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

Total Number of Pages: 03 **B.Tech**
FEME6301

6th Semester Regular / Back Examination 2016-17
FINITE ELEMENT METHOD
BRANCH(S): METTA, MME
Time: 3 Hours
Max Marks: 70
Q.CODE: Z876

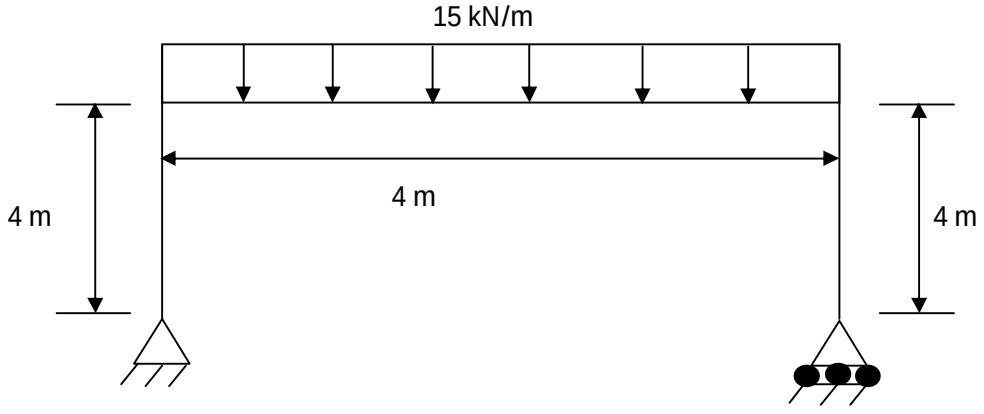
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

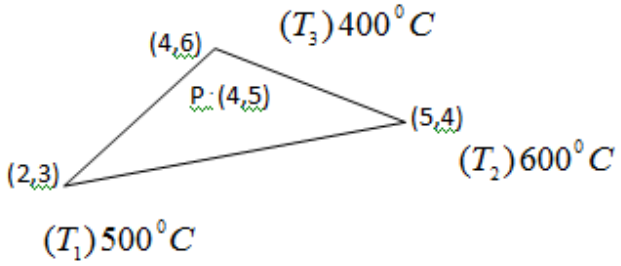
a) Define shape function.
b) What do you mean by axisymmetric analysis?
c) During discretization mention the places where it is necessary to place a node?
d) Explain the basic principle of Rayleigh-Ritz method.
e) Find out natural frequency of a fixed free bar with one element discretization.
f) Write down the shape function matrix for a 2D truss element..
g) Give two examples of plane strain problems.
h) Distinguish between essential boundary conditions and natural boundary conditions.
i) What are the advantages of post processing in FE analysis?
j) Name any four FEA softwares?

Q2 **a)** Write down the difference between FEM and FDM. **(2)**
b) Derive the shape function, strain displacement relation matrix [B] and element stiffness matrix for a 3-noded triangular element. (CST) . **(8)**

Q3 **a)** Determine the reactive forces developed at the supports of the frame shown in below figure. The cross section area and the second moment of area of all members are $0.06m^2$, 2×10^{-4} m^4 , respectively. Take E= 200 Gpa. **(5)**

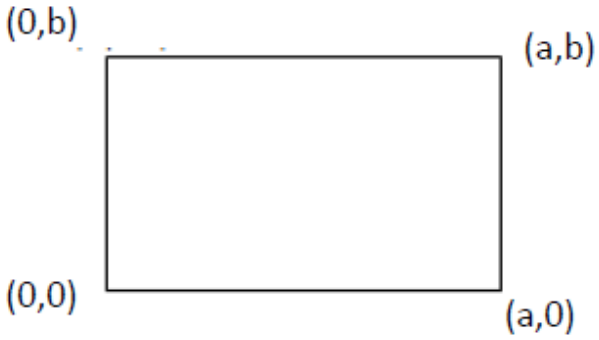


b) Consider a triangular element as shown in figure. Find out the temp at point P. **(5)**

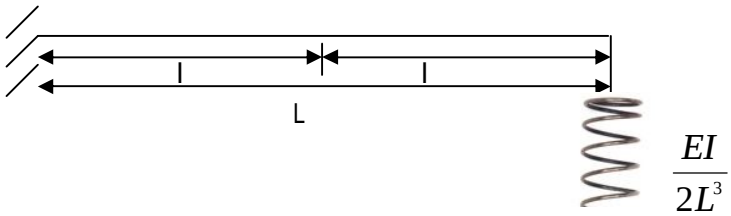


Q4 **a)** A simply supported beam of length L and constant section is subjected to a uniformly distributed load of intensity q_0. Determine the maximum deflection and maximum bending moment using the basic Galkerin method. **(5)**

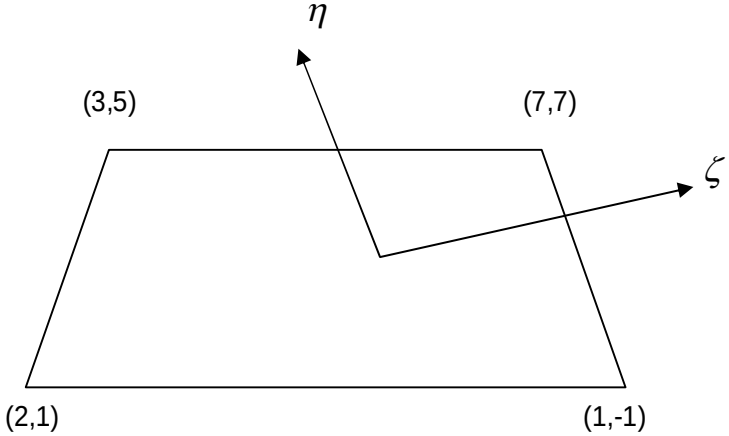
b) Find out the strain displacement matrix for the isoparametric element given below. **(5)**



Q5 **a)** Find the Global stiffness matrix with 2 element discretization. Consider the spring as mass less. **(5)**

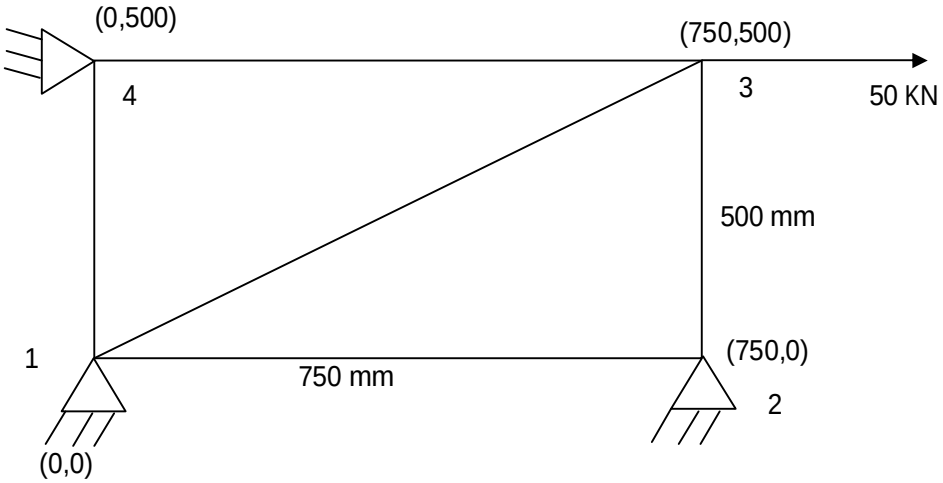


b) A quadrilateral element is shown in figure. Determine the coordinates of a point inside the element having natural coordinates (0.5, 0.6) **(5)**

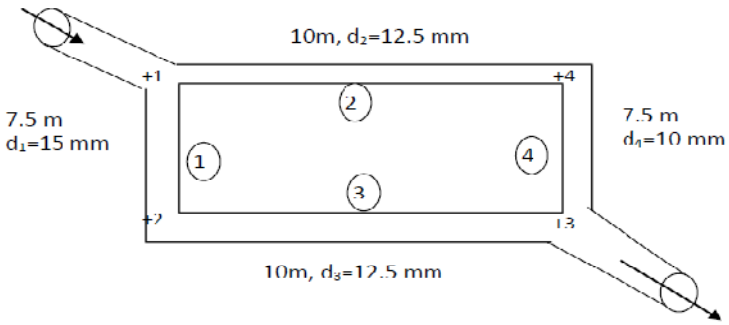


Q6 **a)** The Cartesian coordinates of the corner nodes 1,2 and 3 of a triangular element are given by (1,1), (3,1) and (2,3) respectively. Determine the shape functions N_1, N_2 and N_3 at a interior point P(2,2). **(5)**

b) For the given figure determine the nodal displacements. Assume Plain strain condition. Take E= 200 GPa, Poisson's ratio= 0.25 and thickness t= 15mm.Dimensions are in mm. **(5)**



Q7 Find flow rate at various sections of pipe and state whether flow is laminar or turbulent by using FEM in the below mentioned figure. Flow rate of water at inlet is 0.016 lit./sec. Density of water is taken as 995 kg/ m^3 and absolute viscosity $\mu = 8 \times 10^{-4}$ Pa.sec **(10)**



Q8 **Write short answer on any TWO:** **(5 x 2)**

a) General variational method in elasticity problems.
b) Basic steps involved in FEM..
c) Shape function for a 2 noded beam element.
d) Write down the advantages and disadvantages of FEM.