Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: MR 306

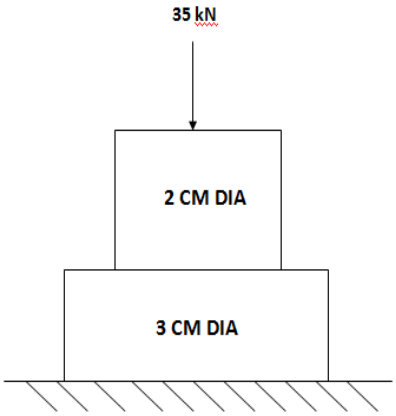
Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

		Marks
1	Define stress. What are the different types of stresses?	(5)
2	A stepped bar is subjected to an axially compressed load of 35 KN as shown in figure. Find the maximum and minimum stress produced.	(5)



3	Find an expression for torque in terms polar moment of inertia.	(5)
4	What do you mean by simple bending or pure bending? Mention the assumptions made in it.	(5)
5	Explain different types of loading in beams.	(5)
6	Draw SFD and BMD for simply supported beam with a point load at mid point	(5)
7	What are the sign conventions for the bending of the columns?	(5)
8	Define helical spring. Name the two important types of helical springs and their applications	(5)

PART B

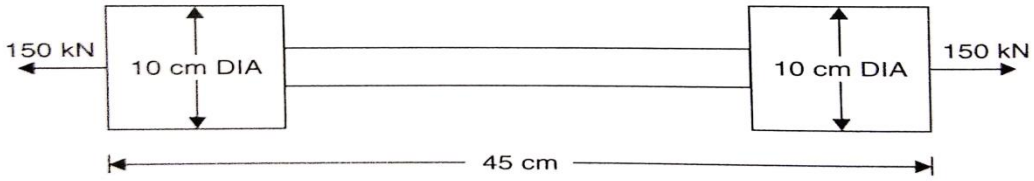
Answer any three questions, each carries 10 marks.

9	A tensile test was conducted on a mild steel bar. The following data was obtained from the test:	(10)

(i) Diameter of the steel bar = 4 cm; (ii) Gauge length of the bar = 22 cm;
(iii) Load at elastic limit = 250 kN; (iv) Extension at a load of 150 kN = 0.22 mm;
(v) Maximum load = 400 kN; (vi) Total extension = 60 mm;
(vii) Diameter of the rod at the failure = 2.5 cm.
Determine: (a) the Young's modulus, (b) the stress at elastic limit, (c) the percentage elongation, (d) the percentage decrease in area and (e) ultimate stress.

10 A steel rod of 2 cm diameter is enclosed in a hollow copper tube of external diameter 4 cm and internal diameter of 3.5 cm. The composite bar is then subjected to an axial pull of 50 kN. If the length of each bar is equal to 20 cm, determine: (i) the stress in the rod and tube, and (ii) load carried by each bar. Take E for steel = 2×10^5 N/mm^2 and for copper = 1×10^5 N/mm^2. (10)

11 The bar shown in figure is subjected to a tensile load of 150 kN. If the stress in the middle portion is limited to 160 N/mm^2, determine the diameter of the middle portion. Find also the length of the middle portion, if the total elongation of the bar is to be 0.25 mm. Young's modulus is given as equal to 2×10^5 N/mm^2. (10)



12 Derive a) Shear stress produced in a circular shaft (10)

b) Torque transmitted by a hollow shaft
c) Torque in terms of polar moment of inertia

13 Prove the relation, (10)

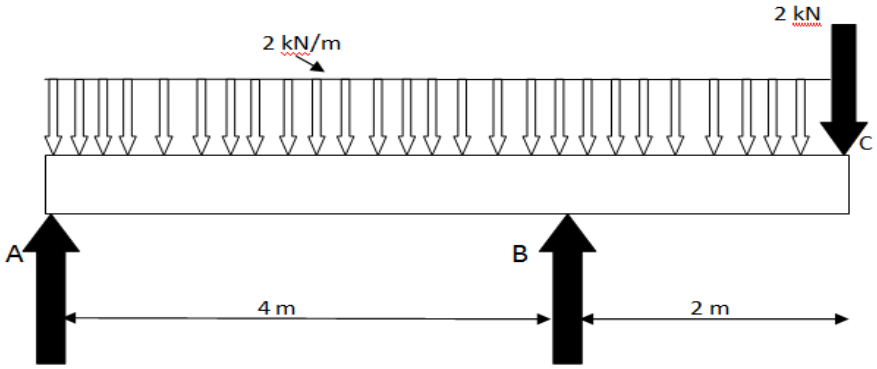
$$M/I = \sigma/y = E/R$$

PART C

Answer any two questions, each carries 15 marks.

14 A cantilever of length 6 m carries two point loads of 2 kN and 3 kN at a distance of 1 m and 6 m from the fixed end respectively. In addition to this the beam also carries a uniformly distributed load of 1 kN/m over a length of 2 m at a distance of 3 m from the fixed end. Draw the SF and BM diagrams. (15)

15 Draw the SFD and BMD for the overhanging beam carrying UDL of 2 kN/m over the entire length and a point load of 2 kN as shown in figure. (15)



16 Derive an expression for the Euler's crippling load for a long column with both ends are fixed. (15)

17 a) A column of timber section 15 cm x 20 cm is 6 metre long both ends being fixed. If the Young's modulus for timber is 17.5 kN/mm^2 . Determine (10)

i)Crippling load

ii)Safe load for the column if FOS is 3

b) Define slenderness ratio. State the limitations of Euler's formula (5)