B.TECH SEM – VIII (2007 COURSE) (MECHANICAL ENGG.) : SUMMER - 2018

SUBJECT: FINITE ELEMENT METHOD

Day : **Saturday** **S-2018-2896** Time: **02.30 PM TO 06.30 P.M.**
Date : **02/06/2018** Max. Marks: 80

N.B.:

1) **Q.No.1** and **Q.No.5** are **COMPULSORY**. Out of the remaining attempt **ANY TWO** questions from each section.
2) Answers to both the section should be written in **SEPARATE** answer books.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Figures to the right indicate **FULL** marks.
5) Assume suitable data if necessary.

SECTION – I

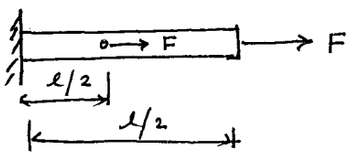
Q.1 **a)** Explain error in Finite Element Method. Also explain various measures of error. **[05]**

b) Derive the strain-displacement matrix. **[04]**

c) Explain higher order element. **[05]**

Q.2 A steel rod of 15 mm diameter and 250 mm length as shown in figure is subjected to two equal forces and magnitude 15kN at the midpoint and end. The modulus of elasticity for steel is 200 Gpa. Using Rayleigh Ritz method. Determine: **[13]**

a) Approximate displacement function.
b) Approximate strain function.
c) Approximate stress function.



Q.3 Explain : **i)** Elimination approach **ii)** Penalty approach. **[13]**
What are the limitations of these methods?

Q.4 **a)** What are shape functions? **[04]**

b) The temperature at node – 1 is 100^0C and at node – 2 is 40^0C. The length of element is 200 mm. Evaluate the shape functions. Calculate the temperature of point P at a distance of 150 mm from node^{-1}. **[09]**

SECTION – II

Q.5 **a)** Explain Choleski method of solving Eigen value problem. **[05]**

b) Explain Galerkin approach for beams. **[05]**

c) Derive the equation $KU = \lambda MU$. **[04]**

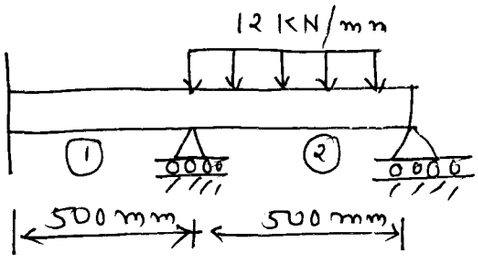
P.T.O.

Q.6 Evaluate : $\int_{y=4}^{y=6} \int_{x=-2}^{x=2} (1-x)^2 (4-y)^2 \, dx \, dy$ by using Gauss quadrature method. **[13]**

Q.7 For the beam and loading shown in figure determine **[13]**

a) Slope at 2 and 3.

b) Vertical deflection at midpoint of distributed load.



E - 200 GPa

I - 4×10^6 mm^4

Q.8 Explain mass matrices for: **[13]**

a) Frame element

b) Tetrahedral element

c) Lumped mass matrices

d) Quadrilateral element

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