CBCS SCHEME

USN | | | | | | | | | | **18ME61**

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 Finite Element Methods. Explain general steps in Finite Element Methods. **(10 Marks)**

b. Fig.Q.1(b) shows a bar fixed at both ends subjected to an axial load as shown. Determine displacement at loading point and corresponding stress using R-R method. **(10 Marks)**

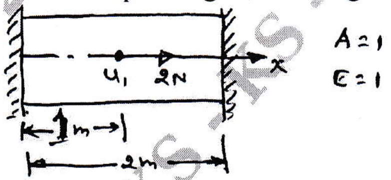

Fig.Q.1(b)

OR

2 a. Explain convergence criteria and different types of elements in Finite Element Methods. **(10 Marks)**

b. A cantilever beam subjected to U.D.L. Derive an equation for maximum deflection using Galerkin's method use polynomial function. **(10 Marks)**

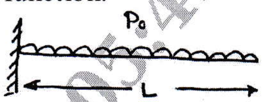

Fig.Q.2(b)

Module-2

3 a. Derive shape functions for TET-4 element. **(10 Marks)**

b. A stepped bar shown in Fig.Q.3(b). Determine the nodal displacement and stresses at each node. Take $E = 2 \times 10^5 N/mm^2$.

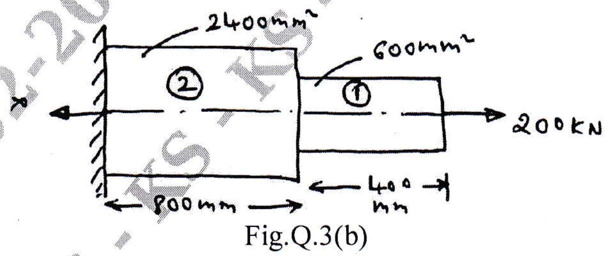

Fig.Q.3(b)

(10 Marks)

OR

4 a. Derive shape functions for C.S.T element in natural coordinates. **(10 Marks)**

b. Using Gaussian quadrature evaluate,

$$I = \int_{-1}^{+1} \left[3e^3 + 3^2 + \frac{1}{3+2} \right] d_3$$ by one point and two point formula. **(10 Marks)**

Module-3

5 a. Derive Hermite shape functions for beam element. **(10 Marks)**

b. A cantilever beam subjected to point load of 250kN as shown in Fig.Q.5(b). Determine deflection at free end and support reactions. E = 200GPa, I = $4 \times 10^6 mm^4$. **(10 Marks)**

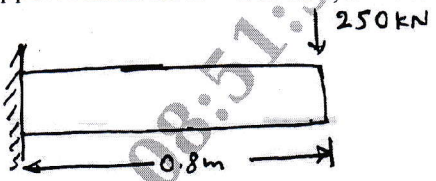

Fig.Q.5(b)

OR

6 a. Derive stiffness matrix for torsion of shaft. **(10 Marks)**

b. A solid stepped bar of circular cross section as shown in Fig.Q.6(b). Subjected to torque of 1kN-m at free end and torque 3kN-m at change in C/S. Determine angle of twist and shear stresses in bar E = $2 \times 10^5 N/mm^2$ G = $7 \times 10^4 N/mm^2$. **(10 Marks)**

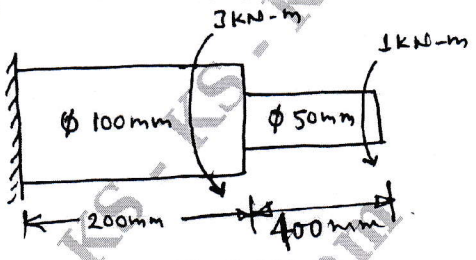

Fig.Q.6(b)

Module-4

7 a. Derive differential equation for 1D heat conduction. **(10 Marks)**

b. Determine the temperature distribution in a rectangular fin shown in Fig.Q.7(b). Assume steady and only conduction process. Heat generated inside the fin as $400 W/m^3$. **(10 Marks)**

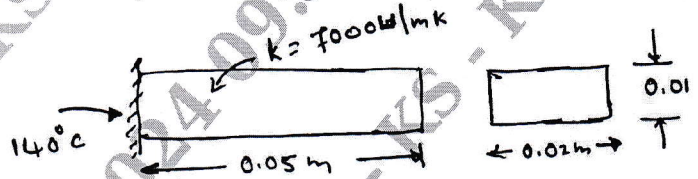

Fig.Q.7(b)

OR

8 For the smooth pipe of variable C/S shown in Fig.Q.8. Determine the potential at junctions, the velocities in each section pipe and volumetric flow rate. The potential at left end $P_1 = 10 m^2/sec$ and that at right end $P_4 = 1 m^2/sec$ for the fluid flow through smooth pipe $K_x = 1$. **(20 Marks)**

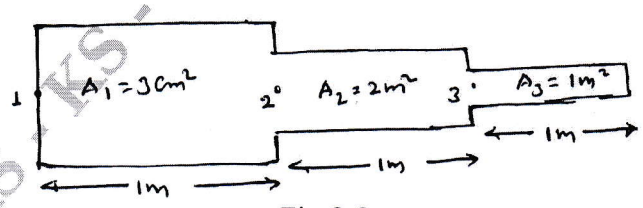

Fig.Q.8

Module-5

9 a. For the element of axisymmetric body rotating with constant angular velocity W = 1000 lev/min shown in Fig.Q.9(a). Determine the body force vector include weight of material, where specific density is 7850kg/m^3. **(10 Marks)**

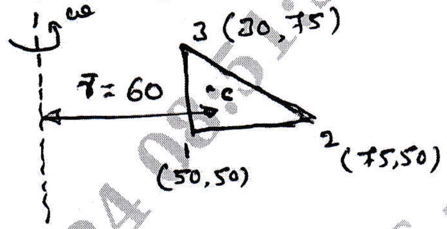

Fig.Q.9(a)

b. Evaluate nodal forces used to replace the linearly varying surface traction shown in Fig.Q.9(b). **(10 Marks)**

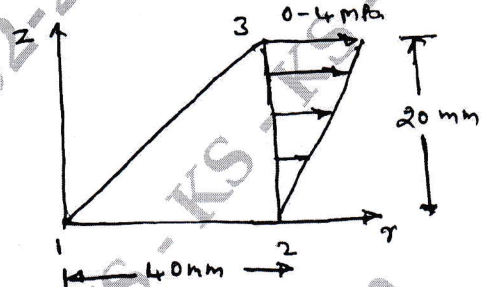

Fig.Q.9(b)

OR

10 a. Derive an equation for consistent mass matrix of 1D bar element. **(10 Marks)**

b. Derive an equation for truss element in consistent mass matrix. **(10 Marks)**

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CBCS SCHEME

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18ME62

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Use of design data handbook is permitted.
3. Assume missing data suitably.

Module-1

1 a. Derive an expression for shear stress induced in helical compression spring. **(08 Marks)**

b. A truck spring has a overall length of 1.2m and sustain a load of 60kN. The spring has 3 full length and 15 graduated leaves. All the leaves are stressed to 360MPa when fully loaded. The ratio of total depth to width is 2. Take E = 206GPa. Determine the width and thickness of leaves, the camber and load exerted on band. **(12 Marks)**

OR

2 a. Define slip and creep in belt. Explain the effect of slip on velocity ratio. **(10 Marks)**

b. Select a V-belt drive to transmit 10kW of power from a pulley of 200mm pitch diameter mounted on an electric motor running at 720rpm to another pulley mounted on compressor running at 200rpm. The service is heavy duty varying from 10 hrs to 14 hrs per day and centre distance between centres of pulleys is 600mm. **(10 Marks)**

Module-2

3 a. Derive Lewis equation of spur gear teeth. **(05 Marks)**

b. It is required to transmit 25kW power from a shaft running at 1000rpm to a parallel shaft with speed reduction 2.5:1. The centre distance of shafts is to be 300mm. The material used for pinion is steel $(\sigma_{d_1} = 200\text{MPa}, \text{BHN} = 250)$ and the gear is CI $(\sigma_{d_2} = 140\text{MPa}, \text{BHN} = 200)$. Considering class-II gear with tooth profile is 20° FDI. Design the spur gear and check the design for dynamic and wear load. **(15 Marks)**

OR

4 A pair of steel helical gear is to transmit 15kW at 5000rpm of the pinion, both pinion and gears are made of the same material, hardened steel with allowable bending stress of 120MPa. The gears are to be operated at a centre distance of 200mm, speed reduction is 4:1. The teeth are 20° FDI. On transverse plane, helix angle is 45°. The gears are manufactured to class-III accuracy (precision class). Face width can be taken as 16 times the normal module. Design the helical gears and suggest suitable hardness. **(20 Marks)**

Module-3

5 a. Derive an equation for "formative number of teeth" on bevel gear. **(08 Marks)**

b. A pair of bevel gears transmitting 7.5kW at 300rpm of pinion. The pressure angle is 20°. The pitch diameters of pinion and gear at their large ends are 150mm and 200mm respectively. The face width of the gears is 40mm. Determine the components of the resultant gear tooth force and draw a free body diagram of forces acting on the pinion and the gear. **(12 Marks)**

OR

6 Complete the design and determine the input capacity of a worm gear speed reducer unit which consists of a hardened steel worm and a phosphor bronze gear having 20° stub involute teeth. The centre distance is to be 200mm and transmission ratio is 10 and worm speed is 2000rpm. **(20 Marks)**

Module-4

7 a. Derive an equation for torque transmitted by disc clutch. **(10 Marks)**

b. A cone clutch with asbestos friction lining transmits 30kW at 500rpm. The coefficient of friction is 0.2 and the permissible intensity of pressure is 0.35N/mm^2. The semi-cone angle is 12.5°. The outer diameter is fixed as 300mm from space limitations. Assuming uniform wear theory calculate:

i) The inner diameter
ii) The face width of friction lining and
iii) The force required to engage the clutch. **(10 Marks)**

OR

8 a. A single block brake shown in Fig.Q.8(a) is to balance a torque of 500Nm on a drum shaft at 1000rpm. Assuming coefficient of friction to be 0.25 and $2\theta < 60°$ determine:

i) Tangential force on the shoe
ii) Normal force
iii) Force 'F' required to apply brake
iv) The dimension 'C' required to make the brake self locking assuming other dimensions remain the same.
v) Heat generated. **(10 Marks)**

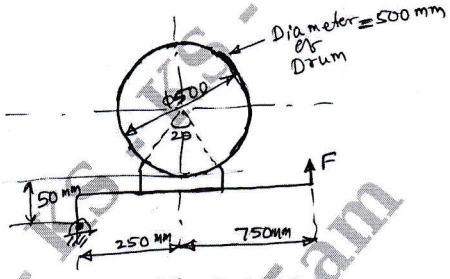

Fig.Q.8(a)

b. A differential band brake is shown in Fig.Q.8(b). The width and the thickness of the steel band are 100mm and 3mm respectively and the permissible tensile stress in the band is limited to 50N/mm^2. The coefficient of friction between the friction lining and the brake drum is 0.25, calculate: i) Tensions in the band ii) The actuating force iii) The torque iv) Find out whether the brake is self locking? **(10 Marks)**

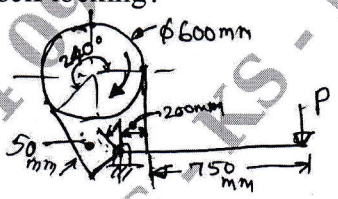

Fig.Q.8(b)

Module-5

9 a. Derive Petroff's equation, also list the assumptions made. **(08 Marks)**

b. A 200mm diameter bearing is 100mm long and has a load of 30kN. It runs at 900rpm. Clearance is 0.1mm. Oil used as SAE40. Operating temperature = 70°C. Find the power loss due to friction. **(12 Marks)**

OR

10 Select suitable single row radial ball bearings to carry a radial load of 1.5kN and a thrust load of 1.2kN at 900rpm. The bearing is to be used 7 hours per day and average service life of 8 years is desired. Consider the design load for bearing during selection with speed factor, life factor, thrust factor and application factor. **(20 Marks)**

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18ME63

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 heat transfer, thermodynamic data handbook and steam tables are permitted.***

Module-1

1 a. Write down three-dimensional heat conduction for Cartesian coordinates. Explain all the terms involved. Also reduce this equation as the Poisson's, Laplace, Fourier equation and one dimensional equation. **(08 Marks)**

b. A plane wall of thickness L is subjected to a heat supply at a rate of q_0 W/m^2 at one boundary surface and dissipates heat from the surface by convection to the ambient which is at a uniform temperature of T_∞ with a surface heat transfer coefficient of h_∞. Write the mathematical formulation of the boundary conditions for plane wall. **(08 Marks)**

c. What is meant by thermal diffusivity? What is its significance? **(04 Marks)**

OR

2 a. Derive the general three dimensional conduction equation in Cartesian coordinates and state the assumptions made. **(08 Marks)**

b. A wall of a furnace is made up of inside layer of silica brick 120 mm thick covered with a layer of magnesite brick 240 mm thick. The temperatures at the inside surface of silica brick wall and outside surface of magnesite brick wall are 725°C and 110°C respectively. The contact thermal resistance between the two walls at the interface is 0.0035°C/W per unit wall area. If thermal conductivities of silica and magnesite bricks are 1.7 W/m°C and 5.8 W/m°C. Calculate:
(i) The rate of heat loss unit area of wall
(ii) The temperature drop at the interface **(08 Marks)**

c. What is meant by critical insulation? What is its significance on steam pipe and electrical cables? **(04 Marks)**

Module-2

3 a. Derive the differential equation governing the temperature distribution for a fin of a uniform cross section by assuming thermal conductivity, the heat transfer coefficient and ambient temperature being constant. **(08 Marks)**

b. A rod [K = 200 W/mK] 5 mm in diameter and 5 cm long has its one end maintained at 100°C. The surface of the rod is exposed to ambient air at 25°C with convection heat transfer coefficient of 100 W/m^{2}K. Assuming other end is insulated. Determine:
(i) The temperature of rod at 20 mm distance from the end at 100°C.
(ii) Heat dissipation rate from the surface. **(08 Marks)**

c. Differentiate between effectiveness and efficiency of fin. **(04 Marks)**

OR

4 a. Obtain an expression for instantaneous heat transfer for lumped heat transfer analysis of heat conduction problem. **(08 Marks)**

b. A 12 cm diameter long bar initially at a uniform temperature of 40°C is placed in a medium at 650°C with a convective coefficient of 22 W/m^2K. Calculate the time required for the bar to reach 255°C. Take K = 20 W/mK, $\rho = 580\ kg/m^3$, c = 1050 J/kgK. **(08 Marks)**

c. What are Heisler charts? Explain their significance. **(04 Marks)**

Module-3

5 a. Explain formulation of differential equation 1-D steady heat conduction. **(08 Marks)**

b. Explain different solution method used in numerical analysis of heat conduction. **(08 Marks)**

c. Explain application and computations error of numerical analysis heat conduction. **(04 Marks)**

OR

6 a. State and explain:
(i) Stefan Boltzman law (ii) Krichoff's law
(iii) Wien's displacement law (iv) Lambert's cosine law **(08 Marks)**

b. Calculate the net radiant heat exchange per unit area for two large parallel plates at temperature of 427°C and 27°C respectively, $\epsilon_{hotplate} = 0.9$, $\epsilon_{coldplate} = 0.6$. If a polished aluminium shield is placed between them. Find the percentage reduction in heat transfer, $\epsilon_{shield} = 0.04$. **(08 Marks)**

c. Write concept of Black Body. **(04 Marks)**

Module-4

7 a. Explain physical significance of:
(i) Grashoff number (ii) Prandtl Number
(iii) Nusselt number (iv) Reynolds number **(08 Marks)**

b. A tube of 0.036 m OD, 40 cm length is maintained at a uniform temperature of 100°C. It is exposed to air at a uniform temperature of 20°C. Determine the rate of HT from the surface of the tube (i) If tube is vertical (ii) if tube is horizontal **(08 Marks)**

c. A vertical door of a hot oven is 0.5 m high and is maintained at 200°C. It is exposed to atm air at 20°C find local heat transfer coefficient half way up to the door. Take properties of air at 110°C, $\nu = 24.29 \times 10^{-6}\ m^2/s$, Pr = 0.687, K = 0.03274 W/mL. **(04 Marks)**

OR

8 a. Using dimensional analysis, obtain the dimensionless parameters in forced convection heat transfer. **(08 Marks)**

b. Air at 20°C and 1 atm flows over a flat plate at 35 m/s. The plate is 75 cm long and is maintained at 60°C. Assuming unit depth in the z-direction. Calculate heat transfer from the plate. **(08 Marks)**

c. What is difference between:
(i) free and forced convection
(ii) Laminar and turbulent flow **(04 Marks)**

Module-5

9 a. Derive an expression for LMTD of counter flow heat exchanger. State the assumptions made. **(08 Marks)**

b. The flow rate of hot and cold flux streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/sec respectively. The inlet temperature on the hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficient on both sides are 650 $W/m^2°C$. Calculate area of heat transfer. **(08 Marks)**

c. Write a note on Fouling Factor. **(04 Marks)**

OR

10 a. Water is boiled at a rate of 30 kg/hour in a copper pan 30 cm dia at atmospheric pressure. Estimate temperature at bottom of the surface of the pan. Assuming nucleate boiling condition. **(08 Marks)**

b. A vertical cooling fin approximate a flat plate of 40 cm height and is exposed to saturated steam at 100°C. (h_{fg} = 2257 kJ/kg). The fin is maintained at a temperature of 90°C. Calculate:
   (i) Thickness of film at bottom of film
   (ii) Average heat transfer coefficient
   (iii) Heat transfer after incorporating Mc-Adam's correction factor.
   Take $\rho = 965.8$ kg/m^3, K = 0.68 W/mK, $\mu = 3.153 \times 10^{-4}$ kg/m-s **(08 Marks)**

c. Differentiate:
   (i) Sub cooled boiling and saturated boiling
   (ii) Drop wise condensation and film wise condensation. **(04 Marks)**

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18ME641

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Explain the need of NTM and give the complete classification of NTM. **(10 Marks)**

b. Difference between traditional and non-traditional machining process. **(10 Marks)**

OR

2 a. Explain NTM process selection. **(10 Marks)**

b. Explain different feed mechanisms used in Ultrasonic Machining (USM). **(10 Marks)**

Module-2

3 a. Explain the parameters that effect on metal removal in USM process. **(10 Marks)**

b. With a neat sketch explain equipment and operation of Ultrasonic machining. **(10 Marks)**

OR

4 a. With neat sketch explain equipment and operation at Abrasive Jet Machining (AJM). **(12 Marks)**

b. Explain process characteristics of AJM. **(08 Marks)**

Module-3

5 a. Explain the chemistry of ECM process with diagram. **(08 Marks)**

b. With a neat sketch explain chemical blanking process and list out CHM applications. **(12 Marks)**

OR

6 a. Explain process parameters of ECM. **(10 Marks)**

b. With a neat sketch, explain chemical milling process. **(10 Marks)**

Module-4

7 a. Explain with sketch, the mechanism of metal removal in electrical discharge machining. **(10 Marks)**

b. Which are the important considerations are to be made in the design of plasma torch? **(10 Marks)**

OR

8 a. With a neat sketch, explain the working of PAM. List out the advantage and limitations of process. **(14 Marks)**

b. With a neat sketch, explain Electrical Discharge Grinding (EDG). **(06 Marks)**

Module-5

9 a. With a neat sketch, explain equipment of Laser Beam Machining (LBM). **(10 Marks)**

b. Explain process parameters of EBM and its applications. **(10 Marks)**

OR

10 a. With a neat sketch, explain electron beam machining and list out its advantages and disadvantages. **(12 Marks)**

b. With a neat sketch, explain Nd – YAG (neodymium Yttrium – aluminum garnet) layer used in LBM. **(08 Marks)**

CBCS SCHEME

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18ME653

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 a Supply Chain? Define its objectives and importance. **(10 Marks)**

b. Describe the two process views of a Supply Chain in detail. **(10 Marks)**

OR

2 a. What is a Strategic Fit? How do you achieve it? Explain. **(12 Marks)**

b. List the Drivers and Enablers of Supply Chain and discuss the role of them in Supply Chain performance. **(08 Marks)**

Module-2

3 a. How do Firms take make Vs Buy decisions? Explain with an example of a Telecommunication Company. **(12 Marks)**

b. Explain the terms Economics of Scale , Agency Costs and Transaction Costs. **(08 Marks)**

OR

4 a. What is the impact of Internet on Sourcing Strategy? Discuss. **(12 Marks)**

b. Mr. Mahesh and Suresh wanted to open a Bakery. The major decision should be taken by them is whether to make Cakes on site (or) buy Cakes from others. If they buy from other's they require some air tight containers which costs Rs 2000/- annually. The buying cost per Cake is Rs 0.8/-. If they make the Cakes in house, they need Kitchen costing Rs 30,000 per year and Rs 0.3/- per Cake to make. They trust themselves that they will sell 1,20,000 Cakes. So Mahesh and Suresh wants to know if they should make (or) buy the Cakes. **(08 Marks)**

Module-3

5 a. Differentiate Centralized and Decentralized Stores in detail. **(08 Marks)**

b. Briefly explain what is Stores Management, its objectives and functions. **(12 Marks)**

OR

6 a. What are the various factors influencing the network design decisions? Discuss. **(10 Marks)**

b. Enlist the design options for a distribution network and explain Manufacturing storage with direct shipping. **(10 Marks)**

Module-4

7 a. What is the role of forecasting in a Supply Chain? Explain. **(05 Marks)**

b. Discuss about the Time series method of forecasting. **(07 Marks)**

c. Write a short note on Safety Stock. **(08 Marks)**

OR

8 a. Explain the Decision Tree Methodology in detail. **(10 Marks)**

b. State the impact of Uncertainity on Network design and brief about Discounted Cash Flow (DCF). **(10 Marks)**

Module-5

9 a. What are the effects due to lack of co-ordination in Supply Chain? Explain. Also list the various obstacles for coordination. **(12 Marks)**

b. What is the future of IT in Supply Chain? Discuss. **(08 Marks)**

OR

10 a. "Supply Chain Restructuring", explain the process. **(08 Marks)**

b. List the various problems in implementing the Postponement strategy. **(04 Marks)**

c. "Building Partnership and Trust" in a Supply Chain. Discuss. **(08 Marks)**

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