Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: AO204

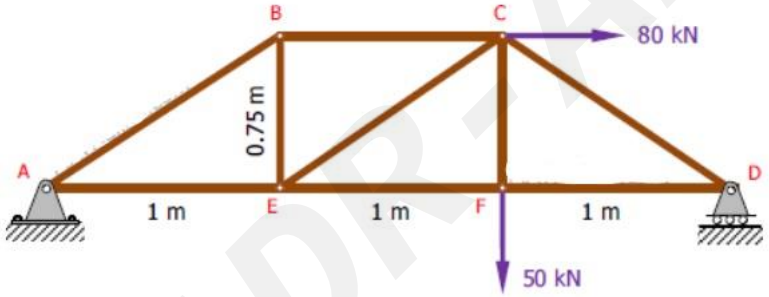
Course Name: AIRCRAFT STRUCTURES-I (AN)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions. Each question carries 10 marks.

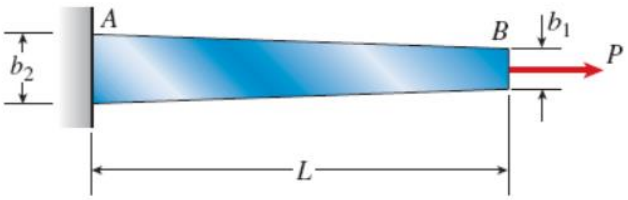
1 Determine forces in the member CF, FC, CD and FD using method of joints. 10



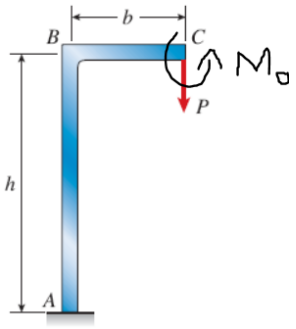
2 Derive Clapeyron's 3 moment equation for a continues beam with constant flexural rigidity. 10

3 a) Explain strain energy density due to axial loading using stress-stain diagram. 3

b) A slightly tapered bar *AB* of rectangular cross section and length *L* is acted upon by an axial force *P* (see figure). The width of the bar varies uniformly from b_2 at end *A* to b_1 at end *B*. The thickness *t* is constant. Find the strain energy of the bar. 7



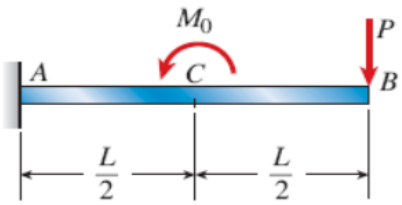
4 The frame *ABC* supports a concentrated load *P* at point *C*. Members *AB* and *BC* have lengths *h* and *b*, respectively. Determine the vertical deflection and angle of rotation of the frame. (Use base form or modified form as convenient) 10



PART B

Answer any three full questions. Each question carries 10 marks.

5 A cantilever beam *ACB* supports two concentrated loads *P* and M_0 as shown in the figure. 10



Calculate deflection at point C and angle of rotation at point B using dummy load method.

6 a) What is Maxwell's reciprocal deflection theory, explain with example. 5

b) What is Betti's law theory, explain with example. 5

7 a) Derive an expression for maximum compressive stress acting on a beam column which is pinned at both ends. 7

b) Draw the Euler's curve of a beam column for different eccentric ratio 3

8 a) Explain how inelastic buckling is differ from elastic buckling? 3

b) Explain tangent modulus theory of inelastic buckling using Euler's curve. 5

c) Explain why Initial curvature leads to an eccentric effect to the column. 2

PART C

Answer any four full questions. Each question carries 10 marks.

9 a) Explain maximum distortion energy theory? 2

b) Derive failure criteria according to maximum distortion energy theory. 6

c) Draw the failure surface of maximum distortion energy theory 2

10 The state of stress at critical point of a prismatic circular bar in rectangular coordinate system is given below. 10

$$\begin{bmatrix} 30 & 10 & 0 \\ 10 & 20 & 0 \\ 0 & 0 & 10 \end{bmatrix} \text{ MPa}$$

Material properties are: yield stress in tension = 200MPa, Ultimate stress in tension = 310 MPa and poisons ratio = 0.3.

I. Find principle stresses.

II. Find factor safety according to maximum shear stress criterion.

III. Find factor of safety according maximum distortion energy theory.

11 10

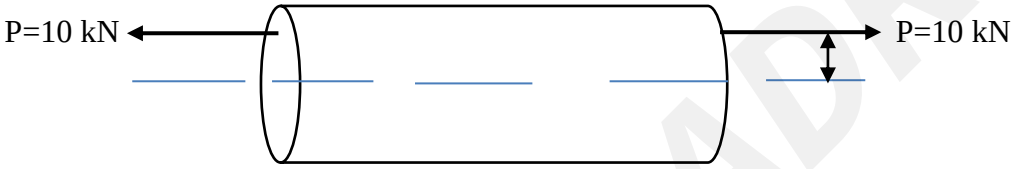
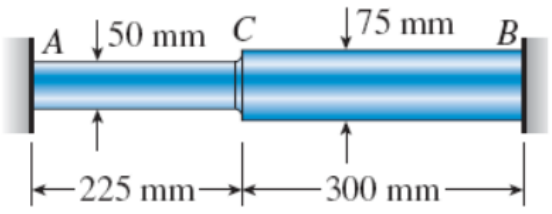


Figure shows a prismatic circular bar subjected to eccentric axial load of 10 kN with eccentricity e = 10 mm from axis of the bar. Find diameter of the bar using Maximum principle stress theory.

Material properties are: Yield stress in tension = 235 MPa and Ultimate tensile strength = 300 MPa. Factor of safety = 3.5.

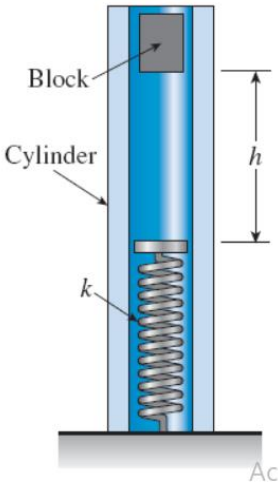
12 A plastic bar *ACB* having two different solid circular cross sections is held between rigid supports as shown in the figure. The diameters in the left- and right-hand parts are 50 mm and 75 mm, respectively. The corresponding lengths are 225 mm and 300 mm. Also, the modulus of elasticity *E* is 6.0 GPa, and the coefficient of thermal expansion is 100 x 10^{-6}/°C. The bar is subjected to a uniform temperature increase of 30°C. 10



Calculate:

1. Maximum compressive stress
2. Displacement of point C

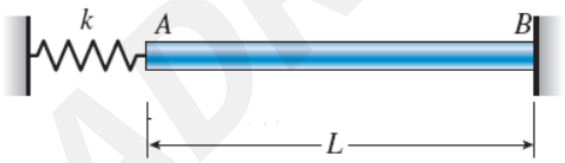
13 A block weighing *W* =5.0 N drops inside a cylinder from a height *h* = 200 mm onto a spring having stiffness *k* = 90 N/m 10



I. Determine the impact factor.

II. Determine the maximum shortening of the spring due to the impact

14 a) A circular rod of length L and cross section area A is attached to spring having stiffness K as shown in the figure. 5



Let E is the young's modulus and α be the coefficient of thermal expansion of the rod. If the bar subjected to temperature increase of ΔT, determine the expression for thermal stress developed on the cross section.

b) What is endurance limit? Explain the failure mechanism of components under fatigue loading. 5