Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, February 2015
(2013 Scheme)
Branch : Mechanical Engineering
Stream : Machine Design
MDC1005 : FINITE ELEMENT METHOD

Time : 3 Hours Max. Marks : 60

Module – 1

1. Find the stresses and compressions in each section of the composite member shown in Fig. 1. Use $E_s = 30\times10^6$ psi, $E_a = 10^7$ psi, $E_b = 15\times10^6$ psi, and the minimum number of linear elements. Convert the dimensions and other given parameters to SI units and solve the problem. 10

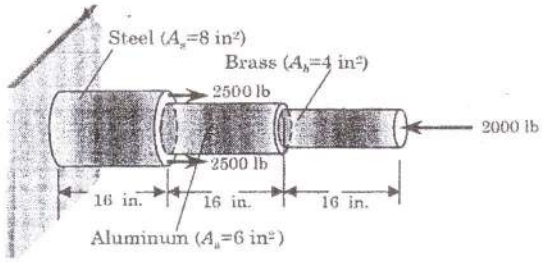

Fig. 1

2. For the plane truss structures shown in Fig. 2, give
   a) the transformed element matrices,
   b) the assembled element matrices, and
   c) the condensed matrix equations for the unknown displacements and forces. Convert the dimensions and other given parameters to SI units and solve the problem. 10

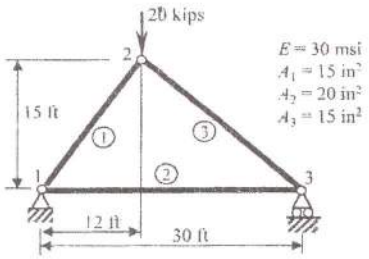

Fig. 2

3. Derive the stiffness matrix of a beam element. 10

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Module – 2

4. Use Galerkin's method of weighted residuals to obtain a one-term approximation to the solution of the differential equation $\frac{d^2y}{dx^2} + y = 4x \quad 0 \le x \le 1$ with boundary conditions.y (0)= 0, y (1) = 1. 10

5. a) Explain patch test and its benefits. 5

   b) Explain the different types of refinements in finite element. 5

6. Explain the steps involved in the development of the stiffness matrix of a linear strain triangle element. 10

Module – 3

7. Derive the stiffness matrix of an axisymmetric 2 noded isoparametric ring element. 10

8. For the beam shown in Figure 3, determine the natural frequencies using two elements. Let E; ρ, and A be constants for the beam. 10

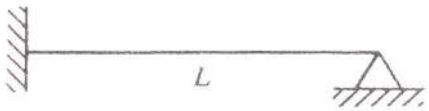

Fig. 3

9. Evaluate the eigen values and eigen vectors for the stepped bar shown in the Figure. Take E = 200 GPa specific weight = 7850 kg/m^3. Draw the mode shape also. Take $A_1 = 400\,mm^2$, $A_2 = 200\ mm^2$. 10

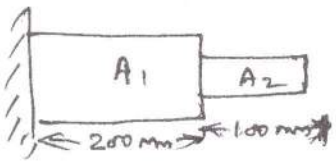

Fig. 4