CBCS SCHEME

USN | 1 | K | I | 1 | 6 | M | E | 4 | 3 | 2 | 15ME61

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Finite Element Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Finite Element Method, explain basic steps involved in FEM. **(10 Marks)**

b. A rectangular bar is subjected to an axial load "p" as shown in Fig.Q1(b), determine the expression for P.E functional and hence determine value of the potential energy (PE) for the following data : E = 200GPa, P= 3kN, L = 100mm, b = width = 20mm, t = 10mm. **(06 Marks)**

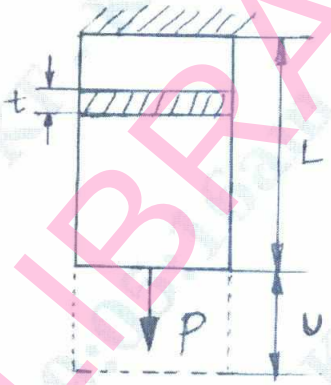

Fig.Q1(b)

OR

2 a. Find the maximum deflection using Galerkin's method, Fig.Q2(a). **(10 Marks)**

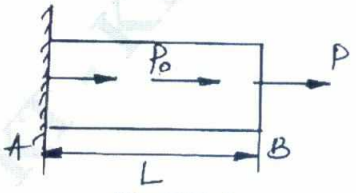

Fig.Q2(a)

b. Explain Simplex, Complex and Multiplex Elements with examples. **(06 Marks)**

Module-2

3 a. Derive the shape function of a bar element in Global Co-Ordinate System. **(10 Marks)**

b. Use two-point Gaussian quadrature formula to evaluate the integral $I = \int_0^3 (2^{\xi} - \xi)\, d\xi$. **(06 Marks)**

OR

4 a. The structured member shown in Fig.Q4(a) consists of two bars. An axial load of P = 200kN is loaded as shown. Determine the following :

i) Element Stiffness Matrix
ii) Global Stiffness Matrix
iii) Global Load Vector
iv) Modal Displacement. **(06 Marks)**

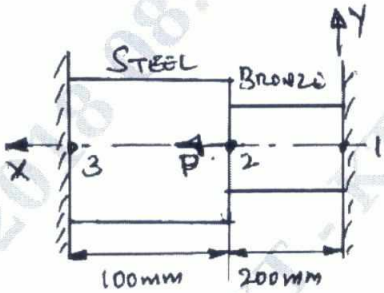

Fig.Q4(a)

b. A 4 bar truss element as shown in Fig.Q4(b), determine i) Nodal displacement ii) stress in each element, area of truss element = 100mm; E = 2×10^5N/mm^2. **(10 Marks)**

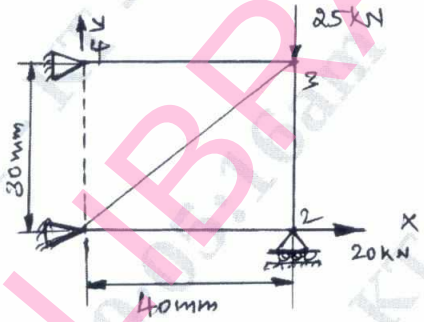

Fig.Q4(b)

Module-3

5 a. Derive Hermite shape functions of a beam element and show the variation of the shape function over the element. **(10 Marks)**

b. Derive the potential energy functional (π) for beam. **(06 Marks)**

OR

6 a. A cantilever beam subjected to point load of 250 kN as shown in Fig.Q6(a). Determine the deflection at the free end and the support reactions. Take E = 200GPa, I = 4×10^6 mm^4. **(10 Marks)**

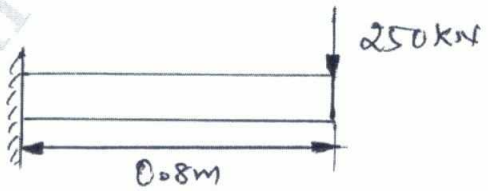

Fig.Q6(a)

b. Derive the stiffness matrix for a circular shaft subjected to pure torsion. **(06 Marks)**

Module-4

7 a. Derive the one-dimensional formulation of fin (Heat transfer thin fins). **(10 Marks)**

b. Determine the temperature distribution in the rectangular fin as shown in Fig.Q7(b). Assume steady and only conduction process. Take heat generated inside the fin as $400 w/m^3$. **(06 Marks)**

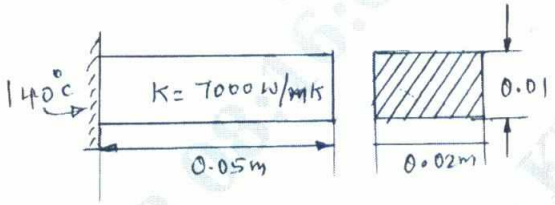

Fig.Q7(b)

OR

8 a. For the smooth pipe shown in Fig.Q8(a) with uniform cross–section of $1m^2$, determine the flow velocities at the centre and right end, knowing the velocity at the left is $V_x = 2m/sec$. **(10 Marks)**

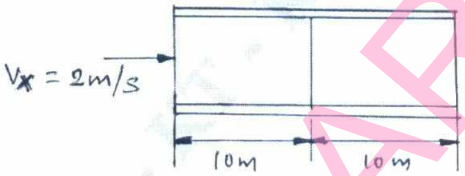

Fig.Q8(a)

b. Derive the stiffness matrix for one dimensional fluid element. **(06 Marks)**

Module-5

9 a. Derive the stiffness matrix of axisymmetric bodies with triangular elements. **(10 Marks)**

b. For the element of an axisymetric body rotating with a constant angular velocity w = 1000 rev/min as shown in Fig.9(b). Determine the body force vector. Include the weight of the material, where the specific density is $7850 kg/m^3$. **(06 Marks)**

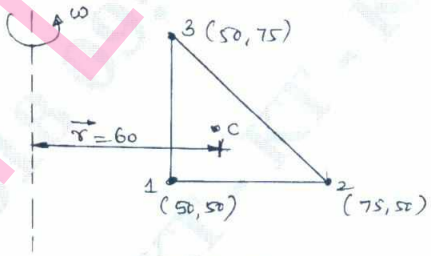

Fig.Q9(b)

OR

10 a. Derive the consistent mass matrix for truss element. **(06 Marks)**

b. Determine the natural frequency of longitutational vibration of the bar shown in Fig.Q10(b). Take E = 200GPa ; $\rho = 7840 kg/m^3$; $A = 240mm^2$. **(10 Marks)**

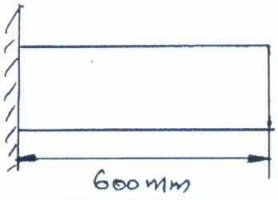

Fig.Q10(b)

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CBCS SCHEME

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15ME63

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Heat Transfer

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of heat transfer data hand book and steam tables are permitted.*

Module-1

1 a. Explain three modes of heat transfer with their basic laws. **(06 Marks)**

b. The inner wall of the furnace is made of fire brick of thickness 115 mm and the outer wall is made of red brick of thickness 230 mm. The temperature of the inside furnace is 685°C and the temperature of outside surface of red brick is 121°C under steady state condition to reduce the heat loss a layer of Magnesia insulation of thickness 50 mm is added on the outer surface of red brick after steady state condition is reached. The various temperature are measured as flame side of furnace 712°C junction between the fire brick and red brick is 655°C, junction between the red brick and Magnesia is 490°C outer surface Magnesia temperature is 77°C. Calculate the heat loss in first and second cases and find the percentage of heat loss reduction. Assume thermal conductivity of Magnesia is 0.085 W/m°C. **(10 Marks)**

OR

2 a. State the assumptions and derive general 3-dimensional heat conduction equation in Cartesian co-ordinates. **(08 Marks)**

b. A hollow sphere is made up of steel having thermal conductivity of 45 W/m°C. It is heated by means of a coil of resistance 100 Ω which carries a current of 5 amps. The coil is located inside a hallow space at the centre. The outer surface area of sphere is 0.2 m^2 and its mass 32 kg assuming density of the sphere material to be 8 gm/cc. Calculate the temperature difference between the inner and outer surface. **(08 Marks)**

Module-2

3 a. Derive an expression for the temperature distribution and heat flow for a pinfin, when the tip of the fin is insulated. **(08 Marks)**

b. A thin rod of copper K = 100 W/m°C, 12.5 mm in diameter spans between two parallel plates 150 mm apart. Air flows over the rod providing a heat transfer co-efficient of 50 W/m^2°C. The surface temperature of the plate exceeds the air by 40°C. Determine (i) The excess temperature at the centre of the rod over that of air and (ii) Heat lost from the rod in watts. **(08 Marks)**

OR

4 a. Show that the temperature distribution under lumped analysis is given by,

$$\frac{T - T_\infty}{T_i - T_\infty} = e^{-BiFo}$$

Where T_i = Initial temperature

T_∞ = Ambient temperature **(08 Marks)**

b. A 15 mm diameter mild steel sphere (K = 42 W/m°C) is exposed to coding air flow at 20°C resulting in the convective co-efficient h = 120 W/m^2°C. Determine the following:

(i) Time required to cool the sphere from 550°C to 90°C.
(ii) Instantaneous heat transfer rate for 2 mins after start of cooling.
(iii) Total energy transferred from the sphere during first 2 mins.

Take for mild steel S = 7850 kg/m^3, C_P = 475 J/kg°C, α = 0.045 m^2/hr **(08 Marks)**

Module-3

5 a. Explain three types of boundary conditions applied in Finite difference representations. **(09 Marks)**

b. Consider steady-state heat conduction in a square region of side 2b, in which energy is generated at a constant rate of g w/m^3. The boundary conditions for the problem are shown in Fig. Q5 (b). Write the finite difference equations for nodes 1, 3 and 5 in this Fig. Q5 (b) **(07 Marks)**

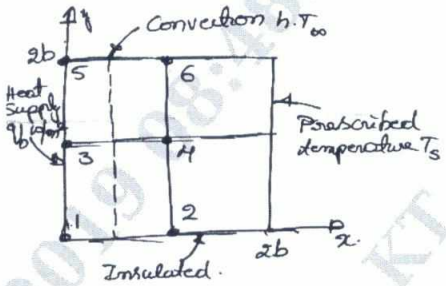

Fig. Q5 (b)

OR

6 a. State and explain : (i) Kirchoff's law (ii) Plank's law (iii) Wein's displacement law (iv) Lambert's cosine law. **(08 Marks)**

b. Two large parallel plots with emissivity 0.5 each are maintained at different temperatures and are exchanging heat only by radiation. Two equally large radiation shields with surface emissivity 0.05 are introduced in parallel to the plates. Find the percentage reduction in net radiative heat transfer. **(08 Marks)**

Module-4

7 a. With a diagram, explain velocity boundary layer and thermal boundary layer. **(08 Marks)**

b. Lubricating oil at a temperature of 60°C enters a 1 cm diameter tube with a velocity 3.5 m/s. The tube surface is maintained at 30°C. Calculate the tube length required to cool the oil to 45°C. Assume that the oil has the following average properties for the temperature range of this problem S = 865 kg/m^3, K = 0.14 W/m°K, C_P = 1.78 kJ/kgK and $\gamma = 9 \times 10^{-6}$ m^2/s. **(08 Marks)**

OR

8 a. Explain the significance of, (i) Reynold's number (ii) Prandtl number (iii) Nusselt number (iv) Stanton number. **(08 Marks)**

b. Calculate the convection heat loss from a radiator 0.5 m wide and 1 m high maintained at a temperature of 84°C in a room at 20°C. Treat the radiator as a vertical plate. **(08 Marks)**

Module-5

9 a. With assumptions, determine LMTD for counter flow heat exchanger. **(08 Marks)**

b. A parallel flow heat exchanger uses 1500 kg/hr of cold water entering at 25°C to cool 600 kg/hr of hot water entering at 70°C. The exit temperature on the hot side is required to be 50°C. Neglecting the effects of fouling make calculations for the area of heat exchanger. It may be assumed that the individual heat transform co-efficient on both sides are 1600 W/m^{2}K. Use LMTD and NTU approaches. **(08 Marks)**

OR

10 a. With a neat sketch, explain the different regimes of pool boiling. **(08 Marks)**

b. A vertical square plate 300m × 300m is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and the mass of steam condensed per hour. **(08 Marks)**

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CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of hand book is permitted.

Module-1

1 a. List the assumptions made in obtaining stress equation in curved beam. **(06 Marks)**

b. Compute the combined stresses at the inner and outer fiber in the critical cross-section of a crane hook which is required to lift loads upto 25 kN. The hook has trapezoidal cross section with the parallel sides 60mm and 30mm. The distance between them being 90mm. The inner radius of hook is 100 mm. The load line is nearer to the inner surface of the hook by 25 mm than the centre of curvature at the critical section. What will be the stresses at inner and outer fiber, if the beam is treated as straight beam for given load? **(10 Marks)**

OR

2 a. A cast iron cylindrical pipe of outside diameter 300mm and inside diameter 200mm is subjected to an internal pressure of 20 MPa and external pressure of 5 MPa. Determine the tangential and radial stresses at inner, middle and outer surface. Also sketch the stresses distribution across the thickness. **(08 Marks)**

b. A 440 mm outer diameter, 250mm inner diameter and 300mm long steel hub is to be shrink on to a 250mm diameter steel shaft. If the torque is to be transmitted is 300 kNm and $\mu = 0.18$, determine the amount of interference required. **(08 Marks)**

Module-2

3 a. A belt is required to transmit 18.5 kW from a pulley of 1.2m diameter running at 250 rpm to another pulley which run at 500 rpm. The distance between the centres of pulley is 2.7m. The following data refers to open belt drive $\mu = 0.25$. Safe working stress for leather is 1.75 MPa. Thickness of belt 10 mm. Determine the width and length of belt taking centrifugal tension into account. Also find the initial tension in belt and speed at which this can be transmitted. **(08 Marks)**

b. A V-belt is to transmit 20 kW from a 250 mm pitch diameter operating at 1500 rpm to a 900 mm diameter flat pulley. The centre distance between input and output shaft 1 m. The groove angle is 40° and $\mu = 0.2$ for both pulleys and shears combination. The cross section of belt is 38mm wide at the top and 19mm at bottom by 25mm deep. Each belt weighs 11 kN/m^3 and allowable tension per belt is 1000 N. How many belts are required? **(08 Marks)**

OR

4 a. A loaded narrow gauge car weighs 18 kN and moving at a velocity of 80 m/min is brought to rest by a buffer spring of two helical springs. In bringing the car to rest the spring undergoes a compression of 200mm. The allowable shear stress is 0.3 GPa and spring index is 8. Solve for the dimensions of spring. Take G = 84 GPa. **(08 Marks)**

b. A semi-elliptical leaf spring is used for the suspension of the rear axle of a truck. It consists of 2 extra full length leaves and IS graduated leaves with a band of 100 mm. The centre to centre distance between spring eyes is 1.1 m. All leaves are pre-stressed to 400 MPa. E = 200 GPa. The max. force on spring is 75 kN. Take total depth to width ratio as 2. Determine (i) Cross section of leaf (ii) Initial nip (iii) Load on band. **(08 Marks)**

Module-3

5 Design a pair of spur gear 20° involute to transmit 30 kW of power at 600 rpm of pinion. Number on teeth on pinion is 15, transmission ratio is 5:1. Material of the pinion is cast steel (σ = 137.34 MPa) and that of gear is high grade cast iron (σ = 103 MPa.). **(16 Marks)**

OR

6 a. Derive an equation for formative number of teeth on bevel gear. **(06 Marks)**

b. Determine the module for a pair of helical gear to transmit 15 kW of power at 4000 rpm of pinion with i = 5:1. Pinion is made of 0.4% carbon steel untreated (σ = 69.6 MPa) and gear is made of cast iron (σ = 31 MPa). Helix angle is 20°. Number of gear teeth on. Pinion is 24. (Gear system 20° FDI). **(10 Marks)**

Module-4

7 Design worm drive to transmit a power of 2 kW at 1000 rpm, i = 20:1 and centre distance is 200 mm. **(16 Marks)**

OR

8 a. Design a multi-plate clutch to transmit 25 kW at 300 rpm. The plates have friction surfaces of steel and phosphorous bronze run on oil. Design clutch for 25% over load. **(08 Marks)**

b. A simple band brake is required to transmit a torque of 100 kg-m. The brake drum diameter is 400 mm, μ = 0.25. Find the effort required to obtain braking in clock-wise direction. Design the band and the lever. Take θ = 270°. [Refer Fig.Q8(b)] **(08 Marks)**

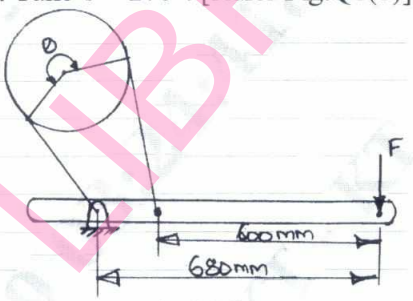

Fig.Q8(b)

Module-5

9 a. Derive Petroff's equation for lightly loaded bearing. **(06 Marks)**

b. A lightly loaded journal bearing has a load of 1 kN. The oil used is SAE60 and mean effective temperature of operation is 40°C. The journal has a diameter of 50 mm and the bearing has a diameter of 50.5 mm. The speed of journal is 15000 rpm. The L/d ratio is limited to 1.2. Determine CoF and power loss in friction. **(10 Marks)**

OR

10 a. Explain the principle of Hydro Dynamic lubrication. **(06 Marks)**

b. A spindle of a wood-working machine runs at 1000 rpm. It is mounted on two single-row ball bearings. One of which is required to carry radial load of 2250 N and thrust load of 1900 N. The machine runs 8 hrs/day. Assuming a life of 4 years a spindle diameter equal to 30 mm. Select a suitable bearing. **(10 Marks)**

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CBCS SCHEME

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15ME653

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Metal Forming

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Give the broad classification of metal working processes based on force applied and explain the above processes, with neat sketches. **(10 Marks)**

b. With an example, explain true stress and true strain. **(06 Marks)**

OR

2 a. What is Yield criteria and explain different types of yield criterion? **(08 Marks)**

b. Explain Hot working and Cold working processes. Also illustrate the effect of temperature on mechanical properties of formed products. **(08 Marks)**

Module-2

3 a. List and explain the effect of various parameters on metal forming processes. **(10 Marks)**

b. Explain i) Deformation zone geometry ii) Residual stresses in wrought products. **(06 Marks)**

OR

4 a. Derive the expression for forging pressure and load in open die forging by slab analysis using suitable assumptions. **(10 Marks)**

b. Explain any two types of hammers used in forging. **(06 Marks)**

Module-3

5 a. List and explain any two types of rolling mills. **(08 Marks)**

b. Calculate the rolling load required on a hot rolled steel sheet from a 40 mm slab thickness of 760mm width. The reduction is thickness achieved is 30%. Using a roll of 900mm diameter. The plane strain flow stress at the entrance and exit are 140 MPa and 200 Mpa respectively. Assume the roll speed of 100 rpm and $\mu = 0.3$. Also determine the power required to drive the rolls. **(08 Marks)**

OR

6 a. Sketch and explain tube drawing process. **(05 Marks)**

b. Explain the phenomenon of redundant work in drawing and its estimation. **(05 Marks)**

c. Explain the different types of drawing variables. **(06 Marks)**

Module-4

7 a. Sketch and explain seamless tube extrusion process. **(08 Marks)**

b. List the defects in extrusion process. **(03 Marks)**

c. Calculate the flow stress at the entry required for extruding a cylindrical aluminum billet of 50mm diameter and 75mm length to a final diameter of 10mm. Assume yield stress of 170 MPa , $\mu = 0.15$ and $\alpha = 45^0$. **(05 Marks)**

OR

8 a. List and explain any one type of die used in sheet metal forming process. (06 Marks)
b. Calculate the total pressure and dimensions of press tools required to produce a washer of 50mm outside diameter, 24mm hole diameter of 4mm thickness. Assume the sheer strength of material as 3600 kg/cm^2. (05 Marks)
c. Explain V – bending process. (05 Marks)

Module-5

9 a. Sketch and explain explosive forming process. (10 Marks)
b. List the advantages , limitations and applications of HERF process (06 Marks)

OR

10 a. With a flow chart, explain different steps involved in powder metallurgy process. (10 Marks)
b. Explain the different methods used for the production of metal powders. (06 Marks)

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CBCS SCHEME

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15ME664

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Total Quality Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define TQM. Explain six basic concepts of TQM. **(08 Marks)**
b. List and explain dimensions of Quality. **(08 Marks)**

OR

2 a. Explain the contributions of Quality Gurus. **(06 Marks)**
b. Sketch the TQM Frame work. **(04 Marks)**
c. Write short note on Benefits of ISO Registration. **(06 Marks)**

Module-2

3 a. Explain the characteristics of Quality Leaders. **(08 Marks)**
b. Define Ethics. List any six leadership concepts. **(08 Marks)**

OR

4 List Deming's 14 points and explain any one. **(16 Marks)**

Module-3

5 a. With a neat sketch, explain Kano – Model. **(08 Marks)**
b. State and explain Elements of customers service. **(08 Marks)**

OR

6 a. Explain Maslow's hierarchy of needs. **(08 Marks)**
b. Define : Motivation , Performance , Reward , Recognition , Empowerment , Gainsharing , Teams , Union. **(08 Marks)**

Module-4

7 a. Write short note on Six – Sigma. **(08 Marks)**
b. Explain i) PDSA cycle with continuous process improvement ii) KAIZEN. **(08 Marks)**

OR

8 a. Explain Control charts for variables and attributes. **(08 Marks)**
b. Explain : i) Pareto diagram ii) Cause and effect diagram. **(08 Marks)**

Module-5

9 a. With a neat sketch, explain Benchmarking Concept. **(08 Marks)**
b. Define QFD. With a neat sketch, explain 4 phases of QFD process. **(08 Marks)**

OR

10 a. Sketch the concept of Quality by Design and list the benefits of Quality by design. **(08 Marks)**
b. Define FMEA. List the stages of FMEA. **(08 Marks)**

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