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

Total Number of Pages: 02 **B.Te**

FEME63

6th Semester Regular / Back Examination 2016-17
FINITE ELEMENT METHOD
BRANCH(S): AUTO, MANUFAC, MANUTECH, MECH
Time: 3 Hours
Max Marks: 70
Q.CODE: Z688

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:** **(2x1**

a) Define isoparametric, superparametric and subparametric elements?
b) What do you mean by axisymmetric analysis?
c) What is discretization?
d) Explain the basic principle of Rayleigh-Ritz method.
e) Define shape function.
f) Distinguish between global and local co-ordinate system.
g) Give two examples of plane stress problems.
h) State the general characteristic equation of finite element analysis and explain the terms?
i) Name any four FEA softwares?
j) What are the advantages of post processing in FE analysis?

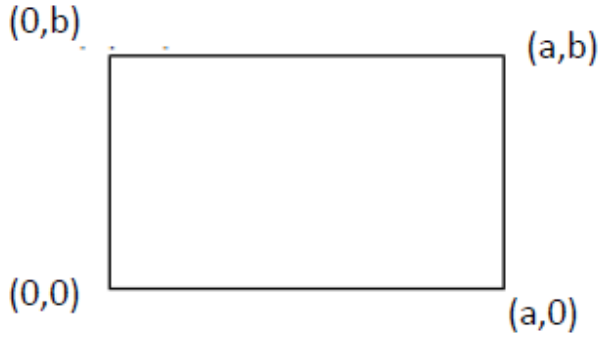
Q2 **a)** Write down the expression of shape function N and displacement u for 1-D bar element. **(2**
b) Derive the shape function, strain displacement relation matrix [B] and element stiffness matrix for a 3-noded triangular element. (CST) **(8**

Q3 **a)** Explain the basic steps involved in FEM. **(5**

b) Derive the shape function for a 2 noded beam element. **(5**

Q4 **a)** Consider a simple supported beam, load acting at its mid point. Find out maximum deflection and slope at the supports. Solve by using finite element method. **(5**

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



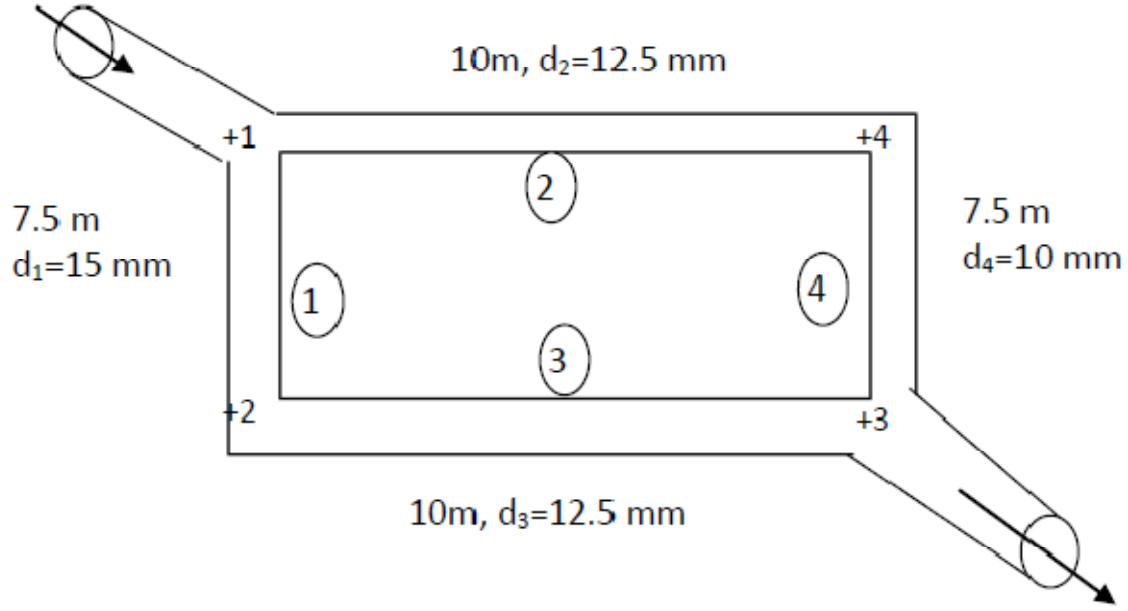
Q5 **a)** Derive an equation for element stiffness matrix $[K^e]$for an axisymmetric ring element. What is the integration procedure? **(5**

b) Write down the Steps of computer program for stress analysis in finite element method. (Flow chart). **(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) A composite wall is made of four materials. The left-most material is of thickness 220 mm and its thermal conductivity is 1 w/m ^{0}C. The thermal conductivity of second material is 0.8 w/m ^{0}C and its thickness is 150 mm. The thermal conductivity and thickness of the third and fourth materials are 0.08 w/m ^{0}C ,50 mm, 70 w/m ^{0}C and 3 mm respectively. The left most part of the composite wall is subjected to convection with the surrounding temperature at 1500 ^{o}C. The convection heat transfer coefficient is 75 w/m^2 ^{0}C. The temperature on the right-most surface of the composite wall is 90 ^{o}C. Determine the temperature distribution across the thickness of the composite wall and the heat flow. Consider the area of heat conduction and convection is 1m^2. **(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**

a) General variational method in elasticity problems.

b) Difference between FEM and FDM.

c) Shape function of a typical quadrilateral element.

d) Write down the advantages and disadvantages of FEM.