Hall Ticket Number:

Code No. : 13516

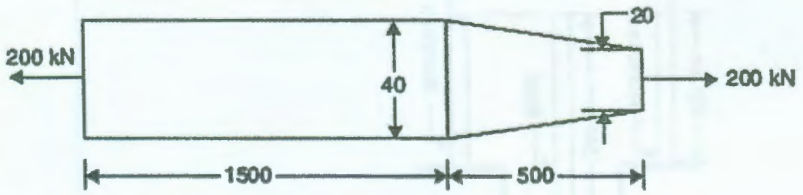
VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg. : CBCS) III-Semester Main Examinations, December-2018

Mechanics of Materials

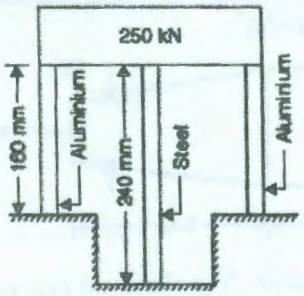
Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Q.No.	Stem of the question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	Define Young's modulus of elasticity and Poisson's ratio.	2	1	1	1
2.	Compute the expansion of a rod of 2m length when its temperature is raised by 50^0C above the ambient temperature. Take $\alpha = 12\times10^{-6}/^0$C.	2	1	1	1
3.	Explain uniform strength in a beam with an example.	2	2	2	1
4.	A cantilever beam of span 2m is subjected to a uniformly distributed load of 10 kN/m. Draw the Shear Force Diagram.	2	1	2	1
5.	Sketch the shear stress distribution across the depth of a circular section of a beam of diameter 60mm and subjected to a shear force 80kN at a section.	2	1	2	1
6.	An element in a strained material is subjected to a biaxial stress system of 80N/mm^2 tensile and 40N/mm^2 compressive. Determine the radius of the corresponding Mohr's circle.	2	2	2	2
7.	A cantilever of span 2m carries a point load at the free end. If the slope at the free end is 1^0, find the deflection at the free end. Take EI = 20x10^6 Nmm^2.	2	2	3	2
8.	Calculate the torsional rigidity of a circular shaft of 200 mm diameter. Assume modulus of rigidity as 80 GPa.	2	1	4	2
9.	Distinguish between circumferential stress and longitudinal stress in a cylindrical shell.	2	2	5	1
10.	What is equivalent length of a column? Calculate the same for a 4m length column which is fixed at one end and hinged at the other.	2	2	5	1
	Part-B (5 × 8 = 40 Marks)				
11. a)	A 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1.5 m and in the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig. Determine the elongation of this bar when subjected to an axial tensile load of 200 kN. Given E = 200 GN/m^2.	4	2	1	2
					
b)	A bar of 25 mm diameter is tested in tension. It is observed that when a load of 60kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0045 mm. Find Poisson's ratio and elastic constants E, G, K.	4	2	1	2

Contd... 2

Code No. : 13516

12. a)	A cantilever beam of span 3m subjected to a point load of 50 kN at the free end in addition to a point load of 30 kN at 2m from the fixed end. Analyse the beam and draw the shear force and bending moment diagrams.	4	4	2	2
b)	A simply supported beam of 5m span is subjected to an uniformly distributed load of 20kN/m intensity over the entire span in addition to a point load of 80kN at 3m from the left end. Analyse the beam and draw the shear force and bending moment diagrams.	4	4	2	2
13. a)	A beam of T-section has the flange 200 mm wide and 20 mm thick and web 20 mm wide and 300 mm deep. It carries a shear force of 250 kN at a cross section. Compute shear stresses at salient points and sketch shear stress distribution across the depth of the T-section.	4	2	2	2
b)	At a certain point in a strained material, the stresses on two planes at right angles to each other are 70 N/mm^2 and 50 N/mm^2, both tensile together with a shear stress of 40 N/mm^2. Compute the location of the principal planes and evaluate the principal stresses.	4	2	2	2
14. a)	A simply supported beam of span 10m carries two concentrated loads 100kN and 60kN at distances of 2m and 5m respectively from the left end. Compute the deflections under each load and maximum deflection. Take EI = $36x10^{13}Nmm^2$.	5	4	3	2
b)	A laminated spring has 12 plates each 50mm wide and 5mm thick, the largest plate being 600mm long. Determine the maximum load on the spring if the maximum bending stress is not to exceed 180MPa and central deflection 15mm.	3	2	4	2
15. a)	A CI pipe has 200mm internal diameter, 50mm metal thickness and carries water under a pressure of $5N/mm^2$. Calculate the maximum and minimum intensities of circumferential stress and sketch the distribution of circumferential stress intensity and the intensity of radial pressure across the section.	4	2	5	2
b)	A short column of rectangular cross-section is 80mm×60mm carries a load of 40kN at a point 20 mm from the longer side and 15 mm from the shorter side. Compute the maximum compressive and tensile stresses in the section.	4	2	5	2
16. a)	Three pillars, two of aluminium and one of steel support a rigid platform of 250 kN as shown in Fig. If area of each aluminium pillar is 1200 mm^2 and that of steel pillar is $1000mm^2$, find the stresses developed in each pillar. Take Es = 2×10^5 N/mm^2 and Ea = 1×10^6 N/mm^2.  	4	4	1	2
b)	A simply supported beam of 5m span is subjected to an uniformly distributed load of 10kN/m intensity over the entire span in addition to a point load of 8kN at 2m from the left end. If the bending stress is not to exceed 8MPa, design a suitable section having depth twice the width.	4	4	2	3

Contd... 3

Code No. : 13516

17. Answer any ***two*** of the following:				
a) Sketch the shear stress distribution across an I-section when subjected to a shear force of 300kN. The top flange has a width of 200 mm and a thickness of 25 mm while the bottom flange has a width of 200 mm and a thickness of 25 mm. The web has a width of 20 mm and a depth of 250mm.	4	3	2	2
b) Derive the standard torsion equation: $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{l}$	4	3	4	2
c) A hollow alloy tube 6m long with external diameter 35mm and internal diameter 25mm was found to extend by 5.2mm under a tensile load of 50kN. Determine the critical load for the tube when used as a column with both ends fixed.	4	4	5	3

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	59%
2	Knowledge on application and analysis (Level-3 & 4)	41%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	-