[5870] - 1027

T.E. (Mechanical)
COMPUTER AIDED ENGINEERING
(2019 Pattern) (Semester - II) (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) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
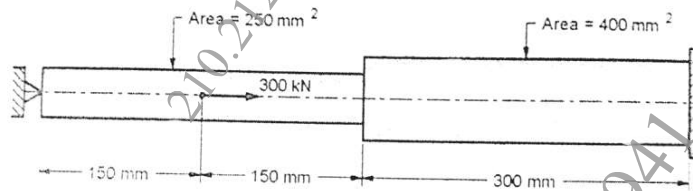4) *Assume the suitable data, if necessary.*

Q1) a) An axial load P = 300 kN is applied on a stepped steel bar as shown Figure 1. A_1 = 250 mm²; A_2 = 400 mm²; E = 200 GPa. **[12]**

Formulate:

i) Element stiffness matrix $[k_1], [k_2], [k_3]$.

ii) Global stiffness matrix [K].

Determine using elimination approach:

i) Nodal displacement vectors $[u_1], [u_2], [u_3], [u_3]$,

ii) Element Stresses $[\sigma_1], [\sigma_2]$

b) State and explain the principle of minimum potential energy. **[6]**

OR

Q2) a) For the two-bar truss shown in Figure 2 below. All the elements have E = 200 GPa and A = 600 mm². **[12]**
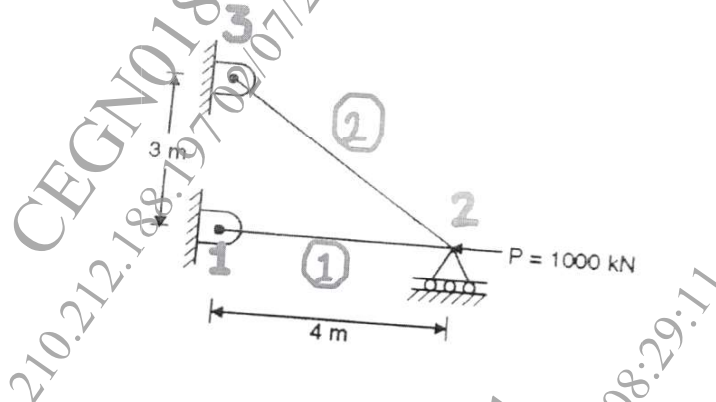
P.T.O.

Formulate:

i)   Element stiffness matrix $[k_1], [k_2]$

ii)   Global stiffness matrix $[K]$.

Determine using elimination approach:

i)   Nodal displacement vectors at node 2 $[u_3]$.

ii)   Element Stresses in element 1 $[\sigma_1]$.

b)   Formulate an expression of temperature effects of bar element. **[6]**

Q3) a)   Explain what is meant by Plane Stress and Plane Strain condition and how it is used for conversion of 3D problem into 2D problem. **[9]**

b)   What is CST element? Explain in details natural coordinate and shape function for CST element. **[8]**

OR

Q4) a)   In Post-processing of Computer Aided Engineering (CAE). **[10]**

i)   How to validate and check accuracy of the result in Computer Aided Engineering.

ii)   How to view and interpret results.

b)   Write down the special tricks for Post Processing. **[7]**

Q5) a)   What is Non-linear analysis? Write down the comparison of linear and non-linear finite element analysis. **[9]**

b)   Explain Geometric Nonlinearity and Material Nonlinearity related to non-linear problems. **[8]**

OR

Q6) a) What is Dynamic analysis? Write down the comparison of static and dynamic finite element analysis. **[9]**

b) Explain the following terms in dynamic analysis **[8]**
   i)   Time domain

   ii) Frequency domain

   iii) Simple harmonic motion

   iv) Free vibrations

Q7) a) Illustrate the applications of Computer Aided Engineering (CAE) in Noise, Vibration and Harness with examples. **[10]**

b) Elaborate the CAE based applications in casting and sheet metal simulations. **[8]**

OR

Q8) a) Elaborate the durability analysis used in finite element method. Explain in detail FEA based fatigue analysis using: **[10]**

   i)   Stress - life approach

   ii) Strain - life approach

b) Illustrate the applications of Computer Aided Engineering in Computational Fluid Dynamics in different sectors. **[8]**