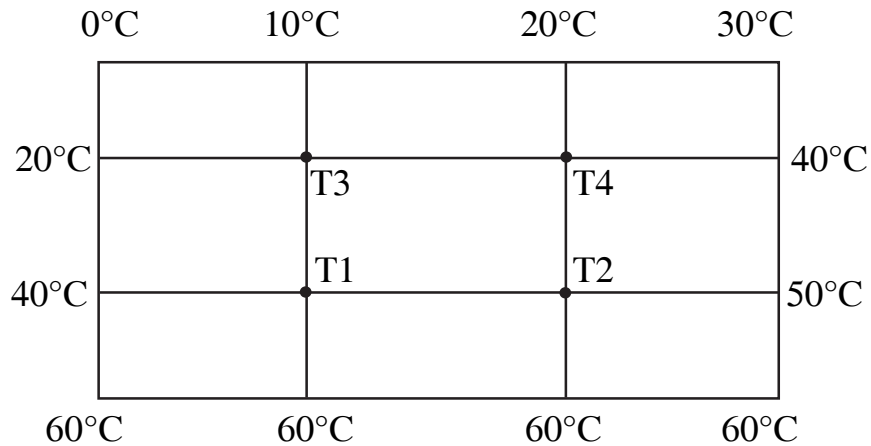
In the process use Jacobi method to solve linear simultaneous solution and carry out 3 iterations.

Q7) a) Solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ for the following condition **[5]**

At $t = 0, u = \sin(\pi x)$ where $0 \le x \le 1$.

$u = 0$ for $x = 0$ and $x = 1$ for $0 \le t \le 0.006$

Take increment in x as 0.2 and increment in t as 0.002

Find all values of u for t = 0 to $t = 0.006$ and for $x = 0$ to $x = 1$

b) Solve the following simultaneous equations by Guass – Seidel method. Carryout four iterations. **[5]**

$x + 20y + 9z = -23$

$2x - 7y - 20z = -57$

$20x + 2y + 6z = 28$

Q8) a)   Use Heun's method to solve the initial value problem.   **[5]**

$$y(0) = 1 \text{ over } [0,2] \text{ using step size of } 0.5$$

b)   Solve $\dfrac{\partial^2 u}{\partial t^2} = 16\dfrac{\partial^2 u}{\partial x^2}$ for the following condition   **[5]**

Given that $u(0,t) = u(5,t) = 0$

$u(x, 0) = x^2 (5 - x)$ and

Find u for $0 <= t <= 1.25$

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$$y'(x) = \frac{\partial u}{\partial t}(x,0) = \frac{x - y}{2} = 0,$$

[5255] - 1030
M.E. (Mechanical) (Heat Power Engineering)
ADVANCED THERMODYNAMICS & COMBUSTION TECHNOLOGY
(2017 Pattern) (Semester - I)

Time :3 hours]   *[Max. Marks :50*
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 logarithmic table, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

    5)   *Assume suitable data, if necessary*

Q1) a)   Write down van der Waal's equation of state? How does it differ from the ideal gas equation?   **[4]**

    b)   Ethane gas (C_2H_6) is placed in a container at a pressure of 34.2 bars and a specific volume of 0.0208 m^3/kg. It is heated at constant volume until the pressure reaches 46.4 bars. Estimate the temperature change for the process based on generalized Z-chart (supplied).

       Given for methane: P_{CR} = 48.8 bars and T_{CR} = 305 K, R= 0.2765 kj/kg K.**[6]**

Q2) a)   A boiler drum contains water and steam at 1 bar pressure, all air having been expelled and the stop valve closed. Determine the heat required for generating dry saturated steam at 6 bar. When the stop valve is opened and the boiler supplies the dry saturated steam at 6 bar, determine the additional heat input required if the feed water is at 45 °C.   **[6]**

    b)   Sketch the Mollier chart and explain why do the isobars diverge from one another on Mollier Diagram?   **[4]**

Q3) One kg of air is contained in a piston cylinder assembly at 10 bar pressure and 500 K temperature. The piston moves outwards and the air expands to 2 bar pressure and 320 K temperature. Make calculations for

a) The availability in the initial and final states

b) The maximum useful work and

c) The irreversibility for the system.

Assume that the system is insulated and the environmental conditions are at 1 bar and 290 K. further for air: $c_v = 0.718$ kj/kg K, $c_p = 1.005$ kj/kg K.   **[10]**

Q4) a) One kg of ice at -4 °C is exposed to the atmosphere which is at 20 °C. The ice melts and comes into equilibrium with the atmosphere. Determine the entropy increase of universe, for ice, take $c_p = 2.09$ kj/kg K and latent heat of fusion = 333 kJ/ kg.   **[6]**

b) Explain the concept of the third law of thermodynamics and the thermal death of Universe.   **[4]**

Q5) a) Set up the following expression for the difference in heat capacities C_P and c_v from first and second Tds equation.   **[5]**

$$c_p - c_v = -T * \left(\frac{\partial v}{\partial T} \right)_p^2 * \left(\frac{\partial p}{\partial v} \right) T$$

b) Set up a Tds relation in the following form:

$$T \, ds = c_v \, dT + \left(\frac{\beta T}{\alpha} \right) dv$$

Where β is the coefficient of volume expansion, α is the isothermal compressibility, and the other Symbols have their usual meanings,   **[5]**

Q6) a) Write a short note on Clausius - Clapeyron equation.   **[4]**

b) What is adiabatic flame temperature? List the factors influencing the same.   **[6]**

Q7) a) Define fugacity and activity. **[4]**

b) What do you understand by the enthalpy of formation and enthalpy of combustion? **[4]**

c) Discuss Amagat's law. **[2]**

Q8) Write note on **[10]**

a) Energy conversion efficiency of biological system

b) Thermodynamics of Nutrition and exercise
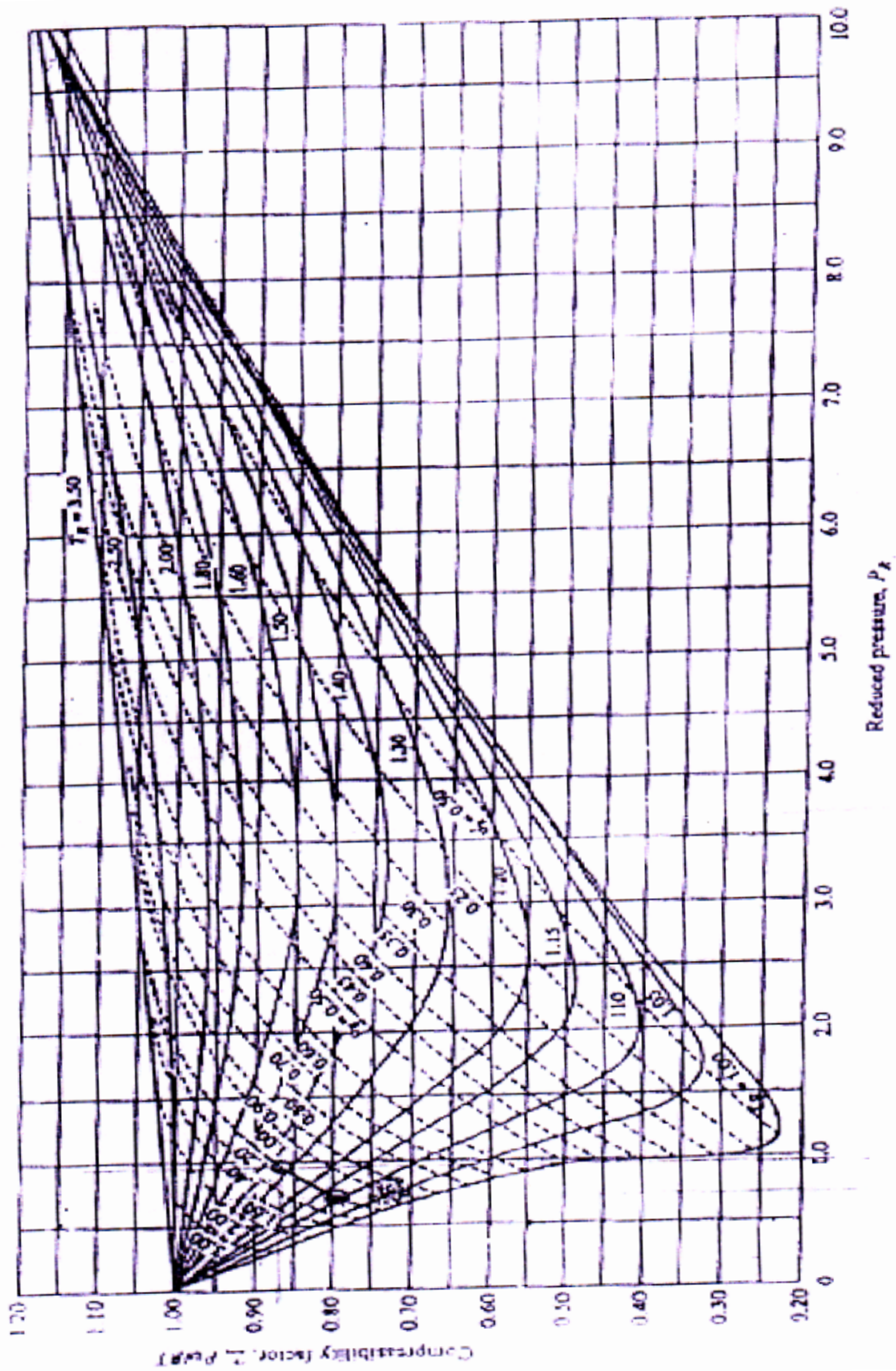
Fig. A.1 Compressibility chart, low pressure range

[5255]-1031

M. E. (Mechanical) (Heat Power) (Semester - I)
ADVANCED FLUID MECHANICS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer five questions from following.*

2) *Draw Diagrams wherever necessary.*

3) *Use of scientific calculator is allowed.*

4) *Assume suitable data wherever necessary.*

Q1) a)   Explain the term;   **[5]**

   i)   vorticity

   ii)   stream function

   iii)   velocity potential

b)   Find the acceleration and vorticity components at a point $(1,1,1)$ for the following flow field. $u=2x^2+3y$, $v=-2xy+3y^2+3zy$, $w=-3/2z^2+2xz-9y^2z$.   **[5]**

Q2) a)   Derive an expression for conservation of momentum equation in following

   form; $\rho \dfrac{D\bar{V}}{Dt} = \bar{f}$ **[5]**

b)   Consider steady gas flow through porous wall as shown in fig. Leakage mass flow through the porous wall leaves in a direction normal to the pipe axis. Determine the axial force of the fluid on the pipe.   **[5]**

P.T.O.

At the top, a figure showing a porous-walled pipe control volume (CV):
- $A = 0.15 \, m^2$
- $p = 400 \, kPa \, (abs)$
- $\rho = 6 \, kg/m^3$
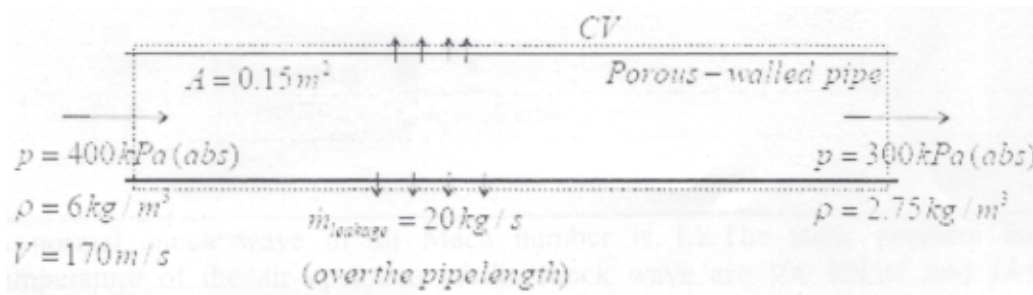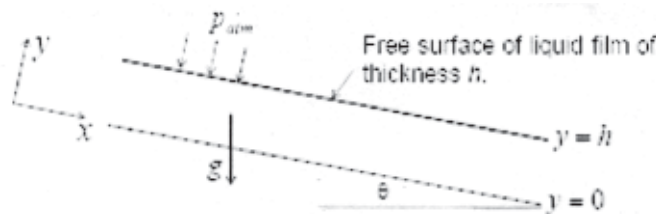- $V = 170 \, m/s$
- $\dot{m}_{leakage} = 20 \, kg/s$ (over the pipe length)
- $p = 300 \, kPa \, (abs)$
- $\rho = 2.75 \, kg/m^3$

Q3) a) Derive an expression of velocity profile for fully developed laminar flow over flat plate. **[5]**

b) Derive an expression for velocity and shear stress profile for fully developed flow down an inclined plane as shown in fig. Also estimate maximum shear stress for θ=30°, h= 10 mm, dynamic viscosity of liquid = 0.4 kg/m.s, ρ= 920kg/m³ **[5]**

Figure showing free surface of liquid film of thickness h, with axes x, y, gravity g, angle θ, $y = h$ and $y = 0$, p_{atm}.

Q4) a) The pressure far from an irrotational vortex (a simplified tornado) in the atmosphere is zero gage. If the velocity at r = 20 m is 20 m/s, estimate the velocity and the pressure at r = 2 m. (The irrotational vortex ceases to be a good model for a tornado when r is small. In the "eye" of the tornado the motion is approximated by rigid-body motion. **[5]**

b) Derive an expression for lift on rotating cylinder. (Kutta-Joukowsky theorem) **[5]**

Q5) a) Obtain momentum-integral equation for the boundary-layer. **[5]**

b) Assume that the velocity profile in a boundary layer. flow can be approximated by a parabolic velocity profile $\dfrac{u}{U_x} = A + By + Cy^2$. Calculate the boundary-layer thickness and the wall shear stress. **[5]**

Q6) a) Explain different types of free turbulent flows. What is a need of turbulence modeling. **[5]**

b) Water is flowing through a rough pipe, 500 mm in dia.and 800 m length at the rate of 0.5 m³/s. Calculate the power loss in overcoming friction per m length of pipe, if the roughness element height (ε)= 0.15 mm. Also calculate the maximum velocity. **[5]**

for laminar flow $f = \dfrac{64}{R\varepsilon}$

for turbulent flow $\dfrac{1}{\sqrt{f}} = 2log_{10}\left(\dfrac{R}{\varepsilon}\right) + 1.74$

$u_c = \sqrt{\dfrac{\tau}{\rho}}$ $\dfrac{u_{max}}{u_c} = 8.5 + 2.5log_e\left(\dfrac{R}{\varepsilon}\right)$

Q7) a) Air at I MPa and 600°C enters a converging nozzle, shown in Fig. with a velocity of 150 m/s. Determine the mass flow rate through the nozzle for a nozzle throat area of 50 cm² when the back pressure is (a) 0.7 MPa and (b) 0.4 MPa. **[5]**
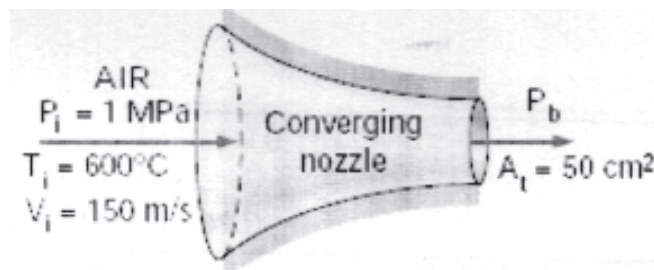
b) A normal shock wave in air Mach number is l.8.The static pressure and temperature of the air upstream of the shock wave are 100 kN/m² and 15°C respectively, determine the Mach number, pressure, and temperature downstream of the shock. **[5]**

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[5255] - 1032
M.E. (Mechanical - Automotive Engineering)
AUTOMOTIVE ENGINE DESIGN
(2017 Pattern)

Time :3 hours]   *[Max. Marks :50*

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 of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

    5)   *Assume suitable data, if necessary.*

Q1) a) In an air standard otto cycle the compression ratio is 7 & compression begins at 1 bar & 313K. The heat added is 2510 kj/kg. Find

    i)   Maximum temperature & pressure of cycle.

    ii)   Work done per kg of air.

    iii) Cycle efficiency.

    iv) Mean effective pressure.   **[6]**

    Take C_v = 0.713 kj/kg k & R = 287 j/kg k.

b) Explain octane number & Cetane number.   **[4]**

Q2) a) Find the engine dimensions of two cylinder two stroke IC engine from following data.

    engine speed = 4000 rpm, volumetric efficiency = 0.77, Mechanical efficiency = 0.75, fuel consumption = 10 lit/hr specific gravity of fuel = 0.73, Air fuel ratio = 18:1. Piston speed = 600m/min. Indicated mean effective pressure = 5 bar.

    Also find the brake power. Take R = 281 j/kg k at STP.   **[6]**

b) Explain the various sources of emission in IC Engine.   **[4]**

Q3) a) Why balancing of crankshaft is necessary? Explain how the balancing is done with neat sketch. **[6]**

b) What are the different forces acting on connecting rod. **[4]**

Q4) a) Explain the operating variables that affect performance of CI engine.**[6]**

b) Explain the general engine design procedure using flowchart. **[4]**

Q5) a) What materials are commonly used for piston? Explain the merits & limitations. **[5]**

b) Explain the causes of torsional vibrations. **[5]**

Q6) a) Explain in detail design process of connecting rod, by Rankine formula.**[8]**

b) What is the importance of selection of lubricant. **[2]**

Q7) Write short note (Any two) **[10]**

a) Catalytic converter.

b) Design of cooling system

c) Turbocharging of engine.

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[5255]-1033

M. E. (Mechanical) (Automotive Engineering) (Semester - I)
AUTOMOTIVE SAFETY AND REGULATIONS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

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 logarithmic tables, slide rules and electronic pocket calculator is allowed.

5) Assume suitable data, if necessary.

Q1) a) What do you understand by vehicle safety? What are the objectives of it? List out various provisions of safety aspects incorporated in a modern car? **[5]**

b) Define crashworthiness and explain with neat sketch how a vehicle structure is designed for crashworthiness. **[5]**

Q2) a) Explain role for ergonomics in vehicle safety. **[5]**

b) Explain with example what do you understand by occupant restraint system? Describe it with neat sketch. **[5]**

Q3) a) Explain under run protection devices used in automobiles. **[5]**

b) Explain the types of safety glasses? What are the requirements of it? **[5]**

P.T.O.

Q4) a) What is the role of proper lighting and reflecting devices in automobile safety? Name different types of lighting and signaling devices used in modern automobiles? **[5]**

b) Explain briefly construction and working principle of head lamp, its testing procedure as per CMVR rule. **[5]**

Q5) a) Write a detail note on various automotive standard giving procedure for type approval and conforming safety of critical components. **[5]**

b) Sketch any five road signs specifying dimensions and color code as per CMVR rule. **[5]**

Q6) a) Explain role of automobile seat anchorage. **[5]**

b) Describe head lamp low beam measuring screen test point grid. **[5]**

Q7) Write short notes on the following (Any two) **[10]**

a) Anthropometry data for automobile occupancy.

b) Door locks and retention system.

c) Adoptive front lighting system.

d) Testing tracks for vehicles.

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[5255]-1034
M. E. (Mechanical) (CADME)
ADVANCED MACHINE DESIGN
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Attempt any two question from Q1,Q2 &Q3*

   2)   *Q4 and Q5 are compulsory*

   3)   *Figures to the right indicate full marks.*

   4)   *Assume suitable data, if necessary.*

Q1) a)   The creep data at a certain temperature is obtained as

      S1=15 MPa $\in 1$ = 0.022 percent per 1000 hrs

      S2=17 MPa $\in 2$ = 0.035 percent per 1000 hrs

      Determine the constants of hyperbolic sine law and calculate the creep rates of stress 45 MPa and 48 MPa   **[8]**

   b)   Derive the expression for Airy's stress function in Cartesian coordinate.**[7]**

Q2) a)   Describe Rheological models and its application   **[7]**

   b)   Determine strain energy release rate for a double cantilever beam with a>> 3h and 1>>3h as shown in figure. The P is a applied load and B is the width of beam   **[8]**
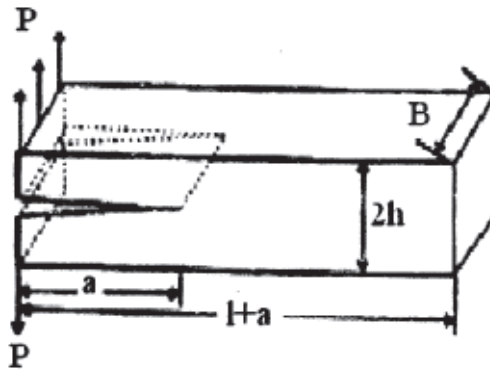
Q3) a) Explain the concept of energy balance during crack growth. **[7]**

b) Describe the elasto-plastic analysis for torsion of bars. **[8]**

Q4) Solve any two :

a) Derive the expression for octahedral shearing stress theory. **[6]**

b) Explain stress concentration around cut outs in composite laminates.**[4]**

c) Write short notes on relations between elastic constants. **[4]**

Q5) Solve any two:

a) A continuous and aligned glass fiber reinforced composites consist of 40%volume of glass fiber having modulus of elasticity 69 GPa and 60% volume of fiber polyster resin having modulus of elasticity of 3.4 GPa.**[6]**

   i) Calculate modulus of elasticity of composite in longitudinal direction

   ii) If c/s area is 250 mm^2 and stress of 50 MPa is applied in longitudinal direction, determine the magnitude of load carried by each of fiber and matrix phase

b) Explain of Castigliano's theorems with its application. **[4]**

c) Describe the Influence of super imposed static stresses in fatigue. **[4]**

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[5255]-1035
M.E. (Mechanical) (CADM & E)
COMPUTER AIDED DESIGN
(2017 Pattern) (Semester - I)

Time :3 Hours]

[Max. Marks : 50

Instructions to the candidates:

 1) *Answer any five questions from the following.*

 2) *Neat diagram must be drawn wherever necessary.*

 3) *Figures to the right side indicate full marks.*

 4) *Assume Suitable data if necessary.*

 5) *Use of Calculator is allowed.*

Q1) What do you understand by analytical curves & synthetic curves? **[10]**

Q2) Explain the CGS approach of solid modelling? **[10]**

Q3) What do you understand by C-rep & B-rep approaches? Compare them. **[10]**

Q4) Explain in detail the concept of Boundary Representation. **[10]**

Q5) Derive the parametric representation of Bezier curve. State its limitation. **[10]**

Q6) Discuss the need for standardization in computer Graphics. **[10]**

Q7) How are hidden lines and hidden surface algorithms classified? Explain each one of them briefly. **[10]**

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[5255]-1037

M.E. (Mechanical - Mechatronics)
CONTROL SYSTEMS - I
(2017 Pattern) (Semester - I)

Time :3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
    1)   *Answer any five questions.*
    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) Write the cost function of a LQR type controller, discuss the significance of the terms Q and R as well as the advantages and dis-advantages of such controller. **[10]**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & -25 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \qquad \text{Eq.....Q1-1}$$

$$y = \begin{bmatrix} 2500 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0]u$$

Q2) a)   The open loop state space model of a second order system is given by Eq Q1 -1. Convert this model into an equivalent transfer function. **[5]**

     b)   For the system in Eq Q1 -1, determine the location of the poles, the zeros and comment on the stability of the system. **[5]**

Q3) Using a suitable example, discuss the significance of controllability, measurability and observability with respect to full state feedback control.**[10]**

Q4) a) For the system in Eq Q1 -1, determine a full state feedback gain, k, such that the desired closed loop system has maximum percentage overshoot of 5% and a 5% settling time of 0.05 seconds. **[5]**

b) For the system in Eq Q1-1, determine the state space model of the closed loop system using the full state feedback gain k from Q4a. **[5]**

Q5) a) For the system in Eq Q1-1, using a suitable method, build a full state observer such that the observer poles are located at 10 times the closed loop poles. Consider the closed loop poles to be of the closed system from Q4 (b). **[5]**

b) For the system in Eq Q1-1, determine the A matrix for the compensator using the full state feedback gain k, and the observer gain L from Q-4 (a) and Q-5(a) respectively. **[5]**

Q6) Draw a suitable block diagram and discuss, in detail, the design of a command tracking system. **[10]**

Q7) Draw a suitable block diagram and discuss the design of an observer based full state feedback control for an arbitrary second order system. **[10]**

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[5255]-1038
M.E. (Mechanical - Mechatronics)
SENSORS, TRANSDUCERS AND INTERFACING TECHNIQUES
(2017 Pattern)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:
1) *Attempt any five questions.*
2) *Figures to the right indicate full marks.*
3) *Draw neat figures, diagrams wherever necessary.*
4) *Use of scientific calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Explain the different types of errors which occur in the measurement process. State how errors can be minimized? **[5]**

b) Following measurements of weight (in kg)are carried out-
101.25,101.36,101.48,101.56,101.21,101.32,101.71,101.63,
101.22,101.54,101.45,101.64,101.59. Calculate the mean, deviation, standard deviation and variance of the reading. Comment on the result.**[5]**

Q2) Enlist the important specifications/capabilities of dual trace CRO and digital storage oscilloscope. Draw the neat block diagram of dual trace CRO and explain function of each block. State the various applications of CRO. **[10]**

Q3) a) Draw & explain the Knudsen gauge. State its advantages & explain any one application in brief. **[5]**

b) Explain pressure measurement using elastic elements with the help of neat diagram. **[5]**

Q4) a) State the different schemes of flow measurement by drag effect and explain any two methods briefly indicating advantages/limitations. **[5]**

b) Explain in details- **[5]**
  i) Pressure probes
  ii) Hot film anemometers

Q5) Explain the following measurement techniques of -   **[10]**

    a)   Thermal conductivity,

    b)   Humidity

    c)   Temperature.

Q6) a)   Explain the terms strain and stress. State the different types of strain gauges and explain any one in detail.   **[5]**

    b)   Explain the concept of temperature compensation with respect to strain measurement.   **[5]**

Q7) a)   What is the need of data acquisition system? With the help of neat block diagram explain the working of 4-channel DAS.   **[5]**

    b)   State the different types of ADC's and explain working of the most widely used type ADC using neat block diagram.   **[5]**

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[5255]-1039

M. E. (Mechanical - Energy Engineering)
ADVANCED THERMODYNAMICS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

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 logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables are allowed.*

   5)   *Assume suitable data if necessary.*

Q1) a)   Write down the van der Waals equation of state. How does it differ from the ideal gas equation of state? What is the force of cohesion? What is co-volume?   **[5]**

    b)   The specific heats of a gas are given by $C_p = a + kT$ and $C_v = b + kT$, Where a, b, and k are constants and T is in K. Show that for an isentropic expansion of this gas $T^b v^{a-b} e^{kT} = $ constant.   **[3]**

    c)   What is compressibility factor? What is its significance?   **[2]**

Q2) a)   Describe the phase change process for water at constant pressure. Show the various stages on P-V, T-V, and T-S diagrams.   **[5]**

    b)   A Steam boiler initially contains 5 m^3 of steam and 5 m^3 of water at 1 MPa. Steam is taken out at constant pressure until 4 m^3 of water is left. What is the heat transferred during the process?   **[5]**

Q3) a) Explain increase in entropy principle and entropy generation. **[5]**

b) A system has a heat capacity at constant volume $C_V = AT^2$ where A=0.042 J/K³. The system is originally at 200 K, and a thermal reservoir at 100 K is available. What is the maximum amount of work that can be recovered as the system is cooled down to the temperature of the reservoir? **[5]**

Q4) a) Derive an equation for exergy balance for a closed system. **[5]**

b) Calculate the decrease in exergy when 25 kg of water at 95°C mix with 35 kg of water at 35°C, the pressure being taken as constant and the temperature of the surrounding being 15°C (C_p of water is 4.2 kJ/kg K). **[5]**

Q5) a) Write short note on Clausius-Clapeyron equation **[4]**

b) Prove that $C_P = \left(\dfrac{dh}{dT}\right)_{P=C}$ *and* $C_V = \left(\dfrac{du}{dT}\right)_{V=C}$ **[6]**

Q6) a) explain enthalpy of formation and enthalpy of combustion. **[5]**

b) Pentane (C_5H_{12}) is burned with 150% theoretical air. Determine the composition of products when burned with 150% air and stoichiometric air fuel ratio. **[5]**

Q7) a) Define Boyle temperature? How it is computed? **[5]**

b) Explain Inversion Curve and Joule-Thompson Coefficient. **[5]**

Q8) a) Derive the first and second TdS equations using Maxwell relations. **[5]**

b) What is the adiabatic flame temperature? **[5]**

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[5255]-1040

M. E. (Mechanical - Energy Engineering)
NON-CONVENTIONAL ENERGY SOURCES
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

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 non programmable calculator is allowed.*
5) *Assume Suitable data if necessary.*

Q1) a) What are the Renewable and non-renewable energy sources? Describe briefly **[5]**

b) What are the prospects of non-conventional energy sources? **[5]**

Q2) a) What is the principle of solar photovoltaic power generation and what are the main elements of it? **[5]**

b) Write a note on: **[5]**

    i) Solar pumping

    ii) Solar cell arrays

Q3) a) "Sun is major source of all types of energy". Justify. **[5]**

b) Describe the factors while selecting a site for wind power stations. **[3]**

c) What is the basic principle of wind energy conversion? **[2]**

Q4) a) Explain in detail the microhydel power plant. **[4]**

b) Explain biomass conversion in brief **[3]**

c) What is meant by anaerobic digestion? Explain factors affecting it? **[3]**

Q5) a) What are the advantages and disadvantages of Geothermal energy forms? **[4]**

b) What are the main types of OTEC power plants? Describe their working in brief? **[6]**

Q6) a) Write a short note on wave energy conversion? **[5]**

b) Explain with sketches the various methods of tidal power generations. What are the limitations of each method? **[5]**

Q7) a) Describe in detail hydrogen fuel cell energy storage system **[4]**

b) How are Gasifiers classified? What is Pyrolysis? **[3]**

c) What are the main applications of Biogas? **[3]**

Q8) Write a short note on any two : **[10]**

a) Diesel PV system

b) Wind PV system

c) Microhydel-PV system

d) Solar wind system

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SEAT No. :

[Total No. of Pages : 3

[5255]-1041

M.E. (Electronics - Digital Systems)
ANALOG & DIGITAL CMOS DESIGN
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to candidates:

 1) *Answer any five qeustions.*

 2) *Neat diagrams must be drawn wherever necessary.*

 3) *Figures to the right indicate full marks.*

 4) *Use of electronic pocket calculators is allowed.*

 5) *Assume suitable data if necessary.*

  Metal - 1 resistivity : $0.08\ \Omega\ /\ \square$, $C_s = 0.9^\mu\ F/^\mu\ m$, $C_b = 0.4\ ^\mu\ F\ /^\mu\ m^2$

Q.1) a) What do you mean by scaling in CMOS VLSI circuits? Classify various scaling techniques. **[4]**

  b) Explain layout design rules with reference to any process technology used in IC fabrication. Draw the stick diagram for two input OR gate.**[4]**

  c) Explain how to fabricate resistor on CMOS IC **[2]**

Q2) a) What is Lithography? Explain photolithography process **[4]**

  b) Draw the stick diagram and layout of the following functions two input NAND gate. **[4]**

  c) Explain non-ideal I-V effects in MOS transistors and explain body. **[2]**

Q3) a) Derive the expression for static and dynamic power dissipation in CMOS logic circuit. **[4]**

b) Compute and Plot the Elmore delay for metal-1 wire of size 4000 λ. X 4 λ using : **[4]**

    i)   2-sections

    ii)   4-sections

    iii) 8-sections

c) What is short circuit dissipation? How to minimize it. **[2]**

Q4) a) Draw CMOS inverter circuit and describe its switch level RC delay model. **[4]**

b) Derive the expression for Power Delay Product. What is the significance of PDP? **[4]**

c) What arc the components that account for the power dissipation in a CMOS VLSI Circuit? Calculate approximate dynamic power dissipation in a chip operating with VDD of 5 V at 200 MHz with an internal switched capacitance of 500 pF. **[2]**

Q5) a) What is band gap reference circuits? Explain the same with any reference circuit. **[4]**

b) Draw the schematic of CMOS differential amplifier and give the expressions for voltage gain, output resistance. CMRR and ICMR. **[4]**

c) Draw and explain Switched Capacitors CMOS circuit. **[2]**

Q6) a) Draw and describe CMOS differential amplifier with current mirror load. Draw and describe voltage transfer curve. **[4]**

b) Explain current sink & current source in detail. Give expressions for output voltage range and output resistance. **[4]**

c) Draw and explain DAC design using CMOS circuit. **[2]**

Q7) a) List the low power design techniques. Explore any one in detail. **[4]**

b) What is need of NORA logic? Explain operation of such typical logic. **[4]**

c) Draw and explain sense amplifier circuit. **[2]**

Q8) a) Implement the following Boolean equation in dynamic CMOS logic and conventional static CMOS logic: **[4]**

$Y = A (B + C) + DE$. Compare the two circuits with respect to speed and area

b) Explore Domino logic with appropriate example. **[4]**

c) Write note on static CMOS. **[2]**

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[5255]-1042

M. E. (Electronics) (Digital Systems)
MULTIRATE SIGNAL PROCESSING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
  1) *Solve any five questions.*
  2) *Assume suitable data if necessary.*
  3) *Figures to the right indicate marks.*

Q1) a) Design a 2-stage decimator which is used to reduce sampling rate from**[5]**

       240 KHz to 8 KHz

       PB ripple   : 0.07

       SB ripple   : 0.02

       Freq. band of interest : 0-3.4 KHz

       Also calculate storage required

       and multiplication per seconds

    b) Explain steepest descent algorithm of adaptive filter. What are limitations of this algorithm.   **[5]**

Q2) a) Design a 2-stage interpolator which is used to increase sampling rate from 64 KHz to 2048 KHz.   **[5]**

       PB ripple   : 0.02

       SB ripple   : 70 dB

       Freq. band of interest : 0-30 KHz

    b) What is need of wavelet packet? Explain wavelet packet decomposition.**[5]**

P.T.O.

Q3) a) Derive the expression for output spectrum of decimator in terms of input spectrum. **[4]**

b) What is characteristics of QMF's frequency response? How to design these filters. **[4]**

c) Compare short time fourier transform and wavelet transform. **[2]**

Q4) a) Explain how to use wavelet transform for filtering. **[4]**

b) Find the pade approximation of second order to a signal x(n) that is given by x(n) = { 2,1, 0,-1, 01,1,-1,0, ...}^{T} with two pole and two zero. **[4]**

c) Determine the output y(n) in terms of input x(n) for the multirate system **[2]**

shown in figure
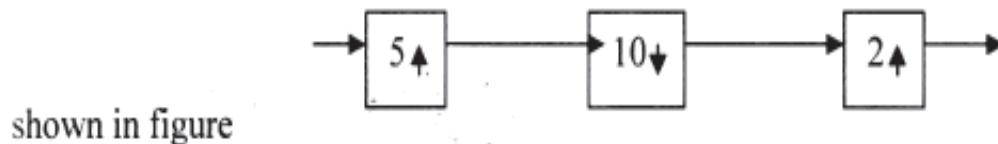
Q5) a) Explain use of adaptive filter for echo cancellation. **[4]**

b) Explain the concepts of image resizing. **[4]**

c) Is decimation is time variant?. Justify. **[2]**

Q6) a) Transfer function is H(z)=(1+ 0.85 Z^{-1})/(1-0.65Z^{-1}). perform polyphaser decomposition of H(Z) into 4 section. **[4]**

b) What are the standard wavelets ? explain any two **[4]**

c) Calculate time bandwidth product for wavelet decomposition. **[2]**

Q7) a) Explain the concept of decimation for image resizing. **[4]**

b) Derive the expression for output spectrum of decimator in terms of input spectrum. **[4]**

c) What are the properties of DCT **[2]**

Q8) a) Write a note on sampling rate conversion by a rational factor. Also comment on sequence of multirate. **[4]**

b) Explain application of multirate DSP in ADC/DAC **[3]**

c) Calculate 2-level decomposition using Haar wavelet of h(n) h(n) = { 1 2 3 7 8 2 1 }, Comment on its energy compaction. **[3]**

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[5255]-1043

M. E. (Electronics - Digital Systems)
EMBEDDED SYSTEM DESIGN
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*
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) Assume suitable data if necessary.

Q1) a)   Explain design metrics for embedded systems.   **[4]**

b)   Explain integrated development environment (IDE) used for Arduino, Beaglebone, Rasberry Pi, intel Galileo Gen 2. Also describe their applications.   **[4]**

c)   Describe features of ARM-CORTEX series.   **[2]**

Q2) a)   Draw and explain architecture of LPC-1768.   **[6]**

b)   Describe CMSIS standard.   **[4]**

Q3) a)   Compare VXWorks and Micro-C/OS-II.   **[4]**

b)   Write features of Micro-C/OS-II.   **[4]**

c)   Explain use of watch dog for task execution and monitoring.   **[2]**

Q4) a)   Describe the structure of Android.   **[4]**

b)   Describe the process of Android application development.   **[2]**

c)   Explain task creation and management in RTOS.   **[4]**

P.T.O.

Q5) a) What are the steps to implement device driver for blinking of LED. **[4]**

b) Explain Linux Kernel construction. **[4]**

c) What are the advantages of Embedded Linux. **[2]**

Q6) a) Explain device driver and its types. **[4]**

b) Explain Linux Kernel initialization. **[6]**

Q7) a) Explain design of Digital Camera. **[6]**

b) Explain importance of EMI/RFI certification in embedded product. **[4]**

Q8) a) Explain automatic metering system in detail. **[8]**

b) Explain types of documents to be prepared for embedded real time product. **[2]**

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[5255]-1044

M.E. (Electronics / Electronics and Telecommunication)
RESEARCH METHODOLOGY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

   1)   *Answer any five questions.*

   2)   *Support your answer with neat diagram if necessary.*

   3)   *Figures to the right indicates full marks.*

   4)   *Assume suitable data if necessary.*

Q1) a)   Explain briefly the different steps involved in a research Process   **[5]**

      b)   Describe the difference between an experimental research and survey **[5]**

Q2) a)   Discuss problems encountered by researchers in our country   **[5]**

      b)   What is research design? Give two functions of research design.   **[5]**

Q3) a)   Explain basic instrumentation scheme with example for experimental research.   **[5]**

      b)   Explain with reference to measurements and statistical analysis -   **[5]**

          i)   Measures of Skewness and

          ii)   Measures of Relationship

Q4) a)   Explain the meaning of Analysis of variance (ANOVA)and explain eight steps of 'ONE WAY ANOVA'   **[5]**

b) With reference to Simple Linear Regression analysis. Explain the terms -**[5]**

    i)   Least Squares Estimation and

    ii)   Coefficients of determination.

Q5) a) Explain in brief 'Interpretation' in the contest of research methodology.**[5]**

    b) Explain the significance of research report and give the various steps in writing research report **[5]**

Q6) a) How to write literature review to develop conceptual framework for research? **[5]**

    b) Explain the process of formulating the research problem **[5]**

Q7) a) How to prepare Institutional Research Proposal to setup research and development cell in your institute? explain with example **[5]**

    b) What are the measures of evaluating the research outcome? **[5]**

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[5255]-1045

M. E. (E&TC) (Microwave)
ELECTROMAGNETICS AND ANTENNA THEORY
(2017 Pattern) (Revised) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

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) a)   Explain the Principle of Pattern Multiplication with reference to the antenna array with the help of mathematical derivation. **[5]**

    b)   Derive the array factor for a linear antenna array with uniform spacing and non uniform amplitude taking the centre as reference for the number of elements to be even and odd. **[5]**

Q2) a)   Sketch the radiation pattern of a linear array with uniform spacing and amplitude and the number of elements to be 6. Assume the distance between the elements to be half wave length. **[5]**

    b)   Design the antenna array using Dolph - Tschebyshceff's procedure for N=6 elements and the side lobe level to be below 26dB. Assume the antenna elements are equi-spaced and half wave length spacing between the elements. **[5]**

Q3) a)   A plane in free space (z≤0)is incident normally on a large block of material with $\varepsilon_r=16,/\mu_r=4$, $\sigma=0$ which occupies (z ≥ 0). If the incident electric field is $\overline{E}=10\sin(4\pi\times10^6 \text{ t}-z)\hat{a}_y$ V/m Find: (i) ω (ii) the standing wave ratio (iii) the reflected magnetic field (iv) the average power density of transmitted wave **[8]**

    b)   State the field equivalence principle and Uniqueness theorem **[2]**

P.T.O.

Q4) a) In a region 1 (z>0), $\bar{B}_1 = 1.2\hat{a}_x + 0.8\hat{a}_y + 0.4\hat{a}_x$ (T) Find $\bar{B}_2$ in region 2 and the angles between the field vectors and a tangent to the interference(z=0).(Assume $\mu_{r1}=1$, $\mu_{r2}=15$). **[6]**

b) Define the following terms with the help of mathematical expressions and illustrative diagrams with reference to an antenna **[4]**

    i) Polarization

    ii) Directivity

    iii) Gain

    iv) Radiation Pattern

Q5) Derive the far field equations for a linear antenna with a length ($l < \lambda/50$) starting from the current distribution. Determine its radiated power and radiation resistance. Also sketch its radiation pattern. **[10]**

$$\overline{\mathbf{H}}$$

Q6) a) Write a short note on Helical antennas discussing structural details, significant parameters, design equations, applications and also sketch the radiation pattern of each antenna. **[5]**

b) A pyramidal Horn of mouth length 10λ cm is fed by a rectangular wave guide in TE_{10} mode. Determine the design parameters of the antenna at operating frequency 2.5GHz. **[5]**

Q7) a) Draw the geometrical diagrams of E-plane, H-plane, Pyramidal, compare them in terms of radiation pattern, gain, directivity. **[5]**

b) Design a rectangular microstrip antenna using substrate with dielectric constant of 3, h=0.15 cm, so as to resonate ate 12 GHz. Also discuss the design procedure. **[5]**

Q8) a) Why is the spiral antenna a broadband antenna? **[2]**

b) Compare the Cassegrain and offset feeding methods for reflector antennas.**[3]**

c) Specify the dimensions of each element of Yagi-Uda antenna in terms of wave length. **[3]**

d) Explain the Babinet's principle and its applications in antenna theory. **[2]**

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[5255]-1046

M. E. (E&TC) (Microwave)
RF AND MICROWAVE CIRCUITS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Solve any five questions.*
2) *Figures on the right indicate full marks.*
3) *Assume suitable data, wherever necessary.*

Q1) a) For an arbitrary N port microwave device, derive the relationship between Transmission (ABCD) matrix and impedance matrix. **[5]**

b) Derive the expressions for Propagation Constant, Impedance, and Power Flow for the Lossless Coaxial Line. **[5]**

Q2) a) A transmission line with a characteristic impedance of $Z_0=50\Omega$ is terminated into the following load impedances : **[5]**

   i) $Z_L = 0\Omega$ (short circuit)

   ii) $Z_L = \infty$ (open circuit)

   iii) $Z_L = 50\Omega$

   iv) $Z_L = (16.67-j16.67)\Omega$

   v) $Z_L = (50+j\,150)\Omega$

b) Consider a load resistance $R_L=100\Omega$ to be matched to a 50Ω line with a quarter-wave transformer. Find the characteristic impedance of the matching section and plot the magnitude of the reflection coefficient versus normalized frequency, f/fo, where fo is the frequency at which the line is $\lambda/4$ long. **[5]**

P.T.O.

Q3) a) Explain with working of following microwave components using proper diagrams : **[5]**

   i) Wilkinson Power divider

   ii) Two hole Coupler

b) Find the scattering parameters of the 3 dB attenuator circuit shown in following figure **[5]**
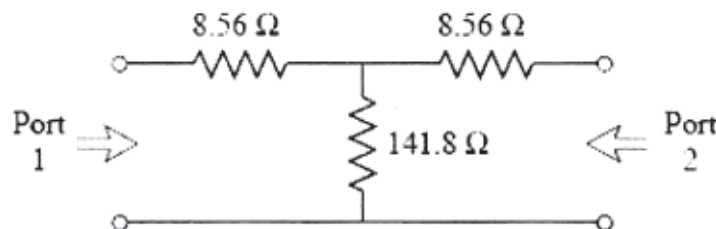
Q4) a) Write a note on dynamic range and sources of noise in microwave circuits.**[5]**

b) Explain the concept of Intersymbol Interference. How ISI affects the wireless communication? Derive expression for Roll of Factor. **[5]**

Q5) a) How RF diode differs from conventional semiconductor diode? Explain construction and working of Schottky diode with related parametric derivation. **[5]**

b) Describe in detail construction and operating principal of PIN diode.**[5]**

Q6) a) A schottky diode is created as an interface between gold contact material and n-type silicon semiconductor. The semiconductor is doped to $N_D = 10^{16} cm^{-3}$ and the work function V_M for gold is 5.1 V.The affinity for Si is $x = 4.05$V. Find the schottky barrier voltage Vd, space charge width ds and capacitance C_J if the dielectric constant of silicon is $\varepsilon_r = 11.9$. Assume cross-sectional diode area to be $A = 10^{-4}$ cm^2 and temperature = 300° K. **[5]**

b) Explain MESFET in terms of Construction, Working & frequency response. **[5]**

Q7) Using signal flow graph of single stage amplifier, derive the following relationships: Incident power to the amplifier P_{inc} available power P_A, Transducer gain G_T and Unilateral transducer gain G_{TU}. **[10]**

Q8) a) Write a note on RF filters **[5]**

b) Design a BJT Colpitts oscillator for 200 MHz in common emitter configuration having bias point of $V_{ce} = 3V$, $I_c = 3mA$. Following circuit parameters are given at room temperature of 25°C. $C_{BC} = 0.1fF$, $r_B = 2 K\Omega$, $r_{CE} = 10K\Omega$, $C_{BE} = 10fF$. If the inductance should not exceed $L_3 = L = 5nH$, Find the values for capacitances in the feedback loop. **[5]**

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[5255]-1047

M. E. (E & TC)

MICROWAVE MEASUREMENT

(2017 Pattern)

Time : 3Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1) Attempt any one Question from Q.1 and Q.2.

    2) Attempt any two Question from Q.3, Q.4 and Q.5.

    3) Attempt any two Question from Q.6, Q.7 and Q.8.

Q1) a) Derive the expression for impedance and reflection coefficient for lossless two conductor transmission line.   **[5]**

    b) Explain with necessary diagram the cross-section of Microstrip transmission line.   **[5]**

Q2) a) Explain the sources of uncertainty in RF and Microwave measurements.**[5]**

    b) Write the Equations for phase-velocity and phase constant for sinusoidal waves of a transmission line.   **[5]**

Q3) Explain the working of a co-axial connectors with diagram. Write the output Equation for co-axial connector.   **[10]**

Q4) What are the different methods to reduce noise. Which factors are considered to calculate signal to Noise ratio.   **[10]**

Q5) Explain the different parameters to be considered for attenuation measurement. Draw a practical circuit to measure attenuation, with graph. **[10]**

Q6) Explain the method of calibration and verification of Automatic Network analyzers. **[10]**

Q7) State the different types of power splitter used in RF power measurement, Explain any one. **[10]**

Q8) Write short note on : **[10]**

a) Networks Analyzers

b) Spectrum 2 Analyzers

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[5255]-1049
M.E. (E & TC) (Signal Processing)
DIGITAL IMAGE AND VIDEO PROCESSING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Neat diagram must be drawn wherever necessary.*
2) *All questions carry equal marks.*
3) *Attempt any five questions.*
4) *Use of electronic calculator is allowed.*

Q1) a) Explain the concept of image sampling and quantization with the help of a suitable sketch. **[5]**

b) What is a wavelet transform? How wavelets are used in signal decomposition? **[5]**

Q2) a) what is a color model? Compare RGB and YIQ color model with respect to its application. **[5]**

b) Define 2D Haar transform and explain its properties. **[5]**

Q3) a) You are given an image that suffers from the following problems related to the image quality. **[5]**

    i) Image does not have enough good contrast. Most of the area in the Image appears to be bright.

    ii) The structure and boundaries in the image are blurred and thus it is hard to see the objects in the image.

    iii) There are random sparse black spots (pepper noise).

Suggest and explain image processing algorithm to enhance the quality for each problem.

b) Explain wiener filter. **[5]**

Q4) a) A 2 × 2 image $f(m,n) = \begin{bmatrix} 4 & 2 \\ 5 & 8 \end{bmatrix}$ is passed through the linear filter

$h = \dfrac{1}{2}\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$, what is the resultant image? (Assume zero padding) **[5]**

b) What is pseudo coloring? give its application. **[5]**

Q5) a) Explain in brief following estimation techniques of the degradation function in image restoration. **[5]**

　　i) By Experimentation,

　　ii) By Observation

b) Explain Homomorphic Filtering. **[5]**

Q6) a) Explain image segmentation based on thresholding. Explain various types of thresholding techniques used in image segmentation. **[5]**

b) Discuss and compare edge detection using following operators. **[5]**

　　i) Sobel,

　　ii) Laplacian

Q7) a) Explain Arithmetic coding and decoding with the help of the example. **[5]**

b) Explain basic operations of morphology and hence explain hit or miss transform and its application. **[5]**

Q8) a) Explain 2D motion tracking. **[5]**

b) Explain 3D subband coding. **[5]**

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[5255]-1051

M.E. (E&TC) (Communication Networks)
MODELLING AND SIMULATION OF COMMUNICATION NETWORKS
(2017 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

 1) Answer any five questions.

 2) Draw neat diagram whenever necessary.

 3) Figures to the right indicate full marks.

 4) Use of electronic pocket calculator is allowed.

Q1) a) What are the aspects for selection of sampling frequency for a simulation? **[4]**

 b) What is random process modeling? How does it differ from modelling of individual blocks? **[4]**

 c) Compare and contrast deterministic and stochastic simulations with suitable examples. **[2]**

Q2) a) Explain Inverse transform method to map uniform random variables to an arbitrary pdf. **[4]**

 b) Explain Rejection Method to map uniform random variables to an arbitrary pdf. **[4]**

 c) Explain what a stationary random process is? Hence explain ergodic random process. **[2]**

Q3) a) What are the various techniques to test random number generators? Explain any one technique in detail. **[4]**

P.T.O

       i)   Scatter plots

       ii)   Durbin-Watson Test

  b)   What are correlated Gaussian numbers? Why do we need them? Explain any one technique to generate correlated Gaussian numbers in detail.**[4]**

  c)   Elaborate various methodologies used in mapping a problem into a simulation model. **[2]**

Q4) a)   What are the different methods to map uniform random variables to an arbitrary pdf? Explain in detail Inverse Transform Method. **[4]**

  b)   Describe the situations when one will choose the following estimation routines based on the data generated by simulation process. **[4]**

       i)   Histogram   ii)   PSD

  c)   What are PN sequence generators? What are the properties of PN sequence generators? **[2]**

Q5) a)   Write an algorithm to estimate value of π using Monte Carlo estimation.**[4]**

  b)   What are the empirical models based on swept tone measurement? Explain any one model in detail. (Poza's model, Saleh's model) **[4]**

  c)   Enlist factors to be considered while simulating nonlinearities. **[2]**

Q6) a)   What is tapped delay line model for LTV system? How various tap gains are generated? **[4]**

  b)   Explain random process model with reference to time varying system.**[4]**

  c)   What are the properties of LTV (Linear Time Variant) System? **[2]**

Q7) a) What are categories of a communication channel? Explain multipath fading in wireless communication channel. **[4]**

b) What are the various parameters that must be considered while simulating a radio channel? **[4]**

c) Compare and contrast discrete memory less channel model and Markov model for discrete channel with memory. **[2]**

Q8) a) Write an algorithm to demonstrate two state Markov model for discrete channel with memory. **[4]**

b) What are different techniques used to reduce run-time of the Monte Carlo method? Hence explain importance of sampling. **[4]**

c) Explain valid and invalid use of tail extrapolation. **[2]**

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[5255]-1052
M.E. (E & TC) (Communication Networks)
HIGH SPEED COMMUNICATION NETWORKS
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Answer five questions.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*

Q1) a) Explain Frame Relay network with an example of its application. **[5]**

b) Explain any two Dynamic Protocols. **[5]**

OR

Q2) a) Discuss various ATM protocols. **[5]**

b) Explain the working with architecture of 802.11. **[5]**

Q3) a) Describe various characteristics of queuing system. **[5]**

b) How is Congestion control done in Frame Relay? **[5]**

Q4) a) Discuss performance of TCP over UBR and ABR. **[5]**

b) Discuss GFR Traffic Management. **[5]**

Q5) a) Describe various ISA components and services. **[5]**

b) Explain Image compression techniques. **[5]**

Q6) a) Discuss basic approaches to Motion estimation. **[5]**

b) Explain H.264/AVC coder. **[5]**

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[5255]-1053

M. E. (E & TC - Communication Networks) (Semester - I)
NETWORK SECURITY
(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Solve any three question from Q1, Q2, Q3 and Q4.*
2) *Question no.5 and 6 are compulsory.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data if necessary.*

Q1) a) Explain Hash Message Authentication Code(HMAC) in detail **[5]**

b) Explain requirements of Web Security. **[5]**

Q2) a) Compare Public key and private key algorithm with example. **[5]**

b) Why there is a need of cyber security for wired and wireless networks? **[5]**

Q3) a) Explain the properties of digital signature. **[5]**

b) Explain Diffie - Hellman algorithm in detail and compare with RSA algorithm. **[5]**

Q4) a) Elaborate on the types of Intrusion Detection Systems. **[5]**

b) What are the different key management approaches and explain anyone in brief. **[5]**

Q5) a) Explain Cyber Security for Voice Over Internet Protocol **[5]**

OR

a) Explain Secure/Multipurpose Internet Mail Extensions (S/MIME) IP security **[5]**

P.T.O.

Q6) Write short notes on any three : [15]

    a)   Secure Hash Function

    b)   SSL/TSL

    c)   Secure Electronic Transaction.

    d)   Security Technology and Protocols

    e)   Cyber Physical System

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[5255]-1054

M. E. (E & TC) (VLSI & Embedded Systems)
DIGITAL CMOS DESIGN
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1)   *Answer any five questions.*
2)   *Assume suitable data if necessary.*
3)   *Neat diagrams must be drawn wherever necessary.*
4)   *Use of nonprogrammable calculator is allowed.*

Q1) a)   What is technology scaling? Explain the types & effects in detail.   **[5]**

     b)   Explain any one type of CMOS fabrication process in detail.   **[5]**

Q2) a)   Derive the expressions for static & dynamic power dissipations in CMOS logic. Compare these dissipations.   **[5]**

     b)   Explore delay estimation techniques in detail.   **[5]**

Q3) a)   Draw ac equivalent ckt of MOSFET & explain various performance parameters.   **[4]**

     b)   Explain various resistances & capacitances pertaining to MOSFET & wire interconnect that are involved in layout.   **[4]**

     c)   Draw layout cross section diagram of CMOS Inverter and mention the dimensions.   **[2]**

Q4) a)   Certain logic has load of 10 pF, supply voltage of 1 Volt & operates at 1GHz. Calculate total dissipation if number of MOSFETs is 100 & leakage current per MOSFET is 1 pA. Calculate power delay product for this logic if propagation delay is 10ps.   **[4]**

     b)   What is cross talk? What are the sources & solutions?   **[4]**

     c)   Write note on fan in & fan out.   **[2]**

Q5) a) Design CMOS logic for Y=ABC + D + EF. Calculate active area. Assume technology of 90 nm. **[4]**

b) Draw a flip flop using Transmission Gates (TG) & its timing diagram.**[4]**

c) Explain the concept of tristate logic? **[2]**

Q6) a) Draw FSM diagram & write HDL code for 1110 Moore sequence detector.**[4]**

b) What are the sources of metastability? What are the solutions? Explore with example. **[4]**

c) What are the merits & demerits of Transmission Gates? **[2]**

Q7) a) With the help of schematic, explain the concept of ratioed ckts. **[4]**

b) Explore domino logic in detail. **[4]**

c) Write note on materials for performance improvement. **[2]**

Q8) a) Explain dynamic ckts. **[4]**

b) What are the methodologies for high speed design? Explain any one of them. **[4]**

c) What is need of BiCMOS? Explain in brief. **[2]**

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[5255]-1055
M.E. (E & TC) (VLSI & Embedded Systems)
RECONFIGURABLE COMPUTING
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Answer any five questions.*
2) *Neat diagram 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) Give Von Neumann computer architecture and explain its flow for program execution. **[4]**

b) Explain Fine grained, Coarse-Grained fabrics in FPGA. **[4]**

c) Write short note on Application specific processor. **[2]**

Q2) a) Explain with diagram single context and multi-context configuration. **[4]**

b) Explain DSP processor as domain specific processor, give example of DSP processor. **[3]**

c) Elaborate application of Reconfigurable Computing **[3]**

Q3) a) With labelled diagram, Explain PAM as Reconfigurable computing platform. **[4]**

b) Explain Pipeline and block Reconfigurable architectures. **[3]**

c) Explain FPGA design flow with necessary diagram **[3]**

Q4) a) Explain Relocation and Defragmentation w.r.t.RC point of view. **[5]**

b) Explain integration of RPF into Traditional Computing Systems. Also explain RaPiD architecture. **[5]**

Q5) a) What is SoPC and explain in detail the main components of system on programmable Chip. **[5]**

b) Explain Non-frequently reconfigurable systems and its application **[5]**

Q6) a) What are the Computational Characteristics and Performance parameters of FPGAs. **[4]**

b) Elaborate with help of diagram the transfer of System from PCB to System on Programmable chip. **[4]**

c) Give various FPGA design tools. **[2]**

Q7) a) Explain pattern matching as application of Reconfigurable Computing. **[5]**

b) Write short note on: Architecture of an adaptive cryptographic system.**[5]**

Q8) a) Elaborate Reconfigurable Computing for Software Defined Radio. **[4]**

b) Explain about Compile-time reconfiguration & Run -time reconfiguration. **[3]**

c) What are the communication protocol involved in a network. **[3]**

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[5255]-1056

M. E. (E & TC) (VLSI & Embedded System)
EMBEDDED SYSTEM DESIGN
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer any five questions from total eight questions.*

2) *Figures to right indicate full marks.*

3) *Assume suitable data if necessary.*

Q1) a)   How the Design metrics of embedded systems are tightly constrained? Justify it.   **[5]**

b)   List the different types of life cycle models in embedded system Design and explain any one in detail.   **[5]**

Q2) a)   Draw and explain the Software architecture Embedded System.   **[5]**

b)   Compare the different types of development Platform Trends in terms of IDE, board details and applications.   **[5]**

Q3) a)   Draw and explain the Cortex Microcontroller Software Interface Standard (CMSIS) structure of Cortex series.   **[5]**

b)   Draw and explain the Architecture of LPC 1768 ARM Cortex-M3 based microcontroller.   **[5]**

Q4) a)   Explain the different features of LPC 1768 ARM Cortex.   **[5]**

b)   Compare the CORTEX based controllers from various manufacturers with respect to different features.   **[5]**

Q5) a)   What is Linux-Kernel configuration? Give steps for Linux Kernel configuration.   **[5]**

b)   Compare the BIOS v/s Boot loader.   **[5]**

Q6) a) Explain how kernel initialization and space initialization is carried out in Embedded Linux. **[5]**

b) Explain file structure and its uses in Embedded Linux. **[5]**

Q7) a) Discuss Digital camera as Embedded system case study with respect to following points: **[7]**

   i) Block diagram

   ii) Design considerations

   iii) Algorithm/flowchart

   iv) O.S.

b) Explain reliability and failure analysis of embedded systems. **[3]**

Q8) a) Discuss an automated meter reading (AMR) as case study with respect to following points : **[7]**

   i) Block diagram

   ii) Design considerations

   iii) Algorithm/flowchart

   iv) O.S.

b) Explain testing and documentation for embedded system? **[3]**

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[5255]-1057

M.E. (Electrical - Control System)
OPTIMIZATION TECHNIQUES IN CONTROL SYSTEM
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Answers Qu 1 or 2, Qu 3 or 4, Qu 5 or 6, Qu 7 or 8.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right side indicate full marks.*

    4)   *Use of Calculator is allowed.*

    5)   *Assume Suitable data if necessary.*

Q1) Explain what do you understand by local, Global extremum and unimodal function. **[9]**

<div align="center">OR</div>

Q2) Use the Lagrange multiplier approach to minimize the function **[9]**

$F(x) = 4x_1^2 + 5x_2^2$ subjected to $g(x) = 2x_1 + 3x_2 - 6 = 0$.

Q3) Find the maximum of $f = X(1.5 - X)$ in the interval 0 - 1 within 10% of exact value by Dichotomous search method. **[9]**

<div align="center">OR</div>

Q4) Write & Explain Revised Simplex method for solving LPP. **[9]**

Q5) Explain the multistage Decision process in dynamic programming. **[16]**

<div align="center">OR</div>

Q6) Explain the concept of suboptimization and principle of optimality used in multistage decision problem. **[16]**

Q7) a) Explain the integer nonlinear programming. **[8]**

b) Write and explain Dynamic programming. **[8]**

OR

Q8) Minimize $\qquad f = -3x_1 - 4x_2$ **[16]**

Subject to $\qquad 3x_1 - x_2 + x_3 = 10$

$\qquad\qquad\qquad 3x_1 + 11x_2 + 2x_4 = 64$

$x_i \geq 0$, i = 1 to 4 and x_i is integer

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[5255]-1058

M.E. (Electrical) (Control System)
AUTOMATION IN MANUFACTURING
(2017 Pattern)

Time : 3 Hours]   **[Max. Marks : 50**

Instructions to the candidates:

1)   *Answer any three questions from question 1 to 4.*

2)   *Question Nos. 5 and 6 are compulsory.*

3)   *Neat diagrams must be drawn wherever necessary.*

4)   *Figures to the right indicate full marks.*

5)   *Use of logarithmic tables, electronic pocket calculator and steam tables is allowed.*

Q1) What is meant by "relay"? Explain the difference between relay and contactor classify relays. Explain in detail bimetallic overload relay and latching relay with their applications.   **[6]**

Q2) Explain with neat diagram the construction and working of stepper motor. Write equation for step angle. State the advantages and applications of stepper motor.   **[6]**

Q3) State and explain the reasons for servicing of compressed air in pheumatic control system. Explain what is meant of FLR unit. Explain the filter unit in detail.   **[6]**

Q4) Explain the terms cyber physical system and cyber physical production system. Explain the two main functional components of cyber physical system & its architecture. State the advantages of cyber physical system in manufacturing.   **[6]**

Q5) a) Explain basic process of digital manufacturing in detail. **[10]**

b) Write note on reverse engineering. **[6]**

Q6) a) Explain the benefits of industry-4.0 promises for small-medium enterprises. **[10]**

b) What is industry - 4.0 approach and its goal? Which any four main characteristics of industry 4.0. Explain product differentiation and cost cutting. **[6]**

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[5255]-1059

M.E. Electrical (Control System)
NON LINEAR CONTROL SYSTEM
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

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

Q1) a) What is mean by non linear control system? Discuss classification of nonlinear control system with suitable examples. **[6]**

b) Explain Delta method for constructing a phase plane trajectory. **[6]**

c) A linear second order servo is described by the equation : **[6]**

$\ddot{e} + 2\zeta w_n \dot{e} + w_n^2 e = 0$

Where $\zeta = 0.15$, $w_n = 1$ *rad / sec*, $e(0) = 1.5$ and $\dot{e}(0) = 0$ Determine the singular point. Construct the phase trajectory, using the method of isoclines.

OR

Q2) a) Explain different singular points for non-autonomous system. **[6]**

b) Explain describing function for dead- zone nonlinearity. **[6]**

c) Explain the terms in the sense of Liapunov. **[6]**

    i) Stability

    ii) Asymptotic stability

    iii) Global Asymptotic stability

Q3) a) Explain feedback linearization in sliding mode control techniques. **[8]**

b) Explain methods for elimination of chattering phenomenon in sliding mode control. **[8]**

OR

Q4) a) Explain the terms : **[8]**

   i) Sliding surface.

   ii) Reaching phase.

   iii) Multidimensional sliding modes

b) Explain concept of sliding modes in variable structure systems. **[8]**

Q5) a) Explain sliding mode control design method based on decoupling principle. **[6]**

b) Explain sliding mode control design technique in relay system. **[10]**

OR

Q6) Write short note on :

a) Effect of matched uncertainty **[8]**

b) Reachability condition for single input case **[8]**

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[5255]-1061

M.E. (Electrical) (Power Systems)
COMPUTER APPLICATIONS IN POWER SYSTEM
(2017 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

   1)   *Neat diagrams must be drawn wherever necessary.*

   2)   *Figures to the right indicate full marks.*

   3)   *Use of calculator is allowed.*

   4)   *Assume Suitable data, if necessary.*

Q1) a)   Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ using steepest descent method. Perform single iterations. **[6]**

    b)   Define the following terms : **[3]**

       i)   Objective function

       ii)   Design Vector

       iii) Design Surface

<div align="center">OR</div>

Q2) a)   Find the minima of $f(X) = x_1^2 + x_2^2 - 2x_1 + x_1x_2 + 1$. **[6]**

    b)   What is difference between direct and indirect search methods of optimization. **[3]**

Q3) a)   Write stepwise algorithm used in decoupled load flow method. **[6]**

    b)   What are the notations used in three phase load flow method? **[3]**

Q4) a) Derive the residual equations used in AC-DC load flow method for converter. **[6]**

b) What are the assumptions made in fast decoupled load flow method? **[3]**

Q5) a) The cost characteristic of two units in a plant are **[8]**

$$C_1 = 0.4P_1^2 + 160P_1 + K1\,Rs/h$$
$$C_2 = 0.45P_2^2 + 120P_2 + K2\,Rs/h$$

where P_i is power generated by i^{th} station in MW. Find the optimal load allocation between the two units, when the total load is 162.5 MW. What will be the daily loss if the units are loaded equally.

b) Explain solution economic load dispatch problem using Newton-Raphson method. **[8]**

OR

Q6) Incremental cost of two units in a plant are **[16]**

$$IC_1 = 0.8P_1 + 160 \text{ Rs/MWh}$$

$$IC_2 = 0.9P_2 + 120 \text{ Rs/MWh}$$

where P_i is power generated by i^{th} station in MW. The maximum and minimum load allocation on each unit is 20MW and 100MW respectively. For following load curve find optimal allocation of load between the generating units with incremental cost.
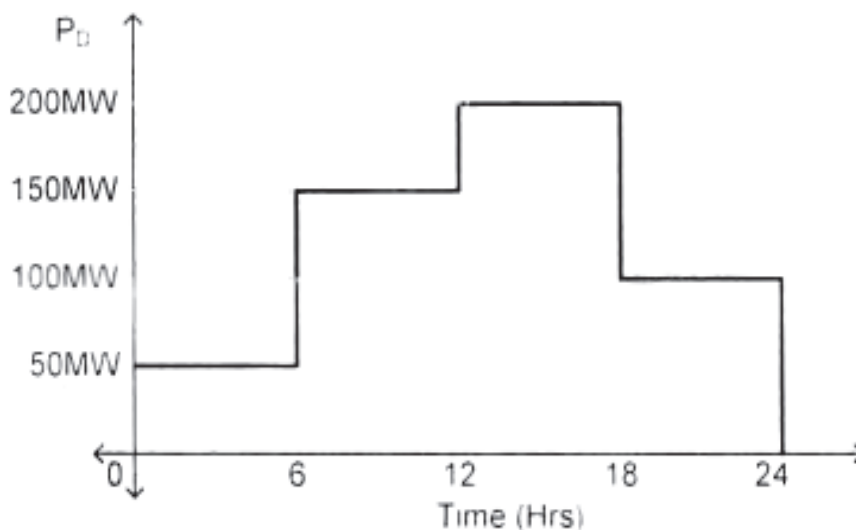
Q7) a) The transmission loss coefficients B_{mn} expressed in MW^{-1} of a power system network having three plants are given by **[8]**

$$B = \begin{vmatrix} 0.0001 & -0.00001 & -0.00002 \\ -0.00001 & 0.0002 & -0.00003 \\ -0.00002 & -0.00003 & 0.0003 \end{vmatrix}$$

Three plants supply power of 100MW, 200MW and 300MW respectively into the network. Calculate the transmission loss and incremental transmission losses of the plant.

b) Explain economical load dispatch for active and reactive power balance. **[8]**

OR

Q8) a) Show that transmission loss formula is a function of generation and load. **[8]**

b) Derive transmission loss coefficient using sensitivity factor. **[8]**

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[5255]-1062

M.E. (Electrical Power Systems)
POWER SECTOR ECONOMICS AND MANAGEMENT
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*

2) *Figures to the right side 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) Attempt any three of the following   **[18]**

a)   What are the challenges before India Power sector undergoing reforms?.

b)   For an initial investment of Rs. 1500000 for project the net returns for six years are Rs. 300000. The available discounting factor is 12% . Calculate net present value of the project. Also state economic viability of the project.

c)   Explain the regulatory process in India.

d)   Explain the factors to be considered while deciding tariff for renewable energy sources such as wind and solar energy.

e)   What are the responsibilities of ISO in restructured power industry? Explain model of ISO which includes power exchange as an integral part of it.

f)   What is Market Power? Why it exists? How to exercise the same?

Q2) a) Explain future contract market. Also explain characteristics spot market.**[8]**

b) What are ancillary services? Why these are required? How these are acquired? **[8]**

OR

Q3) a) Discuss operation of power market and also explain factors affecting market operation. **[8]**

b) Explain forward market and option contracts. **[8]**

Q4) a) Explain different methods for pricing transmission services. **[8]**

b) How game theory methods are useful for planning operation of power system? **[8]**

OR

Q5) a) What are transmission rights? Explain the effect these on operation of power network. **[8]**

b) Discuss availability based tariff. How it is useful in operation of power network? **[8]**

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[5255]-1063

M.E. Electrical Power Systems
POWER SYSTEM MODELING

(2017 Pattern)

Time : 3 Hours]   *[Max. Marks :50*

Instructions to the candidates:

    1)   *Solve Total Three questions. Answer 1 question from Q 1 and Q2, Q3 or Q4, and Q5 or Q6 each.*

    2)   *Assume suitable data, if necessary.*

    3)   *Write down all the assumptions made.*

    4)   *Given $F^{abc} = [p] F^{dq0}$, Where Park's transformation.*

$$[P] = \begin{bmatrix} k_d \cos\theta & k_q \sin\theta & k_0 \\ k_d \cos\left(\theta - \dfrac{2\pi}{3}\right) & k_q \sin\left(\theta - \dfrac{2\pi}{3}\right) & k_0 \\ k_d \cos\left(\theta + \dfrac{2\pi}{3}\right) & k_q \sin\left(\theta + \dfrac{2\pi}{3}\right) & k_0 \end{bmatrix}$$

$$\left(where, K_d = K_q = \sqrt{2/3} \, and \, K_0 = \sqrt{1/3}\right)$$

Q1)   A synchronous machine is having one damper winding on *d-* axis and two damper windings on *q-* axis. Derive the stator and rotor voltage equations in dq_0 frame of reference for this machine. Write down assumptions involve in it.   **[18]**

OR

Q2) Derive the model of phase shifting transformer having complex turns ratio of $n = n\angle\alpha$. Explain, what turns ratio need to be maintained for phase shifting transformer for symmetrical network of the power system. Discuss difference between tap changing and phase shifting transformers. **[18]**

Q3) Write down a working of d.c. generator exciter excitation control scheme of alternator. Also state and explain modifications needed in developing dc exciter with pilot exciter scheme and its working. Draw appropriate diagrams. **[16]**

OR

Q4) Write down a working of static excitation control scheme of alternator. Draw appropriate diagram. Discuss difference between static and rotating diode type excitation control scheme. **[16]**

Q5) With the help of appropriate transformation using α-β variables, develop the model of long transmission line. Discuss about the assumptions and approximations involved in it. **[16]**

OR

Q6) Explain various types of static load modeling used in power system. Discuss the assumptions and approximations involved in static load modeling. **[16]**

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[5255]-1064

M.E. (Electrical)

RESEARCH METHODOLOGY

(2017 Pattern) (Power System)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) *Attempt any three questions from question 1 to 4.*
2) *Question Nos. 5 to 6 are compulsory.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of logarithmic tables slide rule, pocket calculator and is allowed.*
6) *Assume suitable data if necessary.*

Q1) Explain different types of research. **[6]**

Q2) Write the structure and components used for writing thesis. **[6]**

Q3) Explain the terms citation Index, i 10 index, H index. **[6]**

Q4) Write down linear programming problem in standard form along with characteristics of linear programming problem. Also write the transformations required in problem for writing it in standard form. **[6]**

Q5) a) Explain the simplex method of optimization of linear programming problem. **[12]**

b) Define the terms basic solution, basic feasible solution, non degenerate basic feasible solution and optimal solution. **[4]**

Q6) What do you understand by genetic algorithm of optimization? Explain how it is different from the other methods of optimization. **[16]**

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[5255]-1065

M.E. (Electrical) (Power Electronics and Drives)
LINEAR SYSTEMS THEORY AND DESIGN
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer all questions.*
2) *Figures to the right side indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of logarithmic tables, electronic pocket calculator and steam tables is allowed.*

Q1) a)   If $a = 3i - j + 2k$ and $b = i + 3j - 2k$ **[4]**

   i)   Calculate the dot product $e = a.b$ and cross product $d = a \times b$.

   ii)   Show that the vector d is orthogonal to the vector $c = 9i + 2j + 2k$.

   b)   For the two bases for R^2, $B = \{(1, -1), (0, 6)\}$ and $C = \{(2, 1), (-1, 4)\}$, Find the Transition matrix from B to C.   **[5]**

<div align="center">OR</div>

Q2) a)   For the vectors $a = 2i + 4j - 3k$ and $b = i + 3j + 2k$, find the angle between the vectors using the dot product and direction cosines.   **[4]**

   b)   For the vectors $v_1 = (1, 0, 0)$, $v_2 = (1, 1, 0)$ and $v_3 = (0, 1, 0)$ **[5]**

   i)   Describe the span of these vectors

   ii)   Determine if this set of vectors will be a basis for R^3

Q3) a)   Solve the following set of equations using the matrix method and confirm your answer through the Gaussian elimination method.   **[6]**

$x + 3y + 2z = 3$

$2x - y - 3z = -8$

$5x + 2y + z = 9$

b) For the following data set : **[6]**

Mass	$0 \leq x < 20$	$21 \leq x < 40$	$40 \leq x < 60$	$60 \leq x < 800$	$80 \leq x < 100$
Number of fruits	10	18	24	14	8

    i) Construct a frequency density table.

    ii) Determine the modal class.

    iii) Use the mid-point interval to calculate the mean

c) For the matrix B test for orthogonality and skew symmetry **[3]**

$$B = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix}$$

Q4) a) A continuous random variable has the following probability function :**[6]**

X(x)	0	1	2	3	4	5	6	7
p(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

    i) Find k

    ii) Evaluate $p(x < 6)$, $p(x \geq 6)$ and $p(0 < x < 5)$

    iii) If $p(X \leq x) > 0.5$, find the minimum value of x.

b) Lengths of metal strips are normally distributed with a mean length of 150cm and standard deviation 10cm. Find the probability that the length is **[5]**

    i) Shorter than 165 cm

    ii) Within 5cm of the mean

c) In an examination, the mean mark obtained was 64.5 and variance 64. The mean mark for 100 scripts is denoted by $\overline{X}$. Find **[5]**

    i) $P(\overline{X} > 65.5)$

    ii) $P(63.8 < \overline{X} < 64.5)$

OR

Q5) **a)** The random variable X is distributed normally such that X ~ N(50,20). Find **[6]**

    i) $P(X > 60.3)$

    ii) $P(X < 59.8)$

b) The Chi-square test is an important test performed in statistics.

    i.   Describe the importance and process of the Chi-square test

    ii.   A group of 256 artists were surveyed to find out their zodiac signs. The results are Aries (29), Taurus (24), Gemini (22), Cancer (19), Leo (21), Virgo (18), Libra (19), Scorpio (20), Sagittarius (23), Capricorn (18), Aquarius (20) and Pisces (23).

       Calculate the Chi-square statistic for this data. **[10]**

Q6) **a)** Successive masses of 1 kg each were added at the hook at the lower end of a vertically hanging wire. The position of a mark at the lower end was measured using an ordinary scale. The following results were obtained.**[8]**

Load (x) kg	1	2	3	4	5	6	7	8	9	10
Mark (y) cm	6.05	6.20	6.25	6.35	6.40	6.50	6.55	6.60	6.70	6.75

Determine the equation of the best fitting straight line using :

    i)   Graphical method

    ii)   Method of sequential differences

b) In an air cooled engine cylinder simulation study, a circular cooling fan was heated in the central region and placed in an air stream. Ten thermocouples were placed at equal distances radially on the fin for temperature measurement. During a test run, the following data was obtained:

Radius (R) cm	Temperature (T) °C
2	75.5
4	73.1
6	70.5
8	67.7
10	64.2
12	62.1
14	59.4
16	57.2
18	54.8
20	52.2

Determine the coefficients for the curve of the form $T = C0 + C1R$ using **[8]**

i)   Method of extended differences

ii)   Method of least squares

[5255]-1066

M.E. (Electrical) (Power Electronics & Drives)
MODELING AND ANALYSIS OF ELECTRICAL MACHINES
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
2) *Figures to the right indicate full marks.*
3) *Use of calculator is allowed.*
4) *Assume suitable data if necessary.*

Q1) a) Derive equations for steady state speed and torque and discuss steady state and transient analysis of the dc motor. **[9]**

b) Draw and explain Primitive machine. Draw the Kron's Machine model for 3 phase Induction motor. **[9]**

OR

Q2) a) Explain d-q model of three-phase induction motor in arbitrary reference frame. **[9]**

b) Derive the transformations for currents between a rotating 2-phase and a pseudo-stationary 2-phase winding. Show that the transpose of current transformation matrix is equal to its inverse. **[9]**

Q3) a) Explain how Park's transformations transform equations in [a, b, c] variables to [d, q, 0] variables. **[8]**

b) Discuss voltage equations in the dynamic model of synchronous machine in arbitrary reference frame. **[8]**

OR

Q4) a) Obtain an expression for instantaneous torque in 3-phase salient-pole synchronous machine. Use impedance matrix to derive the same. **[8]**

b) Derive equations for armature to field mutual inductances and armature self inductances for a salient pile synchronous machine. **[8]**

Q5) a) Discuss the method to linearise dynamic model of induction motor. **[8]**

b) Explain theory of small displacement stability and Eigen values. **[8]**

OR

Q6) a) Discuss linearised model of synchronous machine. **[8]**

b) Write short notes on linearised model of 3-phase induction machine.**[8]**

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[5255]-1067

M.E. Electrical (Power Electronics & Drives)
POWER CONVERTERS - I
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.

    2)   Figures to the right indicate full marks.

    3)   Use of electronic calculator is allowed.

    4)   Assume suitable data if necessary.

Q1) a) Draw and explain static V-I characteristics of a Silicon controlled rectifier (SCR) **[10]**

    b) The Buck regulator has an input voltage of Vs =12V. The required output voltage is Va=5 V at R=500 Ω and peak to peak output ripple voltage of 20mV the switching frequency is 25kHz. If the peak to peak ripple current of L is limited to 0.8 A, Determine **[8]**

        i)   The duty cycle

        ii)   The filter inductance

        iii) The filter capacitance

OR

Q2) a) Explain the working of a Single Phase fully controlled bridge converter supplying RLE load with a neat diagram and waveform. Derive the expression for average output voltage. **[10]**

    b) With a block diagram and waveforms explain the working of a full bridge voltage source inverter. **[8]**

Q3) a) A 230 V 1kW electric heater is fed through AC voltage controller from 230V, 50Hz Ac supply. Find the load power for a firing angle delay of 70 degrees. **[8]**

b) Compare triac based voltage regulator and AC voltage regulator with two SCR's connected in antiparallel. **[8]**

OR

Q4) a) Explain integral control method and Phase angle control method in a single phase AC/AC voltage regulator. **[8]**

b) With circuit diagram and relevant waveforms explain the working of a single phase voltage controller with resistive load. **[8]**

Q5) a) With a neat diagram and relevant waveform explain the working of a single phase to single phase step up midpoint type cycloconverter. **[8]**

b) With a neat diagram and waveforms explain the working of three-phase to single phase cycloconveter. **[8]**

OR

Q6) a) With a neat diagram and relevant waveform explain the working of a single phase to single phase bridge type cycloconverter. **[8]**

b) The input voltage of the cycloconverter is 120V (RMS), 60Hz. The load resistance is 5 ohms and the load inductance is L= 40mH. The frequency of the output voltage is 20Hz. If the converter are operated as semi converters such that $0<=\alpha<=\pi$ and ther delay angle $\alpha_p =2 \pi/3$. Determine **[8]**
  i) The RMS value of the output Voltage(V_0)
  ii) RMS current of each thyristor I_R
  iii) The input Power Factor

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[5255]-1068

M.E. (Power Electronics and Drives)
RESEARCH METHODOLOGY
(2017 Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Attempt Q.1 OR Q. 2, Q.3 OR Q.4, Q.5 OR Q.6.*

    2)   *Figures to the right indicates full marks.*

    3)   *Assume suitable data if necessary.*

Q1) a) Explain the detailed procedure of inserting figures and making tables in report writing while using LATEX documentation tool. **[6]**

    b) Justify the necessity of literature review in formulation of research problem. **[4]**

    c) Discuss the various ways in which research misconduct can take place. **[4]**

    d) With reference to data processing and analysis explain the following operations : **[4]**

        i) Editing

        ii) Coding

OR

Q2) a) How LATEX tool is used in writing the supplementary parts of report such as list of symbols, list of tables, annexure? **[4]**

    b) What are the objectives and motivation of research? **[4]**

    c) What are the methods of data collection? Explain any one. **[4]**

    d) Explain different aspects of Intellectual property rights. **[6]**

Q3) a) What are the different funding agencies and different schemes for carrying out engineering research? **[8]**

b) Explain the following types of papers to report the research work : **[8]**

    i) Poster Paper

    ii) Survey Paper

OR

Q4) a) Explain the different steps involved in preparation of research proposal. **[8]**

b) Compare conference paper and journal paper. **[8]**

Q5) a) Explain the technique and importance of oral presentation of research findings. Is only oral presentation sufficient? If not, Why? **[8]**

b) Explain the significance of research report and give the detailed structure and components of technical report. **[8]**

OR

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

    i) Bibliography and its importance in the context of research report

    ii) Referencing and footnotes in the context of research report

b) What are different types of reports? Compare them. **[6]**

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[5255]-1069

M.E. (Instrumentation & Control - Process Instrumentation)
MATHEMATICAL METHODS IN INSTRUMENTATION
(2017 Pattern) (Semester - I)

Time : 2 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Answer any five questions.*

    2)   *Assume suitable data if necessary.*

    3)   *Figures to the right side indicate full marks.*

    4)   *Use of Calculator is allowed.*

Q1) a)   Determine basis and dimension of vectors $(3,8,-3,-5)$, $(1,-2,5,-3)$, $(2,3,1,-4)$ in a vector space $V = R^4$. **[4]**

    b)   Show that the vectors $(1,1,1)$, $(1,1,0)$, $(1,0,0)$ is linearly independent in R^3. **[4]**

    c)   Define linear combination of vector with suitable examples. **[2]**

Q2) a)   Let $\bar{v}_1 = \left(\dfrac{1}{\sqrt{2}}, 0, \dfrac{1}{\sqrt{2}}\right)$ $\bar{v}_2 = \left(-\dfrac{1}{\sqrt{2}}, 0, \dfrac{1}{\sqrt{2}}\right)$ be an orthonormal set of vectors in R^3, if $\bar{u} = (1, 2, 3)$ find orthogonal projection $\bar{u}$ on W and orthogonal component of $\bar{u}$ to W. **[5]**

    b)   Use Gram-Schmidt process to transform the basis $\{(1, 1, 1), (0, 1, 1), (1, 2, 3)\}$ for R^3 into an orthogonal basis for R^3. **[5]**

Q3) a)   Find square root of 18 by Newton Raphson method. **[3]**

    b)   Solve by Gauss-Seidal iteration method **[5]**

        $20x_1 + x_2 - 2x_3 = 17,$

        $3x_1 + 20x_2 - x_3 = -18,$

        $2x_1 - 3x_2 + 20x_3 = 25.$

    c)   Explain Role of Numerical method in Process Instrumentation. **[2]**

Q4) a) Determine the value of y when x = 0.1 ,by Euler modified method given

that $\frac{dy}{dx}=1+xy$, y(0) = 1 and h = 0.1. **[5]**

b) Between 2 P.M. and 3 P.M. The average number of phone call per minute coming into company are 3. Find the probability that during one particular minute , there will be 2 or less calls. **[5]**

Q5) a) Let X be a random variable define by a density function **[5]**
$f(x) = e^{-x}$, $x \geq 0$ and f(x) = 0, otherwise. Find
   i) E(X),
   ii) E(X²).

b) Explain the terms : **[5]**
   i) Moments
   ii) Moments Generating Function.

Q6) a) A joint PDF of two continuous random variable X and Y is : **[6]**
$f(x, y) = c(2x + y)$, $0 < x < 1$, $0 < y < 2$ and $f(x, y) = 0$, otherwise
   i) Find the value of constant C

   ii) Find $p\left[X > \frac{1}{2}, Y < \frac{3}{2}\right]$.

b) Define addition and multiplication theorems of probability. **[4]**

Q7) a) Explain skewness and kurtosis of with suitable examples. **[5]**

b) Let R^4 have a Euclidean inner product, Find the cosine of angle between the vectors $\overline{u} = (-1, 2, 3, 4)$ and $\overline{v} = (4, 1, 2, 1)$. **[5]**

Q8) a) Find singular value decomposition of the matrix : **[5]**

$$A=\begin{bmatrix} 2 & -1 \\ 2 & 2 \end{bmatrix}$$

b) Assume that the mean height of a soldiers to be 68.22 inches with variance 10.8 inches. How many soldiers in a regiment of 10,000 would you expect to be over 6 feet tall. Area at (z = 1.15) = 0.3749. **[5]**

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[5255]-1070

M.E. Instrumentation & Control (Process Instrumentation)
TRANSDUCER DESIGN

(2017 Pattern) (Semester - II)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
    1)   *All questions are compulsory.*
    2)   *Neat diagram must be drawn whenever necessary.*
    3)   *Figure to the right candidates indicate full marks.*
    4)   *Use of electronic pocket calculator.*
    5)   *Assume suitable data, if necessary.*

Q1) Attempt any two of the following :

    a)   Give detail classification of transducers with examples. **[5]**

    b)   List different pressure transducers. Explain design aspects of any one electrical type pressure transducer. **[5]**

    c)   With neat sketch explain different signal conditioning circuits used for conversion of resistance in to voltage. **[5]**

Q2) Attempt any two of the following :

    a)   Explain requirements of different electronics circuits for transducer design. **[5]**

    b)   Design temperature indicator for 0-200°C range using Pt-100 RTD. **[5]**

    c)   Explain design of level measurement system using potentiometer in detail. **[5]**

Q3) Attempt any two of the following :

    a)   List different Biosensors and explain each sensors application. **[5]**

    b)   Write note on Chemical sensors and its application. **[5]**

    c)   Give different types gas sensors with their applications. **[5]**

Q4) Attempt any two of the following :

    a)   What is SMART sensor? Explain any SMART sensor in detail.   **[5]**

    b)   Write note on Recent trends in sensor technology.   **[5]**

    c)   Explain manufacturing process of MEMS with neat sketch.   **[5]**

Q5) Attempt any two of the following :

    a)   Explain different types of sensors used in home automation application.

            [5]

    b)   List transducers used in aerospace. Explain any two in detail.   **[5]**

    c)   Discuss role of sensors in automobile application.   **[5]**

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[5255]-1071

M.E. Instrumentation & Control (Process Instrumentation)
INDUSTRIAL AUTOMATION

(2017 Pattern) (Semester - I)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　　*[Max. Marks : 50*

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) a) Discuss in brief with suitable block diagram any two major components of the DCS. **[5]**

　　b) Describe the data flow and number conversions involved in PLC analog operation. **[5]**

Q2) a) Draw a famous automation hierarchy for an industrial application. Explain the function of each level of automation hierarchy. **[5]**

　　b) Explain with an example 'Sequential Function Chart'. **[5]**

Q3) a) Explain working principle of HART protocol in detail. **[5]**

　　b) Explain in brief calibration of Profibus. State advantages of Profibus.**[5]**

Q4) a) Explain with example Process Hazard Analysis. **[5]**

　　b) Explain in brief application of safety system. **[5]**

Q5) a) Describe in brief SCADA systems in terms of their architecture and interface to process hardware. **[5]**

　　b) Discuss the various selection criteria that must be considered for selection of a suitable PLC for a specific process control. **[5]**

Q6) a) Explain in brief different types of Sequencer. **[5]**

b) Develop Programmable Ladder diagram for mixing of two liquids as per below

Sequence: When the start P.B. is pressed, the inlet valve A switches ON till the middle level sensor has not sensed the liquid. When middle level is sensed inlet valve B switches ON till the high level sensor has not sensed the liquid. Then the motor spins the stirrer for 10 seconds for mixing of both the liquids. After this drain valve switches ON and remains on till the low level is not reached. **[5]**

Q7) a) List and define the various major types of PLC analog inputs and outputs. **[5]**

b) The input sensor signal varies from 0 to 1.1 Amp. If the sensor signal exceeds 0.5 Amp blue lamp must be turn on. Further, if the sensor signal is between 0.8 to 1.1 Amperes red lamp must go on. Develop programmable ladder diagram for the same. **[5]**

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[5255]-1072

M.E. (Process Instrumentation & Control)
RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer any five questions.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data, if necessary*

Q1) a) What are different types of research? Give examples for each. **[5]**

   b) Distinguish between research method and methodology. **[5]**

Q2) a) Write a short notes on (any one) **[5]**

   i) Criteria of good research

   ii) Motivation in Research

   b) Explain primary and secondary data collection methods. **[5]**

Q3) a) Enlist Static and dynamic characteristics of instruments used in experimental set up. **[5]**

   b) Use following data to workout linear regression analysis. **[5]**

Sr. No.	Price	Sales
1	140	110
2	160	90
3	180	80
4	200	75
5	220	70

Find linear regression equation, Coefficient of correlation.

P.T.O.

Q4) a) Write a short notes on Sensitivity theory. **[5]**

b) Write a short notes on asymptotic analysis. **[5]**

Q5) a) Distinguish between the following : **[5]**

Simple hypothesis and composite hypothesis.

b) Explain hypothesis testing with different types. **[5]**

Q6) a) Explain the different sections / formats in a project proposal. **[5]**

b) Enumerate the different methods of collecting data. **[5]**

Q7) a) Describe the layout of research proposal. **[5]**

b) Explain different steps in writing research report. **[5]**

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[5255]-1073

M.E. (Computer Engineering)
RESEARCH METHODOLOGY
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   All questions are compulsory.

    2)   Figures to the right indicate full marks.

    3)   Draw neat diagrams wherever necessary.

Q1) a)   Define "Research". Explain the significance of Engineering Research for the society with examples.   **[9]**

<div align="center">OR</div>

     b)   What are specific characteristics of Engineering Research? Comment on desired outcomes from Engineering Research with examples.   **[9]**

Q2) a)   What is Code of Ethics? State Major ethical expectations by IEEE code of Ethics from the Engineering researchers.   **[8]**

<div align="center">OR</div>

     b)   What are various methods of publishing Research outcomes? How the impact of publication is validated?   **[8]**

Q3) a)   Give the use of following statistical methods in data analysis.   **[8]**

       i)   ANOVA

       ii)   t-test

       iii) Partial correlation coefficients

       iv) Curve Matching

<div align="center">OR</div>

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

       i)   PSPP

       ii)   SOFA

       iii) AQUAD

       iv) CAT

Q4) a) What do you mean by optimization? Explain use of Monte Carlo method for optimization with examples. **[9]**

OR

b) Explain the Simplex optimization Method with example. What are merits and demerits of Simplex method? **[9]**

Q5) a) State and explain the process of selection of respondents for the survey state the general survey Guidelines. **[8]**

OR

b) State the guidelines for ensuring the Quality of Research paper. What are expectations for research presentation? **[8]**

Q6) a) What are methods to report research findings? What are guidelines for ensuring the Quality of thesis? **[8]**

OR

b) Comment on (any two): **[8]**

i) IPR in India

ii) In PASS

iii) US Patent

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[5255]-1074

M.E. (Computer Engineering)

BIO - INSPIRED OPTIMIZATION ALGORITHMS

(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   ***Q. No. 7 is compulsory, solve any 5 from Q. No 1 to Q. No.6***

    2)   ***Neat diagram must be drawn whenever necessary.***

    3)   ***Figures to the right indicate full marks.***

    4)   ***Assume suitable data, if necessary.***

Q1) a) Illustrate hill climbing heuristic. **[4]**

    b) Define self organization. Discuss characteristics of self organization. **[4]**

Q2) a) Write pseudocode of Evolutionary Algorithm. **[4]**

    b) Discuss selection and crossover of Evolutionary Strategies. **[4]**

Q3) a) Interpret the biological terminology into Ant Colony Optimization and Ant Clustering Algorithm. **[4]**

    b) Illustrate optimization of neural network weights using particle swarm optimization. **[4]**

Q4) a) Discuss self tuning framework and self tuning of firefly algorithm. **[4]**

    b) Write pseudocode of Cuckoo search algorithm and discuss idealized rules of Cuckoo search algorithm. **[4]**

Q5) a) Discuss procedure to implement monitoring phase of Negative Selection Algorithm. **[4]**

    b) Summarize aiNet learning algorithm. **[4]**

Q6) a)   Is it possible to recognize emotions from behavioral pattern? Justify using virtual environment and virtual agent.   **[4]**

b)   Discuss architecture of Framstick.   **[4]**

Q7) a)   Describe briefly Ant system for travelling salesman problem.   **[6]**

b)   Discuss scope of Artificial Immune System.   **[4]**

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[5255]-1075

M.E. (Computer Engineering)

SOFTWARE DEVELOPMENT AND VERSION CONTROL

(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*

2) *Figures to the right indicate full marks.*

3) *Assume suitable data if necessary.*

Q1) What are the characteristics of Object Oriented frameworks? How black box and white box frameworks relate in object oriented design of software systems? **[9]**

OR

Q2) a) With the help of suitable figure, explain the various viewpoints of the design model. **[5]**

b) How will you measure design quality? Explain. **[4]**

Q3) What is product line Engineering? How will you handle the systematic reuse problem in order to develop a software product? **[8]**

OR

Q4) What are the various components which represent the architecture view model of a software system? **[8]**

Q5) a) How will you document architecture in agile project? **[4]**

b) Explain the architecture reconstruction process. **[4]**

OR

Q6) a) Explain the attribute driven design method. **[4]**

b) How do document the behavior while building the documentation package? **[4]**

Q7) a) What are the core considerations for scaling the build function? **[4]**

b) What are the criteria for selection of a build tool for your software project? **[4]**

OR

Q8) What are the various types of change controls? **[8]**

Q9) a) Explain the weaknesses of a distributed version control. **[4]**

b) Explain the following commands with respect to centralized version control. **[4]**

i) Commit

ii) Revert

OR

Q10) a) Explain the goals of version control system. **[4]**

b) Explain the following commands with respect to distributed version control. **[4]**

i) Pull

ii) Clone

Q11) a) Explain the following with respect to Apache Subversion. **[6]**

     i)   Merge Tracking.

     ii)   File Locking

     iii) Commit

   b) Explain the features of Git. **[3]**

<div align="center">OR</div>

Q12) a) Explain the differences between Git and Mercurial. **[6]**

   b) Explain the features of Bazzar. **[3]**

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Total No. of Questions : 12]

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[5255]-1076

M.E. (Computer Engineering)
EMBEDDED AND REAL-TIME OPERATING SYSTEM
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt: Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8 Q.No. 9 or Q.No. 10, Q.No. 11 or Q.No. 12.*
2) *Figures to the right indicate full marks.*
3) *Draw neat diagram wherever necessary.*
4) *Make suitable assumptions wherever necessary.*

Q1) With the help of neat diagram, describe different characteristics of embedded systems. **[8]**

OR

Q2) Explain with example two software tools used for designing embedded systems. **[8]**

Q3) It is required to design a real time data acquisition system. For this application select the appropriate processor / microcontroller based on : **[8]**

a) Instruction cycle time

b) Bus width

c) Number of interrupts

d) On-chip RAM, ROM/Flash memory

OR

Q4) Name and explain power management modes of Bluetooth. **[8]**

Q5) Compare of ISA and PCI buses based on the features such as data rate, data size, connector size and applications. **[9]**

OR

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Q6) What do you mean by SPI and SCI? Explain them with the help of interfacing signals. **[9]**

Q7) What are the three important categories of parameters which characterize a task? Also explain the importance of these parameters in describing the behaviour of the task. **[8]**

<div align="center">OR</div>

Q8) What is precedence graph and task graph? Give details. **[8]**

Q9) What is basic priority-inheritance protocol? State the rules governing current priorities of real-time tasks and their scheduling. **[9]**

<div align="center">OR</div>

Q10) How ISR work in RTOS environment? How does it deviate from expected behaviour? Explain using neat diagrams. **[9]**

Q11) Name resource models for multiprocessor system? Give details of any one of them. **[8]**

<div align="center">OR</div>

Q12) Explain different architectures for inter-processor communication. **[8]**

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[5255]-1077

M.E. (Computer Networks)
RESEARCH METHODOLOGY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Solve Q1 or Q2,Q3 or Q4,Q5 or Q6, Q7 or Q8,Q9 or Q10, Q11 or Q12.*
2) *Figures to right indicate full marks.*

Q1) Explain in detail the flow chart of Research Process?   **[10]**

OR

Q2) Write Short Note on :

    i)   Objectives of research;   **[5]**

    ii)   Motivation in research.   **[5]**

Q3) Explain Various Research grants and funding resources for research?   **[8]**

OR

Q4) Explain suitable research proposal in terms of title, details, budget and design for outcomes.   **[8]**

Q5) Explain the various sources of error and uncertainty in measurement.   **[8]**

OR

Q6) Explain One-way (or single factor) ANOVA technique ?   **[8]**

Q7) Explain Monte Carlo optimization technique in detail?   **[8]**

OR

Q8) Write short notes on Google Optimization Tool Open MDAO.   **[8]**

Q9) Explain why a good literature survey is important to narrow the research problem and the technique that might be used [5]. **[8]**

<div align="center">OR</div>

Q10) Explain importance of Statistical analysis and Reporting in research? **[8]**

Q11) Define and Explain significance of IPR, Copyright and Patents in research?**[8]**

<div align="center">OR</div>

Q12) Explain technique of interpretation? What are precautions needed in interpretation? **[8]**

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[5255]-1078

M.E. (Computer Engineering) (Computer Networks)
NETWORK SECURITY
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

   1)   *Attempt Q. No.1 or 2, Q. No.3 or 4, Q, No.5 or 6, Q. 7 or 8, Q. 9 or 10, Q. 11 or 12.*

   2)   *Figure to the right indicates full marks.*

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Assume suitable data, if necessary.*

Q1) What is threat? State and explain four primary classes of threats to network security?   **[9]**

OR

Q2) How to Detect and Prevent Black Hole Attack in Mobile Ad Hoc Networks?**[9]**

Q3) Who are hackers? List different types of hackers and their intention. Explain tools used for hacking.   **[8]**

OR

Q4) Write short note on :   **[8]**

   a)   Spoofing and decoy scans

   b)   Evading firewalls.

Q5) What social engineering is? List different forms of social engineering? Explain any one form of social engineering in detail?   **[8]**

OR

Q6) What is Cross-Site Scripting (XSS) attack? What are different types of cross-site scripting (XSS) attacks?   **[8]**

Q7) What is man-in-the-middle(MITM) attack? Which are the different related types of attacks, explain in detail? **[8]**

OR

Q8) What is SQL injection? Explain different ways to defend against SQL injection attacks. **[8]**

Q9) What is Ack-storm DoS attacks? How it can be launched? How Ack-DoS attacks can be prevented? **[8]**

OR

Q10) State and explain OS Fingerprinting Techniques. How Passive Fingerprinting works? Explain any two Fingerprinting Defenses? **[8]**

Q11) What is Intrusion Detection Systems? What is Host-based IDS? Give an example. **[9]**

OR

Q12) What is Confidentiality Attacks in Wi-Fi? Can Wire shark be used as tools for confidentiality? If yes explain how? **[9]**

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[5255]-1079
M.E. Computer (Computer Networks)
WIRELESS SENSOR NETWORKS
(2017 Pattern)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

    1) *All questions are compulsory.*

    2) *Neat diagrams must be drawn wherever necessary.*

    3) *Assume suitable data, if necessary.*

Q1) a) Discuss process of aggregate data from a sensor network with Syntax of an SQL query. **[6]**

    b) Explain One-shot interactions using Disseminating big data sets via SPIN. **[6]**

OR

Q2) a) Draw the Architecture of a wireless sensor node and explain sensing subsystem in detail. **[6]**

    b) Discuss Challenges and Constraints of WSN. **[6]**

Q3) a) Describe the problems in using CSMA as a medium access control mechanism in aWSN. **[6]**

    b) Describe LEACH operations a setup phase and a steady-state phase with figure. **[6]**

OR

Q4) a) Explain most important properties of localization and positioning procedures. **[6]**

    b) Explain Multihop range estimation using Euclidean distance estimation in the absence of direct connectivity example, also comment on "DV- Hop" and "DV-Distance" methods. **[6]**

Q5) a) Explain several data transport tasks to provide Reliability requirements in sensor networks. **[7]**

b) Explain Single packet delivery using a single path, is it efficient to use only end-to-end acknowledgments? **[6]**

OR

Q6) a) In Pump Slowly Fetch Quickly (PSFQ) block delivery in the sink-to-sensors protocol how a duplicate packet, an in-sequence packet and an out-of-order packet in handled. **[7]**

b) Explain mechanisms for congestion detection and congestion handling in WSN. **[6]**

Q7) a) Explain with figure examples of attacks and the CIA model. **[6]**

b) Discuss various challenges of providing security in Wireless Sensor Networks. **[7]**

OR

Q8) Write Short Notes on (ANY TWO) : **[13]**

a) Physical Layer and Link layer DoS attacks.

b) TinySec and Localized Encryption and Authentication Protocol (LEAP) protocols.

c) Security attacks on Routing and on Transport Layer.

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[5255]-1080

M.E. (Computer Networks)
HIGH PERFORMANCE NETWORKS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *All questions are compulsory.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Write a short onte on :   **[4]**

    i)   802.11

    ii)   802.16

  b) Draw TCP/IP protocol stack and explain all layers.   **[4]**

OR

Q2) a) Distingwish between ATM and MPLS.   **[4]**

  b) Write a short note on :   **[4]**

    i)   SONET

    ii)   ISDN

Q3) a) Draw architecture Gigabit Ethernet and explain in detail.   **[4]**

  b) Explain Gigabit Ethernet physical layer.   **[4]**

OR

Q4) a) Describe in detail Ethernet frame structure.   **[4]**

  b) Explain Ethernet 10/100/1000.   **[4]**

P.T.O.

Q5) a) Write a note on Router Architecture. **[5]**

b) Explain in detail how Packet Scheduling is done in Router. **[4]**

<div align="center">OR</div>

Q6) a) Explain in detail how Resource Allocation is done in Router. **[5]**

b) Write a short note on : **[4]**

i) Input Port Processor (IPP)

ii) Output Port Processor (OPP)

Q7) a) Explain in details MPLS forwarding operation. **[5]**

b) Explain any two MPLS Encapsulation Standards. **[4]**

<div align="center">OR</div>

Q8) a) Explain considerations in the choice of Cells Vs Frames. **[5]**

b) What are the MPLS Distribution Control Protocol Attributes? **[4]**

Q9) a) Write a note on All-optical Switch. **[4]**

b) Explain structure of Optical Cross Connets (OXCs). **[4]**

<div align="center">OR</div>

Q10) a) Write a note on Optical Networking Devices. **[4]**

b) Explain Wavelength Allocation in networks . **[4]**

Q11) a) Explain in brief Borderless Network Architecture. **[4]**

b) Explain Campus Network Design Models. **[4]**

<div align="center">OR</div>

Q12) a) List and explain design principles of Campus Network. **[4]**

b) Write a note on Borderless Campus Network Design. **[4]**

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[5255]-1081

M.E. (Information Technology)

MATHEMATICAL FOUNDATION OF INFORMATION TECHNOLOGY

(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Assume suitable data, if necessary.*

    3)   *Neat diagrams must be drawn wherever necessary.*

    4)   *Figures to the right indicate full marks.*

Q1) Solve any two :

    a)   A graph containing m edges $\{e_1, e_2, ... e_m\}$ can be decomposed into $2^{m-1} - 1$ different ways into pairs of sub graphs g_1 and g_2. **[5]**

    b)   A binary communication channel carries data as one of two types of signals denoted by 0 and 1. Owing to noise, a transmitted 0 is sometimes received as a 1 and a transmitted 1 is sometimes as a 0. For a given channel, assume a probability of 0.94 that a transmitted 0 is correctly received as a 0 and a probability of 0.91 that a transmitted 1 is received as a 1. Further, assume a probability of 0.45 of transmitting a 0. If a signal is sent, determine: **[5]**

        i)   Probability that a 1 is received.

        ii)   Probability that a 0 is received.

        iii)   Probability that a 1 was transmitted, given that a 1 was received.

        iv)   Probability that a 0 was transmitted, given that a 0 was received.

        v)   Probability of error.

    c)   Var $[X+Y]$ = Var$[X]$ + Var$[Y]$, if X and Y are independent random variables. **[5]**

Q2) Solve any two :

a) Suppose on an average I house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during a year? **[5]**

b) The following mistakes per page were observed in a book, **[5]**

No. of mistakes per page	0	1	2	3	4
No. of times of mistakes occurred	211	90	19	5	0

Fit a Poisson distribution of fit data.

c) State and prove Global Convergence Theorem. **[5]**

Q3) Solve any two :

a) Given a linear program instandard form, **[5]**

$$minimize\ c^Tx$$

$$subject\ to\ Ax = b,\ x > = 0$$

where A is an m×n matrix of rank m. Prove that,

i) if there is a feasible solution, there is a basic feasible solution;

ii) if there is an optimal feasible solution, there is an optimal basic feasible solution.

b) The discretized membership functions for a transistor and a resistor are given below : **[5]**

$$A=\left\{\frac{0.2}{1}+\frac{0.3}{2}+\frac{0.4}{3}+\frac{0.5}{4}\right\}$$

$$B=\left\{\frac{0.1}{1}+\frac{0.2}{2}+\frac{0.2}{3}+\frac{1}{4}\right\}$$

Perform following fuzzy operation (i) Algebraic sum (ii) Algebraic product (iii) Bounded sum (iv) Bounded difference.

c) Discuss Fuzzy Bayesian Decision making in detail. **[5]**

Q4) Solve any two :

a) Consider a two fuzzy sets,   **[5]**

$A = \left\{ \dfrac{0}{0.2} + \dfrac{0.8}{0.4} + \dfrac{1}{0.6} \right\}$ and $B = \left\{ \dfrac{0.9}{0.2} + \dfrac{0.7}{0.4} + \dfrac{0.3}{0.6} \right\}$, using Zadeh's notations, express the fuzzy sets into λ-cut sets for $\lambda = 0.4$ and $\lambda = 0.7$ for the following operations,

   i) $\overline{A}$

   ii) $\overline{B}$

   iii) $A \cup B$

   iv) $A \cap B$

   v) $\overline{A} \cup \overline{B}$

   vi) $\overline{A} \cap \overline{B}$

b) Discuss in detail Messy Genetic algorithm.   **[5]**

c) Discuss different crossover operations in Genetic Algorithms.   **[5]**

Q5) Solve any two :

a) Two random variables have the regression equations, $3X + 2Y - 26 = 0$ and $6X + Y - 31 = 0$, Find the mean values and the coefficient of correlation between X and Y. If the variance of $X = 25$, find the standard deviation of Y from the data given above.   **[5]**

b) Based on information on 1000 randomly selected fields about the tenancy status of the cultivation of these fields and use for fertilizers, collected in an agro-economic survey, the following classification was noted,   **[5]**

	Owned	Rented	Total
Using Fertilizers	416	184	600
Not using fertilizers	64	336	400
Total	480	520	1000

Would you conclude the owner cultivation are more inclined towards the user of fertilizers at 5% level? Carry out chi-square test as per testing procedure.

c) Suppose a compute has found, for a given set of values of X_1, X_2 and X_3, $r_{12} = 0.9l$, $r_{13} = 0.33$, $r_{23} = 0.81$. Explain whether these computations may be said to be error free.   **[5]**

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[5255]-1082
M.E. (Information Technology)
ADVANCE SOFTWARE ENGINEERING AND PROJECT MANAGEMENT
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *Attempt any five questions.*
2) *Numbers on right hand indicates full marks.*
3) *Assume suitable data wherever required and clearly state assumption in answer.*

Q1) a) Enlist and Differentiate Various Prescriptive Software Process Models. **[5]**

b) Elaborate the difference in Software Requirement Specification and Elicitation? **[5]**

Q2) a) Differentiate between the descriptive and Operational Software Specifications with stating advantages of Operational Specifications for Software. **[5]**

b) Enlist and Elaborate Basic Rules for Designing the Software User Interface. **[5]**

Q3) a) Define Agile Software Development Methodology and Explain SCRUM. **[5]**

b) State the Significance of Use Case Diagrams in Software Design, elaborating the types of Use Case to Use case relationship. **[5]**

Q4) a) Explain the difference among PERT, CPM, GERT Project Scheduling Techniques. **[5]**

b) Draw the simple network diagram and find out the critical path of the following software project using CPM (Critical path Method) **[5]**

Project Task	A	B	C	D	E	F
Predecessor Task	-	A	A	B	C	D,E
Duration in Days	16	17	10	7	14	5

Q5) a) Write short notes on the following: **[5]**
   i)   Software Code Cloning Vs Software Refactoring
   ii) RMMM (Risk Mitigation, Monitoring, Management)

   b) Explain Ishikawa's seven tools of Software project management   **[5]**

Q6) a) Write short notes on the following.   **[5]**
   i)   Software Quality and configuration management
   ii) Process attributes

   b) Explain Real-time Software Engineering   **[5]**

Q7) a) Explain Agents and Mobile Agents in Software Engineering.   **[5]**
   b) Explain Distributed Software Engineering.   **[5]**

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[5255]-1083

M.E. (Information Technology)
APPLIED ALGORITHMS
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

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) *Assume suitable data, if necessary.*

Q1) a) What is complexity of an algorithm? How it is measured? **[4]**

     b) Explain the standard complexity classes with example. **[3]**

     c) What you mean by empirical measurements of performance? **[3]**

Q2) a) What is recurrence relation? Explain master theorem to solve recurrences.**[3]**

     b) Explain homogeneous recurrence relation with example. **[3]**

     c) Write Tower of Hanoi algorithm and analyze its time complexity. **[4]**

Q3) a) What is Bipartite graphs? Explain its application. **[3]**

     b) What is rooted and binary trees? Write an algorithm for kruskal's minimal spanning tree using greedy approach. **[4]**

     c) Write and explain Floyd Warshall algorithm with example. **[3]**

Q4) a) What is max-flow min-cut theorem? Explain with example. **[4]**

     b) What is Backtracking Strategy? Explain Hamiltonian circuits with example using Backtracking. **[4]**

     c) Write a Randomized algorithm to test whether a number is a prime. **[2]**

P.T.O.

Q5) a) Write an algorithm to check whether any pair of segments intersects.**[5]**

b) What is Rabin-Karp algorithm? Write and explain with example. **[5]**

Q6) a) What is non-deterministic algorithms? Explain different classes of non-deterministic Algorithms. **[5]**

b) What is Approximation algorithms? Explain various Approximation algorithms. **[5]**

Q7) a) Explain properties of B-trees and write insert operation of B-trees. **[5]**

b) What is persistent data structures? Write delete operation of singly linked list. **[5]**

Q8) a) Draw and explain models for parallel computing algorithms. **[5]**

b) What is online algorithm? Explain online Euclidean spanning tree problem solved by the greedy method. **[5]**

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[5255]-1084

M.E. (Information Technology)
RESEARCH METHODOLOGY
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *All questions are compulsory.*

2) *Neat diagrams must be drawn wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

Q1) a) Describe the various classification of research. Differentiate between fundamental research and action research. Elaborate your answer with examples. **[5]**

b) Briefly describe the different steps involved in a research process. What are the techniques involved in defining a research problem? **[5]**

Q2) a) Indicate the main characteristics of a good hypothesis and uses of a hypothesis in various types of research studies. Differentiate between alternative hypotheses and null hypotheses. **[5]**

b) Define the term 'Review of literature', how is it different from traditional meaning? Enumerate the objectives and significance of review of literature. **[5]**

Q3) a) Enumerate the different methods used for collecting data. Explain its merits and demerits. **[5]**

b) What are the main purposes and functions of a data analysis? **[5]**

Q4) a) What do you understand by research report or thesis? Indicate its need and importance in the research work. Indicate the general format of research report. **[5]**

b) What do you understand by the Research proposal? Give the structure of Research proposal. Enumerate the criteria for evaluating the Research proposal. **[5]**

Q5) a) What is meant by Intellectual property? What are Intellectual Property rights? Why does intellectual property need to be promoted and protected? **[5]**

b) Copyright protects the rights of authors. How an author has been defined under the Copyright Act? Briefly explain the procedure relating to registration of copyright. **[5]**

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[5255]-1085

M.E. (Chemical)

MATHEMATICAL AND STATISTICAL METHODS

(2017 Pattern) (Theory)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Answer any five questions from the following.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right side indicate full marks.*

    4)   *All questions carry equal marks.*

    5)   *Assume Suitable data if necessary*

Q1) a)   Solve the differential equation by Power series method   **[5]**

$$y'' + y' = 0$$

    b)   Solve the differential equation :   **[5]**

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 6e^x$$

Q2) a)   Discuss various characteristics of power series techniques?   **[6]**

    b)   Write note on criteria for critical point stability.   **[4]**

Q3) a)   Obtain the Partial differential equation in two dimensions for wave equation.   **[5]**

    b)   Write a note on series of complex terms.   **[5]**

Q4) a)   Find the Laurent and Taylor series expansion of   **[5]**

$$f(Z) = \frac{-2Z + 3}{Z^3 - 3Z + 2}$$

    b)   Discuss the solution techniques using Laurent series techniques?   **[5]**

Q5) a) If the chance that one of the ten telephone lines is busy at an instant is 0.2. **[6]**

     i) What is the chance of that 5 of the lines are busy?

     ii) What is the most probable number of busy lines and what is the probability of this number?

  b) Discuss the bivariate and multiple regression techniques? **[4]**

Q6) a) Fit a binomial distribution to the data : **[6]**

X:	0	1	2	3	4	5
F_0:	38	144	342	287	164	25

  b) Discuss the procedure for factorial experiment design approach? **[4]**

Q7) a) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference in the proportions are significant? **[5]**

  b) What types of errors are associated in testing hypothesis? **[3]**

  c) Distinguish between experimental and extraneous variables. **[2]**

Q8) a) Discuss the various types of Correlation. **[5]**

  b) Obtain the equation of two lines of regression for the following data. Also obtain the estimate of X for Y = 70. **[5]**

X:	65	66	67	67	68	69	70	72
Y:	67	68	65	68	72	72	69	71

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Total No. of Questions : 8]

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[5255] - 1086
M.E. (Chemical)
PROCESS OPTIMIZATION
(2017 Pattern)

Time :3 hours]   **[Max. Marks :50**

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) a)   Explain convex and concave function.   **[5]**

     b)   Explain constrained optimization.   **[5]**

Q2) a)   Draw the flow chart for implementing Fibonacci method.   **[5]**

     b)   Explain the algorithm for Newton-Raphson method.   **[5]**

Q3) a)   Explain the attributes of the process affecting costs/profits make them attractive for the application of optimization.   **[5]**

     b)   Discuss the degree of freedom analysis with suitable example.   **[5]**

Q4) a)   Explain the application of optimization in fitting vapor-liquid equilibrium data.   **[5]**

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

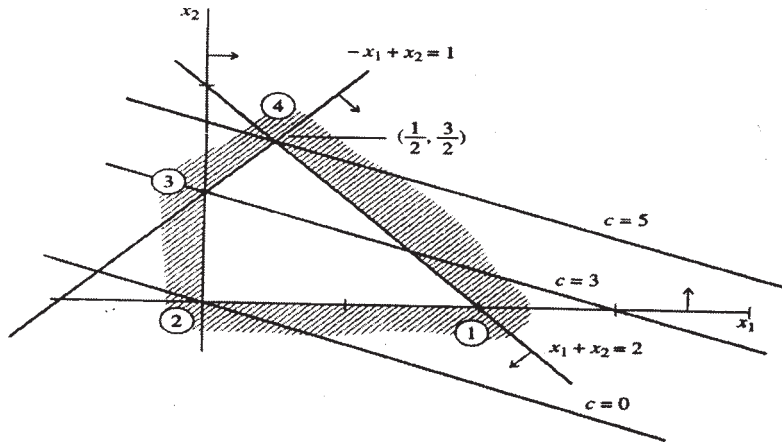**Q5)** a)   Consider the problem illustrated geometrically in the following. Figure given in relations as.

P.T.O.

Maximize: $f = x_1 + 3x_2$

Subject to: $-x_1 + x_2 + x_3 \quad = 1$

$\qquad x_1 + x_2 \quad + x_4 = 2$

$\qquad x_1 \geq 0, \, i = 1, \, \ldots, 4$

Where x_3, x_4 are slack variables. Solve for the maximum using the simplex method. **[10]**

Q6) Explain in detail the reduced gradient method for optimization. **[10]**

Q7) State various conditions of definiteness of a function using Hessian matrix. Find whether the following function is strictly convex/ strictly concave

$f(x) = 2x_1^2 + 5x_1 x_2 + 12x_1 + 13x_2 - 4x_2^2 + 9$ **[10]**

Q8) Write short notes on. **[10]**

a) Parameters used in reactor optimization.

b) Nonlinear constraints.

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[5255]-1087

M.E. (Chemical)
ADVANCED SEPARATION PROCESSES
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Answer any five questions.*

    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) Describe the construction of following membrane modules -   **[10]**

    a)   Spiral wound module.

    b)   Tubular module.

Q2) a)   Explain conventional filtration and membrane filtration process. How membrane separation processes are classified?   **[8]**

    b)   Differentiate between equilibrium governed separation processes and rate governed separation processes.   **[2]**

Q3) a)   Explain Supercritical fluid extraction.   **[2]**

    b)   Which are the driving forces used in membrane processes? Explain with suitable example.   **[8]**

Q4) Describe brief about classification of various chromatographic techniques. Describe HPLC with principle, working mechanism along with typical schematic diagram.   **[10]**

Q5) a) Briefly explain mass diffusion. Give the equations for separability and maximum theoretical separative capacity. **[7]**

b) Explain liquid membranes. **[3]**

Q6) What are different types and choice of adsorbents and adsorption isotherms? Discuss brief about the design procedure of adsorption column. **[10]**

Q7) a) Explain the concept of reactive distillation with suitable example. **[5]**

b) Explain the theory behind cross flow filtration. What are the various resistances in CFF? **[5]**

Q8) a) Explain symmetric and asymmetric membranes. **[5]**

b) Write a note on oil spill management. **[5]**

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[5255]-1088

M.E. (Chemical)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

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) a) Elaborate on applied and fundamental type of research. **[5]**

    b) Explain in detail on "Development of working hypotheses" **[5]**

Q2) a) Explain time-series analyses with a suitable example. **[5]**

    b) In a small scale manufacturing concern, the daily demand for product follows uniform distribution as presented below. **[5]**

$$P(x) = \frac{1}{(450 - 230)}, \quad 230 \le x \le 450$$
$$= 0, \quad \text{otherwise}$$

If the service level of satisfying the demand of the canteen is 0.8, find the highest possible demand which can be satisfied with respect to the service level (cumulative probability)

Q3) a) Justify "Design of experiments generates information on the effect various factors have on a response variable". **[5]**

    b) Write an explanatory note on factorial (2^K) design. **[5]**

Q4) a)   The bar graph given below shows the sales of a local manufacturing company (in thousand number) from six branches of company during two consecutive years 2015 and 2016. **[7]**

Sales of product (in thousand numbers) from Six Branches B1, B2, B3, B4, B5 and B6 of the Company in 2015 and 2016 is shown in figure.

   i)   What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?

   ii) Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?

   iii) What percent of the average sales of branches B1, B2 and B3 in 2016 is the average sales of branches B1, B3 and B6 in 2015?

   iv) What is the average sales of all the branches (in thousand numbers) for the year 2015?
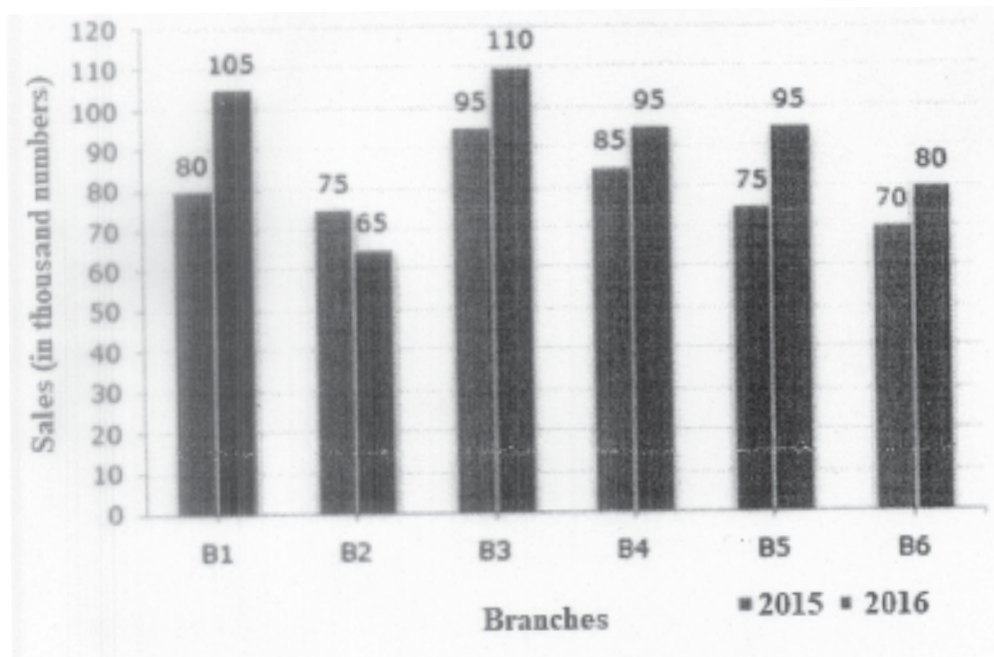
b)   Define frequency distribution and percent frequency distribution.   **[3]**

Q5) a)   What is Histogram? With a neat sketch explain three shapes of histogram.   **[6]**

b)   Elaborate on necessity of selection of choosing the right graph.   **[4]**

Q6) a) What is the significance of research report? Explain the various steps in writing a research report. **[5]**

b) Enlist the precautions for writing a research report. **[5]**

Q7) a) Write an explanatory note on preparation of research presentation. **[5]**

b) Explain the significance of bibliography in writing a research report. **[5]**

Q8) a) Explain in detail Process of Patenting and Development. **[5]**

b) What are the type of patent and the application procedure. **[5]**

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[5255]-1089

M.E. (Environmental Engineering) (Chemical)
APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

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) *Your answers will be valued as a whole.*
  5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
  6) *Assume Suitable data, if necessary.*

Q1) a) Find out the value of quartile deviation and its coefficient from folloiwng data : **[5]**

Roll No.	1	2	3	4	5	6	7
Marks	20	28	40	12	30	15	50

  b) Distinguish between mean deviation and standard deviation. **[5]**

Q2) a) Discuss the procedure for calculating the mean from ungrouped data.**[5]**
  b) Explain coefficient of variance. **[5]**

Q3) a) Two laboratories carry out independent estimates of a particular chemicals in a medicine produced by a certain firm. A sample is taken from each batch, halved and the separate halves sent to the two laboratories. **[5]**
  The following data is obtained :
  No. of samples = 10
  Mean value of the difference of estimates = 0.6
  Sum of the square of difference = 20
  Is the difference significant ?
  Data : value of *t* at 5% level for *g* d.f. is 2.262.
  b) Explain Chebyshev's theorem to demonstrate how σ or σ^2 is indicative of the speed or dispersion. **[5]**

P.T.O.

Q4) a) What types of errors are associated in testing of hypothesis. **[5]**

b) Explain the tests of significance for attributes. **[5]**

Q5) a) Elaborate model equation for lotin square design. **[5]**

b) Explain correlation and Regression analysis. **[5]**

Q6) a) What is multiple regression. **[5]**

b) Explain stepping stone method. **[5]**

Q7) a) Explain stratified sampling and systematic sampling. **[5]**

b) Write note on Degeneracy in transportation problem. **[5]**

Q8) a) What is the function of minimum ratio vule in the Simplex method. **[5]**

b) Explain the degenracy in Simplex method. **[5]**

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[5255] - 1090

M.E. (Chemical) (Environmental Engineering)
ENVIRONMENTAL MANAGEMENT
(2017 Pattern)

Time :3 hours]   *[Max. Marks :50*

Instructions to the candidates:
1) *Answer any five questions.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Explain the National and International environmental management standards for Chemical Industries. **[5]**

b) Discuss various environmental management tools is detail. **[5]**

Q2) a) Discuss trade and environmental management. **[5]**

b) Explain EIA evaluation in India. **[5]**

Q3) a) Explain environmental auditing objectives and its scope. **[5]**

b) What are the features of the directive principles of state policy? **[5]**

Q4) a) Discuss the role of the Parliamentary committees, when a bill is issued in Parliament to become an act. **[4]**

b) Explain command and control regulations. **[3]**

c) What are the different environmental acts. **[3]**

Q5) a) Discuss safety related rules. **[5]**

b) Explain a general procedure for Risk assessment. **[5]**

Q6) a) Enlist different factory act passes by Indian parliament. **[4]**

b) Give the difference between regulations and laws. **[3]**

c) Explain the steps in rule notification. **[4]**

Q7) a) Explain the role of Central Pollution contral Board for sustainable growth. **[5]**

b) Discuss carbon trading. **[5]**

Q8) a) Explain the role of Ministry of forest for conservation of environment. **[5]**

b) Discuss the general features of annual report of Ministry of Environment. **[5]**

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[5255] - 1091
M.E. Chemical (Environmental Engineering)
ENVIRONMENTAL CHEMISTRY
(2017 Pattern)

Time :3 hours] *[Max. Marks :50*

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 logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.

   5)   Assume suitable data, if necessary.

Q1) What is Stoichiometry? Explain its role on Environmental Chemistry in detail.
   [10]

Q2) What are the various Water quality parameters? Explain its environmental significance.   **[10]**

Q3) Write notes on i) photochemical smog. ii) Greenhouse gases.   **[10]**

Q4) What is the cause of alkalinity of soils? What are the disadvantages of alkaline soils?   **[10]**

Q5) What is Nano material? Explain its use in Environmental Engineering.   **[10]**

Q6) What is CO_2 capture mechanism?   **[10]**

Q7) What are different Air Quality parameters. Explain in detail.   **[10]**

Q8) What is cation exchange capacity? How to determine it.   **[10]**

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Total No. of Questions : 8]

P4441

SEAT No. :

[Total No. of Pages : 2]

[5255] - 1092
M.E. (Chemical Environmental Engineering)
RESEARCH METHODOLOGY
(2017 Pattern)

Time :3 hours]   *[Max. Marks :50*

Instructions to the candidates:

    1)   *Attempt any 5 questions.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right indicate full marks.*

    4)   *Assume suitable data, if necessary.*

Q1) a)   Discuss the Objectives and types of research.   **[5]**

       b)   Explain in detail with diagram different steps in "Research Methodology".   **[5]**

Q2) a)   What is inductive method and deductive method in research? Explain with flow chart.   **[5]**

       b)   Discuss the criteria for choice of topic of research.   **[5]**

Q3) a)   How to collect data and represent it in different forms. Which is best suited for engineering research.   **[5]**

       b)   How do you estimate mean deviation? Sum of squares between samples and sum of squares within sample.   **[5]**

Q4) a)   Explain how to carry out linear regression analysis using computer program. What is the significance of R^2 value?   **[5]**

       b)   Discuss the Fundamentals of statistical analysis and inference.   **[5]**

Q5) Explain the Factorial experimental design and discuss about the Designing Engineering experiments.   **[10]**

P.T.O.

Q6) Explain the different formats in a project proposal. Discuss about the estimation of budget for the proposed project? Enlist the various funding agencies. **[10]**

Q7) Explain the difference in journal publications, conference paper and short communication. Discuss about the Impact Factor of a journal. **[10]**

Q8) Explain the term IPR. Which are different categories of IPR. Discuss the different steps involved in obtaining patent. **[10]**

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[5255]-1093

M.E. (Production) (Common to CAD/CAM & Manu. & Auto. Engg.)
MATHEMATICS & STATISTICS
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:
1) *Answer any 5 Questions Out of 8 Questions.*
2) *Neat diagrams should be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *All questions carry equal marks.*
5) *Use of Logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6) *Assume Suitable data, if necessary.*

Q1) a) Show that $u = y^3 - 3x^2y$ is a harmonic function. Find its harmonic conjugate And the corresponding analytic function in terms of z.   **[5]**

     b) Evaluate, $\oint_C \dfrac{z^2 + z + 1}{(z-1)} dz$ where C is the contour   **[5]**

         i) $|z-1|=1$

         ii) $|z|=\dfrac{1}{2}$

Q2) a) A mass, suspended at the end of a light spring having spring constant k, is set into vertical motion. Use Lagrange's equation, to find the equation of motion of the mass.   **[5]**

     b) Find the extremals of the functional   **[5]**

$$\int_{x_1}^{x_2} (y'^2 / x^3)dx$$

Q3) a) Solve the partial differential equation

$\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = 0 = y$, $x = 3 = y$ with $u = 0$ on the boundary and the mesh length $= 1$. **[5]**

b) Solve

$\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = \sin \pi x$, $0 \le x \le 1$; $u(0, t) = u(1, t) = 0$.

carry out computations for two levels taking $h = \dfrac{1}{3}, k = \dfrac{1}{36}$. **[5]**

Q4) a) By using series expression for $J_n(x)$ derive **[5]**

$$J_n(x) = \frac{x}{2n}\left[J_{n-1}(x) + J_{n+1}(x) \right]$$

b) Show that Rodrigueg's formula is given by **[5]**

$$p_n(x) = \frac{1}{n! 2^n} \frac{d^n}{dx^n} \left(x^2 - 1 \right)^n$$

Q5) a) A machinist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts show a mean diameter 0.742 inch with a standard deviation of 0.04 inch. On the basis of this sample, would you say that the work is inferior? Given that t at 5% level of significance for 9 degrees of freedom is $t_{0.05} = 2.262$. **[5]**

b) A set of five similar coins is tossed 320 times and the results is **[5]**

No. of heads :   0   1   2   3   4   5

Frequency :   6   27   72   112   71   32

Test the hypothesis that the data follow a Binomial distribution

Given for 5 degree of freedom $\chi_{0.05}^2 = 11.07$

Q6) a) Discuss the transformation $w = \sqrt{z}$. **[5]**

b) The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured, find the probability that **[5]**

i) Exactly two will be defective

ii) At least two will be defective

Q7) a) Fit a Poisson distribution to the set of observations : **[5]**

x :   0   1   2   3   4

f :   46   38   22   9   1

b) Find the bilinear transformation which maps the points **[5]**

$z = 1, i, -1$ onto the points $w = 0, 1, \infty$

Q8) a) A continuous random variable has probability density function **[5]**

$f(x) = \quad ke^{-x/5}, \; x \geq 0$

$\quad\quad = \quad 0 \quad$ else where,

Find the value of k.

b) Find the mean recurrence time for each state of the following Markov Chain **[5]**

$$P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.5 & 0.4 \end{bmatrix}$$

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Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

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[5255]-1094

M.E. (Production - Manufacturing & Automation)
RESEARCH METHODOLOGY
(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

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) a) Briefly describe the different steps involved in a research process. **[4]**

    b) "Empirical research in India in particular creates so many problems for the researchers". State the problems that are usually faced by such researchers. **[4]**

    c) Short note on criteria of good research. **[2]**

Q2) a) Explain in brief basic principles of experimental designs. **[4]**

    b) What is research design? Explain research design in case of exploratory research studies. **[4]**

    c) What are the features of good design? **[2]**

Q3) a) Explain the difference between collection of data through questionnaires and schedules. **[6]**

    b) Explain any two method of collecting primary data particularly in descriptive research. **[4]**

Q4) a) Short note on neural network. **[5]**

    b) For the data given below, find the equation to the best fitting exponential curve of the form $y = ae^{bx}$. **[5]**

X	1	2	3	4	5	6
Y	1.6	4.5	13.8	40.2	125	300

P.T.O.

Q5) a) Determine the size of the sample for estimating the true weight of the castings having population size of 5000. The variance of the weight is 4 Kg and the estimate should be within 0.6 Kg of the true average weight with 96% probability.

The areas under standard normal curve are as shown in Table below.**[6]**

z	1.5	1.6	1.7	1.8	1.9	2	2.1
Area under curve	0.4332	0.4452	0.4554	0.4641	0.4713	0.4772	0.4821

Assume linear interpolation for values in between.

b) Find the value of χ^2 for the following information. **[4]**

Class	A	B	C	D	E
Observed frequency	8	29	44	15	4
Theoretica frequency	7	24	38	24	7

Q6) a) Explain steps of TOPSIS method for decision making. **[6]**

b) Determine the weights of four criteria (C_1 to C_4) for the following relative importance matrix also check the consistency of the data. **[4]**

$$\begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \end{array} \begin{array}{cccc} C_1 & C_2 & C_3 & C_4 \\ \begin{bmatrix} 1 & 1/3 & 4 & 2/3 \\ 3 & 1 & 1/4 & 1/3 \\ 1/4 & 4 & 1 & 1/5 \\ 3/2 & 3 & 5 & 1 \end{bmatrix} \end{array}$$

Q7) a) Briefly explain types of reports. **[4]**

b) Short note on Genetic Algorithm. **[4]**

c) State manufacturing applications of artificial neural network. **[2]**

Q8) a) "Interpretation is a fundamental component of research process", explain.**[5]**

b) Describe different steps in writing report. **[5]**

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[5255]-1095

M.E. (Production) (CAD/CAM)
COMPUTER AIDED DESIGN
(2017 Pattern)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt Qi or Q2, Q3 or Q4 and Q5 or Q6.*
2) *Q7 and Q8 are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw neat self - explanatory sketches wherever necessary.*
5) *Use of calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Discuss the benefits of CAD/CAM to engineering design as compared to conventional methods. **[5]**

OR

Q2) Explain the importance of various stages of product life cycle. **[5]**

Q3) Write down the various techniques used for the construction and editing of solid objects. Explain any two of them in detail. **[5]**

OR

Q4) What is Homogeneous Co-ordinate system? Explain the necessity of Homogeneous co-ordinate system for transformation of geometric entities using suitable examples. **[5]**

Q5) Explain the procedure of mass property calculations in CAD software. **[7]**

OR

Q6) What is blending of curves? Explain how two Bezier segments can be blended with suitable numeric example. **[7]**

Q7) a) What sweep representation scheme used for representation of a solid.**[8]**

b) What is Z-buffer algorithm for B-REP and CSG model? **[7]**

Q8) Write short note on any three : **[18]**

a) Constructive solid geometry

b) Shading algorithms

c) Virtual Realism

d) Parametric programming

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Total No. of Questions : 6]

P4387

[Total No. of Pages : 2

[5255]-1096

M.E. (Production) (CAD/CAM)
COMPUTER AIDED MANUFACTURING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1)   *Answer Q1 OR Q2; Q3 OR Q4; and Q5 & Q6 are compulsory.*

2)   *Assume suitable data if necessary.*

3)   *Figures to the right indicate full marks.*

4)   *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Explain various features of CNC systems.   **[5]**

     b)   Explain various types of CNC machine tools.   **[5]**

<div align="center">OR</div>

Q2) Write NC program for the following job and also explain the meaning of each step (block).   **[10]**
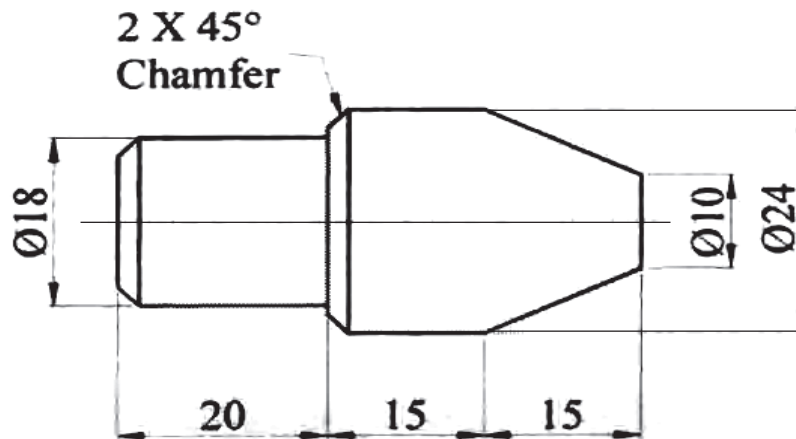
Q3) Write short note on (any two) :   **[10]**

     a)   CNC-Molding machine.

     b)   Automated guided vehicle system.

     c)   CNC-EDM.

<div align="center">OR</div>

P.T.O.

Q4) a) Explain working principle of automatic press with block diagram. **[5]**

b) With the help of neat block diagram explain various elements of ASRS. **[5]**

Q5) a) Write short note on machine vision. **[8]**

b) Write short note on automatic identification. **[7]**

<div align="center">OR</div>

Q6) a) Explain use of bar code system for shop floor data collection. **[7]**

b) Explain the need Human workers in future automated factory and What is impact of it on society? **[8]**

<div align="center">❧❧❧</div>

[5255]-1097

M.E. (Production) (Manufacturing & Automation)
ADVANCED MANUFACTURING PROCESSES
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt any five questions.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume Suitable data, if necessary*
5) *Use of electronic pocket calculator and logarithmic tables is allowed.*

Q1) a) Explain with sketch mechanism of melting and solidification during sand casting. **[4]**

b) How blow molding process takes place? **[4]**

c) List out the limitations of conventional machining processes. **[2]**

Q2) a) How Laser Beam Machining (LBM) take place? **[4]**

b) Explain any four welding defects with their causes and remedies. **[4]**

c) Which are the most common blow molding defects? **[2]**

Q3) a) How Electro Chemical Machining (ECM) differs from Chemical Machining (CM)? **[4]**

b) Differentiate between destructive and Non-destructive testing of castings. **[4]**

c) Which non-destructive tests are used for weld joints? **[2]**

Q4) a) Describe mechanism of material removal of EDM process with it strengths and weaknesses. **[5]**

b) Suggest causes and remedies for the most common arc welding defects. **[5]**

Q5) a) A wire of 5 mm diameter is to be reduced to 2.5 mm diameter. The die angle is 15° and the coefficient of friction at dies and wire interface is 0.5. The flow stress of wire material is 340 N/mm². Determine drawing stress and drawing load if the drawing speed is 0.7 m/s. **[4]**

b) Explain with neat sketch important steps in stretch forming of sheet metal. **[4]**

c) Name any four non-conventional forming processes. **[2]**

Q6) a) What you mean by electromagnetic forming? **[4]**

b) How hot forming differs from cold forming? **[4]**

c) What do you know about high speed forming? **[2]**

Q7) a) Explain important process parameters of electro-hydraulic forming. **[4]**

b) A tube of 30 mm external diameter and 1.5 mm thickness is to be reduced to 25 mm external diameter and 0.5 mm thickness. The die angle is 24° and plug angle is 16°. The coefficients of friction at die and tube interface and tube and plug (mandrel) interface is 0.5. The flow stress of tube material is 340 N/mm². The tube drawing is carried at a speed of 0.4 m/s. Calculate the fixed plug. **[4]**

c) What is high speed blanking? **[2]**

Q8) a) Explain forming limit diagram. **[5]**

b) Which are the various strategies adopted in industry to reduce roll force? **[5]**

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[5255]-1098

M.E. Production (Manufacturing & Automation)
INDUSTRIAL AUTOMATION
(2017 Pattern) (Semester - I)

Time : 3 Hours]   *[Max. Marks : 50*

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) a) Compare the efficiencies of meter in and meter out circuit to carry a load of 10 KN at 5m/min. Neglect flow losses across various components. Assume piston area of actuator to be 0.005 m^2 and piston rod area to be 0.0022 m^2.   **[6]**

   b) With neat sketch explain the application of variable displacement pump to maintain constant flow irrespective of variation in speed of prime mover.   **[4]**

Q2) a) Draw a neat sketch of pneumatic circuit showing application of twin pressure valve and explain functions of all elements used in the circuit.**[6]**

   b) A compressor delivers air at 3 m^3/min through a 25 mm inside diameter pipe at a receiver pressure of 1000 kPa gage. Find the pressure loss for a l00m length of pipe.   **[4]**

Q3) a) Write the program (Mnemonics) to perform following functions :   **[6]**
   - Load the number C5 H in register C
   - Load the number 2E H in register D
   - Subtract the content of register C from register D and display the sum at port 1.

   b) Explain performance criteria for selection of P, PI, or PID controller.**[4]**

Q4) Write short notes on :

    a)   Electro-pneumatic circuit design. **[5]**

    b)   Proportional control valves. **[5]**

Q5) a)   Explain various principles of material handling systems. **[6]**

    b)   Design for automated assembly. **[4]**

Q6) a)   The linear joint of the industrial robot is actuated by the piston mechanism. The length of the joint when fully retracted is 600 mm, and when fully extended is 975 mm. If the robot controller has 8 bit storage capacity, determine the control resolution of this robot. **[4]**

    b)   Discuss various approaches for collision free motion planning of multi-arm robots. **[6]**

Q7) a)   Explain need of simulation in manufacturing. **[5]**

    b)   Explain the role of artificial intelligence in industrial automation. **[5]**

Q8) Write short notes on :

    a)   Industrial applications of expert systems. **[5]**

    b)   Maskable and non- Maskable interrupts. **[5]**

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[5255]-1107

M.E. (Printing)

PROBABILITY, STATISTICS AND REGRESSION ANALYSIS

(2017 Pattern)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Attempt any five questions.*

2) *Assume Suitable data if necessary.*

Q1) The mean and variance of a binomial distribution are 3 and 2 respectively. Find the probability that the variate take values : **[10]**

a) Exactly 2

b) At most 2

Q2) A committee of four has to be formed among 3 among economist, 4 engineers, 2 statisticians and 1 doctor. **[10]**

a) What is the probability that each of four is represented in the committee?

b) What is the probability that the committee consists of the doctor and at least one economist?

Q3) Explain the need of statistical quality control explain 2 types of control chart with neat diagram. **[10]**

Q4) Explain OC curve. **[10]**

Q5) Following Data Shows values of sample mean $\bar{X}$ and range and range R for 10 sample of size of 5 each.

Calculate & Draw the control limits for Mean Chart and range chart. **[10]**

Sample No	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	31.8	34	30.8	35	33	33.8	35.8	34	33	33.8
R	4	2	5	5	19	4	14	7	9	5

Component Specification 40.37 +/- 0.1 A_2=0.577, D_3=0, D_4=2.110

a)   Calculate the value of $\overline{\overline{X}}$ and $\overline{R}$

b)   Calculate Upper limit & Lower limit for $\overline{X}$ chart

c)   Calculate Upper limit & Lower limit for R chart

d)   Plot $\overline{X}$ chart and R chart

Q6) Following are the number of defects found in the 5 samples. Draw appropriate control chart **[10]**

Sample No.	1	2	3	4	5
Number of defects	5	4	6	3	2

a)   Calculate $\overline{C}$

b)   Calculate upper and lower control limit

c)   Draw Appropriate control Chart and

d)   Comment about the process control

Q7) Explain the concept of statistical quality control. State its advantage.   **[10]**

Q8) Explain the Experimental Strategy.   **[10]**

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[5255]-1108
M.E.
PRINTING TECHNOLOGY MANAGEMENT
(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:
1) *All questions compulsory.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*

Q1) a) Explain domestic and foreign market overview for a newspaper printing business. **[9]**

b) Explain factors to be considered for market analysis with reference to changing trends in commercial printing industry using offset process.**[9]**

OR

Q2) Explain with help of flowchart process for shop floor management for a Bindery section. **[18]**

Q3) a) Explain Quality Assurance. Also explain Quality costs. **[8]**

b) Describe a continuous quality improvement plan for a newspaper production system. **[8]**

OR

Q4) Explain activities of a quality control procedures in Offset CTP plate making section. **[16]**

Q5) Explain following : **[16]**
a) Six sigma
b) Failure costs

OR

Q6) What is the use of control charts. Explain control charts in detail for attributes. **[16]**

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P4329

[5255]-1109

M.E. (Printing Engineering & Graphic Communication)
MODERN TRENDS IN PRINTING
(2017 Pattern)

Time : 3 Hours]   *[Max. Marks : 50*

Instructions to the candidates:

    1)   *Draw neat diagram wherever necessary.*

    2)   *Figures to the right indicate full marks.*

Q1) Explain in detail sections of a gravure press.   **[18]**

OR

Explain in detail Sections of an offset press.

OR

Explain in detail flexo press parameters.

OR

Explain the effect of ink rheology on gravure printability.

Q2) Explain the working of servo motors for a web press.   **[16]**

OR

Explain the effect of impression roller on dot reproduction.

Q3) Mention the care and maintenance for litho plates.   **[16]**

OR

Explain the factors affecting ink transfer in flexography.

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[5255]-1110

M.E. (Printing)

RESEARCH METHODOLOGY

(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

1) Attempt any five questions.

2) Assume suitable data, if necessary.

Q1) What do you mean by research? Explain its significance in modern times.**[10]**

Q2) Distinguish between research methods and research methodology. **[10]**

Q3) How do you select research problem? **[10]**

Q4) Explain the need of research design, also list 4 factors in good design. **[10]**

Q5) Explain the advantage and limitation of case study method for data collection. **[10]**

Q6) Explain the technique and importance of oral presentation of research findings. **[10]**

Q7) Describe the steps in writing report. **[10]**

Q8) Explain the Types of technical papers. **[10]**

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