PAPER ID-310892

Subject Code: KME502

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

BTECH
(SEM V) THEORY EXAMINATION 2023-24
STRENGTH OF MATERIAL

TIME: 3 HRS **M.MARKS: 100**

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

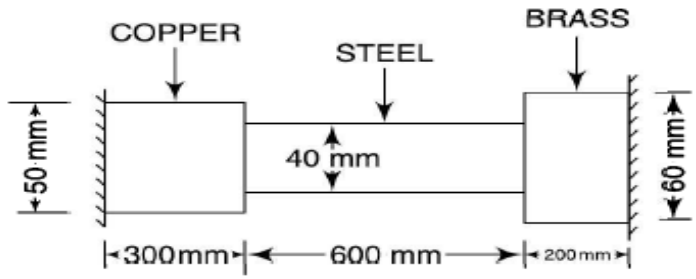
SECTION A

1. Attempt *all* questions in brief.

Q no.	Question	Marks	CO
a.	Briefly explain Poisson's ratio and Bulk modulus.	2	1
b.	What is impact load and write formula for impact stress?	2	1
c.	Why the strain at the common interface is equal in a composite beam?	2	2
d.	What is the importance of section modulus of a beam?	2	2
e.	What is spring? What are different types of spring?	2	3
f.	State the effect of eccentric loading on short column.	2	3
g.	What is 'Shrinkage allowance' in compound cylinders?	2	4
h.	In case of gas as a fluid, which type of container will be used to contain the fluid?	2	4
i.	Briefly explain unsymmetrical bending.	2	5
j.	What assumptions are taken in the analysis of shear center in beams?	2	5

SECTION B

2. Attempt any *three* of the following:

a.	A composite bar made up of copper, steel and brass is rigidly attached to the end supports as shown in figure.  Determine the stresses in the three portions of the bar when the temperature of the composite system is raised by 70ºC if (i) The supports are rigid (ii) The supports yield by 0.6 mm Take E_c= 100GPa, E_s= 205GPa, E_b= 95GPa, α_c= 18 x 10^{-6}/ºC, α_s= 11 x 10^{-6}/ºC and α_b= 19 x 10^{-6}/ºC.	10	1
b.	Derive the relation of torsional equation of shaft.	10	2
c.	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.	10	3
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: (1) The maximum intensity of shear stress induced (2) The change in dimensions of the shell	10	4

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	Take E= 205 GPa, Poisson's ratio= 0.3		
e.	With the help of Winkler batch theory, derive the value of factor h2 for: (i) Circular section (ii) Triangular section	10	5

SECTION C

3. Attempt any *one* part of the following:

a.	For a given loading conditions the state of stress in the wall of a cylinder is expressed as follows : (i) 85 MN/m^2 tensile, (ii) 25 MN/m^2 tensile at right angles to (i), and (iii) Shear stresses of 60 MN/m^2 on the planes on which the stresses (i) and (ii) act; the shear couple acting on planes carrying the 25 MN/m^2 stress is clockwise in effect. Calculate principal stresses and principal planes.	10	1
b.	The load on a bolt consists of an axial pull of 20 kN together with a transverse shear of 10 kN, Calculate the diameter of bolt according to : (i) Maximum total strain energy theory, and (ii) Maximum shear strain energy theory. Take elastic limit in tension 280 MPa, factor of safety=3 and Poisson's ratio = 0.3	10	1

4. Attempt any *one* part of the following:

a.	A timber beam 80 mm wide and 160 mm deep is reinforced with two steel plates 5 mm thick and 60 mm wide on top and bottom. If bending moment of 800 N-m acts at section of this beam, calculate the magnitude of maximum fiber stresses in tensions and compression in wood and steel. Assume E_S/E_W = 15.	10	2
b.	Compare hollow shaft and solid shaft. (i) On the basis of Strength. (ii) On the basis of weight.	10	2

5. Attempt any *one* part of the following:

a.	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 hinged.	10	3
b.	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.	10	3

6. Attempt any *one* part of the following:

a.	Deduce the general equations for circumferential and radial stresses developed in thick cylinders along with assumptions.	10	4
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	10	4

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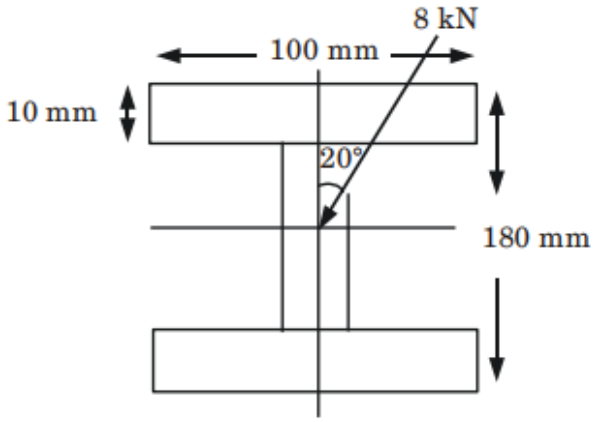
	(i) Radial pressure at the junction, (ii) Hoop stress developed in the two tubes after the shrinking. Take E= 210 GPa		

7. Attempt any *one* part of the following:

a.	A simply supported I-section beam of span 1.5 m carries a concentrated load of 8 kN at an angle of 20° from vertical as shown in Figure. Load passes through the centroid of the section. Determine the maximum bending stress in the beam. 	10	5
b.	Briefly discuss shear centre along with examples. Prove that sum of moment of inertia about any set of rectangular axis is constant.	10	5