Paper id: 252570

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

BTECH
(SEM IV) THEORY EXAMINATION 2024-25
ENGINEERING MECHANICS & STRENGTH MATERIAL

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

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q no.	Question	CO	Level
a.	Define a free body diagram and its importance.	1	K1
b.	What is the significance of the centroid in structural analysis?	2	K1
c.	Differentiate between normal stress and shear stress.	3	K1
d.	What are principal stresses?	3	K1
e.	Define Macaulay's method in the context of beam deflection.	4	K1
f.	State Euler's formula for column buckling.	5	K1
g.	Mention the difference between thin and thick cylinders.	5	K1

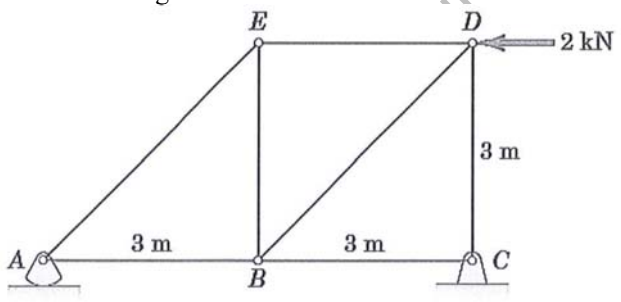
SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

Q no.	Question	CO	Level
a.	A uniform ladder 5m long weighs 180 N. it is placed against a wall making an angle of 60° with floor. The coefficient of friction between the wall and ladder is 0.25 and between the floor and the ladder is 0.35. The ladder has to support a mass 900N at its top. Calculate the horizontal force P to be applied to the ladder at the floor level to prevent slipping.	1	K2
b.	State and prove Lami's theorem.	2	K2
c.	Derive Bending equation with assumptions	3	K2
d.	A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of shaft.	4	K2
e.	Find the expression for cripping load for a long column when one end of the column is fixed and another end is hinged.	5	K2

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Determine magnitude and nature of forces in members of given truss. 	1	K2
b.	Draw the S.F. and B.M. diagrams of a simply supported beam as shown in Fig.	1	K3

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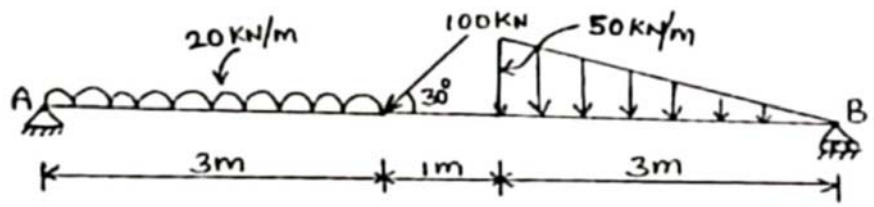

4. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Drive Lames equation for thick cylinder? Also write assumptions.	2	K2
b.	For a closed coiled helical spring subjected to an axial load of 300 N having 12 coils of wire diameter of 16 mm, and made with coil diameter of 250 mm, find. (i)axial deflection. (ii)Strain energy stored, (iii) max. Torsional shear stress in the wire. (iv) Max shear stress. Use Whals correction factor take G=80 G N/ mm^2.	2	K2

5. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Determine the slope and deflection of simply supported beam of length l subjected a uniformly distributed load w over the length of beam by Macaulay's method.	3	K2
b.	A solid steel shaft has to transmit 100 kW at 160 RPM. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20%.	3	K2

6. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	A hollow C.I column whose outside diameter is 200 mm has a thickness of 20 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankin's critical loads. Take 550 N/mm, α=1/1600 in Rankin's formula and E=9.4 x 10^4 N/mm^2.	4	K2
b.	Drive an expression for bending stresses of leaf spring of span length l, width b, thickness t, number of plates n, subjected to load w.	4	K2

7. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under a pressure of 8 N/mm^2. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section.	5	K2
b.	In a cylindrical shell of 0.6 m diameter and 0.9 m long is subjected to an internal pressure 1.2 N/mm^2. Thickness of the cylinder wall is 15 mm. Determine longitudinal stresses, circumferential stress and maximum shear stresses induced and change in diameter, length and volume. Take E=200 GPa and1/m=0.3	5	K2