

**FLUID MECHANICS-I  
(Civil Engineering)****Time: 3 Hours****Max Marks: 60**

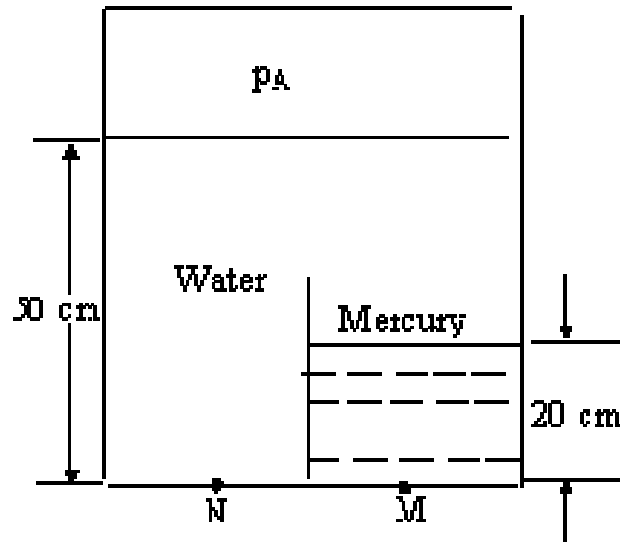
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

**UNIT-I**

1. a) For the system shown in Fig, determine the air pressure  $p_a$  which will make the pressure at N one fourth of that at M.



- b) How would you classify manometers? Explain differential manometer?  
(OR)
2. a) Can you distinguish between Newtonian and nonNewtonian fluids? what do you understand from the following fluid prpoerties. (i) specific weight (ii) specific gravity (iii) viscosity (iv) surfac tension
- b) Distinguish between absolute pressure, guage pressure and vaccum pressure.

**UNIT-II**

3. a) A rectangular plate  $2\text{ m} \times 4\text{ m}$  is vertically immersed in water in such a way that 2 metres side is parallel to the water surface and 2.5 metres below it. Find the total pressure on the rectangular plate. Take  $w = 9.81\text{ kN/m}^3$ .
- b) Derive the Expression for centre of pressure for an inclined submerged lamina.

**(OR)**

4. a) An opening of 1m depth and 3m width is provided in the vertical side of a large tank. The water surface in the tank is 4m above the top of the opening. If the opening is closed by a plate which is held in place by four bolts placed at the corners, determine the force in each bolt.
- b) Explain the concept of hydrostatic pressure distribution.

### UNIT-III

5. a) Define steady, non-steady, uniform, non-uniform flows? The stream function for a two-dimensional flow is given by  $\psi = 3xy$ , calculate the velocity at the point P (2, 3). Find the velocity potential function  $\Phi$ .
  - b) Distinguish between stream lines, streak lines and path lines?
- (OR)**
6. a) For a flow in the xy plane, the 'y' component of velocity is given by  $v = y^2 - 2x - 2y$ . Determine a possible 'x' component for a steady, incompressible flow, how many possible 'x' components are there?
  - b) Define the rotation of flow of flowing fluid and find out the required conditions for irrotational flow if the flow is three dimensional.

### UNIT-IV

7. a) Draw a neat sketch of the Reynolds apparatus, and explain how the laminar and turbulent flow can be demonstrated with the help of apparatus.
  - b) What are the characteristics of Laminar & Turbulent flows.
- (OR)**
8. a) Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum.
  - b) Water is flowing through a pipe of 100mm diameter under a pressure of  $20\text{N/cm}^2$  and mean velocity of 3m/s. Find the total head of the water at a cross section, which is 8m above the datum line.

### UNIT-V

9. a) A  $45^\circ$  reducing bend is connected to a pipe line. The diameter at the inlet and outlet of the bend being 600mm. and 300mm. respectively. Find the force exerted by water on the bend if the intensity of the pressure at inlet to the bend is  $8.8\text{N/cm}^2$  and the rate of flow of water is 600 litres/sec.
- b) A pipe line 2000 m long is used for power transmission. 110KW is to be transmitted through the pipe in which water having a pressure of  $5000\text{KN/m}^2$  at inlet is flowing. If the pressure drop over the length of the pipe is  $1000\text{KN/m}^2$  and co-efficient of friction is 0.0065, estimate: (i) the diameter of the pipe, and (ii) efficiency of the transmission.

**(OR)**

10. a) Derive the expression for discharge through Venturi meter.
- b) Explain briefly the following:
  - (a) Hydraulic Gradient Line (HGL)
  - (b) Energy Gradient Line (EGL)

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

**UNIT-I**

1. a) State and explain Gauss's law. Derive  $\vec{E}$  due to sheet of charge. 8M
- b) A  $2\mu\text{C}$  point charge is located at A(4,3,5) in free space. Find  $\vec{E}_\rho$ ,  $\vec{E}_\phi$ , and  $\vec{E}_z$  at P(8,12,2). 4M

**(OR)**

2. a) A circular disk of radius 'a' is uniformly charged with  $\sigma \text{ C/m}^2$ . The disk lies on the  $z=0$  plane with its axis along the  $z$ -axis. 9M

Show that at point  $(0,0,h)$ ,  $\vec{E} = \frac{\sigma}{2\epsilon} \left\{ 1 - \frac{h}{[h^2 + a^2]^{1/2}} \right\} \vec{a}_z$ .

- b) Derive the  $\vec{E}$  field due to an infinite sheet of charge on the  $z=0$  plane. 3M

**UNIT-II**

3. a) Derive the boundary conditions for dielectric and dielectric. 7M
- b) A large parallel plate capacitor has its plates normal to the  $x$ -axis. Plate 1 with potential  $v=0$  is at  $x=0$ . Plate 2 with a potential  $v=v_1$  at  $x=x_1$ . Use Laplace's equation for the capacitor to show that the potential distribution is given by  $V = (v_1/x_1)x$  volts. 5M

**(OR)**

4. a) Derive continuity equation and explain the terms in the equation. 7M
- b) Conducting spherical shells with radii  $a=10\text{cm}$  and  $b=30\text{cm}$  are maintained at a potential difference of 100V such that  $V(r=b)=0$  and  $V(r=a)=100\text{V}$ . 5M

Determine  $V$  and  $E$  in the region between the shells. If  $\epsilon_r = 2.5$  in the region, and also determine the total charge induced on the shells and the capacitance of the capacitor.

### UNIT-III

5. a) Derive expression for H due to an infinite current carrying conductor lying along z axis. 8M  
b) State and explain Biot - Savarts law. 4M  
(OR)
6. a) Find the magnetic field intensity at a point on the axis, 5m from the centre of a circular coil of area  $100\text{cm}^2$  and carrying a current of 50A 7 M  
b) Derive  $\nabla \times \mathbf{H} = \mathbf{J}$ ; Justify this equation is valid for static magnetic fields. 5 M

### UNIT-IV

7. a) Derive an expression for self inductance of solenoid. 7 M  
b) A coil of 300 turns is wound on a non-magnetic core having a mean circumference of 300 mm and a cross-sectional area of  $300\text{ mm}^2$ . Determine the inductance of the coil corresponding to a magnetizing current of 3A. 5 M  
(OR)
8. a) Derive an expression for torque on a current loop placed in a magnetic field. 8M  
b) Discuss the force exerted on a current element due to a magnetic field B in another current element 4M

### UNIT-V

9. a) State and explain Faradays laws of electromagnetic induction. 4 M  
b) Derive an expression for displacement current density. 8 M  
(OR)
10. a) Write Maxwell's equations for time varying EM fields in both differential & integral form. 7 M  
b) A parallel plate capacitor with plate area of  $10\text{cm}^2$  and plate separation of 6mm has a voltage  $50\sin(10^3t)$  volts required to its plates. Determine the displacement current, assuming  $\epsilon=2\epsilon_0$  5 M

# AR18

**CODE: 18EST203**

**SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**II B.Tech I Semester Regular and Supplementary Examinations, March.2021**

**Engineering Mechanics  
(COMMON TO ME & ECE)**

**Time: 3 Hours**

**Max Marks: 60**

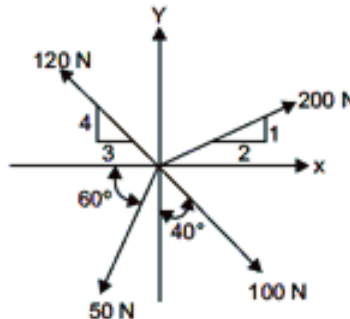
Answer ONE Question from each Unit

All Questions Carry Equal Marks

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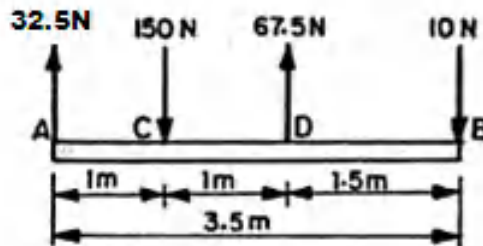
## UNIT-I

1. a) State and prove parallelogram law of forces. (6M)
- b) A system of four forces acting on a body is as shown in figure. Determine the magnitude and direction of resultant. (6M)



(OR)

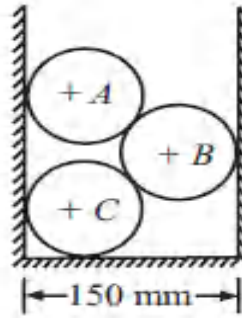
2. a) Differentiate between moment of a force and a couple. Explain how do you resolve a force into a force and a couple (4M)
- b) A system of parallel forces are acting on a rigid bar as shown in figure. Reduce the system to i) a single force, ii) a single force and a couple at A and iii) a single force and a couple at B. (8M)



## UNIT-II

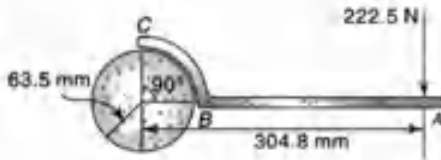
3. a) Briefly explain the following: (4M)
  - i) Free body diagram and its importance
  - ii) Equations of equilibrium in plane force systems
- b) Three spheres A, B, C are placed as shown in figure. The diameter of each sphere is 100mm. Determine the reactions produced at each Contact point. Assume the weight of spheres A, B, C are 1kN.

(8M)

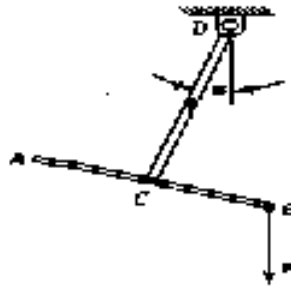


(OR)

4. a) Determine the forces exerted on the cylinder at B and C by the spanner wrench shown in figure due to a vertical force of 222.5 N applied to the handle. Neglect friction at B. (6M)



- b) Two identical prismatic bars AB and CD are welded together in the form of a rigid T and suspended in a vertical plane as shown in figure. Calculate the angle ' $\alpha$ ' that the bar CD will make with the vertical, when a vertical load of  $F = 45$  N is applied at B. The weight of each bar is 25 N. (6M)

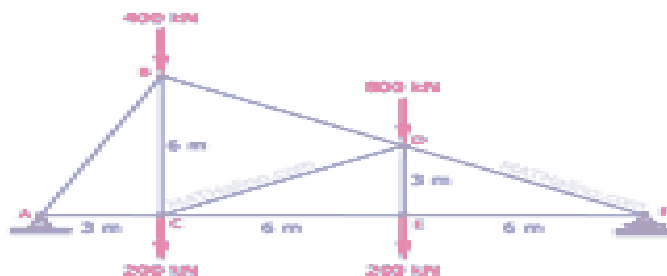


### UNIT-III

5. a) Write short note on the following: i) Types of friction and ii) Laws of friction (4M)  
b) A body resting on a rough horizontal plane required a pull of 18 N inclined at  $30^\circ$  to the plane just to move it. It was found that a push of 20 N inclined at  $30^\circ$  to the plane just moved the body. Determine the weight of the body and coefficient of friction. (8M)

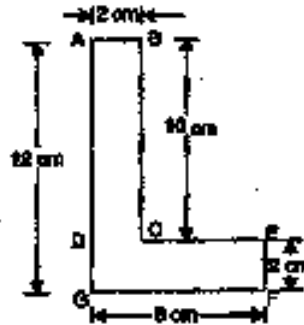
(OR)

6. A truss is loaded as shown in figure. Find the forces in all the members of the truss. (12M)



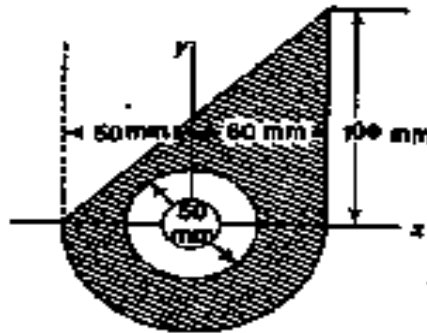
## UNIT-IV

7. a) Distinguish between centroid and centre of gravity. Write the expressions for determining centroid of composite plane areas. (4M)
- b) Find the coordinates of the centroid of the L-section as shown in figure. (8M)



(OR)

8. a) State and prove parallel axis theorem. (4M)
- b) Determine the moment of inertia of shaded area as shown in figure about its horizontal centroidal axes. (8M)



## UNIT-V

9. a) A body under a constant deceleration is moving in a straight line and covers a distance of 20 m in first two seconds and 40 m in the next 5 seconds. Calculate the distance it covers in the subsequent 3 seconds and the total distance covered, before it comes to rest. (6M)
- b) Derive tangential and normal components of acceleration when the particle is moving along a curved path. (6M)

(OR)

10. Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in figure. The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Using D'Alembert's principle, determine the acceleration of the weights and tension in the thread. (12M)



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# AR18

CODE: 18CST202

SET-1

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)

II B.Tech I Semester Regular & Supplementary Examinations, March-2021

## DISCRETE MATHEMATICS

(Common to CSE & IT)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

### UNIT-I

1. a) Derive  $P \rightarrow (Q \rightarrow S)$  using rule CP if necessary, from premises  $P \rightarrow (Q \rightarrow R)$ ,  $Q \rightarrow (R \rightarrow S)$ . 6M
- b) Obtain disjunctive normal forms of  $\neg(P \vee Q) \leftrightarrow (P \wedge Q)$ . 6M

(OR)

2. a) Show  $((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$  is tautology 6M
- b) Show that the following set of premises is inconsistent: || 6M  
If the contract is valid, then John is liable for penalty. If John is liable for penalty, he will go bankrupt. If the bank will loan him money, he will not go bankrupt. As a matter of fact, the contract is valid, and the bank will loan him money.||

### UNIT-II

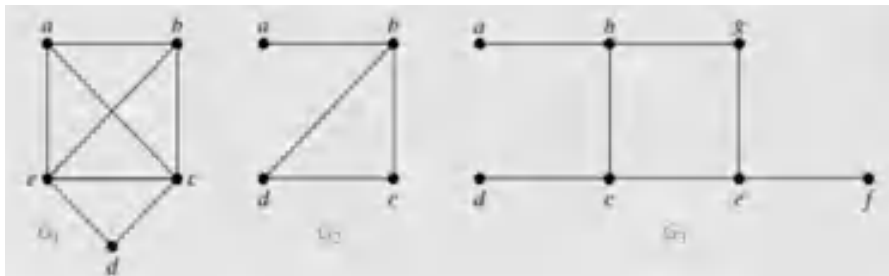
3. a) If  $A = \{1, 2, 3, 5, 30\}$  and  $R$  is divisibility relation. Prove  $(A, R)$  is Lattice. 6M
- b) State Pigeonhole principle. Prove that if 30 dictionaries in a library contain a total of 61,327 pages, then atleast one of the dictionaries must have at least 2045 pages. 6M

(OR)

4. a) Let  $X = \{a, b, c, d, e\}$  and let  $C = \{\{a, b\}, \{c\}, \{d, e\}\}$ . Show that the partition  $C$  defines an equivalence relation on  $X$ . 6M
- b)  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = ax + b$ , for  $a, b \in \mathbb{R}$  and  $a \neq 0$ . Show that  $f$  is invertible and find the inverse of  $f$ . 6M

### UNIT-III

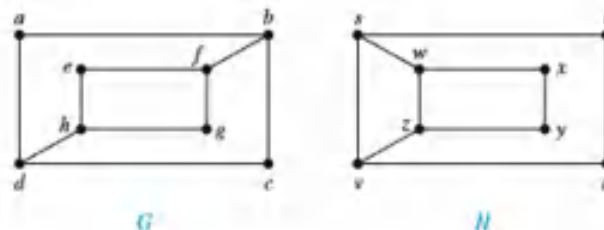
5. a) Which of the following simple graphs in the figure below, have a Hamilton circuit or, if not, a Hamilton path? 6M





b) Determine whether the graphs G and H are isomorphic.

6M



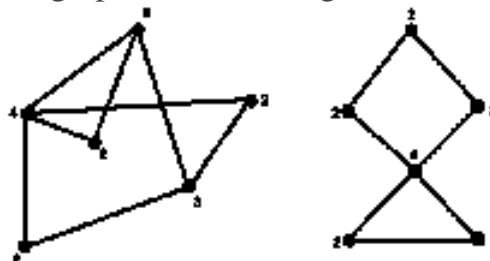
(OR)

6. a) Explain Handshaking property with example

6M

b) Determine graphs shown in fig are Eulerian or not

6M



### UNIT-IV

7. a) Explain BFS Algorithm with Example.

6M

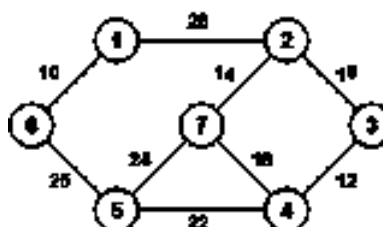
b) Find the chromatic number of wheel graph when total number of vertices is even and odd.

6M

(OR)

8. a) Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm

6M



b) Find the in order, preorder and post order traversal for the following tree

6M



### UNIT-V

9. a) Find the coefficient of  $X^{12}$  in  $\frac{1-x^4-x^7+x^{11}}{(1-x)^5}$ .

6M

b) Solve  $F_{n+2} = F_{n+1} + F_n$  for  $n \geq 0$  given  $F_0 = 0, F_1 = 1$

6M

(OR)

10. a) Solve the recurrence relation

6M

$a_{n+2} - 2a_{n+1} + a_n = 2^n, n \geq 0$  and  $a_0=1, a_1=2$  by method of generating function.

b) The number of virus affected files in a system is 1000(to start with) and this increases 250% every two hours. Use a recurrence relation to determine the number of affected files in the system after one day.

6M

# AR16

**CODE: 16CE2003**

**SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**II B.Tech I Semester Supplementary Examinations, March,2021**

## **FLUID MECHANICS**

**(Civil Engineering)**

**Time: 3 Hours**

**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

### **UNIT-I**

1. a) Explain Newton's law of viscosity and classify the fluids based on viscosity. 7M  
b) Explain the absolute pressure, gauge pressure and vacuum pressure. 7M  
(OR)
2. a) Explain the working of Bourdon's mechanical pressure gauge with the help of a neat sketch. 7M  
b) If  $5\text{m}^3$  of  $\text{CCl}_4$  has a weight of 78kN. Determine its specific weight, density, specific gravity. If the fluid exists on the planet Jupiter, what are the values of specific weight, density and specific gravity? Assume the radius of Jupiter is equal to 11.2m of radius of Earth and the mass of Jupiter is equal to 312 times the mass of Earth. 7M

### **UNIT-II**

3. a) How do you find the resultant force on a vertical plane surface submerged in a fluid? Show that the centre of pressure is always lies below the centroid of the given plane surface submerged in fluid. 8M  
b) Explain the following with reference to floating bodies. 6M  
i) Stable equilibrium and ii) Unstable Equilibrium  
(OR)
4. a) A square plate 4 m x 4 m hangs in water from one of its corner and its centroid lies at a depth of 8m from the free surface of water. Determine the hydrostatic force on plate and the position of centre of pressure with respect to the plate centroid. 8M  
b) Differentiate between centre of buoyancy and meta centre. 6M

### **UNIT-III**

5. a) Explain streamlines, streak-lines and path lines. 6M  
b) A pipe 50cm in diameter branches into two pipes of diameters 25cm and 20cm respectively. The mean velocity of flow in 40cm diameter pipe is 3 m/s. Find i) the discharge through 40cm diameter pipe and ii) the mean velocity of flow in 25cm diameter pipe if the mean velocity of flow in 20cm pipe is 2 m/s. 8M

(OR)

6. a) What is meant by flow-net? How do you construct it? 8M  
b) Check whether the following sets of velocity components represent a possible flow filed or not. 6M  
i)  $u=x^2-y^2$  ,  $v = x-2xy$  ii)  $u=-\ln(xy)$   $v= y/x$

**UNIT-IV**

7. a) Derive general Bernoullis equation for three dimension flow. 8M  
b) Explain the Reynold's experiment with the help of a neat sketch. 6M

(OR)

8. a) At a certain section A of a pipe line carrying an oil of density  $850 \text{ kg/m}^3$  , the diameter is 80cm, the pressure is  $180 \text{ kN/m}^2$  and the average velocity is 5 m/s. At another section B which is 3m higher than A, the diameter is 50m and the pressure is  $100 \text{ kN/m}^2$ . What is the direction of flow? 8M  
b) State the momentum principle. Explain the application of momentum principle to find force on a pipe bend. 6M

**UNIT-V**

9. a) Two reservoirs are connected by a pipeline consisting of two pipes, one of 20 cm diameter and length 20m and the other of diameter 30cm and length 12m. If the difference of water levels in the two reservoirs is 6m, find the discharge in the pipeline. Take Darcy's friction factor  $f=0.02$ . Consider all losses. 8M  
b) What are the advantages of rectangular notch over triangular notch? 6M

(OR)

10. a) Derive the equation for discharge of a Venturi meter. 8M  
b) An orifice meter with orifice diameter 100mm is inserted in a pipe of 200mm diameter. The pressure gauges fitted upstream and down stream of the orifice meter gives reading of  $19.62 \times 10^4 \text{ N/m}^2$  and  $9.81 \times 10^4 \text{ N/m}^2$  respectively. Coefficient of discharge for the orifice meter is 0.6. Find the discharge through pipe. 6M

# AR16

**CODE: 16ME2005**

**SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**II B.Tech I Semester Supplementary Examinations, March-2021**

## **MECHANICS OF SOLIDS**

**(Mechanical Engineering)**

**Time: 3 Hours**

**Max Marks: 70**

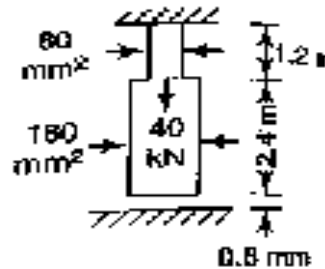
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

### **UNIT-I**

1. A suspended bar consists of two cross-sections as shown in the figure. Initially its lower surface is 0.8 mm above the ground surface. Determine the reaction of the lower support and the stresses in each section when a load of 40 kN is applied as shown in the figure below.  $E = 205 \text{ GPa}$  14



**(OR)**

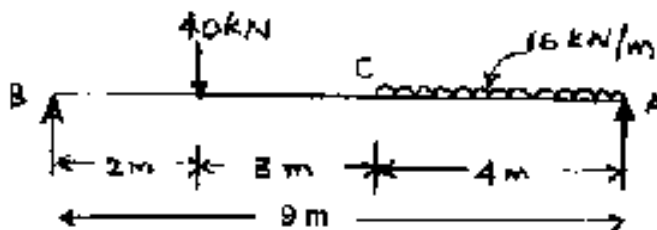
2. A bar of 24 mm diameter and 400 mm length is acted upon by an axial load of 38 kN. The elongation of the bar and the change in diameter are mentioned as 0.165 mm and 0.0031 mm respectively. Determine (i) the Poisson's ratio, (ii) the values of the three moduli 14

### **UNIT-II**

3. The stresses on two mutually perpendicular planes through a point in a body are 120 MPa and 130 MPa both tensile along with a shear stress of 60 MPa. Determine (i) The magnitude and direction of principal stresses stating whether the stress condition is uniaxial or biaxial. 14  
(ii) The planes of maximum shear stresses.  
(iii) The normal and shear stress on the planes of maximum shear stress.

**(OR)**

4. A simply supported beam of 9 m span is loaded as shown in the figure. Draw the shear force and bending moment diagrams indicating principal values. 14



### **UNIT-III**

5. A hollow circular bar used as a beam has outside diameter twice of the inside diameter. If it is subjected to a maximum bending moment of 40 kN-m and allowable bending stress is 100MPa, determine the inside diameter of the bar. 14

**(OR)**

- 6 A simply supported timber beam is 2 m long and is of rectangular section with depth twice the width. It carries a point load of 10 kN at the centre and a uniformly distributed load of 10kN/m over the whole length. Find the suitable cross section of the beam if the permissible shear stress for the timber is 0.8 MPa and bending stress in tension or compression is 10 MPa. 14

### **UNIT-IV**

7. A hollow steel shaft transmits 200 kW of power at 150 rpm. The total angle of twist in a length of 5 m of the shaft is 30. Find the inner and outer diameters of the shaft if the permissible shear stress is 60MPa.  $G=80\text{GPa}$ . 14

**(OR)**

8. What are the different assumptions that are made to analyse struts and columns which fail due to buckling loads. Also derive an expression to calculate the Euler crippling load for a fixed-free beam. 14

### **UNIT-V**

9. Derive differential equation for the elastic curve of a beam. 14

**(OR)**

10. A simply supported beam has a span of 15m and carries three point loads of 4 kN, 6 kN and 9 kN at 6 m, 8 m and 10 m from left support respectively. Find the deflection and slope at each load, if  $E = 200\text{GPa}$ ,  $I = 400 \times 10^6 \text{ mm}^4$ . 14

# AR16

**CODE: 16EC2004**

**SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**II B.Tech I Semester Supplementary Examinations, March,2021**

**PULSE AND DIGITAL CIRCUITS  
(Electronics and Communication Engineering)**

**Time: 3 Hours**

**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

**UNIT-I**

1. a) Derive the expression for the output of a high-pass RC circuit excited by a square input 7

b) Derive the expression for the output of a high-pass RC circuit excited by a step input. 7

**(OR)**

2. a) A Ramp wave is fed to an RC Differentiator. Calculate and plot the output waveform (i)  $T=RC$  (ii)  $T=0.5RC$  (b)  $T=10RC$  7

b) What is an attenuator? How can an uncompensated attenuator be modified as a Compensated attenuator. Give the comparison between perfect compensation, under compensation and over compensation 7

**UNIT-II**

3. Draw and explain the positive peak clamper, negative peak clamper . 14

**(OR)**

4. a) **Design a circuit which clips a signal at  $+1V < V_{out} < +6V$ .** 7

b) Draw and explain the double ended clipper using zener diodes 7

**UNIT-III**

5. a) Explain how diode acts as a switch 7

b) A fixed bias binary uses transistors with  $H_{fe}(\min)=20$ . The circuit parameters are  $V_{cc}=V_{bb}=5V$ ,  $R_c=5k$ ,  $R_2=25k$ . Find  
(i) Steady state voltages and currents.  
Verify whether one transistor is on and other transistor is off.  
(ii) What is the heaviest load the binary can drive?  
(iii) Find the maximum  $I_{cbo}$  at which the circuit functions satisfactorily. 7

**(OR)**

6. a) Explain the design of transistor as a switch? 7

b) Draw & Explain about Schmitt Trigger with neat diagram? 7

#### **UNIT-IV**

7. a) With the aid of circuit diagram, and necessary derivations show that a collector coupled Astable multivibrator can function as a voltage to frequency converter. 7
- b) Derive expression for the pulse width of a monostable multivibrator 7
- (OR)**
8. a) Explain the working of transistor based Bootstrap time base generator circuit, and draw the necessary waveforms. 7
- b) Explain the working of transistor based Miller time base generator circuit, and draw the necessary waveforms. 7

#### **UNIT-V**

9. a) Write an account of bidirectional diode based sampling gates? 7
- b) Explain about four diode sampling gate? 7
- (OR)**
10. a) Draw and explain the unidirectional diode sampling gate for more than one input signal? 7
- b) With the help of neat circuit diagram explain the working of an astable blocking oscillator with Diode- control? 7

# AR16

**CODE: 16CS2003**

**SET-1**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)**

**II B.Tech I Semester Supplementary Examinations, March-2021**

**MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE  
(Common to CSE & IT)**

**Time: 3 Hours**

**Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

## UNIT-I

1. a) Prove the following logical equivalence 6M

$$(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$$

- b) Using mathematical induction prove the following statement is 8M  
true for all positive integers of N.

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left( \frac{n(n+1)}{2} \right)^2 \text{ for } n \geq 1$$

**(OR)**

2. a) Obtain the PCNF of  $(p \wedge q) \vee (\neg p \wedge \neg q)$  7M

- b) Show that  $R \wedge (PVQ)$  is valid conclusion from the premises PVQ, 7M  
 $Q \rightarrow R$ ,  $P \rightarrow M$  and  $\neg M$

## UNIT-II

3. a) If  $A = \{1, 2, 3, 4\}$  and R, S are relations on A defined by 7M  
 $R = \{(1, 2), (1, 3), (2, 4), (4, 4)\}$   $S = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 3), (2, 4)\}$   
find  $R \circ S$ ,  $S \circ R$ ,  $R^2$ ,  $S^2$ , write down their matrices

- b) Draw the Hasse diagram representing the positive divisors of 36

**(OR)**

4. a) Let  $A=B=R$ , the set of all real numbers, and the function 8M  
 $f: A \rightarrow B$  and  $g: B \rightarrow A$  be defined by

$$f(x) = 2x^3 - 1, \forall x \in A; g(y) = \left\{ \frac{(y+1)}{2} \right\}^{1/3}, \forall y \in B \text{ Show that each of f and g}$$

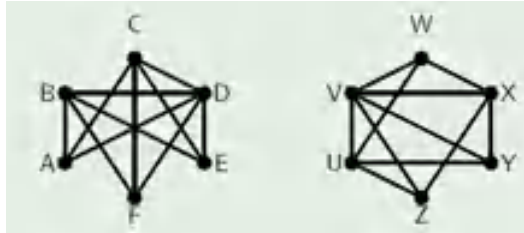
is the inverse of the other.

- b) Find the least number of ways of choosing three different 6M  
numbers from 1 to 10 so that all choices have the same sum.



### UNIT-III

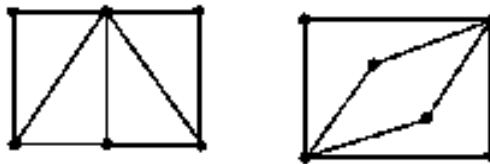
5. a) Define Isomorphic graph? Prove that the two graphs shown below are isomorphic 8M



- b) What is adjacency matrix, incidence matrix. Illustrate with examples. 6M

(OR)

6. a) Define planar and non-planar graph and Show that the bipartite graph  $K_{2,2}$  and  $K_{2,3}$  is planar graph 7M
- b) Define Hamiltonian Graph? Which of the following are Hamiltonian graphs 7M



### UNIT-IV

7. a) What are the application of trees 4M
- b) Write DFS algorithm and discuss with an example 10M

(OR)

8. a) Write the Kruskal's algorithm and find minimal spanning tree of the weighted graph shown below: 8M



- b) Show that a graph is connected if and only if it has a spanning tree 6M

### UNIT-V

9. Solve  $F_{n+2} = F_{n+1} + F_n$  for  $n \geq 0$  given  $F_0 = 0, F_1 = 1$  14M

(OR)

10. Solve the recurrence relation  $a_n + 2a_{n-1} - 3a_{n-2} = 4n^2 - 5$ , for  $n \geq 2$  14M

**Time: 3 Hours****Max Marks: 70****PART-A****ANSWER ALL QUESTIONS****[1 x 10 = 10 M]**

1. a) Define electric field intensity.
- b) Define Gauss law
- c) Write Laplace equation
- d) Define Polarization
- e) State Maxwell's third equation.
- f) Define Amperes law.
- g) Write Lorenz Force Expression.
- h) Define magnetic flux density
- i) Define Self Inductance
- j) Write Modified Amperes law.

**PART-B****Answer one question from each unit****[5x12=60M]****UNIT-I**

2. a) Find the area of a cylinder in  $a_r$  direction, where  $0 \leq \Phi \leq 30$ ,  $0 \leq z \leq 5$ . 6M
- b) Using Gauss law evaluate  $\mathbf{E}$  due to sheet of charge. 6M

**(OR)**

3. a) Derive the expression for Electric Field Intensity due to infinite line charge. 6M
- b) Derive Maxwell's first equation in point form. 6M

**UNIT-II**

4. a) Derive the expression for  $\mathbf{E}$  due to a Dipole. 6M
- b) Explain the behaviour of Conductors in electric field. 6M

**(OR)**

5. a) Explain about boundary conditions between Conductor and Dielectric. 6M
- b) Derive the expression for Capacitance of a Parallel Plate Capacitor. 6M

**UNIT-III**

6. a) Find  $\mathbf{H}$  due to straight infinite current carrying conductor. 6M
- b) Explain about Biot-Savarts law. 6M

**(OR)**

7. a) Show that the expression for magnetic field intensity due to a circular loop located at distance  $(0, 0, h)$  is  $\mathbf{H}(0, 0, h) = \frac{I \rho^2}{2(\rho^2 + h^2)^{3/2}} \mathbf{a}_z$  6M
- b) A circular loop located on  $x^2 + y^2 = 9$ ,  $Z = 0$  carries a direct current of 10 A along  $\mathbf{a}_\phi$ . Determine  $\mathbf{H}$  at  $(0, 0, 4)$ . 6M

**UNIT-IV**

8. a) Derive Lorenz Force Equation 6M
- b) Derive the expression for Force between two straight long and parallel conductors carrying currents. 6M

**(OR)**

9. Define magnetic torque and derive the expression for torque in terms of magnetic dipole moment. 12M

**UNIT-V**

10. a) Derive an expression Displacement current density  $\mathbf{J}_d$ . 6M
- b) Write All Maxwell equations time varying field. 6M

**(OR)**

11. Derive an expression for Poynting theorem. 12M

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI  
(AUTONOMOUS)****II B.Tech. I Sem. Supplementary Examinations, March, 2021****PROBABILITY THEORY & STOCHASTIC PROCESSES  
(Electronics and Communication Engineering)****Time: 3 Hours****Max Marks: 70****PART-A****ANSWER ALL QUESTIONS****[1 x 10 = 10 M]**

1. a) If S1 and S2 are sample spaces of two sub experiments, what is the combined sample space S
- b) How do you write "If 'a' is an element of Set A?"
- c) What is mathematical Expectation?
- d) Define Discrete random variable.
- e) What is joint density function
- f) What is a function of joint random variables??
- g) Define ensemble.
- h) What is deterministic process?
- i) What is cross power density spectrum?
- j) What is an LTI system?

**PART-B****Answer one question from each unit****[5x12=60M]****UNIT-I**

2. a) A Card is drawn at random from a deck of 52 playing cards. Find the probability of drawing a) a 6 or a heart b) neither 9 or a spade. 8 M
  - b) Define Probability based on fundamental Axioms 4 M
- (OR)**
3. a) State and prove Bayes Theorem 8 M
  - b) Two boxes are selected randomly. the first box contains 2 white balls and 3 black balls. The second box contains 3 white balls and 4 black balls. What is probability of drawing a white ball 4 M

**UNIT-II**

4. a) What is probability distribution function and explain its properties 6 M
- b) A random variable X has probabilities shown below 6 M
  - I) Find the value of K
  - II) Find Probability distribution function

X	-3	-2	-1	0	1	2
P(x)	0.2	0.5K	K	0.1	0.3K	K

**(OR)**

5. a) Explain the concept of transformation of a random variable X 6 M
- b) If X be a uniform random variable with pdf 6 M
 
$$f_x(x) = 1/10 \quad -5 \leq x \leq 5$$
 find i)  $E[x]$  ii)  $E[x^2]$  iii)  $E[2X+1]$

**UNIT-III**

6. a) Define and explain joint probability density function with its properties. 8 M  
b) The joint pdf of two variables X,Y is  $f_{X,Y}(x,y) = a^{-(x+y)}$  for  $x \geq 0, y \geq 0$ . Find the constant a. Are X and Y independent? 4 M

**(OR)**

7. a) Write briefly about Joint moments about the origin 6 M  
b) The joint pdf is given as  $f_{X,Y}(x,y) = A e^{-(2x+y)}$  for  $x \geq 0, y \geq 0$ . Find i) the value of A 6 M  
and b) the marginal density functions

**UNIT-IV**

8. a) Explain the Gaussian density function for two random variables 6 M  
b) Two Gaussian random variables  $X_1$  and  $X_2$  have zero mean and  $\sigma_{X_1}^2 = 4$  and  $\sigma_{X_2}^2 = 9$ . Their covariance  $C_{X_1 X_2}$  equals 3. Find the covariance  $C_{Y_1 Y_2}$  of new random variable  $Y_1$  and  $Y_2$  if the transformation is given as

$$Y_1 = X_1 - 2X_2$$

$$Y_2 = 3X_1 + 4X_2$$

**(OR)**

9. a) Explain the concept of Random process and its classifications 6 M  
b) Derive the properties of auto correlation function. 6 M

**UNIT-V**

10. What is power density spectrum of random process? Prove three properties of power density spectrum. 12 M

**(OR)**

11. Derive the relation between cross power spectral density and cross correlation function. 12 M

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(Common to CSE and IT)****Time: 3 Hours****Max Marks: 70****PART-A****ANSWER ALL QUESTIONS****[1 x 10 = 10 M]**

1. a) What is a Well Formed Formula? Explain.
- b) Construct TruthTable for  $P \rightarrow Q$ .
- c) What is DNF?
- d) What is Converse? Give an Example.
- e) What is Euler's Path?
- f) What is Complete Graph?
- g) What is Prime Factorization?
- h) Define Monoid?
- i) What is semi group?
- j) Give an example of homogenous Recurrence Relation.

**PART-B****Answer one question from each unit****[5x12=60M]****UNIT-I**

2. a) Obtain PCNF for  $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$  6M
- b) Find PDNF of  $(\sim P \rightarrow R) \wedge (Q \neq P)$  6M
3. a) Write the following statements into symbolic forms. 8M
  - (i) You will get a speeding ticket if you drive over 70 km per hour.
  - (ii) Driving over 70 km per hour is sufficient for getting a speeding ticket.
  - (iii) If you do not drive over 70 km per hour then you will not get a speeding ticket.
  - (iv) Whenever you get a speeding ticket, you drive over 70 km per hour.
- b) Prove that  $(P \rightarrow Q) \Leftrightarrow (\neg P \vee Q)$  4M

**UNIT-II**

4. a) Find the greatest common divisors of the following pairs of integers 1317 and 56. 6M
  - b) Using mathematical induction, prove that the following statement is true for all positive integers  $n$ .  $1^2 + 2^2 + 3^2 + \dots + n^2 = n(n+1)(2n+1)/6$ . 6M
- (OR)**
5. a) Write pseudo code for Euclidian algorithm? find GCD of 330,616 using Euclidian algorithm. 8M
  - b) Find  $\phi(15)$  4M

# AR13

CODE: 13CS2003

SET-1

## UNIT-III

6. a) What are the rules for constructing a Hamiltonian path and Hamiltonian cycle? 6M  
b) What is Planar Graph? Find whether  $K_5$  is planar or not with example. 6M

(OR)

7. a) Explain Depth First Search algorithm with example. 6M  
b) What is the chromatic number of the following 6M  
i)  $C_n$  ii)  $K_n$  iii)  $K_{m,n}$

## UNIT-IV

8. a) A binary operation  $*$  is defined on  $Z$  by  $a*b=a+b-ab$ ,  $a,b \in Z$  show that  $(Z,*)$  is a semi group. 6M  
b) Show that  $(Z, +)$  is an abelian group. 6M

(OR)

9. a) What is lattice? Explain with suitable example. 6M  
b) What is poset? Explain with suitable example. 6M

## UNIT-V

10. a) Solve  $a_n=3a_{n-1} - 2$ , given  $a_0=1$ . 6M  
b) Solve the recurrence relation of the sequence of numbers  $f_n=f_{n-1}+f_{n-2}$ ,  $n \geq 2$  6M  
With the initial condition  $f_0=1, f_1=1$ .

(OR)

11. a) Find the recurrence relation and the initial condition for the sequence 0, 2, 6, 12, 20, 30, 42, .... Hence find the general terms of the sequence. 6M  
b) Explain Generating function and explain various operations on generating function. 6M