Code: 9A01701 **SS**

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2017

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Discuss how finite element method is evolved in the engineering field.

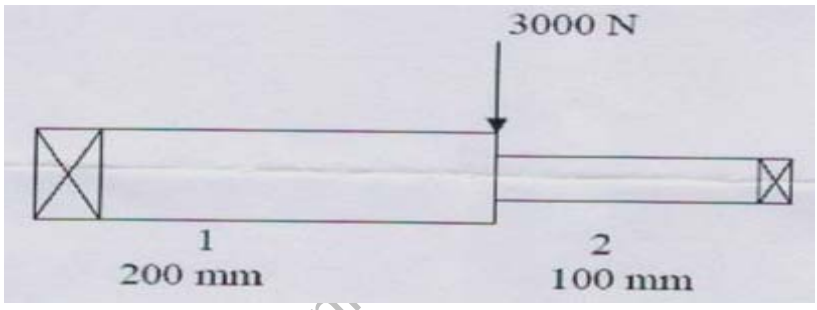
(b) Explain the importance of idealization and mathematical modeling in finite element analysis.

2 (a) What is meant by stress invariants? With a sketch show that stress invariants are same.

(b) Show that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)(\sigma_x+\sigma_y)=0$ for a 2-D elastic body.

3 (a) Starting from the first principles, derive the stiffness matrix for beam element.

(b) Find the deflection under the load and slopes at the end for the shaft shown in figure below. Consider the shaft to be simply supported at bearings. Take I_1 = 12 x 10^4 mm^4, I_2 = 6 x 10^4 mm^4 and E = 200 Gpa.



4 (a) What are shape functions? Derive the shape function for the three noded triangular elements.

(b) Derive the stiffness matrix and equations for a LST element.

5 (a) Discuss about Lagrange's and serendipity elements.

(b) Derive the shape functions for the nine noded rectangular elements in natural coordinate system in Lagrange's interpolation function.

6 (a) Derive the element stiffness matrix for four noded isoparametric element.

(b) Derive the area coordinates for the three noded CST element having Cartesian coordinate node-1 (1, 2) node-2 (3, 3) and node-3 (2, 4).

7 (a) Formulate 3-D eight noded iso-parametric solid element.

(b) Explain the finite element modeling of axisymmetric solids subjected to axisymmetric loading.

8 (a) For the isoparametric quadrilateral element with nodes 1(0, 10), 2(30, 10), 3(30, 40) and 4(0, 40), assemble Jacobian matrix and stiffness matrix for the Gaussian point (0.5773, 0.5773) for plane stress condition. Also check the Jacobian matrix and strain displacement matrix using isoparametric formulation.

(b) Explain numerical integration technique.

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