Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II (Old course)• REMEDIAL EXAMINATION – SUMMER 2015

Subject Code: 1720801 **Date:12/05/2015**

Subject Name: Finite Element Method

Time: 02:30 pm to 5:00 pm **Total Marks: 70**

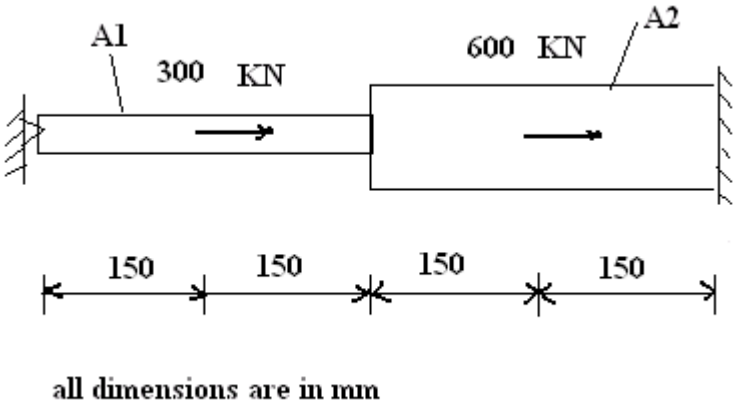
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (A) Explain the general steps of the FEM and engineering application of FEM 05

(B) A two step bar is subjected to loading condition as shown in figure is fixed at one end and free end is at a distance of 0.3 mm from the support. P= 60 KN . Determine (1) the distance at nodal points,(2) the stresses in elements(3) reactions at supports. 09

A1= 300 mm^2 , A2= 500 mm^2 and elastic constant E= 200GPa

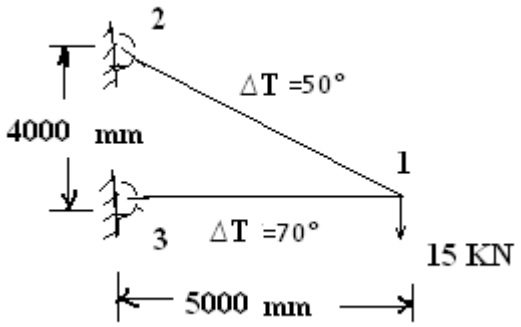


Q.2.(A) Derive the quadratic shape function in FEM and derive it. 05

OR

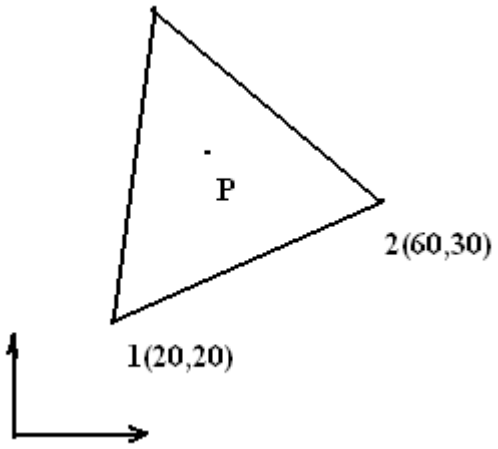
(A) Explain mesh generation technique for finite element method. 05

(B) For two bar truss as shown in figure , determine nodal displacements , elementa stresses and support reactions. A force of P= 800 KN is applied at node 1. E= 200GPa, Area A= 600 mm^2 for each element. Assume $\alpha = 12 \times 10^{-6}$ per °C 09



Q.3(A) What is CST? Explain CST element stiffness matrix (6)

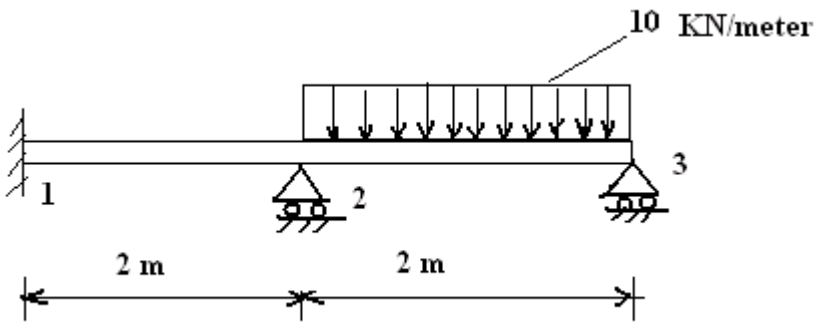
(B) For point P located inside the triangle as shown in figure , the shape function N1 and N2 are 0.3 and 0.4 respectively . Determine the coordinates of point P (8)



OR

Q.3(A) Derive the equation for stiffness matrix for a beam element in finite element method. 07

(B) For the beam loading as shown in figure. Determine slopes at 2 and 3 and , the vertical deflection at the midpoint of distributed load. E= 210Gpa, I= 6×10^5 mm^4 07



Q.4(A)	Explain mathematical formulation for isoparametric element	07
(B)	Explain following elements used in FEA with their specific appliacation. Also sketch the elements. 1. Four noded Qudrilateral element 2. shell element 3axisymetric ring element	07
	OR	
Q.4(A)	What is numerical integration in two dimensional finite element analysis ? Explain with example.	07
(B)	Write a governing equation and boundary condition used to completely define a rod extrusion problem. Also derive its weak form.	07
Q.5(A)	Explain the finite element formulation for two dimensional steady state heat conduction problem.	07
(B)	Giving suitable example explain langrangeôs method for a three degree of freedom spring mass system for FEM. Get the required equation of motion.	07
	OR	
Q.5(A)	Bar having uniform cross section of length L made up of a material with young modulus and density are given by E and ɟ . Estimate the natural frequencies of axial vibration of the bar using both consistent and lumped mass matrix.	07
(B)	Differentiate consistent and lumped mass matrices for FEM vibration problem	07

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