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Code No. : 13559 S N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD*Accredited by NAAC with A++ Grade***B.E. (Mech. Engg.) III-Semester Supplementary Examinations, August-2023****Mechanics of Materials**

Time: 3 hours

Max. Marks: 60

*Note: Answer all questions from Part-A and any FIVE from Part-B***Part-A (10 × 2 = 20 Marks)**

Q. No.	Stem of the question	M	L	CO	PO
1.	A steel bar is fixed at one end and free at the other end and the bar is heated uniformly, find the nature of stress developed in the bar.	2	1	1	1
2.	The modulus of elasticity of a material is twice the rigidity modulus then find the poisson's ratio of the material	2	2	1	2
3.	Draw the shear force diagram of a simply supported beam subjected to point load 'W' at the centre of the beam.	2	3	2	1
4.	What is a point of contraflexure? Give an example of its occurrence in a beam?	2	2	2	1
5.	An element in a strained material is subjected to same intensity of stresses on two mutually perpendicular directions, without shear stress, draw a Mohr's circle to represent the state of stress?	2	2	3	2
6.	Draw shear stress distribution across a hollow circular section?	2	1	3	1
7.	A cantilever beam of span (L) is subjected to a point load (P) at its free end, what is the maximum deflection at a distance of L/2 from free end?	2	3	4	1
8.	What is the ratio of load carrying capacity of a long column subjected an axial load with fixed ends to that of the same column with hinged ends?	2	3	4	1
9.	What is equivalent bending and equivalent shear in a shaft subjected to combined bending moment and twisting moment?	2	1	5	3
10.	A thin cylinder of internal diameter 1m is subjected to an internal fluid pressure of 2 MPa, the hoop stress is not to exceed 100 MPa and longitudinal stress is not to exceed 70 MPa, find the thickness of the cylinder.	2	2	5	1
Part-B (5×8 = 40 Marks)					
11. a)	Draw the stress strain curve for a mild steel bar subjected to axial tension, show salient points?	4	1	1	1

Contd... 2

<p>b) For the cantilever beam as shown in Figure below, the cross-sectional area of the steel, aluminum and bronze part is 500 mm^2, 400 mm^2 and 200 mm^2 respectively. Determine the maximum P that will not exceed a stress in steel of 140 MPa, in Aluminum of 90 MPa or in Bronze of 100 MPa?</p>	<p>4 2 1 3</p>
<p>12. a) Draw bending moment and shear force diagram for the following figure? Show salient points?</p>	<p>6 3 2 3</p>
<p>b) Express the relations between intensity of load, shear force and bending moment of a beam?</p>	<p>2 2 2 1</p>
<p>13. a) A rectangular section 20 mm wide x 100 mm depth is subjected to a moment of 2 KNm. Determine the maximum stress in the beam. Also calculate the radius of curvature of neutral axis at this section. Consider $E = 2 \times 10^5 \text{ N/mm}^2$.</p>	<p>4 3 3 2</p>
<p>b) A two dimensional element is subjected to normal stress in x direction as 100 MPa and normal stress in y direction as 20 MPa, along with a shear stress of 50 MPa on xy plane. Determine</p> <ol style="list-style-type: none"> Principal stresses Maximum shear stress and normal stress on the plane of maximum shear stress 	<p>4 1 3 3</p>
<p>14. a) An overhanging beam of uniform flexural rigidity is loaded as shown in figure, determine the deflection at the free end 'C' ?</p>	<p>5 2 4 3</p>
<p>b) A slender column of unsupported length of 4m, of rectangular cross section of 200 mm x 150 mm, is hinged at one end and fixed at the other end. The column is made of steel with modulus of elasticity of the material as 200 GPa. Determine its safe load carrying capacity using a factor of safety of 3</p>	<p>3 2 4 3</p>

15. a)	A solid circular shaft is used to transmit a power of 40 kW, at 100rpm, the maximum shear stress in the material is not to exceed 100 MPa and angle of twist over one meter length is not to exceed one degree. $G = 60 \text{ GPa}$, determine the minimum diameter of the shaft?	4	2	5	5
b)	A thick cylinder is subjected to internal pressure of 5MPa, its outer diameter is 500 mm and with 15 mm thickness of wall. Determine maximum and minimum hoop stress developed in the cylinder, draw its hoop stress distribution?	4	3	5	2
16. a)	Determine the Tensile force on steel bar circular cross section, 25 mm diameter if the strain is equal to 0.75×10^{-3} . Consider E for steel = 200 GPa.	4	2	1	1
b)	A simply supported beam of length 6m is subjected to a udl of 10 kN/m over its total length and with a point load of 50 kN at a distance of 2m from left support. Draw SFD and BMD?	4	2	2	2
17.	Answer any <i>two</i> of the following:				
a)	An element in 2D, is subjected to pure shear stress of 30 MPa, determine principal stresses?	4	1	3	1
b)	Derive an expression for maximum deflection of a cantilever beam subjected to a point load at the free end using double integration method?	4	2	4	1
c)	Derive the expression for hoop stress in a thin cylinder subjected to internal pressure?	4	2	5	1

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

i)	Blooms Taxonomy Level – 1	22%
ii)	Blooms Taxonomy Level – 2	33%
iii)	Blooms Taxonomy Level – 3 & 4	45%
