Subject Code: KME502

PAPER ID-310702

Roll No:

B TECH
(SEM-V) THEORY EXAMINATION 2020-21
STRENGTH OF MATERIAL

Time: 3 Hours **Total Marks: 100**

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

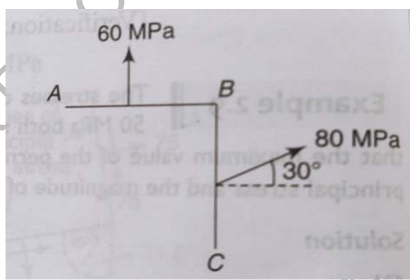
SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a.	What is the difference between bending moment and twisting moment?
b.	What are the main assumptions taken to derive the torsion equation?
c.	Define point of Contraflexure.
d.	Why spherical containers are more preferred to store the gases in comparison to cylindrical containers?
e.	What is the difference between column and strut?
f.	If shear stress τ is induced in shaft due to torque T, then what will be the value of maximum normal stress induced in the shaft?
g.	What is Winkler-Bach theory?
h.	What is proof load?
i.	How will you define the strength of column?
j.	What is flexural rigidity?

SECTION B

2. Attempt any *three* of the following: 10x3=30

a.	The resultant stress on a plane at a point in a material under stress is 80 MPa inclined at 30º to the normal to the plane. The normal component of stress on another plane at right angle to the first plane is 60 MPa. Determine (i) The principal stresses and their planes (ii) The maximum shear stresses and their planes 
b.	Compare the resistance to torsion of a hollow shaft to that of a solid shaft if the inside diameter of the hollow shaft is two-third of the external diameter and the two shafts have the same material and weight and of equal length.
c.	What assumptions are made in the analysis of columns by Euler's buckling theory? Derive an expression for Euler's crippling load when both ends of column are fixed.
d.	Wall thickness of a cylindrical shell of 800-mm internal diameter and 2-m long is 10 mm. If the shell is subjected to an internal pressure of 1.5 MPa, find the following: (i) The maximum intensity of shear stress induced. (ii) The change in dimensions of the shell Take E= 205 GPa, Poisson's ratio= 0.3
e.	With the help of Winkler batch theory, derive the value of factor h^2 for: (i) Rectangular section, (ii) Circular section.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

a.	What are the main theories of failure for a material? Explain maximum principal stress theory with its graphical representation.
b.	A 1-m long bar of rectangular cross section 50 mm X 80 mm is subjected to an axial load of 1.2 kN. Determine the maximum stress and the strain energy developed in the bar if the load applied is: (i) Gradual, (ii) Sudden, (iii) Falls through a height of 25 mm. Take E= 205 GPa

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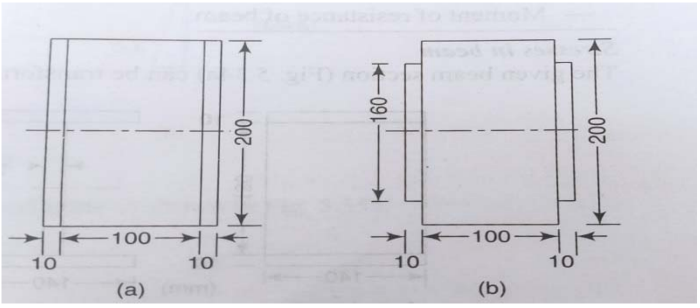
4. Attempt any *one* part of the following: 10x1=10

a.	A timber beam, 100 mm wide by 200 mm, deep is reinforced by bolting on two steel plates each 10 mm thick one on either side of the beam. Find the maximum stress attained in the steel and the moment of resistance of the section if i. The plates are 200 mm deep (figure- a) ii. The plates are 160 mm deep and are symmetrically placed(figure- b) The maximum stress in the timber is to be 8 MPa and the Young's modulus of steel is 20 times that of timber. 
b.	Establish the governing differential equation of beams. What are its limitations?

5. Attempt any *one* part of the following: 10x1=10

a.	A closed-coiled helical spring having 24 turns is made of 8-mm diameter wire. The mean diameter of the spring is 80 mm, and it carries a load of 250 N. determine the shear stress developed, the deflection and the stiffness of the spring. Take G= 84 GPa.
b.	Using Euler's formula, determine the critical stresses for a strut of slenderness ratio 80, 120, 160 and 200 under the condition of (i) Both ends hinged (ii) Both ends fixed Take E= 205 GPa.

6. Attempt any *one* part of the following: 10x1=10

a.	Deduce the general equations for circumferential and radial stresses developed in thick cylinders. What are the assumptions made?
b.	A steel tube of 120-mm external diameter is shrunk on another steel tube of 48-mm internal diameter. After shrinking, the diameter at the junction is 80 mm. Initial difference of diameters at the junction before shrinking was 0.04 mm. Determine: (i) Radial pressure at the junction (ii) Hoop stress developed in the two tubes after the shrinking. Take E= 210 GPa

7. Attempt any *one* part of the following: 10x1=10

a.	What do you mean by shear center? Explain with the help of examples.
b.	A rectangular beam is to be cut out of a cylindrical log of wood with diameter d. Determine the ratio of depth to width of the strongest beam which can be had from log of wood.