Registration no: | | | | | | | | | | |

Total Number of Pages: 02

M.TECH
CEPE207

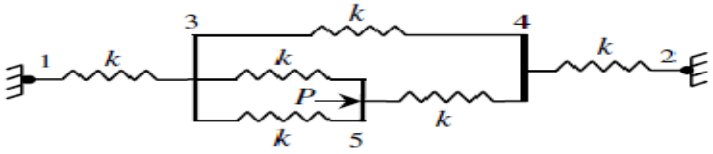
2nd Sem Regular / Back Examination – 2015-16
FINITE ELEMENT ANAYSIS OF SRTUCTURES
Q.CODE:W778
Time: 3 Hours
Max marks: 70

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

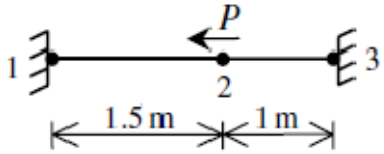
Q1 Answer the following questions: (2 x 10)

a) Differentiate between essential and non-essential boundary conditions.
b) Rayleigh-Ritz method has a classical form and an FE form. Comment.
c) What do you mean by an admissible configuration? Explain with the help of an example.
d) What is reproduction property of FEM?
e) Differentiate between Cartesian and natural coordinates.
f) What are isoparametric elements?
g) Why convergence is required in FEA?
h) Show the quadratic terms of Lagrange and Serendipity family from Pascal's triangle in 2D.
i) Show with the help of an example, the calculation of equivalent nodal loads.
j) What do you mean by C^1 continuity?

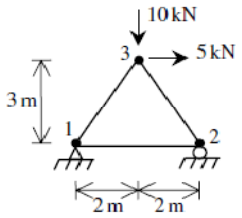
Q2 a) Consider the spring system composed of six springs as shown in figure. Given k = 120 kN/m, P = 20 kN. Determine the global stiffness matrix for the system and apply the boundary conditions. (5)



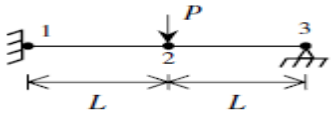
b) Consider the structure composed of two linear bars as shown in figure. Given E = 210 GPa, A = 0.003 m^2, P = 10 kN, and node 3 is displaced to the right by 0.002m, determine the global stiffness matrix and get the reduced stiffness matrix. (5)



Q3 Consider the plane truss shown. E = 210 GPa, A = $1x10^{-4}$ m^2. Assemble the structure stiffness matrix and get the reduced stiffness matrix. Also calculate the horizontal displacement at node 2. (10)



Q4 For the beam shown in figure, the given values are, E = 210 GPa, I = $60x10^{-6}$ m^4, P = 20 kN, L = 2 m. Determine the structure stiffnes matrix and vertical displacement at node 2. (10)



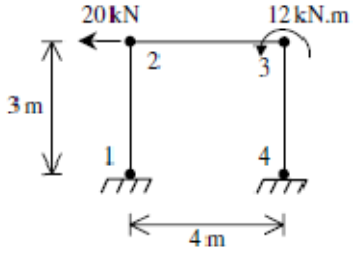
Q5 a) Calculate the shape functions for a rectangular element having 8 nodes in natural coordinate system. (7)

b) What is the role of shape functions in FEA? (3)

Q6 a) Evaluate the integral $I = \int_{-1}^{1} (4^r - r)dr$ using one, two and three point Gaussian quadrature. (5)

b) Discuss Convergence requirements in FEA. (5)

Q7 Consider the plane frame shown in figure. Given values are, E = 210 GPa, I = $5x10^{-5}$ m^4. Assemble the global stiffness matrix of the structure. Neglect axial deformations. (10)



Q8 (5 x 2)

a) Static condensation
b) Pascal's triangle in 2D
c) Jacobian matrix for transformation.
d) Gaussian quadrature technique.