Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (Special Examinations) (FT/S1PT) January 2026 (2015 Scheme)

Course Code: CE201

Course Name: MECHANICS OF SOLIDS

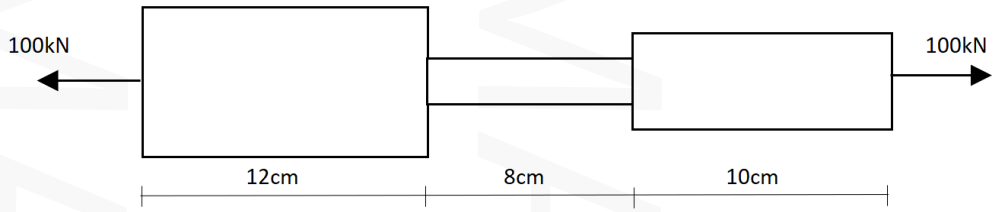
Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Distinguish between (i) Elastic limit and yield point, and (ii) Engineering stress and true stress. (6)

b) A 30cm long bar is 5cm square in section for 12cm of its length, 2.5cm diameter for the next 8cm, and 4cm diameter for the remaining length. If a tensile force of 100kN is applied to the bar as shown in figure, calculate the maximum and minimum stresses produced in it and the total elongation. Assume uniform distribution of load over the cross section. Take E=200GN/m^2. (9)



2 a) Explain how the deformation of an axially loaded circular bar with uniformly varying cross section is calculated? (7)

b) A steel bar of 25mm diameter was tested in tension and following were observed: Limit of proportionality = 196.32kN; Ultimate load = 278.20kN. At the proportional limit, the elongation measured over a gauge length of 100mm was 0.189mm. After fracture, the length between the gauge points was 112.62mm and the minimum diameter was 23.64mm. Determine (i) Young's Modulus (ii) Percentage elongation (iii) Percentage reduction in area and (iv) Ultimate stress. (8)

3 a) A copper rod of 36mm diameter passes centrally through a steel tube of 40mm internal diameter and 50mm external diameter. The composite section is rigidly fixed together with nuts and washers of negligible thickness. The bar is then heated (9)

through 30°C. Find the stresses in the copper rod and the steel tube. Take E_{steel} = 200GN/m^2, E_{copper} = 110GN/m^2, α_{steel} = 0.000012/°C, α_{copper} = 0.000016/°C.

b) State the relationship between the elastic constants. (3)

c) Define (i) Poisson's ratio, (ii) Proof resilience, and (iii) Modulus of resilience. (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) A 6m long simply supported beam carries two point loads of 4kN and 4kN at 1m and 5m respectively from the left end. It also has a uniformly distributed load of 3kN/m run for the length between 2m and 4m from the left end. Draw the shear force and bending moment diagrams. State the position and value of maximum bending moment. (10)

b) Establish the relation between the intensity of loading, shear force and bending moment. (5)

5 a) Derive the bending equation, stating the assumptions made. (8)

b) A 2.5m long cantilever beam of rectangular section is required to carry a udl of 15kN/m over the whole span. If the maximum bending stress is limited to 11N/mm^2, find the dimensions of the cross section assuming depth to width ratio as 2. (7)

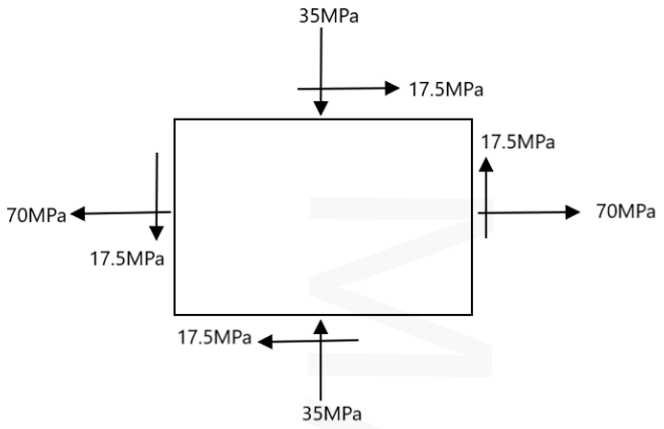
6 a) A T beam having flange 10cm x 2cm and web 2cm x 10cm is simply supported over a span of 6m. It carries a udl of 3kN/m including its own weight over entire span, together with a load of 2.5kN at the mid span. Find the maximum tensile and compressive stresses occurring in the beam section. (10)

b) A simply supported rectangular wooden beam of span 2.5m has cross section 150mm x 250 mm and carries a central point load of 100N. Find the shear stress at 50mm below the top edge of the cross section near the support. (5)

PART C

Answer any two full questions, each carries20 marks.

7 a) A rectangular element ABCD of an elastic material is subjected to a shear stress of 17.5MPa. The planes at right angles carry tensile stress of 70MPa and compressive stress of 35MPa respectively as shown in figure. Determine: (i) The magnitude of the principal stresses, (ii) The direction of the principal planes, (iii) The magnitude of maximum shear stress, and (iv) The orientation of the plane of maximum shear stress. (14)



b) A hollow cast iron column 10m long and 10cm internal diameter and 15cm external diameter is having its one end hinged and other rigidly fixed. Find the crippling load and safe load taking factor of safety as 5. Take E=95kN/mm^2. Use Euler's formula. (6)

8 a) A short cast iron column of hollow circular section has a projecting bracket carrying a load of 50kN. The load line is off the axis of the column by 300mm. The external diameter of the column is 300mm and the thickness of the metal is 25mm. Find the maximum and minimum stress intensities in the section? (12)

b) A steel shaft 8cm diameter and 800cm in length is to transmit certain twisting moment such that angle of twist is not to exceed 2.1°. Determine the value of twisting moment and maximum shear stress. Given N = 0.8 x 10^4 kN/cm^2 (8)

9 a) Derive the expressions for the stresses developed in thin cylinders due to internal pressure. (8)

b) Determine the maximum deflection δ in a simply supported beam of length L carrying a concentrated load P at midspan by using Macaulay's Method. (12)

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