PAPER ID-411409

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2023-24
INTRODUCTION TO SOLID MECHANICS

TIME: 3 HRS **M.MARKS: 70**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

Q no.	Question	Marks	CO
a.	What is maximum allowable working stress?	2	1
b.	Define the term proof resilience.	2	1
c.	Write the nature of SFD under uniformly Varying load.	2	2
d.	How bending moment, shear force and intensity of loading are related?	2	3
e.	Write the assumptions of pure bending.	2	4
f.	What is von Mises stress theory?	2	4
g.	Write the assumptions made in theory of torsion.	2	5

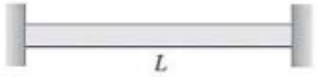
SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a.	A steel bar of square cross-section 35 mm x 35 mm, 500 mm long is observed to stretch 0.2 mm under a pull of 100 kN. The same bar in single shear test under a force of 122.5 kN shows the distortion of original right angel corners by 0.00125 radians. Determine the value of the four elastic constants of the materials.	7	1
b.	An overhanging beam ABC of length 8m is simply supported at B & C over a span of 6m and the portion AB overhangs by 2m. Draw SFD and BMD if it is subjected to udl of 3kN/m over the portion AB and 4kN/m over the portion BC.	7	2
c.	Find the expression for the normal stress at inclined plane when the member is subjected to bi-axial loading.	7	3
d.	Explain with graphical representation of maximum principal strain theory.	7	4
e.	A hollow circular shaft has external diameter of 125 mm and internal diameter 100 mm. Find the safe power can be transmitted if allowable shear stress is 100 MPa and maximum angle of twist 4° for 3.5 m length. Take speed of shaft is 3 revolution per second and maximum torque to exceed by mean torque by 20%. Take G=80 GPa.	7	4

SECTION C

3. Attempt any *one* part of the following: **7 x 1 = 7**

a.	Derive the expression for strain energy stored in a body when the load is applied gradually.	7	1
b.	A steel rod of length L and uniform cross sectional are A is secured between two walls, as shown inn figure. Use L=1.5 m, E=200 GPa, $\alpha = 11.7 \times 10^{-6}$ / °C and $\Delta T = 80$ °C. Calculate the stress for a temperature increase of ΔT for (i) The walls are fixed. (ii) The walls move apart a distance 0.5 m. 	7	1

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4. Attempt any *one* part of the following: 7 x 1 = 7

a.	A simply supported beam of span 10m carries a concentrated load of 10kN at 2m from the left support and a uniformly distributed load of 4 kN/m over the entire length. Sketch the shear force and bending moment diagram for the beam.	7	2
b.	A simply supported beam with point load "W" at a distance 'a' from support A. Determine slope at supports, deflection under load and maximum deflection by Macaulay's Method.	7	2

5. Attempt any *one* part of the following: 7 x 1 = 7

a.	Two circular beams where one is solid of dia. D and other is a hollow of outer dia. D_o and the inner dia. D_i are of same length, same material and of same weight. Find the ratio of section modulus of these circular beams.	7	3
b.	The T-section having flange of dimension 100 mm X 20 mm and web dimension 20 mm x 130 mm is subjected to a shear force of 100 kN. Draw the shear stress distribution diagram and find the maximum stress.	7	3

6. Attempt any *one* part of the following: 7 x 1 = 7

a.	Using Mohr's Circle to how to find principal stresses and angles. Write the procedure.	7	4
b.	Using Euler's formula, determine the critical stresses for a strut of slenderness ratio 80, 160 and 200 under the condition of (i) Both ends hinged (ii) Both ends fixed.	7	4

7. Attempt any *one* part of the following: 7 x 1 = 7

a.	Obtain an expression for thin spherical shell (i) Change in thickness (ii) Change in volume.	7	5
b.	A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimension of the shell, if it is subjected to an internal pressure of 1.5 MN/m^2. Take E = 200 GN/m^2 and μ=0.3	7	5