Printed Pages – 8 Roll No. .....

C037631(037)

B. Tech. (Sixth Semester) Examination, April-May 2022

(AICTE Scheme)

(Mech. Engg. Branch)

FINITE ELEMENT ANALYSIS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) is compulsory and carries 4 marks.*

Unit-I

1. (a) Write about the basic steps adopted for analyzing an engineering problem in the finite element analysis. 4

Attempt any ~~one~~ : two

(b) Write short notes on : 8

(i) Rayleigh-Ritz method

(ii) Weighted Residual method

(c) The governing equation for a fully develop study laminar flow of a Newtonian viscous fluid on an inclined flat surface see fig, below is given by : 8

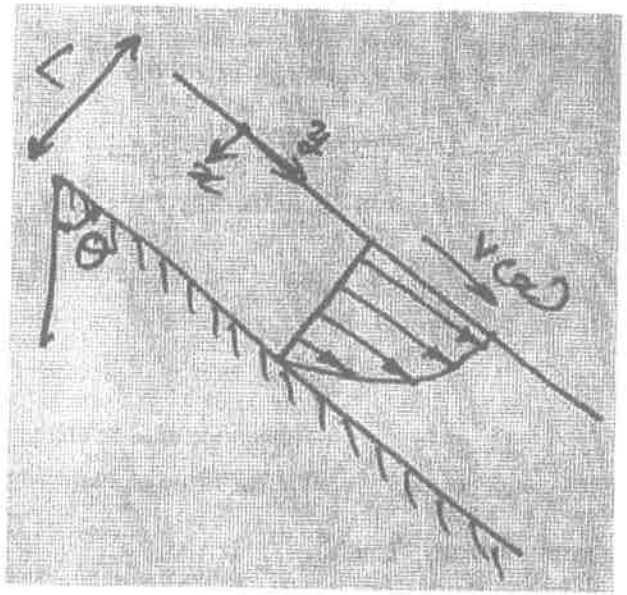
$$\mu = \frac{d^2v}{dx^2} + \rho\, g \cos\theta = 0$$

where :

μ = coefficient of viscosity

V = fluid velocity

ρ = density



The boundary conditions are :

$$\frac{dv}{dx}\Big|_{x=0} = 0$$

$$V(L) = 0$$

Find the velocity distribution $V(x)$ using the weighted residual method.

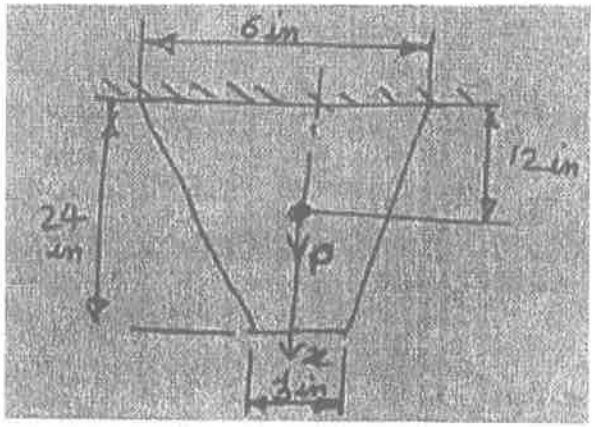
(d) Derive the stiffness matrix for 1-Dimensional element. 8

Unit-II

2. (a) Write about different types of elements used in finite element analysis. 4

Attempt any **one** :

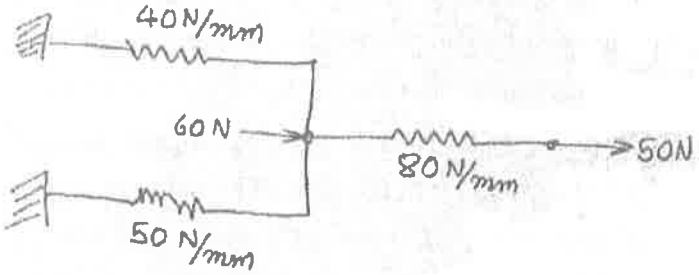
(b) Consider the thin plate (steel) shown in fig. below. The plate has a uniform thickness $t = 1$ in Young's modulus $E = 30\times10^6$ psi and weight density $\rho = 0{\cdot}2836$ lb/in. In addition to its self-weight, the plate is subjected to a point load $P = 100$ lb at its midpoint. 16



Evaluate the stresses in each element, and reaction force at the support.

Or

(c) Determine the displacement of modes of the spring system shown in fig. below. 16



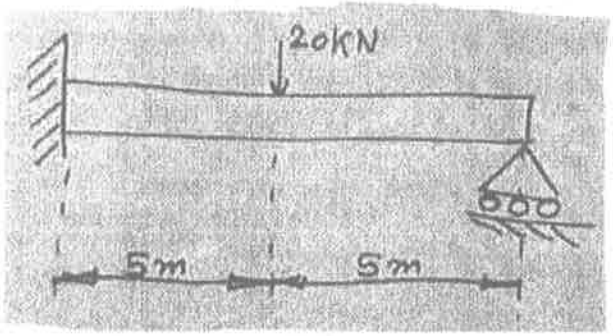
Unit-III

3. (a) Write difference between beam and bar element. 4

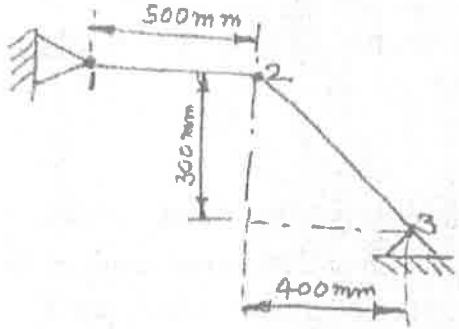
Attempt any **one** :

(b) A beam length of 10 m, fixed at one end and supported by a roller at the other end, carries a 20 kN concentrated load at the center of span. Determine deflection under load. 16

Take E = 200 GPa, $I = 24\times10^{-6}$ m^4.



(c) For the two-bar truss as shown in fig. below. Determine the displacements at node 2 and stresses in both elements. 16



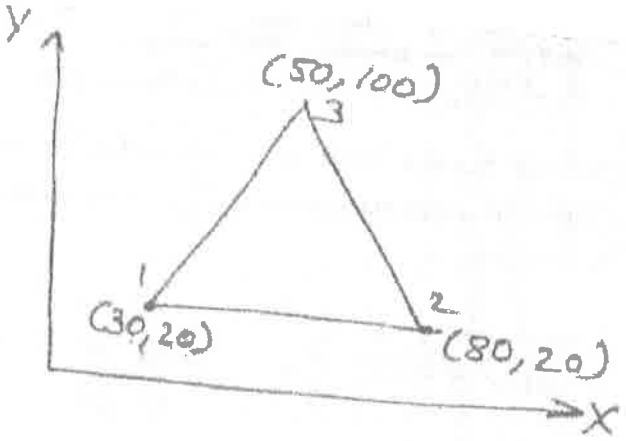
$E = 70$ GPa, $A = 200$ mm^2 for both members.

Unit-IV

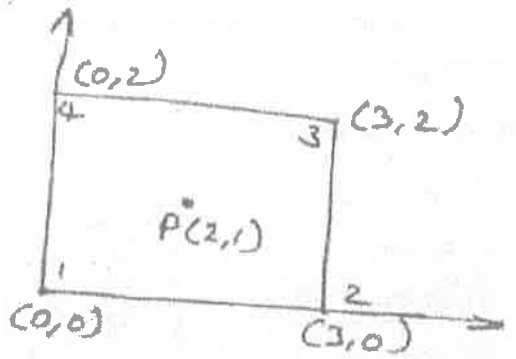
4. (a) Write about plane stress and plane strain elements. 4

Attempt any **one** :

(b) For the plane stress element shown in fig bellow evaluate the stiffness matrix. Assume modulus of elasticity $E = 210\times10^3$ N/mm^2, possion's ratio $\mu = 0{\cdot}25$ element .thickness $t = 10$ mm. The coordinates are given in nm. 16



(c) For four noded rectangular element shown in fig. below. Determine the temperature at the point (2, 1). The nodal temperatures are $T_1 = 42°C$, $T_2 = 54°C$, $T_3 = 56°C$, $T_4 = 46°C$. 16

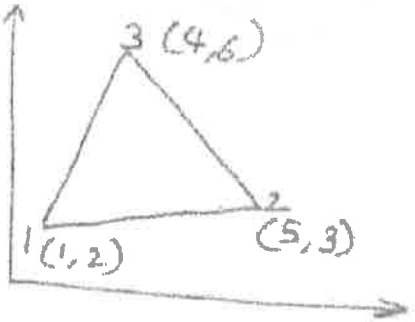


Unit-V

5. (a) Write about Axisymmetric-2 dimensional element. 4

Attempt any **one** :

(b) The nodal coordinates of a triangular elements are shown in figure. At the point P inside the element the x-coordinate is 3·3 and the shape function $N_1 = 0{\cdot}3$. Determine the shape. function N_2, N_3 and the y-coordinate of the point P. 16



(c) Find the element stress and principal stresses and principal angle. 16

Take $E = 70$ GPa, $\mu = 0 \cdot 3$

$u_1 = 0 \cdot 005$ mm

$u_2 = 0 \cdot 0$ mm

$u_3 = 0 \cdot 005$ mm

$v_1 = 0 \cdot 002$ mm

$v_2 = 0 \cdot 0$ mm

$v_3 = 0 \cdot 0$ mm