CBCS SCHEME

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18ME61

Sixth Semester B.E. Degree Examination, July/August 2022
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. Explain steps in finite element method. **(10 Marks)**

b. Explain simplex, complex and multiplex elements. **(10 Marks)**

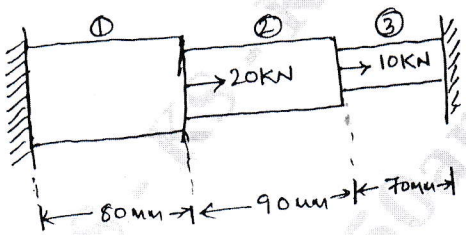
OR

2 a. Explain node numbering scheme. **(10 Marks)**

b. Obtain the shape functions for linear one dimension elements. **(10 Marks)**

Module-2

3 For the bar shown in Fig Q3, find the nodal displacements, stress in the middle portion and left support reaction.



$E_1 = 70$ GPa
$E_2 = 105$ GPa
$E_3 = 200$ GPa
$A_1 = 900$ mm^2
$A_2 = 400$ mm^2
$A_3 = 200$ mm^2

Fig Q3 **(20 Marks)**

OR

4 A four bar truss element as shown in Fig Q4, determine nodal displacement and stress in each element. Area = 100mm^2 E = 2×10^5 N/mm^2

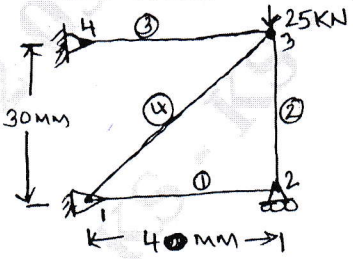


Fig Q4 **(20 Marks)**

Module-3

5 For the beam and loading shown in Fig Q5, determine mine the slopes at 2 and 3.

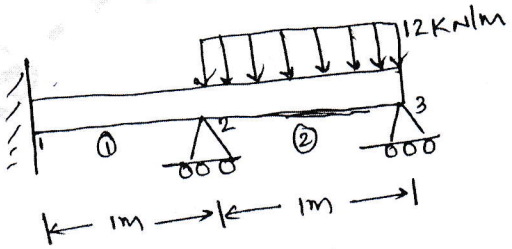


Fig Q5

Take : E = 200 GPa, I = 4×10^6mm^4 **(20 Marks)**

OR

6 A bar of circular cross section having a diameter 50mm is firmly fixed at its ends. It is subjected to torque as shown in Fig Q6. Determine the angle of twist and shear stress. Take $G = 7 \times 10^4$ N/mm^2, $E = 2 \times 10^5$ N/mm^2.

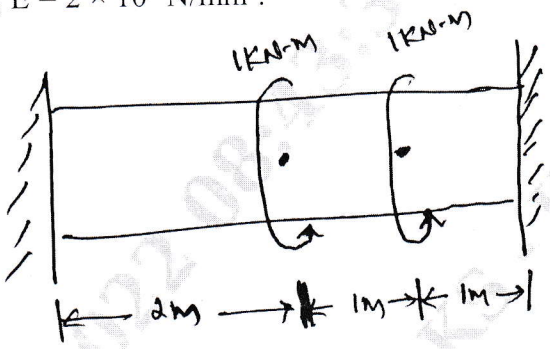
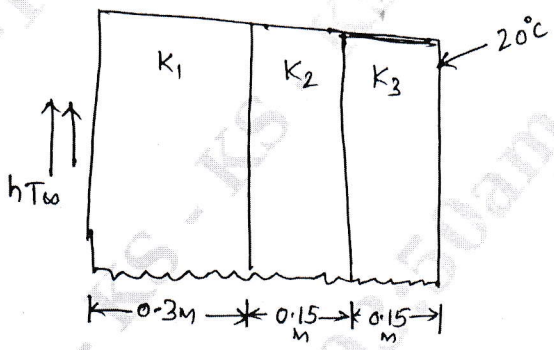


Fig Q6 **(20 Marks)**

Module-4

7 A composite wall consists of three materials, as shown in Fig Q7. The outer temperature is $T_0 = 20°C$, convective heat transfer takes place on the inner surface of the wall with $T_\infty = 800°C$ and $h = 25W/m^{2o}C$. Determine the temperature distribution in the wall.



$K_1 = 20W/m°C$
$K_2 = 30W/m°C$
$K_3 = 50W/m°C$

Fig Q7 **(20 Marks)**

OR

8 a. Derive stiffness matrix for flow through porous medium. **(10 Marks)**

b. Derive 1D heat conductive finite element matrix using variational method. **(10 Marks)**

Module-5

9 a. Derive shape function for axisymmetric triangular element. **(10 Marks)**

b. Derive stiffness matrix of axisymmetric bodies with triangular element. **(10 Marks)**

OR

10 For the stepped bar shown in Fig Q10, determine the Eigen values and Eigen vectors. Take $A_1 = 400mm^2$, $A_2 = 200mm^2$, $\rho = 7850$ kg/m^3, $E = 200GPa$.

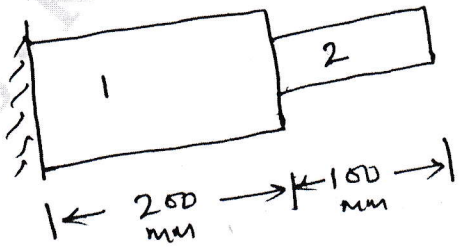


Fig Q10 **(20 Marks)**

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18ME62

Sixth Semester B.E. Degree Examination, July/August 2022
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.

Module-1

1 a. Derive an expression for the stress induced in a helical spring with usual notations. **(10 Marks)**

b. Design a leaf spring for the following specifications for a truck total load = 120kN, number of springs = 4 material for the spring is chrome vanadium steel with permissible stress = 0.55GPa span of spring = 1100mm, width of central band = 100mm and allowable deflection = 80mm, number of full length leaves are 2 and graduated leaves 6. **(10 Marks)**

OR

2 a. Select a V-belt drive to transmit 10kW of power from a pulley of 200mm diameter mounted on a electric motor running at 720rpm to another pulley mounted on a compressor running at 200rpm. The approximate centre distance between the two pulleys is 600mm. The correction factor for service is 1.3. Find the number of belts and the correct centre distance. **(10 Marks)**

b. Select a suitable wire rope to a standard strand to lift a load of 10kN through a height of 600m from a mine. The weight of the bucket is 2.5kN. The load should attain a maximum speed of 50m/min in 2 seconds. **(10 Marks)**

Module-2

3 A 12kW motor running at 1170rpm drives a fan through a pair of spur gears forged steel SAE1030 pinion and cast iron gear with a reduction ratio of 3.9:1. Design the gear pair and check for dynamic and wear loads. **(20 Marks)**

OR

4 Design a steel helical gear pair from the following data power transmitted = 30kW, speed of pinion = 1500rpm, velocity ratio 4:1 number of teeth on pinion = 24, helix angle $\beta = 30°$, static stress for both pinion and gear = 50.7MPa $(BHN)_P = (BHN)_G = 350$ check the design from wear point of view also. **(20 Marks)**

Module-3

5 Design a pair of bevel gears to transmit a power of 25kW from a shaft rotating at 1200rpm to a perpendicular shaft to be rotated at 400rpm. **(20 Marks)**

OR

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

Module-4

7 a. Derive power transmitting capacity of a single plate clutch for:
i) Uniform pressure condition ii) Uniform wear condition. **(10 Marks)**

b. A plate clutch with a maximum diameter of 600mm has maximum lining pressure of 0.35MPa. The power to be transmitted at 400rpm is 135kW and $\mu = 0.3$, find the inside diameter and spring force required to engage the clutch if the spring with spring index 6 and material of the spring wire diameter, if 6 springs used. **(10 Marks)**

OR

8 a. In a band and block brake $\theta = 15°$ and effective diameter is 800mm, P = 0.4, a = 100mm, b = 25mm. The power absorbed at 600rpm is 450kW when the force applied at the end of levels at a distance of 1.20m from a fulcrum is 200N. Find the number of blocks. **(10 Marks)**

b. In a simple bank brake, the length of lever is 440mm. The tight end of the band is attached to the fulcrum of the lever and the slack end to a pin 50mm from the fulcrum. The diameter of the brake drum is 1m and arc of contact is 360°. The coefficient of friction between the band and the drum is 0.35. The brake drum is attached to a hoisting drum of diameter 0.65m that sustains a load of 20kN. Determine: i) Power required at the end ii) Width of steel if the tensile stress is $50N/mm^2$. **(10 Marks)**

Module-5

9 a. Derive Petroff's equation for a lightly loaded journal bearing with usual rotation. State the assumptions also. **(10 Marks)**

b. A full journal bearing 50mm diameter and 50mm long operates at 1000rpm and carries a load of 5kN. The radial clearance is 0.025mm. The bearing is lubricated with SAE 30 oil and the operating temperature is 80°C. Determine:
i) Bearing pressure
ii) Sommefeld number
iii) Minimum film thickness
iv) Heat generated
v) Heat dissipated, if the ambient temperature is 20°C
vi) Amount of artificial cooling necessary. **(10 Marks)**

OR

10 a. Explain the different types of bearings. What are the requirements of lubricant used in the bearings? **(10 Marks)**

b. Select a single-row deep groove ball bearing to carry a radial load of 4kN and a thrust load of 5kN operating at a speed of 1200rpm for an average life of 15 years working 10hrs/day. Assume there are 250 working days/year and loads are steady. **(10 Marks)**

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18ME63

Sixth Semester B.E. Degree Examination, July/August 2022
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 Data Handbook and Seam tables are permitted.*

Module-1

1 a. Explain different modes of Heat transfer citing one example for each mode. **(05 Marks)**

b. A steam pipe of 4cm outer radius is covered with a layer of asbestos insulation of 1cm thickness , thermal conductivity, 0.15 W/m°C that is in turn covered by 3cm thick glass fibre insulation (K = 0.05 W/m° C). The surface of steam pipe is at 330°C and the outer surface of glass fibre layer is at 30°C. Determine interface temperature and the heat loss per meter length of pipe. **(07 Marks)**

c. Obtain the 3-D heat conduction equation in Cartesian co-ordinates stating the assumptions made. **(08 Marks)**

OR

2 a. What are Boundary Conditions? Explain BC 3rd kind for cylindrical geometry. **(05 Marks)**

b. A wire of 2mm diameter is heated electrically while it dissipates heat to the ambient with h = 125 W/m°C. If the wire is covered with 0.2mm thick insulation with K = 0.175 W/m° C. What are your interpretations on increase or decrease in heat loss from the wire? **(07 Marks)**

c. Explain the following terms with illustrations : i) Variable thermal conductivity
ii) Series and parallel arrangement of thermal resistances.
iii) Thermal diffusivity.
iv) Thermal contact resistance. **(08 Marks)**

Module-2

3 a. Explain the significance of fin efficiency and fin effectiveness. **(05 Marks)**

b. A cylinder 1m long and 50mm in diameter is placed in an ambience at 45°C with h = 17W/m^2 °C. It has 12 numbers of longitudinal straight fins (K = 120 W/m°C , height = 12.7mm , thickness = 0.76mm). Evaluate the total heat transfer rate if these fins behave as end – insulated fins when the cylinder surface temperature is held constant at 150°C. **(07 Marks)**

c. A spherical thermocouple junction of 0.706mm diameter measures gas temperature. The convective heat transfer coefficient on the bead surface is 400W/m^2 °C. If the properties of junction material are given to be K = 20W/m°C ; C_p = 400 J/kg K ; δ = 8500 kg/m^3. Estimate the time taken by bead of reach 298°C, when placed into a hot stream of gas at 300°C. The temperature of the bead is initially at 30°C. **(08 Marks)**

OR

4 a. Explain the significance of Biot number and Fourier number in transient heat conduction. **(05 Marks)**

b. An ordinary egg can be approximated as a sphere of 5cm diameter. The initial temperature of the egg is 5°C before it is dropped into 95°C water with convective heat transfer coefficient of 1200W/m^2 °C. Assume the egg properties to be same as that of water and evaluate the time required for the centre of egg to attain a temperature of 70°C. **(07 Marks)**

c. A hot surface at 100°C is to be cooled by attaching 100 numbers of pin fins 3cm long, 0.25cm diameter made of aluminum (end insulated).(K = 237 W/m°C) while surrounding medium is at 35W/m^2 C and 30°C. the 1m × 1m system has heat dissipation through these fins of equal size. Determine the rate of heat transfer from the fin mounted surface. **(08 Marks)**

Module-3

5 a. Explain Explicit scheme of solution to the One – dimensional transient heat conduction problem without heat generation. **(10 Marks)**

b. Briefly illustrate the applications connected with Stefan Boltzmann law. A surface is maintained at a temperature of 800K and radiates heat to another surface at 500K with a unity view factor. If the emissivity of the surfaces are 0.85 evaluate the net exchange of heat between these two surfaces by radiation process. **(10 Marks)**

OR

6 a. Briefly explain the use of numerical techniques to solve the heat transfer problems. Explain the process of discretizate based on finite difference methodology. **(10 Marks)**

b. Explain the following laws with reference to thermal radiation heat transfer :
i) Stefan – Boltzmann law ii) Wein – Displacement law iii) Kirchhoff's law
iv) Lamberts Cosine rule. **(10 Marks)**

Module-4

7 a. Explain the formation of boundary layers (thermal and hydrodynamic) for flow over a flat plate. **(05 Marks)**

b. Engine oil at 60°C flows over the upper surface of a 5m long flat plate whose temperature is 20°C with a velocity of 2m/s. Determine the total drag force and the rate of heat transfer per unit width of plate. **(07 Marks)**

c. Distinguish between Free convection and Forced convection on basis of the associated dimensional numbers. **(08 Marks)**

OR

8 a. Explain the concept of developed and developing flow with respect to internal flow through circular pipe. **(05 Marks)**

b. A long 10cm diameter steam pipe whose external surface is at 110°C passes through some open area that is not protected against winds. Determine the rate of heat loss from the pipe when air is at 1 atmp and 10°C moving at 8m/s. **(07 Marks)**

c. A 6m long section of an 8cm diameter horizontal pipe passes through a large room whose temperature is 20°C. If the outer surface temperature of the pipe is 70°C, evaluate the rate of heat loss from the pipe by natural convection. **(08 Marks)**

Module-5

9 a. Discuss the different regimes of pool boiling curve. **(10 Marks)**

b. Steam condenses at 60°C on shell side of a steam condenser , while cooling water flows inside tubes at 3kg/S. The inlet and outlet temperature of water are 20°C and 50°C respectively. Considering U_m = 2000 W/m^2°C. Calculate the surface area required. **(10 Marks)**

OR

10 a. Distinguish between Drop wise and Film wise condensation. **(08 Marks)**

b. A 2 – shell pass , 4 tube pass heat exchanger is used to cool processed water from 75°C to 25°C on the tube side at a rate of 5kg/S with cold water entering shell side at 10°C with flow rate of 6kg/S. If U_m = 750 W/m^2 °C, find heat exchange area. **(12 Marks)**

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18ME641

Sixth Semester B.E. Degree Examination, July/August 2022
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 Process. Explain the need for non-traditional machining process. **(06 Marks)**

b. Discuss briefly the classification of Non-Traditional Machining process based on different sources of energy. **(06 Marks)**

c. What are the specific advantages, limitations and applications of Non-Traditional machining process? **(08 Marks)**

OR

2 a. Differentiate between conventional (traditional) and Non-Traditional machining process. **(08 Marks)**

b. Write in brief note on the selection of Non-Traditional Machining process. **(08 Marks)**

c. Write history about Non-Traditional Machining. **(04 Marks)**

Module-2

3 a. With the help of neat sketch, explain working principle of ultrasonic machining process. **(08 Marks)**

b. Discuss the effects of the following parameters on the rate and material removal and surface finish obtained in ultrasonic machining:
i) Amplitude and frequency of vibration
ii) Static load
iii) Abrasive grid size. **(06 Marks)**

c. List the advantages and disadvantages of ultrasonic machining process. **(06 Marks)**

OR

4 a. Explain the working principle of abrasive jet machining process with the help of neat diagram. Mention its advantages. **(10 Marks)**

b. With a neat sketch, explain the following variables that influence the MRR in AJM.
i) Standoff distance
ii) Types of abrasive
iii) Carrier gas
iv) Velocity of the abrasive jet
v) Work material. **(10 Marks)**

Module-3

5 a. Explain the working principle of electro chemical machining with the help of neat sketch. **(08 Marks)**

b. Explain with a neat sketch, Electro Chemical Grinding (ECG). **(06 Marks)**

c. Explain the following ECM process characteristics:
i) Material removal rate
ii) Accuracy
iii) Surface finish. **(06 Marks)**

OR

6 a. Explain with neat sketches of chemical blanking process and chemical milling process. (08 Marks)

b. Explain the following in chemical machining process: (06 Marks)
i) Maskants ii) Etchants.

c. What are the advantages, disadvantages and applications of chemical machining process? (06 Marks)

Module-4

7 a. With the help of a neat diagram, working principle of electrical discharge machining process. (08 Marks)

b. Explain the different methods of dielectric flushing in electrical discharge machining. (06 Marks)

c. Sketch and explain travelling wire EDM process. (06 Marks)

OR

8 a. Explain with neat diagram, construction and working principle of Plasma Arc Machining (PAM). (08 Marks)

b. What are the safety precautions in PAM? Explain. (06 Marks)

c. What are the advantages and disadvantages of PAM. (06 Marks)

Module-5

9 a. Explain with neat sketch, working principle of Laser Beam Machining (LBM) process. (08 Marks)

b. What are characteristics and process parameters of LBM? (06 Marks)

c. What are the advantages and limitations of LBM process? (06 Marks)

OR

10 a. Explain working of electron beam machining process with the help of neat sketch. (08 Marks)

b. Explain the equipments used in the Electron Beam Machining (EBM). (06 Marks)

c. Write the advantages and applications of Electron beam machining process. (06 Marks)

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18ME653

Sixth Semester B.E. Degree Examination, July/August 2022
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 do you mean by Supply Chain Management? Explain Supply Chain Network, with suitable sketch. **(10 Marks)**

b. Explain how three revolutions of Supply Chain Management helped in the broader evolution of Economic Environment. **(10 Marks)**

OR

2 a. Discuss the key concepts in Supply Chain Management. **(05 Marks)**

b. Explain the importance of Supply Chain. **(05 Marks)**

c. Enablers of Supply Chain helps firms and nations in reduction of Supply Chain Costs - Discuss. **(10 Marks)**

Module-2

3 a. Explain how Make Versus Buy decisions helps to evaluate firms activities. **(10 Marks)**

b. Discuss how identifying of core processes helps in improving the significant performance of a Firm. **(10 Marks)**

OR

4 a. Illustrate the concept of Portfolio approach with reference to Sourcing strategy. **(10 Marks)**

b. Explain how Internet impacted on Sourcing Strategy. **(10 Marks)**

Module-3

5 a. Explain the significance of Inventory Management in Supply Chain. **(05 Marks)**

b. Network Operations planning is important for effective Supply Chain Management. Discuss. **(05 Marks)**

c. List and explain types of Inventory in Supply Chain. **(10 Marks)**

OR

6 a. Explain the role of network design in Supply Chain. **(10 Marks)**

b. Enumerate the factors influencing network design decisions. **(10 Marks)**

Module-4

7 a. Explain Network Operations Optimization Profit Maximization Model. **(10 Marks)**

b. Uncertainty of demand and price drives the value of building flexible production capacity at a plant. Explain. **(10 Marks)**

OR

8 a. Explain how Network design decisions are evaluated using decision trees. **(10 Marks)**

b. List and explain the characteristics of Forecasts. **(10 Marks)**

Module-5

9 a. What is Supply Chain Integration? Illustrate the three stages of Supply Chain Integration. **(10 Marks)**

b. What is Bullwhip effect? How it effects Supply Chain Inefficiency? **(10 Marks)**

OR

10 a. Illustrate Supply Chain Configuration design for Agile Supply Chain. **(10 Marks)**

b. Discuss the future trends of Information Technology in Supply Chain Management. **(10 Marks)**

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