Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) (FT/WP) / S1 (PT) Examination November/December 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	Differentiate limit of proportionality and elastic limit in stress strain diagrams.	(3)
2	Define the terms factor of safety and working stress.	(3)
3	Define resilience, proof resilience & modulus of resilience.	(3)
4	Explain briefly the term shear stress and complementary shear stress with proper illustrations.	(3)
5	Derive the relation among BM, SF & rate of loading.	(3)
6	What are various types of supports and loading on beams?	(3)
7	What are assumptions of simple bending?	(3)
8	Derive the expression for strain energy due to bending	(3)
9	Determine the polar modulus of section for a solid circular section of diameter d.	(3)
10	What is Mohr's stress circle?	(3)

PART B

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

Module 1

11	A concrete column of C.S. area 400 x 400 mm reinforced by 4 longitudinal 50 mm diameter round steel bars placed at each corner of the column. Calculate (1) maximum axial compressive load the column can support (2) loads carried by each material & (3) compressive stresses produced in each material. (4) also calculate change in length of the column. Assume the column is 2m long. Permissible stresses in steel and concrete are 160MPa and 5MPa respectively. Take E_s = 200GPa and E_c = 14GPa.	(14)
12	A tension test conducted on a mild steel rod of 25 mm diameter using gauge length of 200 mm produced the following observations Extension under the load of 75 kN =0.15 mm Load at yield point = 160 kN	(14)

Breaking load = 250 kN

Total extension = 55 mm

Maximum load 265 kN

Diameter at fracture = 18.5 mm

Determine (1) Young's modulus

(2)Yield stress

(3)Nominal stress and true stress at breaking point

(4)Percentage reduction in area

(5) Ultimate stress

Module 2

13 A composite bar made up of aluminum and steel is held serially between two supports which are at 90 cm apart. The bars are stress free at 40^0C.The length of steel and aluminium bars are 60 cm and 30 cm respectively and area of cross sections of steel and aluminium bars are 2 cm^2 and 3 cm^2 respectively, What will be the stresses in the bars when the temperature drops to 20^0C if (14)

(1) the supports are unyielding

(2) the supports come nearer to each other by 0.1 mm.

Take $E_{al} = 0.7*10^5$ N/mm^2 ; $\alpha_{al} = 23.4*10^{-6}$ /^{0}C

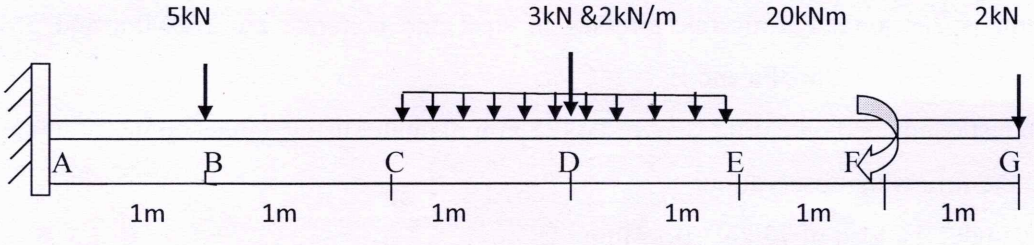
$E_s = 2.1*10^5$ N/mm^2 $\alpha_s = 11.7*10^{-6}$ /^{0}C

14 (a) What is bulk modulus? Derive an expression for Young's modulus in terms of bulk modulus and Poisson's ratio. (4)

(b) A bar 30 mm in diameter was subjected to tensile load of 54 kN and measured extension of 300 mm gauge length was 0.112 mm and change in diameter was 0.00366 mm. Calculate Poisson's ratio and the value of three moduli. (10)

Module 3

15 Draw the SFD & BMD of the cantilever beam shown in figure with proper sign convention (14)



16 Draw the SFD & BMD for the simply supported beam having a span of 10m with concentrated loads of 50kN & 40kN at 2m & 6m from left support and a uniformly distributed load of 10kN/m from 2m to 6m from the left support. (14)

Module 4

17 a) Explain moment curvature relation in a beam. (3)

b) A simply supported wooden beam of span 1.3 m having a cross section 150mm wide by 250 mm deep carries a point load W at the centre. The permissible stresses are 7MPa in bending and 1MPa in shearing. Calculate the safe load W. (11)

18 a) Define the term beam of uniform strength. (4)

b) A beam of cross section of an isosceles triangle is subjected to a shear force of 30kN at a section where the base width is 150 mm and height 450 mm. Determine (1) the horizontal shear at neutral axis, (2) distance from the top of the beam where shear stress is maximum (3) maximum value of shear stress. (10)

Module 5

19 a) Comment on limitations of Euler's formula. (4)

b) A hollow mild steel tube 6 m long and 4 cm internal diameter and 5mm thick, used as a strut with both ends hinged. Find the crippling load and the safe load taking the factor of safety as 3. Take $E = 2x10^5$MPa. (10)

20 a) Derive an expression for power transmitted through a circular shaft (4)

b) In an elastic material, at a certain point on planes at right angles to one another, direct stresses of 120MPa tensile and 100MPa compressive are acting. The major principal stress in the material is limited to 160MPa. To what maximum shearing stress the material may be subjected on the given planes? Also find the minimum principal stress. (10)

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