CBCS SCHEME

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18ME61

Sixth Semester B.E. Degree Examination, June/July 2023
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define FEM. List the advantages and disadvantages of FEM. **(10 Marks)**

b. List and explain steps in FEM. **(10 Marks)**

OR

2 a. Explain simplex, complex and multiplex elements. **(06 Marks)**

b. A cantilever beam of span 'L' is subjected to a point load at its free end as shown in Fig.Q2(b). Derive an equation for the deflection at free end by using RR method. Assume polynomial displacement function.

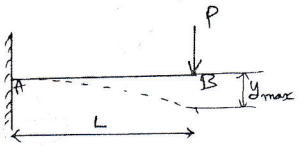

Fig.Q2(b) **(14 Marks)**

Module-2

3 a. Derive the element stiffness matrix of 1D bar element. **(08 Marks)**

b. Using penalty method of handling boundary condition, determine the nodal displacement, stress in each element and support reaction in the bar shown due to applied load in Fig.Q3(b). P = 100 kN.

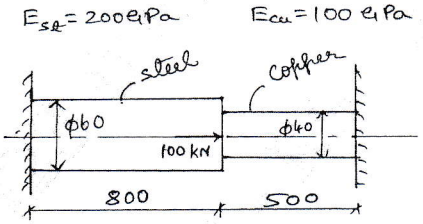

Fig.Q3(b) **(12 Marks)**

OR

4 a. List the assumptions made in Truss. **(04 Marks)**

b. A 4 bar truss element is shown in Fig.Q4(b). Determine the following:
i) Nodal displacement ii) Stress in each element iii) Reaction at supports.
Area of each truss element = 100 mm^2 ; E = 2×10^5 N/mm^2.

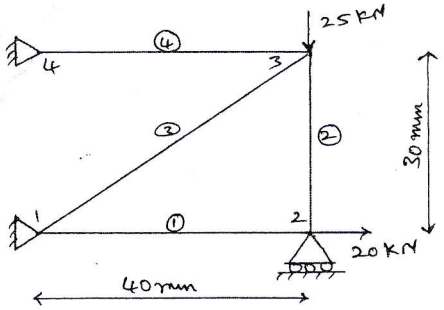

Fig.Q4(b) **(16 Marks)**

Module-3

5 a. Derive the Hermite shape function of a Beam element. **(08 Marks)**

b. For the beam shown in Fig.Q5(b), determine the displacement at node 2 and internal loads. Take E = 210 GPa, b = 0.2 m ; h = 0.4 m.

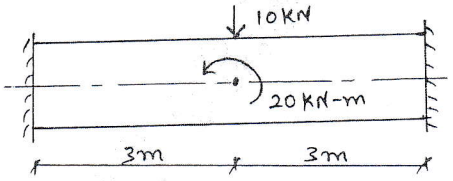

Fig.Q5(b) **(12 Marks)**

OR

6 a. Derive the stiffness matrix for the torsion of shafts. **(08 Marks)**

b. A solid stepped bar of circular cross section shown in Fig.Q6(b) is subjected to a torque of 1 kN-m at its free end and a torque of 3 kN-m at its change in c/s. Determine the angle of twist and shear stresses in the bar. Take E = 2×10^5 N/mm^2 and G = 7×10^4 N/mm^2.

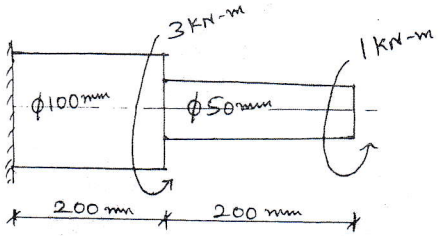

Fig.Q6(b) **(12 Marks)**

Module-4

7 a. Derive the governing differential equation for 1-D heat conduction. **(06 Marks)**

b. Determine the temperature distribution in the composite wall using 1D heat elements, use penalty approach of handling BC's. Refer Fig.Q7(b).

Given :

$k_1 = 20$ W/m °C
$k_2 = 30$ W/m °C
$k_3 = 55$ W/m °C
$h = 30$ W/m^2 C
$T_\infty = 900$°C
A = Unit area

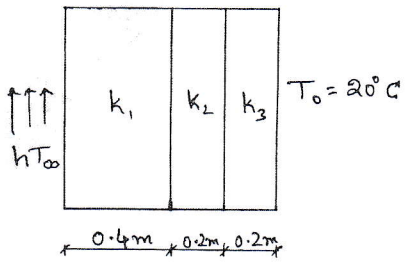

Fig.Q7(b) **(14 Marks)**

OR

8 a. Derive the element stiffness matrix of 1-D fluid flow element. **(06 Marks)**

b. For the smooth pipe of variable cross-section shown in Fig.Q8(b), determine the potential at the junction, the velocities in each section of pipe and the volumetric flow rate. The potential at left end is $P_1 = 10$ m^2/s and at right end is $P_4 = 1$ m^2/s. For the fluid flow through a smooth pipe $k_x = 1$.

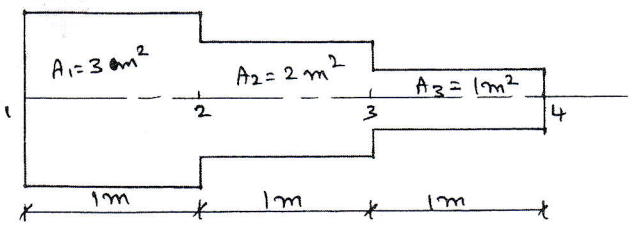

Fig.Q8(b) **(14 Marks)**

Module-5

9 a. Derive the element stiffness matrix of a triangular axisymmetric element using potential energy approach. **(06 Marks)**

b. For the element of an axisymmetric body rotating with constant angular velocity w = 1000 rev/min as shown in Fig.Q9(b). Determine the body force vector. Include the weight of the material, where specific density is 7850 kg/m^3.

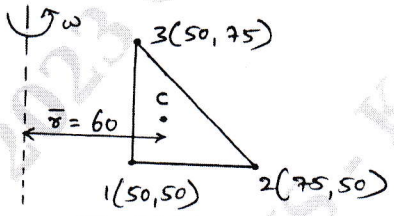

Fig.Q9(b) **(14 Marks)**

OR

10 a. Derive an expression of element mass matrices of
(i) 1-D bar element
(ii) Truss element **(10 Marks)**

b. Evaluate eigen value and eigen vector of longitudinal vibration of the constrained uniform circular bar shown in Fig.Q10(b). Take minimum two elements. Take E = 210 GPa and ρ = 7860 kg/m^3.

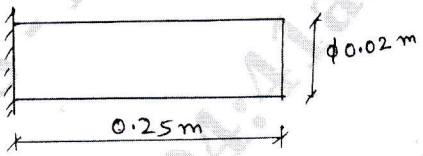

Fig.Q10(b) **(10 Marks)**

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18ME62

Sixth Semester B.E. Degree Examination, June/July 2023
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 100

Note:1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Using design data hand book is permitted.
3. Assume missing data suitably.

Module-1

1 a. Discuss about the following terms :
(i) Active coils
(ii) Deflection
(iii) Solid length
(iv) Free length
(v) Resilience **(05 Marks)**

b. Derive an expression for energy stored in a spring. **(05 Marks)**

c. Design a helical compression spring to carry a load of 500 N with a deflection of 20 mm. The allowable shear stress in the spring material is 350 MN/m^2 and the modulus of rigidity is 82.7×10^3 MN/m^2. The spring index is 6. **(10 Marks)**

OR

2 a. A leather belt 125 mm wide and 6 mm thickness transmits power from a pulley 750 mm diameter which runs at 500 rpm. The angle of lap is 150° and the coefficients of friction between the belt and the pulley is 0.3. If the belt density is 1000 kg/m^3 and the stress in the belt is not to exceed 2.75 N/mm^2, find the power that can be transmitted by the belt. Also find the initial tension in the belt. **(10 Marks)**

b. An oil well has to be drilled to a depth of 900 mm using 100 drill pipe. Assume 200 N for every 15 m length of pipe. The rope sheaves are of 80 mm diameter and acceleration is 2.5 m/s^2. Determine the size of 6×37 wire rope for lifting the string of pipes using a FOS as 3 and ultimate stress as 1800 MPa. **(10 Marks)**

Module-2

3 Design a pair of spur gear to transmit 27 kW for an oil pump with the gear ratio of 3 : 1, the rpm of the pinion is 1200, the centre distance is 400 mm, and the gears are to be forged steel untreated with $14\frac{1}{2}^\circ$ FDI. Check the design for dynamic and wear condition. **(20 Marks)**

OR

4 A pair of helical gears are used to transmit 15 kW. The teeth are 20° full depth in normal plane and have a helix angle of 30°. The pinion has 24 teeth and operates at 1000 rpm. The velocity ratio is 5 to 1. The pinion is made of cast steel $[\sigma_d = 50\,MPa]$ and the gear is of bronze $[\sigma_d = 40\,MPa]$. The pinion material is hardened to 200 BHN. Design the gear pair. **(20 Marks)**

Module-3

5 A pair of straight tooth bevel gear at right angle is to transmit 5 kW at 1200 rpm of the pinion. The diameter of the pinion is 80 mm and the velocity ratio is 3.5 to 1. The tooth form is $14\frac{1}{2}^{\circ}$ composite type. Both pinion and gear are made of CI $\left[\sigma_d = 55\ \text{N/mm}^2\right]$. Determine the face width and the required module from the stand point of strength using Lewis equation and check for design from the stand point of dynamic load and wear load. **(20 Marks)**

OR

6 Design a worm gear to transmit 2 kW at 1000 rpm, speed ratio is 20 and centre distance is 200 mm. **(20 Marks)**

Module-4

7 a. A cone clutch with a face angle of 14° has to transmit 286 N-m of torque at a speed of 600 rev/min. The larger diameter of the clutch is 250 mm, face width is 60 mm and co-efficient of friction is 0.18. Determine (i) Axial force to transmit the torque (ii) Average normal pressure (iii) Maximum normal pressure. Assume uniform wear condition. **(10 Marks)**

b. A single plate friction clutch of both sides effective has 0.3 m outer diameter and 0.16 m inner diameter. The coefficient of friction is 0.2 and it runs at 1000 rpm. Find the power transmitted for uniform wear and uniform pressure distribution cases if the allowable maximum pressure is 0.08 MPa. **(10 Marks)**

OR

8 a. Fig. Q8 (a) shows a CI brake shoe. The coefficient of friction is 0.30. The breaking torsional moment is to be 346 N. Determine

(i) The force P, for anti-clock wise rotation.
(ii) The force P, for clockwise direction.
(iii) Where must the pivot be placed to make the brake self energizing with the counter clockwise direction.

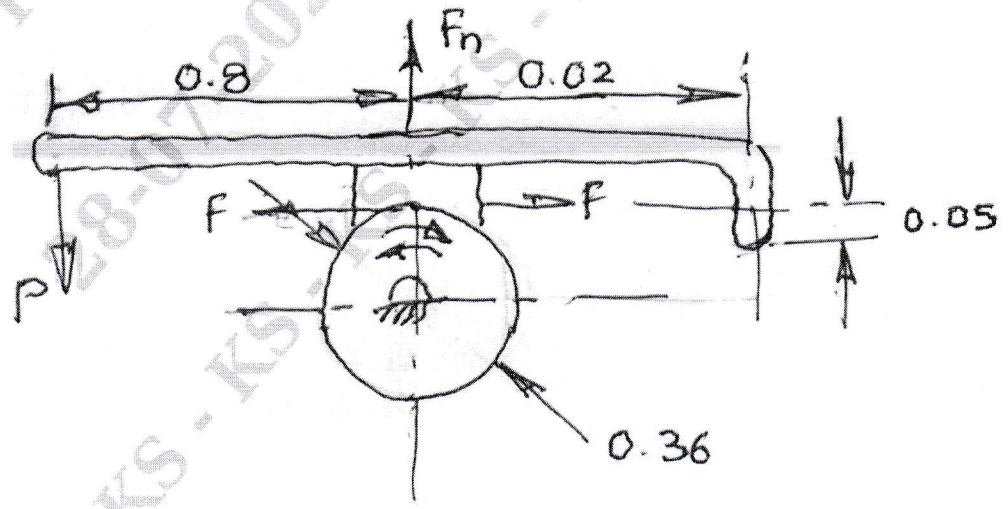

Fig. Q8 (a) **(10 Marks)**

b. In a simple band break, the length of the lever is 440 mm, the tight end of the hand is attached to the fulcrum of the lever and the slack end to a pin 50 mm from the fulcrum. The diameter of the break drum is 1 mm and arc of contact is 300°, the co-efficient of friction between the band and the drum is 0.35. the break drum is attached to a hoisting drum of diameters 0.65 m that sustains a load of 20 kN (Fig. Q8(b)),
   (i) Force required at the end of lever to support the load.
   (ii) Width of steel band if the tensile stress is limited to 50 N/mm^2.

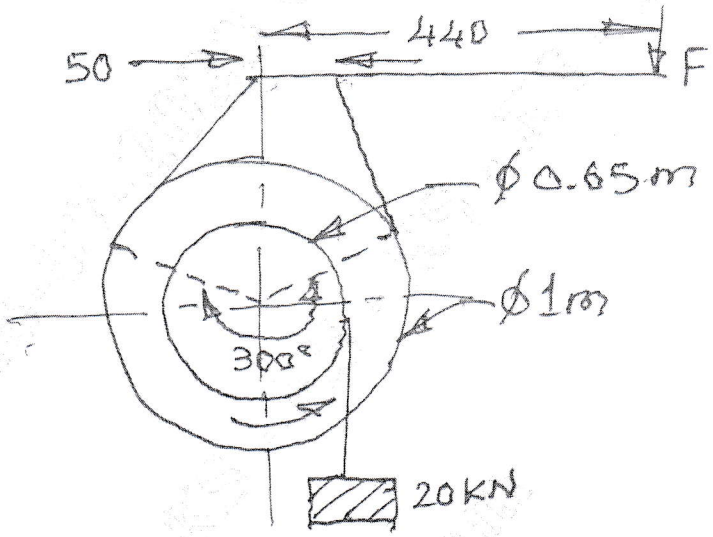

Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Derive Petroff's equation for lightly loaded bearing. **(12 Marks)**

b. For a full journal bearing has the following specification : Shaft diameter 45 mm, bearing length 66 mm, Clearance ratio 0.0015, Speed 2800 rpm, Load 800 N and absolute viscosity 8.27×10^{-3} Pa-S. Determine (a) frictional torque (b) Co-efficient of friction (c) Power loss. **(08 Marks)**

OR

10 a. A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm^2. The speed of journal is 900 rpm and the ratio of journal diameter to the diametrical clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m. The room temperature is 35°C. Determine :
   (i) The amount of artificial cooling required.
   (ii) The mass of lubricating oil required, if the difference between outlet and inlet temperature of the oil is 10°C.
   Take specific heat of 1850 J/kg°K. **(10 Marks)**

b. A bearing for an axial flow compressor is to carry a radial load of 4905 N and thrust load of 2452 N. The service imposes light shock and the bearing is used for 40 hours/week for 5 years. The speed of the shaft is 300 rpm and diameter of the shaft is 60 mm. Select a suitable bearing. **(10 Marks)**

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18ME63

Sixth Semester B.E. Degree Examination, June/July 2023
Heat Transfer

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Thermodynamic and Heat Transfer data hand book is permitted.***
3. ***Any missing data can be suitably assumed.***

Module-1

1 a. With usual notations, starting from 3-dimesional conduction equation, derive one dimensional equation in rectangular coordinates. **(10 Marks)**

b. Explain the different boundary conditions as applicable to heat transfer analysis. **(10 Marks)**

OR

2 a. What is critical thickness of insulation? Derive an expression for critical radius of insulation interms of thermal conductivity and HTC 'h'. **(10 Marks)**

b. A furnace wall is made up of inside silica brick (K = 1.856 W/m-K) and outside magnesia brick (K = 5.568 W/m-K) each 10 mm thick. If inner and outer surface temperature of wall are 820°C and 120°C. Find the heat flow rate through the plane Wall/m^2. Take the contact resistance of 1.722×10^{-3} m^2-K/W. Also find the interface temperature. **(10 Marks)**

Module-2

3 a. With usual notations, derive an expression for temperature distribution for infinite Fin. State the assumptions made. **(10 Marks)**

b. Find the amount of heat transfer through iron fin of thickness 5 mm, height 50 mm and width 100 cm. Take atmospheric temperature as 28°C and K = 50 W/m-K. The HTC = 10 W/m^2-K the temperature difference at the base of the fin = 80°C. Estimate the efficiency of the fin. **(10 Marks)**

OR

4 a. With usual notations derive an expression for temperature distribution through a body for lumped parameter analysis in terms of Biot number and Fourier number. **(10 Marks)**

b. Mild Steel Sphere of 15 mm dia initially at 625°C is exposed to current of air at 25°C with HTC h = 120 W/m^2-K. Calculate:

(i) Time required to cool the sphere to 100°C

(ii) Initial rate of cooling in °C/sec.

(iii) Total energy removed for one minute. The thermophysical properties for MS are K = 43 W/m-K, C = 474 W/m-K, ρ = 7850 kg/m^3 and α = 0.045 m^2/sec. **(10 Marks)**

Module-3

5 a. Write a note on spectral and total emissive power of a body. **(08 Marks)**

b. Write a short note on the concept of black body and grey body. **(04 Marks)**

c. The average solar radiation flux on the earth's atmosphere is 1353 W/m^2. Calculate the temperature of sun (a black body) having diameter 1.392×10^6 km and has a mean distance of 1.496×10^8 km from the earth's atmosphere. State any assumption made. **(08 Marks)**

OR

6 a. Explain Wein's displacement law, Kirchoff's law and Max Plank's law. **(10 Marks)**

b. Two large parallel planes with emissivity of 0.6 are at 900 K and 300 K. A radiation shield with one side polished and having emissivity of 0.05, while the emissivity of other side is 0.4 is proposed to used. Which side of the shield to face the hotter plane, if the temperature of shield is to kept minimum? Comment on your answer. **(10 Marks)**

Module-4

7 a. Explain the concept of development of boundary layer over a flat plate with different zones. **(10 Marks)**

b. Atmospheric air at 2°C and free stream velocity of 20 m/s flows over 1.5 m long flat plate maintained at uniform temperature of 88°C. Calculate:

(i) The average HTC 'h' over the region of laminar boundary layer.

(ii) Average H.T.C. (Heat Transfer Coefficient) for entire length of plate 1.5 m.

(iii) Total Heat Transfer Rate. Take critical Reynolds number $Re_c = 2 \times 10^5$. **(10 Marks)**

OR

8 a. Explain the significance of Reynolds number, Prandtl Number, Nusselt number and Grasshof number with equations. **(10 Marks)**

b. Calculate the total heat loss from a human body, assuming as vertical cylinder, 30 cm in dia and 175 cm in height stand in still air at 13°C. Take the skin temperature as 37°C and emissivity as 0.4. **(10 Marks)**

Module-5

9 a. Define heat exchanger and classify them. **(04 Marks)**

b. Derive an expression for Lag Mean Temperature Difference (LMTD) for counter flow heat exchanger. State the assumptions made. **(08 Marks)**

c. A heat exchanger is required to cool 55000 kg/hr of alcohol from 66°C to 40°C using 44,000 kg/hr of water entering at 5°C. Calculate:

(i) Exit temperature of water

(ii) Heat transfer

(iii) Surface area required for parallel flow and counter flow type heat exchanger design and comment on the results overall HTC U = 580 W/m^2-K, $C_{p(alcohol)}$ = 3760 J/kg-K, $C_{p(water)}$ = 4180 J/kg-K. **(08 Marks)**

OR

10 a. Define film wise and drop wise condensation process. **(04 Marks)**

b. With a neat sketch, explain the modes of pool boiling. **(08 Marks)**

c. Steam at 0.065 bar condenser on a vertical plate 0.6 m square. If the surface temperature of the plate is maintained at 15°C, estimate the rate of condensate. The properties of condensate at mean temperature 26.4°C are, ρ = 1000 kg/m^3, $\mu = 864 \times 10^{-6}$ N-S/m^2, K = 0.913 W/m-K., $h_{fg(latent\ heat)} = 2412 \times 10^3$ J/kg-K. **(08 Marks)**

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18ME641

Sixth Semester B.E. Degree Examination, June/July 2023
Non - Traditional Machining

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define Non-traditional Machining. What are the need of NTM? Explain briefly. **(08 Marks)**

b. What are difference between Conventional and Non – conventional Machining? **(06 Marks)**

c. List and explain the various factors to be considered for selection of NTM process. **(06 Marks)**

OR

2 a. Give classification of NTM process. **(08 Marks)**

b. List applications of NTM. **(06 Marks)**

c. List any 3 advantages and limitations of NTM. **(06 Marks)**

Module-2

3 a. With neat sketch, explain USM process. **(10 Marks)**

b. Explain with neat diagram, process parameters in USM. **(10 Marks)**

OR

4 a. Explain with neat sketch, working principle of Abrasive Jet Machining and also give advantages of AJM. **(10 Marks)**

b. With the neat sketch, explain Water Jet Machining process and also give advantages and limitations of WJM. **(10 Marks)**

Module-3

5 a. With neat sketch, explain the working of ECM process. **(10 Marks)**

b. With neat sketch, explain ECG. Also give the advantages and limitations of ECG. **(10 Marks)**

OR

6 a. Explain the following in Chemical Machining Process :
i) Maskants ii) Etchants. **(08 Marks)**

b. List out advantages and applications of Chemical Machining. **(06 Marks)**

c. Write a short note on Chemical Blanking. **(06 Marks)**

Module-4

7 a. Explain with neat sketch the mechanism of metal removal in Electric discharge machining and also give applications. **(10 Marks)**

b. Explain Die Electric Medium, its functions and desirable properties in EDM process. **(10 Marks)**

OR

8 a. With a neat sketch, explain Plasma Arc Machining Process. **(10 Marks)**

b. Discus some of the important considerations in the design of Plasma torch in PAM. **(10 Marks)**

Module-5

9 a. With a neat sketch, explain working principle of Laser Beam Machining. **(08 Marks)**

b. What are the advantages and disadvantages of LBM process? **(06 Marks)**

c. List the limitations and applications of LBM proces. **(06 Marks)**

OR

10 a. Explain with the help of neat diagram Principle of Electron Beam Machining (EBM). **(10 Marks)**

b. What are the advantages , disadvantages and applications of EBM process? **(10 Marks)**

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18ME653

Sixth Semester B.E. Degree Examination, June/July 2023
Supply Chain Management

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is Supply Chain Management? Explain the network of SCM, with a relevant diagram. **(10 Marks)**

b. Explain the importance of SCM in the present context for an Organization. **(10 Marks)**

OR

2 a. Explain two views of SCM process. **(12 Marks)**

b. What is Responsiveness with reference to SCM? How do you achieve it? Explain. **(08 Marks)**

Module-2

3 a. Explain the Strategic Outsourcing process, with a neat flow chart. **(10 Marks)**

b. What is Make V/s Buy strategy? How Economics of Scale influences Make V/s Buy decision? Explain briefly. **(10 Marks)**

OR

4 a. What are the two different modes of supplier selection? Explain briefly. **(10 Marks)**

b. Why Supplier development is essential to achieve or create a World class supply base. **(10 Marks)**

Module-3

5 a. List and explain different objectives of Stores and Warehouse Management. **(10 Marks)**

b. Explain briefly different modes of transportation of transporting goods. **(10 Marks)**

OR

6 a. Explain various factors which influence the distribution network design. **(08 Marks)**

b. List and briefly explain the objective function, constraints of following models :
i) Capacitated plant location model ii) Gravity location model. **(12 Marks)**

Module-4

7 a. Mr. Sampath is planning to open a Computer store. He has 2 choices to make , large or small. The demand can be either low or high with probabilities of 0.45 and 0.55 respectively. If small store is built at high demand annual revenue is estimated as Rs 20 lakhs. Later he can either expand that or do nothing. If he expands the revenue will increase to 40 lakhs with an investment for expansion being 5 lakhs. If he does nothing , his revenue will remain same as earlier. At low demand he will do nothing and revenue will be 10 lakhs. If he builds large store, at high demand , he will earn Rs 80 lakhs annually. At low demand, either he can sell it for Rs 30 lakhs or wait for better future which will get him a revenue of Rs 50 lakhs. If the cost of building and large store is Rs 30 lakhs and small store is Rs 10 lakhs, which store must be built? Use decision tree for your analysis over a 1 year period. Without considering discounted cash flow. **(12 Marks)**

b. Explain the law of demand and optimal pricing decision with a suitable example. **(08 Marks)**

OR

8 a. Explain the concept of overbooking with relevant model and a suitable example. **(10 Marks)**

b. A Manager at a warehouse department plans for the size of the warehouse. The study reveals that the housing needs is normally distributed with a mean of 6,00,000 square feet and standard deviation of 195, 000. The Manager can lease a warehouse in advance for next 3 years at Rs 300000/year or purchase the warehouse on the spot market at an average of Rs 500000/year. How large, the annual contract should the Manager sign? **(10 Marks)**

Module-5

9 a. Why Integration is necessary in a supply chain? How do you achieve it? Explain. **(10 Marks)**

b. What is Bull Whip effect? What causes it? How do you control it? Explain briefly. **(10 Marks)**

OR

10 a. Explain the concept of Supply Chain Mapping with relevant diagrams. **(10 Marks)**

b. Is information technology a key driver for the success of SCM? What characteristics of Information will support supply chain decision? Explain briefly. **(10 Marks)**

Note : for question 8b , choose the suitable value from the following table :

Value of K	Service level in %
- 0.1	46.0
- 0.2	42.1
- 0.3	38.2
- 0.4	34.5
- 0.5	30.8
- 0.6	27.5
- 0.7	24.5

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