Code No: **R31031/R10**

| **Set No. 1** |

III B.Tech I Semester Supplementary Examinations, Nov - 2015
FINITE ELEMENT METHODS
(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours   **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) For the spring system shown in the figure find the displacements at the nodes and the   [10]
        reactions. Given K_1=200 N/mm, K_2=K_4=150 N/mm, K_3= 200 N/mm, F_1=500 N,
        F_2=600N.
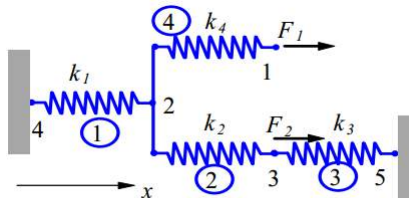
   b) Write the applications of FEM.   [5]

2 a) Explain the procedure to handle boundary conditions by using elimination method.   [8]
   b) Explain the properties of stiffness matrix and discuss banded matrix.   [7]

3 a) Derive the stiffness matrix of a truss element.   [8]
   b) Explain how temperature effects are taken into consideration for a truss element.   [7]

4 a) A fixed beam is loaded with uniformly distributed load of intensity w/m. Assume EI is   [8]
        constant throughout. Analyze the beam by dividing it into two elements and find the
        following at mid span.
        (a) Deflection (b) Slope (c) Shear force (d) Bending moment.
   b) Explain the ways in which a three dimensional problem can be reduced to a two   [7]
        dimensional approach give examples.

5 a) Discuss a few applications of axi-symmetric elements.   [8]

   b) What are the properties of constant-strain triangular element? Explain.   [7]

6 a) Derive the shape functions of two dimensional four noded iso-parametric element. Plot the [8]
        shape functions.
   b)   [7]
        Use Gaussian quadrature with two points to evaluate the integral $\int\limits_{-1}^{+1}\dfrac{\cos x}{1-2x^2}dx$

        The gauss points are ± 0.5774 and the weights at the two points are equal to unity. Compare
        the result with actual integral value.

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7   A Steel rod of diameter d = 2cm, length L = 5 cm and thermal conductivity k = 50   [15]
     W/m°C is exposed at one end to a constant temperature of 320°C. The other end is in
     ambient air of temperature 20°C with a convection coefficient of h = 100 W/m^2 ^{0}C.
     Determine the temperature at the midpoint of the rod.

8 a) Discuss Eigen value and Eigen vector analysis.   [8]
   b) i) Derive the force matrix for uniformly distributed load on a beam.   [7]
       ii) Write a short note on global coordinates and natural coordinates.

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