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B.TECH.
THEORY EXAMINATION (SEM–VIII) 2016-17
FINIT ELEMENT METHOD

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Explain the following: **10 x 2 = 20**

(a) What is the stiffness matrix?
(b) What is finite element analysis?
(c) Write the advantage of Finite element method.
(d) Write the limitation of FEM.
(e) Explain Galerkin method in short.
(f) What is the convergence?
(g) What is the Global matrix?
(h) Write the stiffness matrix for the beam element.
(i) Write the stages in finite element formulation.
(j) Write the stiffness matrix for truss.

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Derive the shape function for linear rectangular element in local coordinate system; give its dimension of side ‘r’ and‘s’ respectively.

(b) Discuss the errors involved in finite element solution with the example of a model second order differential equation in one dimension.

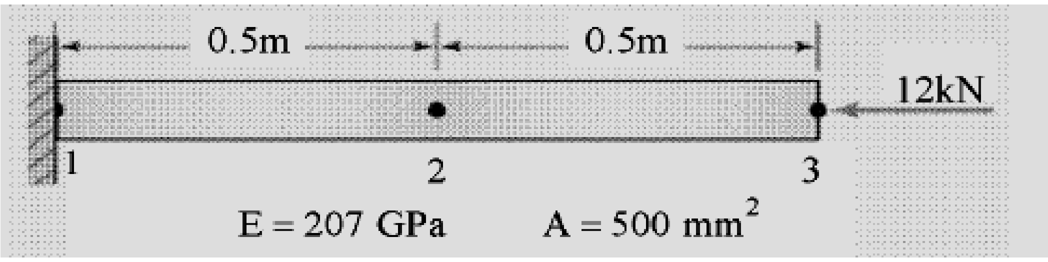
(c) For a square, isotropic elastic body of thickness ‘h’, the displacement are approximated by: $u(x, y) = (1 – x)\, y u_1 + x(1 – y) u_2$ □(x, y) = 0.

(d) State Kirchhoff’s theory and Mindlin theory for plate bending problem. Using four corner nodes plate, explain displacement, rotation, strain force and moments for both

(e) What do you mean by isoparametric formulation of a finite element problem? Give an example of real field problem where superparameteric elements can be used and why?

(f) Derive the Jacobian for a four nodel rectangular element having coordinates (0, 0), (2, 0), (2, 1) and (0, 1).

(g) A steel rod subjected to compression is modeled by two bar element, as shown in figure. Determine the nodal displacement and the axial stress in each element. What other concern should be examined?



(h) Line one dimensional element to approximate the temperature distribution along a fan. The nodal temperature and their corresponding position are shown in figure. What is the temperature at (a) x= 4cm and (b) x= 8cm

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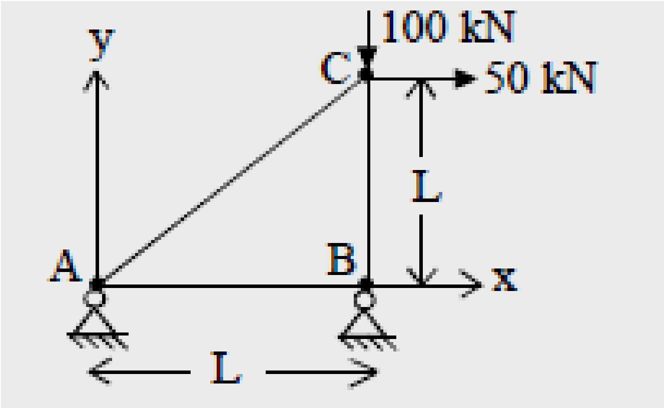
SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3 The three member truss shown have identical cross-section ‘A’ an elastic modulus ‘E’. Derive the global finite element matrix and evaluate the horizontal and vertical displacement at the joint ‘C’ and the reactive forces at joint ‘A’ and ‘B’ at hinged support.



4 A composite plane wall consist of three materials with conduction and convective coefficient given as (k1, K2, k3) and (h1, h2, h3) with cross sectional area ‘A’ each. Find the effective resistance with an analogy to thermal circuit. Develop global matrix for temperature change from 400ºC to 100ºC from one side of wall to other side.

5 Using Rayleigh-Ritz method, compute the axial displacement ‘u’ and axial stress ‘□x’ for an uniform cross section bar loaded with an uniformly distributed axial load variation as q = cx along length, where ‘c’ is load per unit cross section.

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