Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) (FT/WP) (S1 PT) Examination May 2025 (2019 Scheme)

Course Code: CET201

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1	Define the term Factor of Safety.	(3)
2	State Hooke's law and write down the expression for the deformation of a rod under axial load.	(3)
3	What is Bulk modulus of Elasticity? Write the relationship between Bulk modulus of elasticity and Young's modulus of elasticity.	(3)
4	Substantiate the stress developed due to suddenly applied load is twice that of gradually applied load.	(3)
5	Draw the SFD & BMD for a cantilever beam with point load at free end.	(3)
6	What is meant by point of contraflexure.	(3)
7	What is meant by beam of uniform strength	(3)
8	Define section modulus and write down the equation of section modulus for a hollow circular section.	(3)
9	Define slenderness ratio of a column.	(3)
10	State the assumptions made in the theory of torsion	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11	A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow brass tube of external diameter 30mm and internal diameter of 25 mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 40 kN. If E for steel and brass is 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and tube. Also, find the extension of the rod.	(14)

12 A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length the rod should be bored centrally so that the total extension will increase by 15 percent under the same pull, the bore being 25 mm diameter. E = 200 GN/m^2. (14)

Module 2

13.a A cylindrical shell is 3 m long, and is having 1 m internal diameter & 15 mm thickness. Calculate the maximum intensity of shear stresses induced and also the change in the dimension of the shell, if it is subjected to an internal fluid pressure of 1.5 N/mm^2. (7)

E = 200 GN/m^2, μ = 0.3

13.b A bar of square section 6 mm x 6 mm is subjected to an axial pull of 6 kN. The lateral dimension of bar is found to be changed to 5.998 mm x 5.998 mm. If the modulus of rigidity of the material is 0.8 × 10^5 N/mm^2. Determine the poissons ratio and Modulus of elasticity (7)

14 A railway line is laid so that there is no stress in the rails at 8 degrees Celsius. Calculate (14)

a) the stress on the rail at 50 degrees Celsius if there is no allowance for expansion.

b) the stress in the rail if there is an expansion allowance of 8 mm.

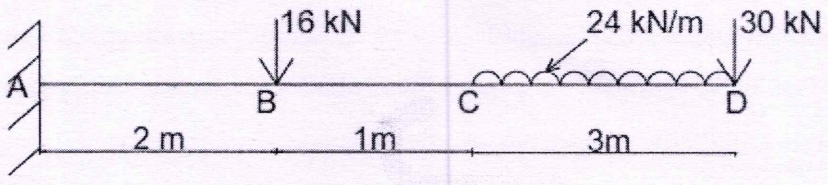
c) the expansion allowance if the stress in the rail is to be zero

d) the maximum temperature to have no stress in the rail if the expansion allowance is 12mm. The rail length is 30 m.

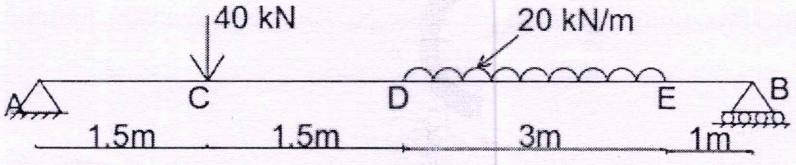
α = 12 x 10^{-6} /°C, E =200 GN/m^2

Module 3

15 A cantilever beam 6 m long carrying an UDL of 24 kN/m is spread over a length of 3 m from the free end. It carries a point load of 30 kN at free end and another point load of 16 kN at 2m from the fixed end shown in figure. Draw the SFD and BMD (14)



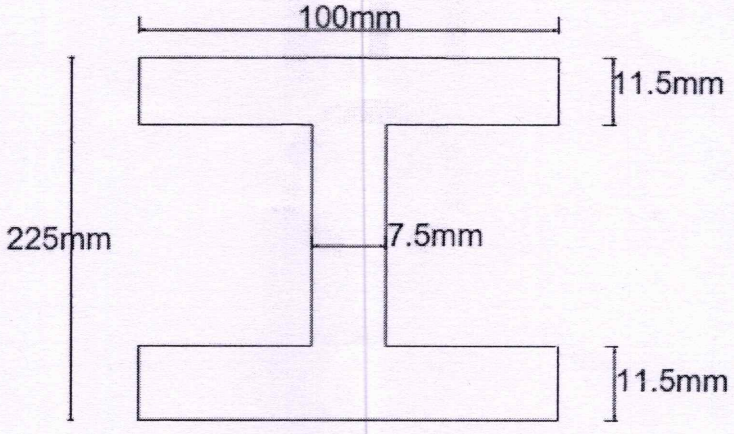
Draw SFD and BMD for the beam shown below. Indicate also the position and magnitude of max bending moment

16 

(14)

Module 4

An I section shown in figure is simply supported over a span of 12 m. If the maximum permissible bending stress is 80 N/mm^2, what concentrated load can be carried at a distance of 4 m from one support.

17 

(14)

18 A symmetrical I section has the following dimensions. Flanges: 15 cm x 2 cm, Web 30 cm x 2 cm. Find the maximum shearing stress developed in the beam for a shearing force of 10 kN. Draw the stress variation. (14)

Module 5

19	A point is subjected to a tensile stresses of 60 N/mm^2 and a compressive stresses of 40 N/mm^2, acting on two mutually perpendicular planes. A shear stress of 10 N/mm^2 is acting on these planes. Determine the principal stresses and the maximum shear stresses and its planes	(14)
20.a	A both end hinged aluminium column of hollow circular cross section has outside diameter of 60 mm and length 2 m. If the actual load applied is 14 kN and critical load is twice the actual load. Determine the necessary inside diameter to prevent failure by bulking. E_a = 70 GN/m^2. Use Eulers formula.	(6)
20.b	The diameter ratio of a hollow shaft is 0.6. It is required to transmit 600 kW at 200 rpm. Determine the diameter, if the allowable stress in the material is 100 N/mm^2 and the angle of twist over 3 m length is not to exceed 1.5°. Take G = 78 kN/mm^2	(8)

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