

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) Design DFA to accept strings with 'c' and 'd' such that number of d's are divisible by 4. 7 M
- b) Explain the procedure for converting DFA to NFA. 7 M

(OR)

2. a) Let  $\Sigma = \{a, b\}$ , a) Give DFA that accepts any string with "aababb" as a substring. 7 M
- b) What is a Finite state machine? Give the mathematical representation of FSM. Explain each component. 7 M

**UNIT-II**

3. a) Define Regular Expression? Explain about the properties of Regular Expressions. 7 M
- b) Give a regular expression that generates the language L over the alphabet  $\Sigma = \{a, b\}$  where each b in the string is followed by exactly one or three a's. 7 M

(OR)

4. a) Show that  $L = \{a^{2n} | n \geq 0\}$  is Regular. 7 M
- b) What is relationship between finite automata and regular expression? Explain the process of converting DFA to regular expression. 7 M

**UNIT-III**

5. a) ) Construct Griebach Normal Form Equivalent to the context free grammar  
 $S \rightarrow ASB/AB,$   
 $A \rightarrow a,$   
 $B \rightarrow b$  7 M

- b) Define Context Free Grammar. State and Explain the closure properties of CFG. 7 M

(OR)

6. a) Consider the CFG with  $\{S, A, B\}$  as the non-terminal alphabet,  $\{a, b\}$  as the terminal alphabet, S as the start symbol and the following set of production rules  
 $S \rightarrow ASA | aB | b$   
 $A \rightarrow B$   
 $B \rightarrow b | \epsilon$   
Find a reduced grammar equivalent to the above grammar. 7 M
- b) Elaborate on left most derivation and right most derivation. 7 M

**UNIT-IV**

7. a) How to convert the following grammar to PDA that accepts the same language by empty stack  
 $S \rightarrow 0AA$   
 $A \rightarrow 0S/1S/0$  7 M
- b) Define Push Down Automata. Explain the basic structure of PDA with a neat graphical representation. 7 M

(OR)

8. a) Construct a PDA that accepts  $L = \{0^n 1^n | n \geq 0\}$  7 M
- b) What is Deterministic PDA? Differentiate acceptance by final state and acceptance by empty state. 7 M

**UNIT-V**

9. a) Design a Turing Machine to accept the set of all palindrome over  $\{0,1\}^*$ . Draw the Transition diagram for the same. 7 M
- b) Explain the design of universal Turing machine with its halting problem. 7 M

(OR)

10. a) Why a Turing machine is called Linear Bounded Automata? Discuss the advantages of Linear Bounded Automata. 7 M
- b) Design a turing machines and its transition diagram to accept language greeted by  $\{a^i b^j c^k | i, j, k \in \mathbb{N}, i+k=j\}$ . 7 M

Answer ONE Question from each Unit

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All parts of the Question must be answered at one place

**UNIT-I**

1. a) State Coulomb's Law. Derive the expression for Coulomb's law to calculate the magnitude of the force between two charges. **7M**  
b) Point charges 5mC and -4mC are located at (3,2,-1) and (-1,-1,4) respectively. Calculate the electric field intensity on 20 nC charge located at (0,3,1) and the electric field intensity at the point. **7M**  
(OR)
2. a) Using Gauss' law derive expression for electric field intensity and electric flux density due to an infinite sheet of conductor of charge. **7M**  
b) Calculate the electric field at a distance 'r' because of two charge particles +Q & -Q separated by a small distance 'd' symmetrically on either side of the origin. **7M**

**UNIT-II**

3. a) Derive an expression for force between two straight long parallel current carrying conductors. What will be the nature of force if the currents are in the same and opposite direction **7M**  
b) With necessary equation explain "*law of conservation of magnetic flux*" **7M**  
(OR)
4. a) An infinitely long current element on x- axis carries a current of 1.0mA in  $\mathbf{a}_z$  direction. Determine H at the point P(5,2,1) **7M**  
b) Derive the conditions of magnetic field at boundary surface of dielectric-dielectric interface. **7M**

### UNIT-III

5. a) Explain Faraday's Law for Time Varying Fields. 7M  
b) Two extensive homogeneous isotropic dielectrics meet on a plane  $z=0$ . For  $z \geq 0$ ,  $\epsilon_{r1}=4$  and for  $z \leq 0$ ,  $\epsilon_{r2}=3$ . A uniform electric field  $\mathbf{E}_1=5\mathbf{a}_x-2\mathbf{a}_y+3\mathbf{a}_z$  kV/m exists for  $z \geq 0$ .  
a) Find  $\mathbf{E}_2$  for  $z \leq 0$  b) the angles  $\mathbf{E}_1$  and  $\mathbf{E}_2$  make with the interface. 7M  
(OR)
6. a) Verify that the displacement current in parallel plate capacitor is as same as the conduction current in the conducting wires. 7M  
b) In free space, the magnetic field of an EM wave is given by  $\mathbf{H}=0.4\omega\epsilon_0 \cos(\omega t-50x) \mathbf{a}_z$  A/m. Find the electric field and displacement current density. 7M

### UNIT-IV

7. a) Explain the significances of Poynting theorem and derive the expression of Poynting vector. Does the Poynting theorem apply to static field? Explain 7M  
b) Define a Uniform Plane Wave and establish a wave equation for a conducting medium & derive the propagation characteristics of a good conductor 7M  
(OR)
8. With neat sketches, define and distinguish between vertical and horizontal polarizations, when a uniform plane is obliquely incident on a perfect dielectric medium from air, with relevant schematics. 14M

### UNIT-V

9. a) Define characteristic impedance and propagation constants of transmission line and obtain for lossless condition 7M  
b) A lossless transmission line with  $z_0=50\Omega$  is 30m long and operates at 2MHz. The line is terminated with a load  $Z_L=60+j40\Omega$ . If  $u=0.6c$  on the line, find the a) reflection coefficient, b) the standing wave ratio, and input impedance. 7M  
(OR)
10. a) Illustrate the procedure to design the double stub. 7M  
b) The antenna with an impedance of  $40+j30\Omega$  is to be matched to a load  $100\Omega$  lossless line with a shorted stub. Determine 7M  
a) The required stub admittance  
b) The distance between the stub and the antenna  
c) The length of the stub.

Answer ONE Question from each Unit

All Questions Carry Equal Marks

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### UNIT-I

1. a) The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force. 10
- b) Classify the systems of forces. 2

**(OR)**

2. a) With a suitable example explain how the resultant of coplanar concurrent forces is calculated. 10
- b) State the principle of moments. 2

### UNIT-II

3. a) A 675 N man stands on the middle rung of a 225 N ladder, as shown in Fig.1. Assuming a smooth wall at B and a stop at A to prevent slipping, find the reactions at A and B. 8

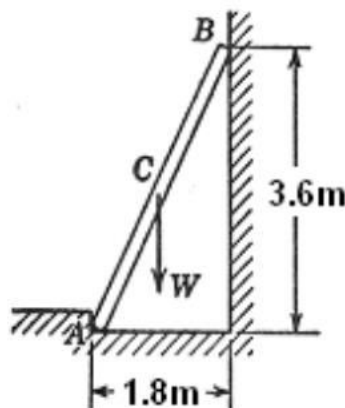


Fig.1.

- b) State and prove Varignon's theorem. 4

**(OR)**

4. a) Find the reactions  $R_a$  and  $R_b$  induced at the supports A and B of the right angle bar ACB supported as shown in Fig.2. and subjected to a vertical load P applied at the mid-point of AC. 10

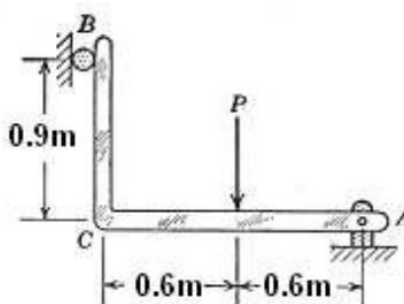


Fig.2.

- b) Define a couple-moment and list its characteristics. 2

### UNIT-III

5. Find the force required to move a load of 300 N up a rough inclined plane, the force being applied parallel to the plane. The inclination of the plane is such that when the same body is kept on a perfectly smooth plane inclined at that angle, a force of 60 N applied at an inclination of  $30^\circ$  to the plane keeps the same in equilibrium. Assume that co-efficient of friction between the rough plane and load is equal to 0.3. 12

(OR)

6. Determine the forces in all the members of the truss shown in Fig. 3. and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at  $60^\circ$  to horizontal and length of each member is 2 m. 12

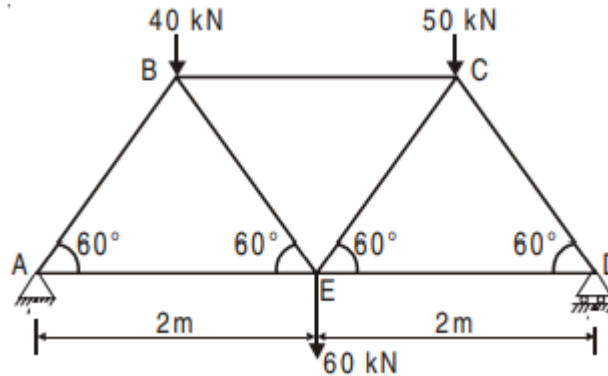


Fig. 3.

### UNIT-IV

7. a) Find the centroid of the given L section as shown in Fig. 4. 8

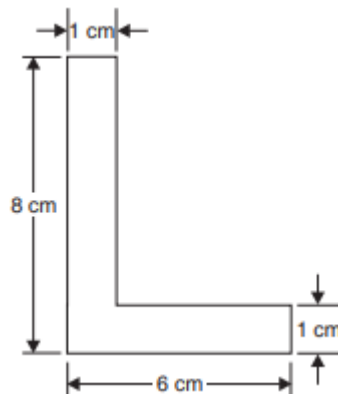


Fig. 4.

- b) Discuss the procedure to find the location of the centre of gravity of a composite body. 4

(OR)

8. a) State and prove transfer formula for product of inertia. 4  
b) Determine moment of inertia of the lamina shown in Fig. 5. 8

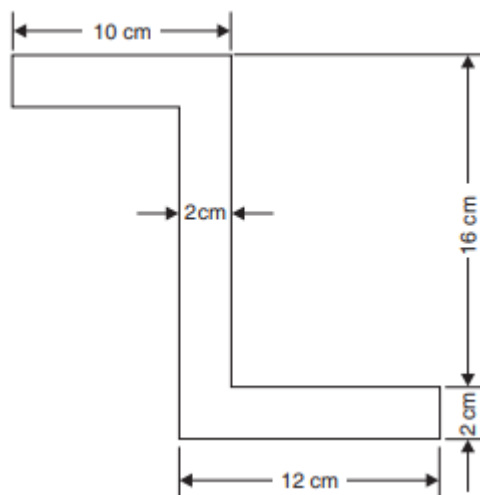


Fig. 5.

## UNIT-V

9. a) What is the difference between Newton's Second law and D'Alembert's principle. 2
- b) Find the acceleration of the moving loads as shown in Fig.6. Take mass of P=120 kg and that of Q=80 Kg and coefficient of friction between surfaces of contact is 0.3. Also find the tension in the connecting string. 10

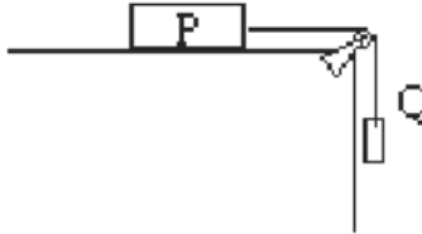


Fig.6.

**(OR)**

10. a) A body moves along a straight line and its acceleration 'a' which varies with time 't' is given by  $a = 2 - 3t$ . Five seconds after the start of observation, the velocity is 20 m/s. The distance moved by the body 10sec after the start of observation of motion from origin is 85 m. Determine the following: 8
- i). The acceleration, velocity and distance from the origin at the start of observation.
  - ii). The time after the start of observation at which the velocity becomes zero and the distance travelled from the origin.
- b) A food packet is dropped from a plane going at an altitude of 1000m, what is the path of packet as seen from plane? What is the path as seen from the ground? What will be the actual path? 4

# AR18

**CODE: 18MET204**

**SET-1**

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

**II B. Tech II Semester Supplementary Examinations, May, 2025**

**STRENGTH OF MATERIALS**

**(Mechanical 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 straight bar 600mm long consists of three portions the first 180 mm length is of 30mm diameter, the middle 260mm length is of 20mm dia. and the remaining 16 cm length is of 25mm dia. If it is subjected to an axial pull of 100kN find the total extension of the bar. Find also the stresses, strains and changes in length of different portions. Take  $E = 200 \text{ GPa}$  12M

**(OR)**

2. A steel rod 28 mm diameter is fixed concentrically in a brass tube of 42mm outer diameter and 30 mm inner diameter. Both the rod and tubes are 450 mm apart long. The compound rod is held between two stops which are exactly 450mm apart and the temperature of the bar is raised by  $70^\circ\text{C}$ . (a) Find the stresses in the rod and tube if the distance between the stops is increased by 0.30 mm. (b) Find the increase in the distance between the stops if the force exerted between them is 90kN Take  $E_s = 200 \text{ kN/mm}^2$ ;  $\alpha_s = 11.2 \times 10^{-6} \text{ per}^\circ\text{C}$ ,  $E_b = 90 \text{ kN/mm}^2$ ;  $\alpha_b = 2.1 \times 10^{-5} \text{ per}^\circ\text{C}$  12M

## UNIT-II

3. a. A cylindrical shell 90 cm long 20 cm internal diameter having thickness of metal as 8 mm is filled with fluid at atmospheric pressure. If an additional  $20 \text{ cm}^3$  of fluid is pumped into the cylinder, find (i) the pressure exerted by the fluid on the cylinder and (ii) the hoop stress induced. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\mu = 0.3$ . 6M

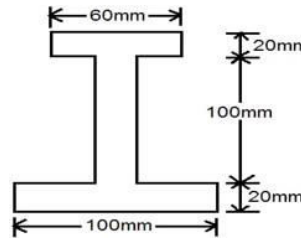
- b. Derive an expression for circumferential stress for a thin shell subjected to an internal pressure. 6M

**(OR)**

4. A simply supported beam of length 8m carries point loads of 4 kN and 6 kN at a distance of 2 m and 4m from the left end. Draw the S.F. and B.M. diagrams for the beam. 12M

### UNIT-III

5. A beam of I-section shown in fig is simply supported over a span of 4m. Determine the load that the beam can carry, if the allowable bending stress in beam is  $30.82 \text{ N/mm}^2$ . 12M



(OR)

6. A beam of I-section is having overall depth as 500 mm and overall width as 190 mm. The thickness of flanges is 25 mm whereas the thickness of web is 15 mm. If the section carries a shear force of 40 kN, calculate the maximum shear stress. Also sketch the shear stress distribution across the section. 12M

### UNIT-IV

7. A hollow shaft dia ratio  $3/5$  is required to transmit 450kW at 1200rpm, the shearing stress in the shaft must not exceed  $60 \text{ N/mm}^2$  and the twist in a length of 2.5m is not to exceed  $1^\circ$ . Calculate the minimum external dia of the shaft. Take,  $C=8.0 \text{ kN/mm}^2$ . 12M

(OR)

8. Calculate safe compressive load on a hollow cast iron column with one end rigidly fixed and other end is hinged of 100 mm external diameter and 70 mm internal diameter and 8m in length. Use Euler's formula with a factor of safety 4. Take  $E= 95 \text{ kN/mm}^2$ . 12M

### UNIT-V

9. A steel girder of uniform section, 14 meters long, is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at two points 3 meters and 4.5meters from the two ends respectively. (a) Calculate the deflection of the girder at the two points under the two loads.(b) The maximum deflection. Use Macaulay's Method. Take:  $I = 16 \times 10^4 \text{ m}^4$ , and  $E = 210 \times 10^6 \text{ kN/m}^2$ . 12M

(OR)

10. a) Explain in detail the Moment Area method 6M  
b) Determine the deflection at the free end of a cantilever beam point load at the free end. 6M



Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

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**UNIT-I**

Mark s	CO	Bloom s Level
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1. Identify whether the function  $f(z)$  defined by
- $$f(z) = \begin{cases} \frac{(\bar{z})^2}{z}, & (z \neq 0) \\ 0 & (z = 0) \end{cases}$$
- satisfies Cauchy-Riemann conditions and derivative at origin or not?

10M	CO1	K3
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(OR)

2. Build the analytic function  $f(z)$ , whose real part is  $e^x(x \cos y - y \sin y) + 2 \sin x \sin y + x^3 - 3xy^2 + y$  with Milne-Thompson method.

10M	CO1	K3
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**UNIT-II**

3. Verify Cauchy's theorem for the function  $f(z) = z^3 - iz^2 - 5z + 2i$ ,  $C$  is the circle  $|z| = 1$ .

10M	CO2	K4
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(OR)

4. Evaluate  $\int_C \frac{(\sin \pi z^2 + \cos \pi z^2)}{(z-1)(z-2)} dz$  where  $C$  is  $|z| = 3$  using Cauchy's integral formula.

10M	CO2	K4
-----	-----	----

**UNIT-III**

5. Using residues, evaluate  $\int_C \frac{z \cos z}{(z - \frac{\pi}{2})^2} dz$  where  $C$  is
- (i)  $|z - 1| = 1$       (ii)  $|z| = 2$

10M	CO3	K3
-----	-----	----

(OR)

6. Show that  $\int_0^\infty \frac{\cos x}{\sqrt{x}} = \sqrt{\frac{\pi}{2}}$

10M	CO3	K3
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**UNIT-IV**

7. 20% of the items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) none is defective (ii) one is defective (iii)  $p(1 < x < 4)$ .

10M	CO4	K3
-----	-----	----

(OR)

8. The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11%. Estimate (i) How many students got marks above 90%.(ii) what was the highest mark obtained by the lowest 10% of the students. 10M CO4 K3

#### UNIT-V

9. Construct S.D. of means for the population 3,7, 11, 15 by drawing samples of size two without replacement. Determine (a)  $\mu$  (b)  $\sigma$  (c)  $\mu_{\bar{x}}$  (d)  $\sigma_{\bar{x}}$ . 10M CO5 K3

**(OR)**

10. Assuming that the population standard deviation is 0.3, calculate the (a) 95% and (b) 99% confidence intervals for the mean lead concentration in a river if the mean lead concentration recovered from a sample of lead measurements in 36 different locations is 2.6 gms/ml. 10M CO5 K3

#### UNIT-VI

11. A random sample of 40 'geyers' produced by company A have a mean lifetime (*mlt*) of 647 hours of continuous use with a *s.d.* of 27 hours, while a sample 40 produced by another company B have *mlt* of 638 hours with *s.d.* 31 hours. Does this substantiate the claim of company A that their 'geyers' are superior to those produced by company B at 0.05 L.O.S. 10M CO6 K3

**(OR)**

12. A study was conducted to determine whether physical handicappers (P.H.) affects the performance of worker's in an industry with the following results: 10M CO6 K3

Performance

	Good	Satisfactory	Not Satisfactory	Total
Blind	21	64	17	102
Deaf	16	49	14	79
No Handicap	29	93	28	150
Total	66	206	59	331

Test the claim that handicaps have no effect on performance at 0.05 L.O.S. Using chi-square test for independent attributes

Answer ONE Question from each Unit

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**UNIT-I**

1. A random variable X has the following probability distribution

Marks CO BTL  
10 CO1 L2

x	1	2	3	4	5	6
P(x)	K	3K	5K	7K	9K	11K

(i) Find K, (ii) Evaluate  $P(1 < X < 5)$ , (iii) Evaluate the mean of X.

**(OR)**

2. a. Explain the Poisson Distribution function. 4 CO1 L2  
b. If a bank received on the average 6 bad cheques per day, 6 CO1 L2  
what are the probabilities that it will receive  
a) 4 bad cheques on any given day?  
b) 10 bad cheques over any 2 consecutive days

**UNIT-II**

3. A continuous Random Variable has a pdf  $f(x) = kx^2e^{-x}$ ,  $x \geq 0$ . 10 CO2 L2  
Find (i) k, (ii) mean

**(OR)**

4. Given a Standard Normal distribution, find the area 10 CO2 L3  
under the curve which lies i) To the left of  $z=1.43$ ;  
ii) to the right of  $z=-0.89$  iii) between  $z=-2.16$  and  $z=-0.65$

**UNIT-III**

5. A population consists of five numbers 2,3,6,8,11. 10 CO3 L2  
Consider all possible samples of size 2 that can be drawn without replacement from this population. Find  
(i) The population mean. (ii) The population standard deviation. (iii) The mean of the sampling distribution of the means. (iv) The standard deviation of the sampling distribution of the means.

**(OR)**

6. a. Find the maximum error for  $\mu$  based on  $\bar{x} = 128.3$ ,  $n = 64$ ,  $s = 32.4$ , and confidence level of 98%. 4 CO3 L2
- b. A union official wanted to estimate the mean hourly wage  $\mu$  of its members. A random sample of 100 members gave  $\bar{x} = \$18.30$  and  $s = \$3.25$  per hour. Find an 95% confidence interval for  $\mu$ . 6 CO3 L2

#### UNIT-IV

7. In a sample of 1000 people in Karnataka 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat eaters are equally popular in this state at 1% level of significance? 10 CO4 L2

(OR)

8. A manufacturer claims that a special type of projector bulb has an average life 160 hours. To check this claim an investigator takes a sample of 20 such bulbs, puts on the test, and obtains an average life 167 hours with standard deviation 16 hours. Assuming that the life time of such bulbs follows normal distribution, does the investigator accept the manufacturer's claim at 5% level of significance? 10 CO4 L3

#### UNIT-V

9. A die is thrown 264 times with the following results. Show that the die is biased. Given  $\chi^2 = 11.07$  at 5% los, 5 degrees of freedom. 10 CO5 L3

$x$	1	2	3	4	5	6
$f$	40	32	28	58	54	52

(OR)

10. To compare the two kinds of bumper guards, 6 of each kind were mounted on a certain kind of compact car. Then each car was run into a concrete wall at 5 miles per hour, and the following are the cost of the repairs  
Bumper guard 1: 107 148 123 165 102 119  
Bumper guard 2: 134 115 112 151 133 129  
Use the 0.01 level of significance to test whether the difference between the means of these two samples is significant? 10 CO5 L3

#### UNIT-VI

11. Height of fathers and sons in inches are given below 10 CO6 L2
- |                  |    |    |    |    |    |    |    |    |
|------------------|----|----|----|----|----|----|----|----|
| Height of Father | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 71 |
| Height of Son    | 66 | 68 | 65 | 69 | 74 | 73 | 72 | 70 |
- Find the correlation coefficient.

(OR)

12. Find the Spearman's rank correlation coefficient from the given data. 10 CO6 L2

X	1	5	4	2	6	3
Y	79	160	125	15	214	103

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

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**UNIT-I**

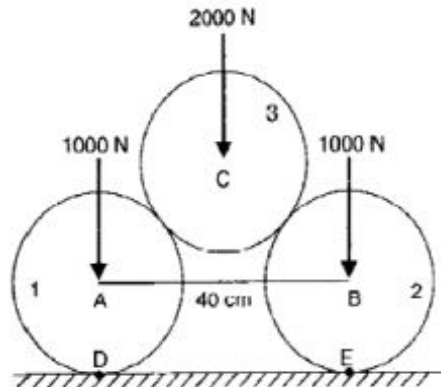
1. What are the laws to add two forces and several concurrent, coplanar forces? Explain in detail

Marks	CO	BTL
10	CO1	L2

**(OR)**

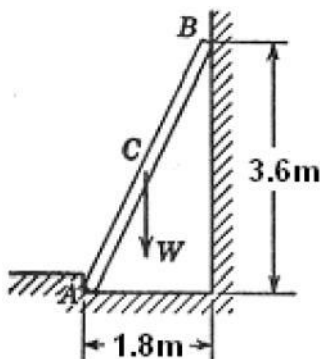
2. Two smooth circular cylinders, each of weight  $W = 1000\text{N}$  and radius  $15\text{cm}$ , connected at their centres by a string  $AB$  of length  $40\text{cm}$  and rest upon a horizontal plane supporting above them a third cylinder of weight  $2000\text{N}$  and radius  $15\text{cm}$  as shown in fig. below. Find the force in string  $AB$  and the pressure produced on the floor at the points of contact  $D$  and  $E$

Marks	CO	BTL
10	CO1	L3

**UNIT-II**

3. A  $675\text{N}$  man stands on the middle rung of a  $225\text{N}$  ladder, as shown in figure. Assuming a smooth wall at  $B$  and a stop at  $A$  to prevent slipping, find the reactions at  $A$  and  $B$

Marks	CO	BTL
10	CO2	L3

**(OR)**

4. State and prove Varignon's theorem with a suitable example

Marks	CO	BTL
10	CO2	L2

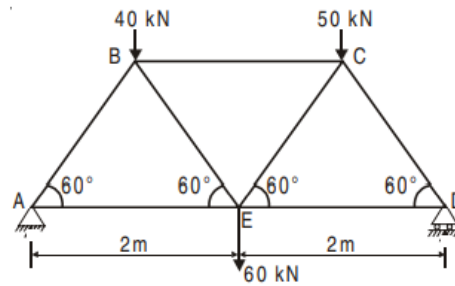
**UNIT-III**

5. A uniform ladder of weight  $800\text{N}$  and of length  $7\text{m}$  rests on a horizontal ground and leans against a smooth vertical wall. The angle made by the ladder with the horizontal is  $60^\circ$ . When a man of weight  $600\text{N}$  stands on the ladder at a distance  $4\text{m}$  from the top of the ladder, the ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor.

Marks	CO	BTL
10	CO3	L3

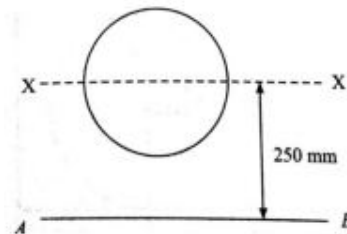
**(OR)**

6. Determine the forces in all the members of the truss shown in Fig. 3. and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at  $60^\circ$  to horizontal and length of each member is 2 m. 10 CO3 L4



#### UNIT-IV

7. A circle of diameter 120mm is placed above on axis AB in such a way that its centre is 250mm above the axis AB as shown in figure. Using parallel axis theorem, determine moment of inertia about reference axis AB and also determine polar moment of inertia. 10 CO4 L4



(OR)

8. Find the centroid of the given L section as shown in Fig. 4. 10 CO4 L3

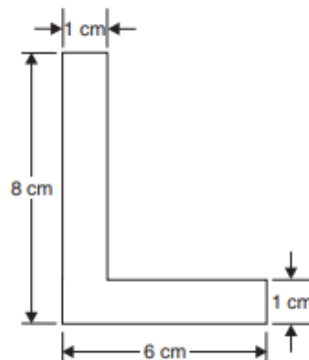


Fig. 4.

#### UNIT-V

9. A cage descends a mine shaft with an acceleration of  $0.6\text{m/sec}^2$ . After the cage has travelled 30m, a stone is dropped from the top of the shaft. Determine the time taken by the stone to hit the cage and distance travelled by the cage before impact. 10 CO5 L3

(OR)

10. A projectile is aimed at a target on the horizontal plane and falls 12m short when the angle of projection is  $15^\circ$  while it overshoots by 24m when the angle is  $45^\circ$ . Find the angle of projection to hit the target. 10 CO5 L3

#### UNIT-VI

11. A body of weight 2000N moves on a level horizontal rough road for a distance of 200m. The resistance of the road is 10N per 1000N weight of the body. Find the work done by the resistance on the body. 10 CO6 L3

(OR)

12. A bullet of 25 g mass is fired with a speed of 400 m/s. What is its kinetic energy? If the bullet can penetrate 20 cm in a block of wood, what is the average resistance of the wood? If the bullet were fired into a similar block of 10 cm thick wood, what would be the exit speed 10 CO6 L3

Time: 3 Hours

Max Marks: 60

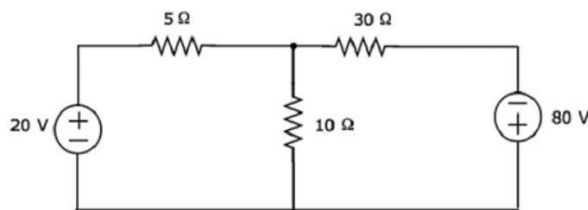
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

**UNIT-I**

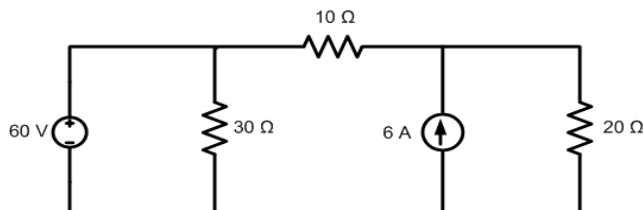
1. a Find the voltage across  $30\ \Omega$  resistor using Mesh analysis.



- b Explain Superposition theorem with suitable example.

(OR)

2. a Find the current through  $30\ \Omega$  resistor using Nodal analysis.



- b Explain Norton's theorem with suitable example.

**UNIT-II**

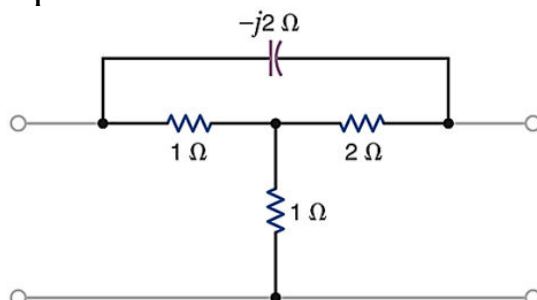
3. State and explain Maximum Power Transfer theorem.

(OR)

4. State and explain Tellegen's theorem.

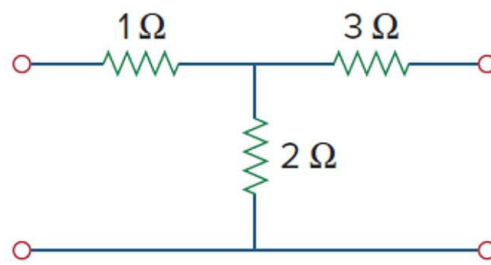
**UNIT-III**

5. Find the Z parameters for the network below



(OR)

6. Obtain the y parameters for the T network shown figure 10 3 3



#### UNIT-IV

7. A series L–R–C circuit has a sinusoidal input voltage of maximum value 12 V. If inductance,  $L = 20 \text{ mH}$ , resistance,  $R = 80 \Omega$ , and capacitance,  $C = 400 \text{ nF}$ , determine (i) the resonant frequency, (ii) the value of the p.d. across the capacitor at the resonant frequency (iii) the value of the maximum voltage across the capacitor. 10 4 3

**(OR)**

8. A coil of inductance 5 mH and resistance  $10 \Omega$  is connected in parallel with a 250 nF capacitor across a 50 V variable-frequency supply. Determine (i) the resonant frequency, (ii) the current at resonance, and (iii) the circuit Q-factor at resonance. 10 4 3

#### UNIT-V

9. Explain the key characteristics of filters. 10 5 2

**(OR)**

10. Explain the concept of M-derived filters and how they improve upon prototype filters. 10 5 2

#### UNIT-VI

11. Derive the transient response of an R-L circuit excited by a DC source 10 6 3

**(OR)**

12. Discuss the transient response of an R-L-C circuit under sinusoidal AC excitation. 10 6 3



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**

- |   |   | Marks | CO | BTL |
|---|---|-------|----|-----|
| 1 | The saturated steam at a pressure of 35bar is entered the turbine in simple Rankine cycle and exhausted at a pressure of 0.26 bars. Assume the flow rate of 9.5kg/s. Determine the work of Pump and Turbine, the efficiency of Rankine cycle and Condenser efficiency also find the Dryness fraction at the end of expansion. | 10    | 1  | K3  |

(OR)

- |   |   |    |   |    |
|---|---|----|---|----|
| 2 | Explain the any two methods to increase the efficiency of Rankine cycle | 10 | 1 | K2 |
|---|---|----|---|----|

**UNIT-II**

- |    |  |    |   |    |
|----|--|----|---|----|
| 3. | Explain the construction and Working of Cochran boiler | 10 | 2 | K2 |
|----|--|----|---|----|

(OR)

- |   |   |    |   |    |
|---|---|----|---|----|
| 4 | Explain the construction and Working of Bobcock & Wilcox boiler | 10 | 2 | K2 |
|---|---|----|---|----|

**UNIT-III**

- |    |  |    |   |    |
|----|--|----|---|----|
| 5. | Steam at the rate of 7.5kg/s flows through a set of nozzles. The inlet pressure is 14bar and superheat is 55°C. The exit pressure is 6 bar. Neglect the velocity of approach and assume the expansion of steam is isentropic. Find the number be the correct exit area of nozzles used if the outlet area of each nozzle is approximately 2.3cm <sup>2</sup> . What should be the correct exit area. | 10 | 3 | K3 |
|----|--|----|---|----|

(OR)

- |   |   |   |   |    |
|---|---|---|---|----|
| 6 | a Explain the working of surface condenser.                           | 5 | 3 | K2 |
|   | b Explain the working of counter flow jet condenser with neat sketch. | 5 | 3 | K2 |

**UNIT-IV**

- |   |  |    |   |    |
|---|--|----|---|----|
| 7 | Steam at 5 bar 200°C is supplied to a single stage steam turbine at 50kg/min. The condenser at a pressure of 0.2 bar. The blade speed is 400m/s. The nozzles are inclined at an angle of 20° to the plane of the wheel and the outlet blade angle is 30°. Neglecting friction losses determine the power developed, blade efficiency and stage efficiency. | 10 | 4 | K3 |
|---|--|----|---|----|

(OR)

- |    |  |    |   |    |
|----|--|----|---|----|
| 8. | A reaction turbine with rotor mean rotor diameter of 1.5m and speed ratio=0.72 is at rotor speed of 3000rpm. The blade outlet angle is 20°. Estimate diagram efficiency. Also find the percentage increase in diagram efficiency and rotor speed, if the rotor is designed to run at the best theoretical speed, the exit angle being 20°. | 10 | 4 | K3 |
|----|--|----|---|----|

**UNIT-V**

- |   |  |    |   |    |
|---|--|----|---|----|
| 9 | The minimum and maximum temperature limits in a gas turbine plant are 288 K and 1100 K. The pressure limits are 1 bar and 8 bar. Determine the thermal efficiency and work | 10 | 5 | K3 |
|---|--|----|---|----|

(OR)

- |    |   |    |   |    |
|----|---|----|---|----|
| 10 | Explain. different parameters influence the performance of gas turbine cycle. | 10 | 5 | K2 |
|----|---|----|---|----|

**UNIT-VI**

- |     |   |    |   |    |
|-----|---|----|---|----|
| 11. | A small office hall of 25 persons capacity is provided with summer air conditioning system with the following data: Outside conditions = 34° C DBT and 28°C WBT, inside conditions = 24° C DBT and 50 % RH, Volume of air supplied = 0.4 m <sup>3</sup> /min/person, Sensible heat load in room = 125600 kJ/h, Latent heat load in the room = 42000 kJ/h. Find the sensible heat factor of the plant. | 10 | 6 | K3 |
|-----|---|----|---|----|

(OR)

- |     |  |    |   |    |
|-----|--|----|---|----|
| 12. | Sketch the psychometric chart and represent the different psychometric properties on the same. | 10 | 6 | K2 |
|-----|--|----|---|----|