

Total No. of Questions : 8]

SEAT No. :

PB-3902

[Total No. of Pages : 4

[6262]-167

**T.E. (Mechanical Engineering)**  
**COMPUTER AIDED ENGINEERING**  
**(2019 Pattern) (Semester - II) (302050)**

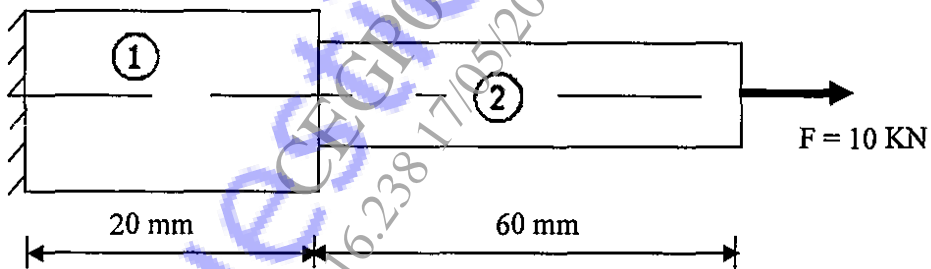
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

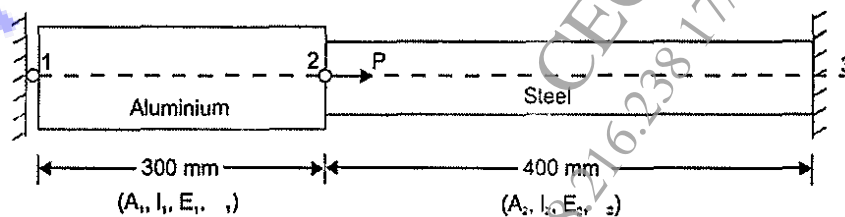
- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Use of electronic pocket calculator is allowed.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

Q1) a) A stepped bar is made of two materials joined together as shown in fig. The bar is subjected to an axial pull of 10kN. Determine the displacements, stress and reaction of each of the section using 1D element  $A_1 = 200 \text{ mm}^2$ ,  $A_2 = 180 \text{ mm}^2$ ;  $E_1 = 200 \times 10^3 \text{ N/mm}^2$ ;  $E_2 = 120 \times 10^3 \text{ N/mm}^2$ . [8]



b) Determine the nodal displacements at node 2, stresses in each material and support reactions in the bar shown in Figure, due to applied force  $P = 400 \times 10^3 \text{ N}$  and temperature rise of  $30^\circ\text{C}$ . Given: [9]

$A_1 = 2400 \text{ mm}^2$	$A_2 = 1200 \text{ mm}^2$
$l_1 = 300 \text{ mm}$	$l_2 = 400 \text{ mm}$
$E_1 = 0.7 \times 10^5 \text{ N/mm}^2$	$E_2 = 2 \times 10^5 \text{ N/mm}^2$
and $\alpha_1 = 22 \times 10^{-6}/^\circ\text{C}$	$\alpha_2 = 12 \times 10^{-6}/^\circ\text{C}$

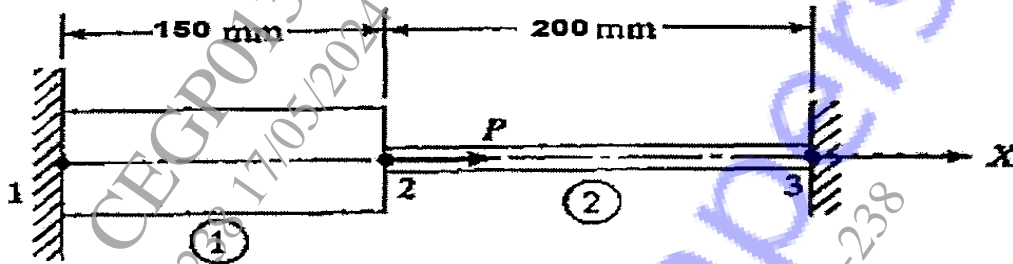


OR

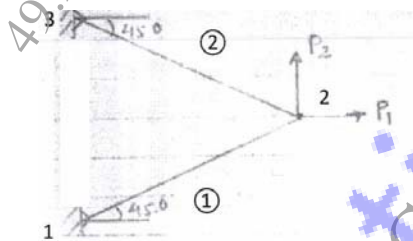
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Q2) a) Consider the bar element shown in figure. An axial load  $P = 200 \times 10^3 \text{ N}$  is applied as shown.  $A_1 = 2000 \text{ mm}^2$ ;  $A_2 = 800 \text{ mm}^2$ ;  $E_1 = 70 \times 10^3 \text{ N/mm}^2$ ;  $E_2 = 200 \times 10^3 \text{ N/mm}^2$ . [7]

- Determine the nodal displacement
- Determine the stress in each material
- Determine the reaction forces



b) Determine the nodal displacements and stresses in each element in the following truss problem. [10]



Data

$$P_1 = 5000 \text{ N}$$

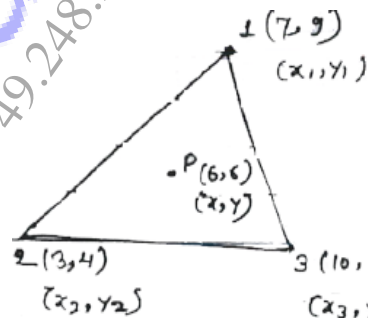
$$P_2 = 7000 \text{ N}$$

$$L = 500 \text{ mm}$$

$$A = 50 \text{ mm}^2$$

$$E = 200 \text{ kN/mm}^2$$

Q3) a) A constant strain triangular element is defined by three nodes as shown in figure. Evaluate the shape functions  $N_1$ ,  $N_2$  and  $N_3$  at the interior point  $P(6,6)$ . [6]

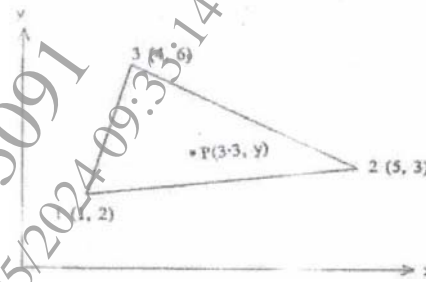


b) How to verify and validate results in CAE post-processing? [6]

c) What are the steps for interpretation of results during postprocessing in Finite element analysis? [5]

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.  $N_1 = 0.3$ . Determine  $N_2$ ,  $N_3$  and the y-coordinate of point P. [6]



- b) What are the modifications are suggested based on the interpretation of results during postprocessing in CEA? [6]
- c) Explain the tricks for postprocessing in computer aided Engineering. [5]
- Q5) a)** Explain difference between static analysis and dynamic analysis. [6]
- b) Explain free and forced vibration. [6]
- c) Explain modal analysis, harmonic analysis and transient analysis to study the dynamic properties of the structures. [6]

OR

- Q6) 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]

- Q7) a)** What is durability, reliability and fatigue? Explain S-N Curve with low cycle, high cycle and infinite fatigue life. [6]

- b) Write typical application of computation fluid dynamics in various industries for the following domains: [6]
- i) Aerospace Engineering
  - ii) Automobile Engineering
  - iii) Civil Engineering
- c) Explain use of FEA to optimize plastic injection mold materials. [6]

OR

- Q8) 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 16 software with their applications. [6]

