Time: 3 Hours **Marks:80**

N.B.:

1. Question No.1 is compulsory.
2. Illustrate your answer with neat sketches wherever necessary.
3. Missing data may be assumed suitably.
4. Figures to the right indicate full marks.
5. Solve any three questions from Q.2 to Q.6.

Solve any four from the following questions.

Q1. a) What is Significance of the shape functions? **20**

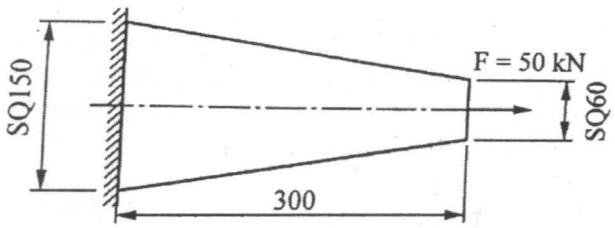
b) Explain Weak & Non-Weak method used in FEA.

c) Derive Shape function1-D Quadratic element in natural Coordinates.

d) Write a short Note on advantages and limitations of Finite Element Method.

e) Write short note on Sources of Error in FEA.

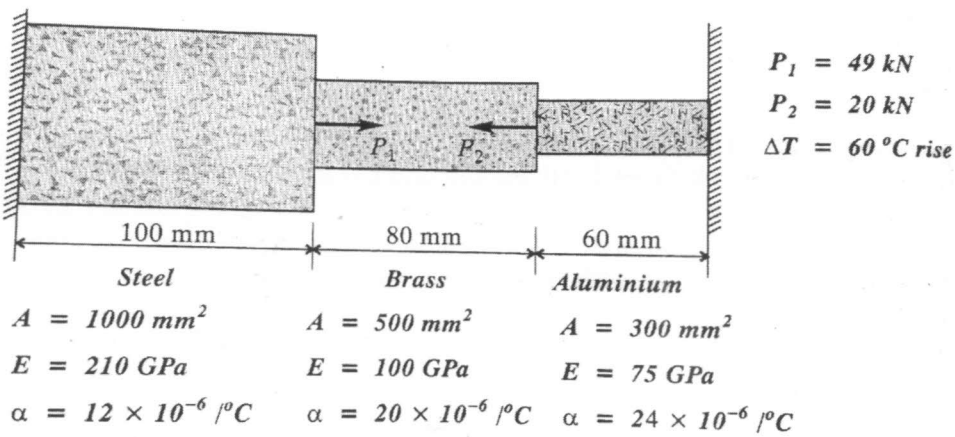
Q2. a) A tapered bar is shown in figure below. Model the bar by considering it as made of 3 elements and determine deflections at ends. **10**



b) Given a differential equation **10**

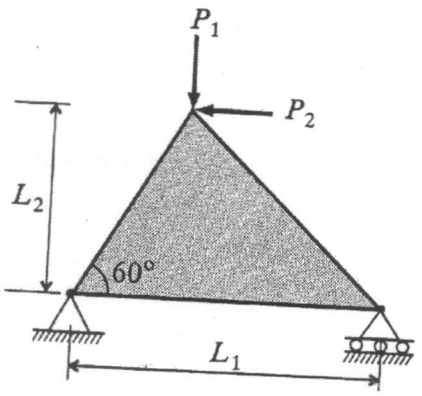
$\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0\ ; 0 < x < 1; y(0) = 1\ ; y'(1) = 0$ Find of y (0.2) by using Least Square Method & compare it with Exact solution.

Q3 a) Analyse completely the problem given below using directly the element matrix equation corresponding to that field. Stepped bar with thermal effect is shown in figure below. **15**



b) Explain pre & post processing in FEM. **5**

Q4 a) Analyse the plane truss for nodal displacements, reactions, elemental stresses and strains. **15**



Data :

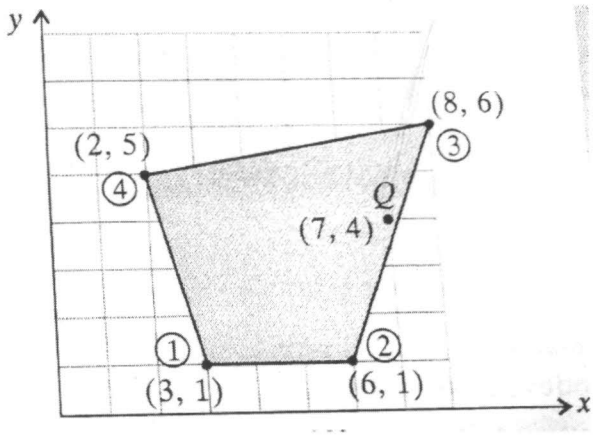
$L_1 = 0.6\ m$ $L_2 = 0.4\ m$

$P_1 = 5\ kN$ $P_2 = 2\ kN$

$E = 180\ GPa$ $A = 6\ cm^2$ *for all elements*

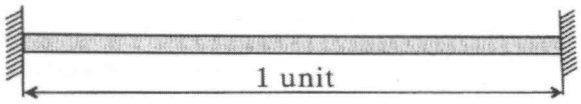
b) Explain Significance of Jacobian Matrix. **5**

Q5 a) For the iso-parametric quadrilateral element shown in fig, determine the local coordinates (ε, η) of the point Q which has Cartesian coordinates (7, 4). **10**



b) A CST element has nodal coordinates (10,10) ,(70,35) and (75,25) for nodes 1,2 and 3 respectively . The element is 2 mm this and its of material with properties E=70 GPa. Poisson's ratio is 0.3. Up on lading of model the nodal deflections were found to be $u_1 = 0.01mm$,$v_1 = -0.04mm$, $u_2 = 0.03$ mm , $v_2 = 0.02mm$, $u_3 = -0.02$ mm and $v_3 = -0.04mm$. Determine strains e_x , e_y &e_{xy} . **10**

Q6 a) Find the two natural frequencies of transverse vibrations of a beam fixed at both ends as shown in figure. Used Lumped Mass Matrix. **10**



$EI = 10^6$ units
$\rho A = 10^6$ units

b) Derive shape functions for a quadrilateral Element using Natural Coordinates. **10**

Subject: Correction : 1T01725 - T.E.(PRODUCTION)(Sem V) (Choice Based) / 32907 - Elective I: Finite Element Analysis QP Code: 59577

From: University of Mumbai<support@muapps.in> on Tue, 18 Dec 2018 15:37:24

To: <exam_kgce2010@rediffmail.com>

University of Mumbai

Correction : 1T01725 - T.E.(PRODUCTION)(Sem V) (Choice Based) / 32907 - Elective I: Finite Element Analysis **QP Code: 59577**

Q.2 a) A tapered bar is shown in figure below. Model the bar by considering it as made of three elements and determine the deflections at ends. **Assume the modulus of elasticity as 200Gpa**

Q.2 b) Read as **y'(1)=0.1** instead of **y'(1)=0**

Q.5 b) Read as **Up on loading** instead of **Up on lading.**

Subject: Correction : 1T01725 - T.E.(PRODUCTION)(Sem V) (Choice Based) / 32907 - Elective I: Finite Element Analysis QP Code: 59577

From: University of Mumbai<support@muapps.in> on Tue, 18 Dec 2018 15:48:57

To: <exam_kgce2010@rediffmail.com>

University of Mumbai

Correction : 1T01725 - T.E.(PRODUCTION)(Sem V) (Choice Based) / 32907 - Elective I: Finite Element Analysis **QP Code: 59577**

Q. 5 b) Read as **The element is 2 mm thick** instead of **The element is 2 mm this**