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Name.....

Reg. No.....

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2007**

ME 04 604—FINITE ELEMENT METHODS

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

Answer all questions.

- I. (a) What is a shape function ? State its characteristics.
(b) Mention different sources of errors in FEA.
(c) Express the shape functions of a 1-D beam element.
(d) What is a natural co-ordinate system ?
(e) Express the shape functions of a bilinear rectangular element.
(f) Briefly explain how element matrices are assembled with the help of few triangular elements.
(g) What are essential and non-essential boundary conditions ?
(h) Briefly describe Rayleigh-Ritz method.

(8 × 5 = 40 marks)

- II. (a) Explain with suitable example, the basic steps involved in finite element analysis of a structural problem.

Or

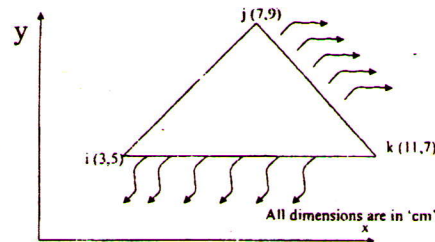
- (b) Describe the applicability and applications of FEA in various engineering disciplines and comment on its historical development.

- III. (a) Derive an expression for stiffness matrix of a 1-D beam element.

Or

- (b) (i) Discuss on the significance of using various local and global co-ordinates in FEA.
(ii) Comment on how node numbering schemes affect bandwidth of stiffness matrix and subsequently computer memory.

- IV. (a) Compute the element matrices and load vectors for the element shown below. The edges kj and ik are subjected to convection. $h = 8 \text{ W/cm}^2 \text{ } ^\circ\text{C}$; $T_\infty = 30^\circ \text{ } ^\circ\text{C}$; $k = 55 \text{ W/cm } ^\circ\text{C}$; $q_0 = 50 \text{ W/cm}^3$



Or

Turn over

- (b) Derive a strain-displacement matrix for a CST element. Write the constitutive matrix for a plane stress approximation.

- V. (a) Describe the principle of stationary potential energy with a suitable example. Also comment on finite element formulation from a functional.

Or

- (b) Derive the shape functions of a constant strain triangular element. Also briefly explain area co-ordinates.

(4 × 15 = 60 marks)