Total No. of Questions : 8]

SEAT No. :

PD4366

[Total No. of Pages : 4

[6403]-165

T.E. (Mechanical Engg.)

COMPUTER AIDED ENGINEERING

(2019 Pattern) (Semester - VI) (302050)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

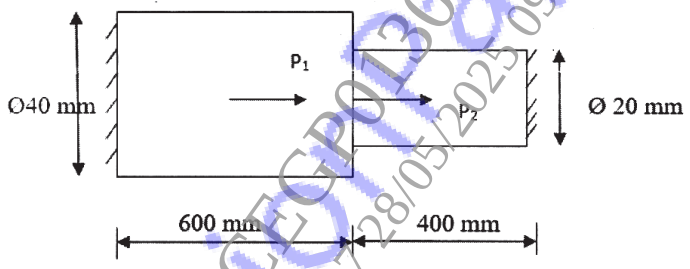
1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***

Q1) a) Figure shows the stepped bar subjected to load P_1 (at center) and P_2 using 1-D element. **[8]**

E = 200 GPa, P_1 = 50 KN, P_2 = 20KN. Find

i) Nodal displacement

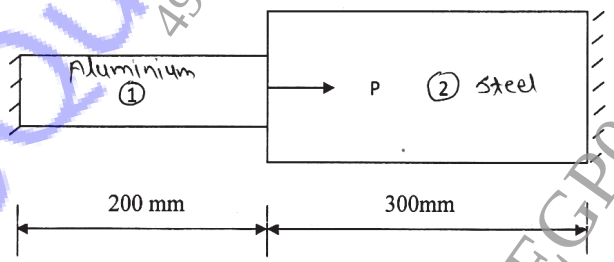
ii) Stresses in each element



b) An axial load P = 400 × 10^3 N is applied at 20ºC to the rod as shown in figure. The temperature is then raised to 50ºC. **[9]**

i) Assemble the K and F matrices.

ii) Determine the nodal displacement and element stresses



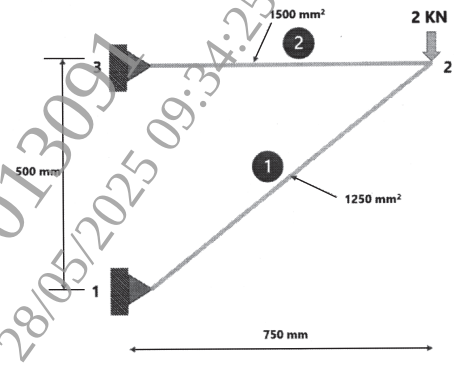
① Aluminium	② Steel
$E_1 = 70 \times 10^9$ N/m^2	$E_2 = 200 \times 10^9$ N/m^2
$A_1 = 900$ mm^2	$A_2 = 1200$ mm^2
$\alpha_1 = 23 \times 10^{-6}$ per ºC	$\alpha_2 = 11.7 \times 10^{-6}$ per ºC

OR

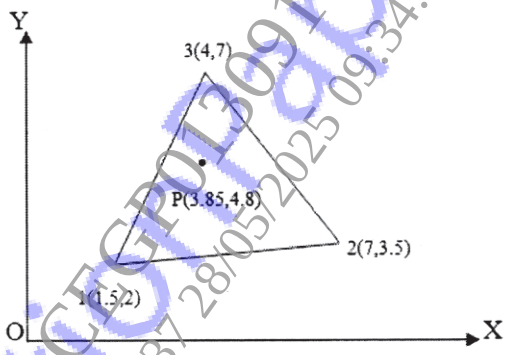
P.T.O.

Q2) a) Derive element stiffness matrix for two and three noded (linear) bar element connected in series. **[7]**

b) Determine the nodal displacements, stresses in each element and reaction at support in the following truss elements. E = 85 GPa. **[10]**

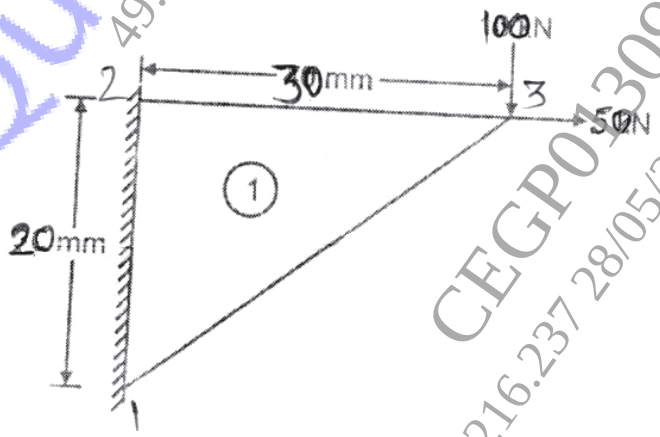


Q3) a) A constant strain triangular element is defined by three nodes 1(1.5,2), 2(7, 3.5) and 3(4, 7). Evaluate the shape functions N1, N2 and N3 at the interior point P(3.85, 4.8). Also determine the Jacobian of the transformation J. **[7]**



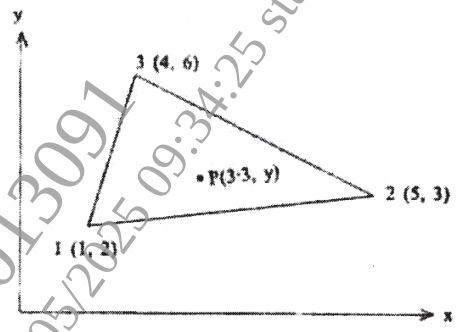
b) In a plane stress condition of a CST element shown in figure. Determine element stiffness matrix and nodal displacement. **[10]**

Thickness = 10mm and poisons ratio = 0.3, E = 70 × 10^3N/mm^2.



OR

Q4) a) The nodal coordinate of triangular element are shown in the figure. At the interior point 'P' the x-coordinate is 3.3. N1 = 0.3. Determine N2, N3 and the y-coordinate of point P. **[7]**



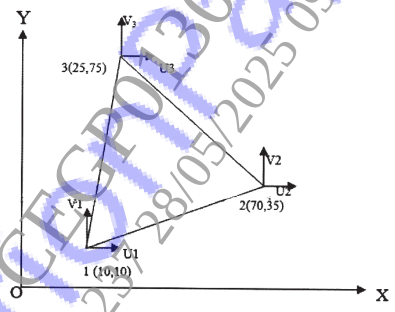
b) The triangular metallic plate ($E = 200\times10^3$ N/mm^2, $\nu = 0.25$) of thickness 10mm is used to machine assembly. The coordinates of three vertices of the plate are shown in figure. The deflections observed at three nodes are :

$U_1 = 0.01$mm $\quad V_1 = -0.04$mm

$U_2 = 0.03$mm $\quad V_2 = 0.02$mm

$U_3 = -0.02$mm $\quad V_3 = 0.05$mm

Assuming the plate as CST element, determine the strains and stresses. **[10]**



Q5) a) Give comparison of Linear and Nonlinear Analysis CAE Problems with respect to its characteristics features - load-displacement relation, stress-strain relation, scalability, stress-strain measures, superposition, reversibility, solution scheme, computational time, and user interaction with software. **[6]**

b) What are the different kinds of geometric non-linearities in CAE Project? Explain with figures. **[6]**

c) Write a general procedure for Non-linear static analysis project. **[6]**

OR

Q6) a) Explain difference between static analysis and dynamic analysis. **[6]**

b) Explain free and forced vibration. **[6]**

c) What is natural frequency? How many natural frequencies are there for any projects? Why it is necessary to evaluate? **[6]**

Q7) a) What is Computational Fluid Dynamics (CFD)? Explain the three dimension of fluid dynamics. **[6]**

b) Discuss the concept of FEA for structural dynamics and acoustics used in NVH analysis. **[6]**

c) Enlist the CAE software used for different application of CAE. Write at least 10 software with their applications. **[6]**

OR

Q8) a) What is durability, reliability and fatigue? Explain S-N Curve with low cycle, high cycle and infinite fatigue life. **[6]**

b) Write the comparison of Explicit and Implicit method for following criteria: **[6]**

i) Common software

ii) Stability

iii) Computational speed/cost

iv) Maximum size of computational problem

v) Numerical scheme

vi) Handling nonlinearity

vii) Filtering of frequencies

c) How to validate and check accuracy of the CAE results and how to view and interpret the CAE results? Explain with computation accuracy and correlation with actual testing. **[6]**

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