



PAPER ID-411424

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Subject Code: KCE402

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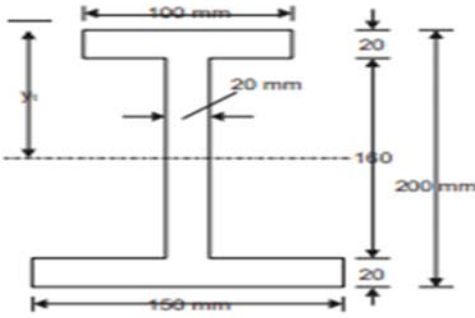
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BTECH
(SEM IV) THEORY EXAMINATION 2023-24
INTRODUCTION TO SOLID MECHANICS

TIME: 3 HRS**M.MARKS: 100****Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q no.	Question	Marks	CO
a.	Define elastic limit.	02	1
b.	What is meant by resilience in a stress-strain curve?	02	1
c.	What is slope and deflection of determinate beams?	02	2
d.	What do you mean by pure bending?	02	2
e.	Give the name of theories of failure.	02	3
f.	Give the examples of torque in our daily life.	02	3
g.	Write the assumption made in the theory of torsion.	02	4
h.	Define stiffness of spring	02	5
i.	Give the functions of springs.	02	5
j.	What do you mean by helical springs	02	5

SECTION B**2. Attempt any three of the following:****3 x 10 = 30**

a.	Obtain a relation for the stress induced in a body, if a load P is applied with an impact.	10	1
b.	The unsymmetric I-section shown in Fig. The the cross-section of a beam, which is subjected to a shear force of 60 kN. Draw the shear stress variation diagram across the depth. 	10	2
c.	With neat sketches describe the nature of bending stress for following: (i) Simply supported beam (ii) Cantilever beam.	10	3
d.	At a certain point in a stressed body the principal stress is $\sigma_x = 80$ MPa and $\sigma_y = -40$ MPa. Determine σ and τ on the plane whose normal are at $+30^\circ$ and 120° with the x-axis. Show your results on a sketch of differential element.	10	4
e.	Find out the expression for closed helical spring for following (i) Strain energy stored by the spring (ii) Work done is equal to strain energy.	10	5

SECTION C**3. Attempt any one part of the following:****1 x 10 = 10**

a.	Derive the expression for strain energy stored in a body when the load is applied gradually.	10	1
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b.	Using Mohr's Circle to how to find principal stresses and angles.? Write the procedure.	10	1
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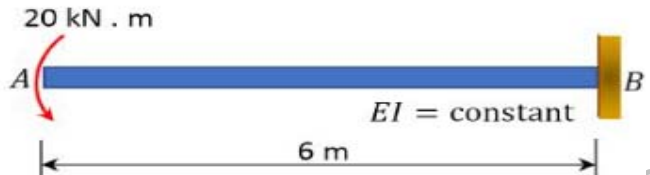
4. Attempt any one part of the following: 1 x 10 = 10

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.	10	2
b.	How bending moment, shear force and intensity of loading are related?	10	2

5. Attempt any one part of the following: 1 x 10 = 10

a.	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.	10	3
b.	Two circular beams where one is solid of dia. D and other is a hollow of outer dia. Do and the inner dia. Di are of same length, same material and of same weight. Find the ratio of section modulus of these circular beams.	10	3

6. Attempt any one part of the following: 1 x 10 = 10

a.	A cantilever beam shown in Figure is subjected to a concentrated moment at its free end. Using the moment-area method, determine the slope at the free end of the beam and the deflection at the free end of the beam by moment area method.  $20 \text{ kN} \cdot \text{m}$ $EI = \text{constant}$ 6 m	10	4
b.	Obtain an expression for Euler's crippling load of a column when one end fixed and other end hinged.	10	4

7. Attempt any one part of the following: 1 x 10 = 10

a.	A closed helical spring 10 cm mean diameter is made up 1.0 cm diameter rod and has 20 turns, The spring carries an axial load of 300 N. Determine the shearing stress induced. Taking the value of modulus of Rigidity as $8.2 \times 10^4 \text{ N/mm}^2$, find the deflection of spring when carrying this load. Also calculate the stiffness of spring.	10	5
b.	A spherical shell of internal diameter 0.9m and of thickness 10mm is subjected to an internal pressure of 1.4 N/mm^2 . Determine the increase in diameter and increase in volume. $E=2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio=1/3	10	5