D

0800MRT205122002

Pages: 3

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Examination December 2020 (2019 Scheme)

Course Code: MRT205

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1 Define the term 'state of stress at a point' in terms of polar co-ordinate system. (3)

2 Discuss about equality of cross shears. (3)

3 Draw and explain stress-strain diagram for different materials. (3)

4 Derive an equation for finding thermal stress and thermal strain in a body. (3)

5 What are the sign conventions for shear force and bending moment in general? (3)

6 What do you mean by strength of a shaft? (3)

7 Discuss about castigliano's second theorem. (3)

8 Define the terms strain energy, resilience and proof resilience. (3)

9 Discuss guest's theory for maximum shear stress. (3)

10 Define slenderness ratio and explain the assumptions made in Euler's column theory. (3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11 For the given state of stress, determine the principal stresses and their directions. (14)

$$[\tau_{ij}] = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

12 The state of stress at a particular point relative to the XYZ co-ordinate system is given by the stress matrix $\begin{bmatrix} 15 & 10 & -10 \\ 10 & 10 & 0 \\ -10 & 0 & 40 \end{bmatrix}$ N/m^2. Determine the normal stress (14)

and the magnitude and direction of shear stress on a surface intersecting the point and parallel to the plane given by the equation $2x-y+3z = 9$

Module 2

13 A steel rod of 30mm diameter and 5m long is connected to two grips and the rod is maintained at 95° C. Determine the stress and pull exerted when temperature falls to 30 ° C. If

(i) The ends do not yield (7)

(ii) The ends yield by 0.12 cm. (7)

Take $E = 2\times10^5$ MPa, $\alpha = 12\times10^{-6}$/° C

14 Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30mm and of length 1.5m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Assume as $E = 1x10^5$ N/mm^2 (14)

Module 3

15 A solid circular shaft transmits 75kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length and the shear strength is limited to 50 N/mm^2. Take $C = 1x10^5$ N/mm^2 (14)

16 A simply supported beam of length 6 m carries point load of 3 kN and 6 kN at distances of 2 m and 4 m from the left end. Draw the shear force and bending moment diagrams for the beam. (14)

Module 4

17 A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1m and 3m respectively from the left support.(Using Macaulay's Method) (14)

Find:

(i) Deflection under each load.

(ii) Maximum deflection

(iii) The point at which maximum deflection occurs. Given $E = 2\times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4

18 Derive an expression for strain energy stored in a body when the load is applied gradually and when the load is applied suddenly. (14)

Module 5

19	a)	Derive an expression for circumferential stress for a thin shell subjected to an internal pressure	(7)
	b)	A thin cylindrical pressure vessel of 500 mm diameter is subjected to an internal pressure of 2 N/mm2. If the thickness of the vessel is 20 mm, find the hoop stress, longitudinal stress and the maximum shear stress.	(7)
20		A hollow alloy tube 5m long with external and internal diameters 40 mm and 25 mm was found to extend 6.4 mm under the tensile load of 60 kN. Find the buckling load for the tube of column with both ends fixed. Also find the safe load for the tube, taking FOS = 4.	(14)

*****