Registration no.

Total Number of Pages: 03

M.TECH
MDPE205

2nd Semester Regular/Back Examination – 2015
FINITE ELEMENT METHODS IN ENGINEERING
BRANCH(S): MECHANICAL SYSTEM DESIGN
Time: 3 Hours
Max marks: 70
Q.CODE: T436

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

1. Answer all the following questions. 2×10=20

a) Define isoparametric, superparametric and subparametric elements?

b) What is discretization?

c) List out different areas of engineering where finite element analysis is applied?.

d) What is the difference between finite element method and finite difference method?

e) What do you mean by axisymmetric analysis?

f) Draw Pascal's triangle and state its importance.

g) Define shape function.

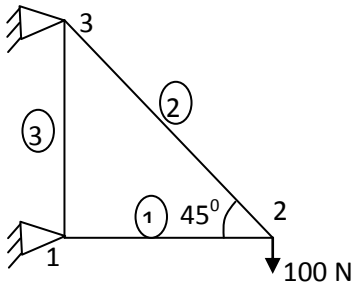
h) Give two examples of plane stress problems.

i) State the general characteristic equation of finite element analysis and explain the terms?

j) Name two FEA Softwares.

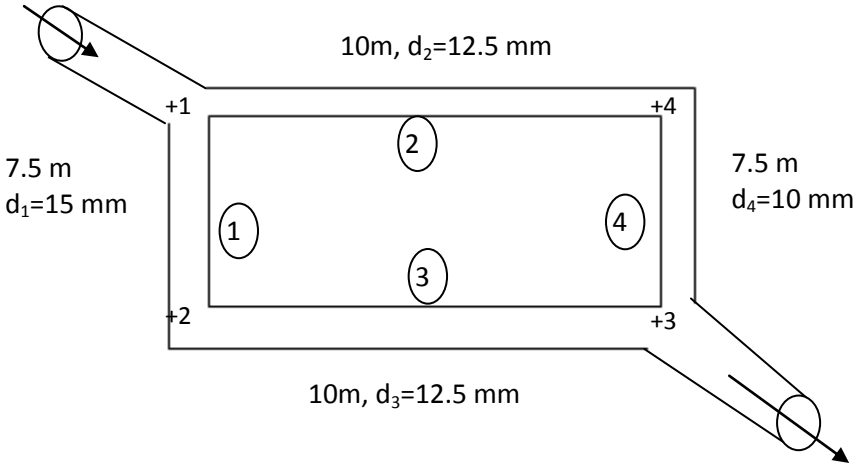
2. Derive the shape function, strain displacement relation matrix [B] and element stiffness matrix for a 3-noded triangular element. (CST) [10]

3. Find out the deflections at node 2. Take $\frac{EA}{L}$ = 1000 N/mm [10]

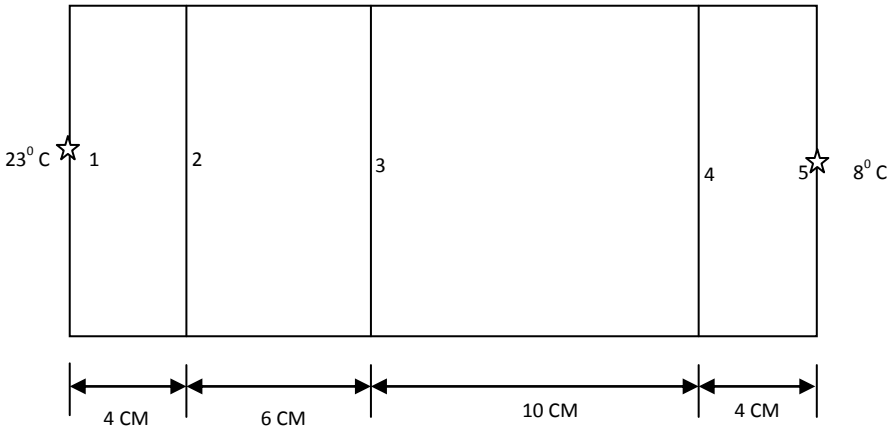


4. Find flow rate at various sections of pipe and state whether flow is laminar or turbulent by using FEM. Flow rate of water at inlet is 0.016 lit./sec. Pressure at exit is

zero. Density of water is taken as 995 kg/ m^3 and absolute viscosity $\mu = 8 \times 10^{-4}$ Pa.sec. [10]



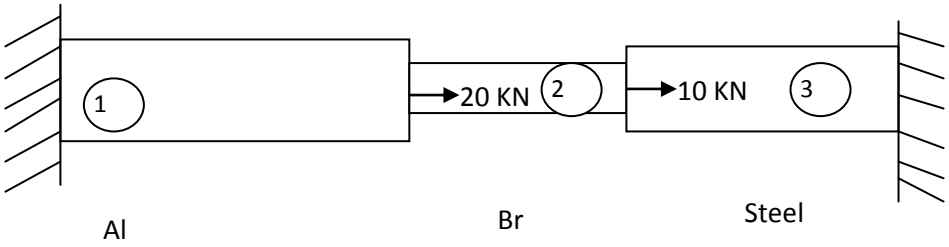
5. Find out the temperatures at the interfaces and the heat flow rate for the given figure. K_1= 0.2 W/m^0C, K_2= 0.12 W/m^0C, K_3= 0.16 W/m^0C, K_4= 2 W/m^0C, $A_1 = A_2 = A_3 = A_4$=1 m^2 [10]



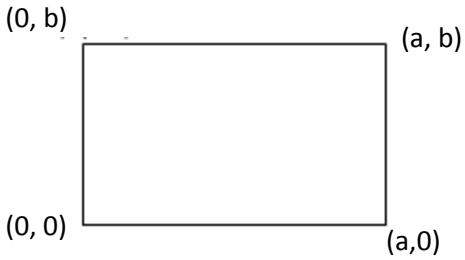
6. Consider the axially loaded bar as shown in the figure below. Calculate the following [10]

(i) Nodal displacements (ii) Element stresses (iii) Support Reactions.

Material Properties	Al	Br	Steel
E(GPa)	70	105	200
A(mm^2)	900	400	200
L(mm)	80	90	70



7. Find out the strain displacement matrix for the isoparametric element given below. [10]



8. Write Short notes on any Two 5×2

a) Steps in finite element analysis

b) Steps of computer program for stress analysis in finite element method. (Flow chart)

c) Shape function of a typical quadrilateral element.

d) Potential energy method used in FEM