Code: 15A01701

R15

B.Tech IV Year I Semester (R15) Regular & Supplementary Examinations November/December 2019

FINITE ELEMENT METHODS

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is the common principle used in FEM and finite difference method?

(b) Write the steps in Rayleigh-Ritz method of functional approximation.

(c) What are the shape functions of a 1-D 3-noded line element?

(d) Explain balanced representation of terms in a polynomial function.

(e) Write the nodal load vector for a CST element when no surface forces are acting and only body forces exist.

(f) Write the shape functions for a 2-D 4-noded rectangular element.

(g) What are super parametric elements?

(h) What are Lagrange elements?

(i) Write the Gauss integration rule in one dimension with two Gauss points.

(j) What do you mean by a sky matrix?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) What are the various methods of analysis which were used prior to FEM? Explain.

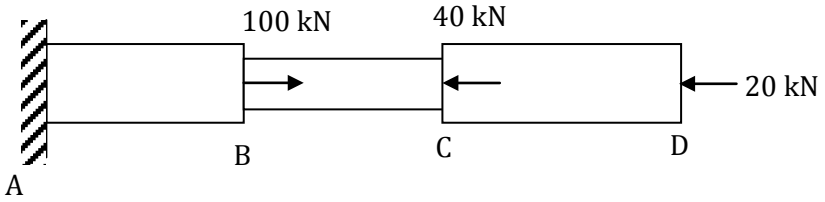
(b) Write the advantages, disadvantages and limitations of FEM.

OR

3 Find the maximum deflection for a simply supported beam subjected to u.d.l throughout the whole span and a concentrated load at the midpoint using Rayleigh-Ritz method.

UNIT – II

4 A brass bar of length 3 m is subjected to loads as shown in figure below. The cross section of the bar is a circle. The segment AB is of length 0.5 m and the diameter is 50 mm. The length of BC is 1 m and the diameter is 20 mm. The length of CD is 1.5 m and the diameter is 30 mm. Given E = 100 GPa, compute the stresses in three segments of the bar.



OR

5 What is a natural co-ordinate system? Explain area and volume co-ordinate systems.

Contd. in page 2

UNIT – III

6 (a) The nodal co-ordinates of a constant strain triangular element are (in cm); 1(2, 2), 2(4, 3) and 3(3, 6). Derive the strain-displacement matrix.

(b) Derive the strain displacement matrix and shape functions for a CST element.

OR

7 Derive the shape functions, strain displacement and stiffness matrices for a 4-noded rectangular element.

UNIT – IV

8 Explain the formulation of 2-D iso-parametric CST element. Derive the stiffness matrix.

OR

9 Derive the Jacobian matrix, strain displacement matrix and stiffness matrix for a 2-D 4-noded iso-parametric quadrilateral element.

UNIT – V

10 Numerically evaluate the following integrals:

(i) $\int_{-1}^{+1}(4x + x^4)\,dx$

(ii) $\int_{-1}^{+1}(2 + 5x + 8x^3)\,dx$

(iii) $\int_{-1}^{+1}\int_{-1}^{+1} 7x^2y^4\,dxdy$

(iv) $\int_{-1}^{+1}\int_{-1}^{+1}(3x^2 + 4y^2)\,dxdy$

OR

11 Write short notes on:

(a) Uniqueness.

(b) Nonuniqueness.

(c) Non-existence of solution.

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