VTU B.E/B.TECH QUESTION PAPER SET

CBCS
SEMESTER VI

FINITE ELEMENT ANALYSIS

Use bookmarks to easily navigate between question papers

Visit Studentmap.in! Get access to all VTU resources for free!

Question Papers	Notes	Syllabus
Exams/Timetable	News	Results

CBCS Scheme

USN ☐☐☐☐☐☐☐☐☐☐   **15ME61**

Sixth Semester B.E. Degree Examination, June/July 2018
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 FEM. Discuss various applications of FEA in different domain. **(04 Marks)**
   b. Explain convergence requirements of a displacement field. **(04 Marks)**
   c. Using minimum potential energy determine the nodal displacement of a spring system shown in Fig. Q1(c). **(08 Marks)**
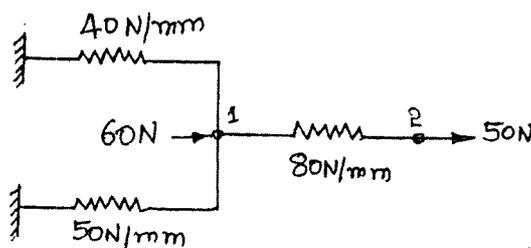

Fig.Q1(c)

OR

2. a. Using Rayleigh – Ritz method, determine the displacement at midpoint and stress variation in a one dimensional rod as shown in Fig.Q2(a). **(09 Marks)**
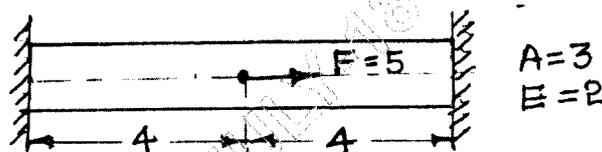

Fig.Q2(a)

   b. Write stress-strain relations for plain stress and plain strain conditions. **(04 Marks)**
   c. What do you mean by simplex, complex and multiplex elements? **(03 Marks)**

Module-2

3. a. What are higher order element? Derive shape function for 1D quadratic element in natural co-ordinates. **(06 Marks)**
   b. Deduce expression for shape function for four noded tetrahedral element (TET4) using Lagrange interpolation functions. **(06 Marks)**
   c. Evaluate $\int_{-1}^{+1} (x^2 + \sin\frac{\pi x}{2})\, dx$ using suitable Gauss points numerical integration. **(04 Marks)**

OR

4 a. For the stepped bar shown in Fig.Q4(a). Determine the nodal displacements, stress in eac element and left support reaction. **(10 Marks**
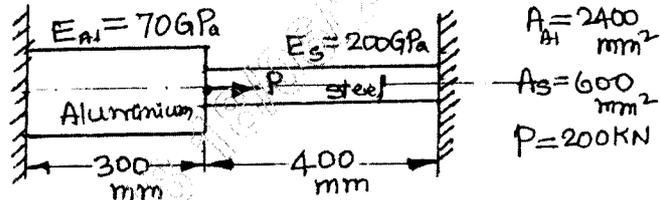

Fig.Q4(a)

b. With assumptions, deduce element stiffness matrix used for analysis of trusses. **(06 Marks**

Module-3

5 a. Derive Hermite shape function for a beam element. **(08 Marks**

b. For the beam and loading as shown in Fig.Q5(b), determine deflection, slope and suppo reaction. Take $E = 110 GPa$, $I = 5 \times 10^{-4} m^4$. **(08 Marks**
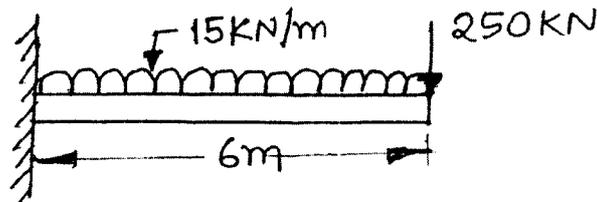

Fig.Q5(b)

OR

6 a. Derive torsional stiffness matrix for a circular shaft subjected to pure torsion. **(06 Marks**

b. For the circulars stepped shaft shown in Fig.Q6(b) determine stresses and angle of twist. **(10 Marks**
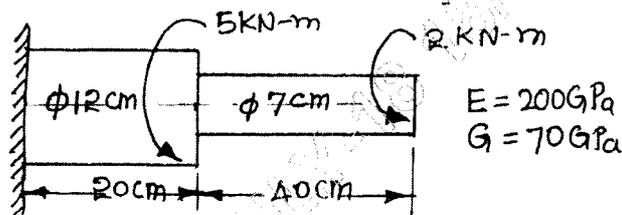

Fig.Q6(b)

Module-4

7 a. Briefly describe rate equations and boundary conditions in heat transfer analysis. **(06 Marks**

b. Determine the temperature distribution through composite wall shown in Fig.Q7(b) whe the convective heat loss occurs on the right surface. Take $K_1 = 6W/m°C$ an $K_2 = 20 W/m°C$. **(10 Marks**
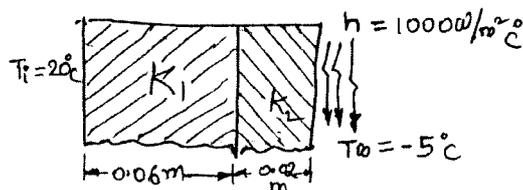

Fig.Q7(b)

OR

8 a. Deduce the governing differential equation for one-dimensional fluid flow through a process medium. **(06 Marks)**

   b. For the smooth pipe of variable c/s 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 the left end is $P_1 = 12 m^2/S$ and that at right end is $P_4 = 3 m^2/S$. Take $K_x = 1$. **(10 Marks)**
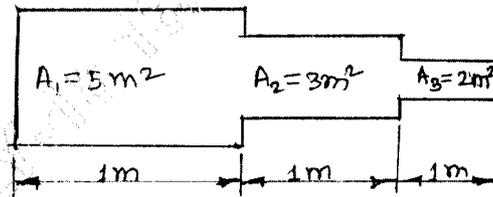

Fig.Q8(b)

Module-5

9 a. What is an axisymmetric element? Derive Jacobian matrix for axisymmetric triangular element. **(08 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 including weight of material with specific density is 7850 kg/m³. **(08 Marks)**
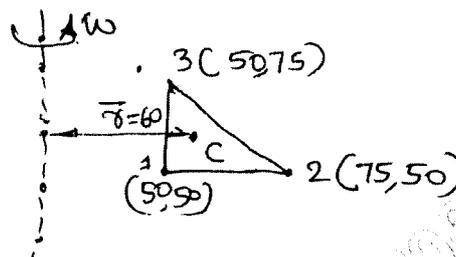

Fig.Q9(b)

OR

10 a. Derive an expression of element mass matrix for a bar element. **(06 Marks)**

    b. For the stepped bar shown in Fig.Q10(b) determine the eigen values and eigen vector. Take $A_1 = 400 mm^2$, $A_2 = 200 mm^2$, $\rho = 7850$ kg/m³, $E = 200$ GPa. **(10 Marks)**

Fig.Q10(b)

* * * * *