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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S,FE) Examination May 2022 (2015 Scheme)

Course Code: MR306

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

1		Distinguish between stress and strain tensor with neat figure.	5
2		Discuss the assumptions and limitations in method of section.	5
3		Write a short note about the following terms a) torsional rigidity, b) Polar moment of inertia, c) strength of a shaft	5
4		Discuss in detail about section modulus and neutral axis.	5
5		A cantilever of length L carrying a point load W at the free end, sketch shear force and bending moment diagrams.	5
6		Demonstrate the concept behind shear force and bending moment using an example.	5
7		Distinguish between columns and struts.	5
8		Define helical spring. Name the two important types of helical springs.	5

PART B

Answer any three questions, each carries 10 marks.

9	a)	Determine the changes in length, breadth and thickness of a steel bar which is 5m long, 40mm wide and 30mm thick and is subjected to an axial pull of 35 kN in the direction of its length. Take E = 2×10^5 N/mm^2 and Poisson's ratio = 0.32.	10
10	a)	Explain about superposition principle with example.	5
	b)	Differentiate between statically determinate and indeterminate structures.	5
11	a)	A brass bar AD of area 900 mm^2 is divided into 3 sections AB, BC and CD of length 0.6m,0.8m and 1m respectively . Axial tensile forces of 40 kN and 70 kN is applied to the left and right of the section AB respectively .Similarly axial tensile forces of 20 kN and 10 kN is applied to the left and right of the section CD	10

respectively. Sketch the figure and using superposition principle, find the total elongation of the bar. Take $E = 1 \times 10^5$ N/ mm ^{2}.

12 a) Derive shear stress produced in a circular shaft with the help of a neat sketch. 5

b) Derive torque transmitted by a solid shaft and express it in terms of polar moment of inertia. 5

13 a) A cantilever of length 2 m carries a UDL of 2 kN/m length over the whole length and a point load of 3kN at the free end. Draw the SFD and BMD. 7

b) List out the assumptions made in the theory of pure or simple bending. 3

PART C

Answer any two questions, each carries 15 marks.

14 a) A simply supported beam of length 8 m rests on supports 5m apart, the right hand end is overhanging by 2m and the left hand end is over hanging by 1m. The beam carries a UDL of 5 kN/m over the entire length. It also carries two point loads of 4 kN and 6kN at each end of the beam. The load of 4 kN is at the extreme left of the beams, where as the load of 6 kN is at the extreme right of the beam. Draw SFD and BMD and find the points of contraflexure. 15

15 a) A simply supported beam of length 6 m, carries point load of 3 kN and 6 kN at distances of 2 m and 4 m from the left end. Draw the SF and BM diagrams for the beam. 10

b) Discuss about diagrammatic sign conventions for supports and loading. 5

16 a) Derive the central deflection of the laminated spring. 8

b) A laminated spring 1m long is made up of plates each 5 cm wide and 1 cm thick. If the bending stress in the plate is limited to 100N/mm^2, how many plates would be required to enable the spring to carry a central point load of 2 kN? 7

If $E = 2.1 \times 10^5$N/mm^2, What is the deflection under the load?

17 a) Write a short note about nipping in leaf springs. 5

b) Derive an expression for deflection in helical springs. 10

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