Hall Ticket Number:

Code No. : 13166 N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Civil Engg. : CBCS) III-Semester Main & Backlog Examinations, January 2024

Strength of Materials-I

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.	**State** the relationship between modulus of elasticity and bulk modulus of a material.	2	1	1	1
2.	An axial pull of 20 kN is acting on a bar of length 250 mm with a diameter of 32mm. If the modulus of elasticity is 2×10^5 N/mm^2, **compute** the elongation of the bar.	2	1	1	2
3.	**Draw** SF and BM diagram for simply supported beam of span L carrying a point load W at a distance of a from the left end. Take $a+b=L$.	2	2	2	2
4.	A cantilever beam is 3 m long and carries a uniformly distributed load of 12 kN/m over the entire span. **Draw** the BM diagram for the beam.	2	2	2	2
5.	A rectangular beam 250 mm deep is simply supported over a span of 3 m and subjected to uniformly distributed load of w N/m run over the entire span. If the bending stress is limited to 60 N/mm^2, **compute** w. Take I = 8 x 10^6 mm^4.	2	2	3	2
6.	A rectangular beam 100 mm width and 200 mm depth is subjected to a shear force of 60 kN. **Compute** the maximum shear stress.	2	2	3	2
7.	**Define** principal stress.	2	1	4	1
8.	**Sketch** the core of a circular section of diameter D.	2	1	4	2
9.	**State** the expressions for circumferential stress and longitudinal stress of a thin cylindrical shell subjected to internal fluid pressure.	2	1	5	1
10.	**State** the expressions for the radial pressure and hoop stress at any point in case of a thick cylinder.	2	1	5	1
	Part-B (5×8 = 40 Marks)				
11. a)	A copper tube 80 mm external diameter and 10 mm thick encloses centrally a solid steel bar of 20 mm diameter. The bar and the tube are rigidly connected at the ends at a temperature of 20° C. **Compute** the stresses in each metal when temperature is raised to 170° C. $E_s = 2\times10^5$ N/mm^2, $E_c = 1\times10^5$ N/mm^2, $\alpha_s = 12\times10^{-6}$ /° C, $\alpha_c = 18\times10^{-6}$/° C	4	3	1	2
b)	A bar of steel has a diameter of 28mm and is 200 mm long. It is subjected to a tensile load of 250 kN along the longitudinal axis. **Compute** the change in the length and diameter of the bar and change in volume. Take E = 2×10^5N/mm^2 and $\mu = 0.3$.	4	3	1	2
12. a)	A simply supported beam of span 5m is carrying a uniformly distributed load of 25kN/m run over the entire span. **Draw** SF and BM diagrams and compute maximum bending moment.	4	4	2	2

Contd... 2

b)	A cantilever of length 4m carries point loads of 8kN and 10kN at distances of 2m and 4m from the fixed end respectively. **Draw** the shear force and bending moment diagrams.	4	3	2	2
13. a)	A simply supported beam of span 4 m carries a point load of 20 kN at the mid-span. The cross section of the beam is T-section. The flange is 200 mm wide and 20 mm thick and the web is 15 mm thick and 160mm deep. **Compute** the bending stresses at the midspan.	4	4	3	2
b)	Derive the expression for shear stress across the depth of a solid circular section of diameter D subjected to a shear force of F. Sketch the shear stress distribution.	4	3	3	2
14. a)	A short column of external diameter 400 mm and internal diameter 250 mm carries a load of 80 kN with an eccentricity of 125 mm. **Compute** the maximum and minimum stresses in the section.	4	2	4	2
b)	The stresses at a point are given by normal stress of 100 N/mm^2 (tensile) along x-direction, 60 N/mm^2 (tensile) along y-direction and shear stress of 20 N/mm^2. **Compute** the principal stresses.	4	3	4	2
15. a)	**Calculate** the change in diameter, change in length and change in volume of a thin cylindrical shell of 1200 mm diameter, 15 mm thick and 4 m long when subjected to an internal pressure of 4 N/mm^2. Adopt $E = 2\times10^5$ N/mm^2 and Poisson's ratio $\mu=0.30$.	4	4	5	2
b)	**Compute** the thickness of metal required for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 60 MPa. The maximum hoop stress is not to exceed 120 MPa.	4	3	5	2
16. a)	A reinforced short concrete column 300mm×400mm in section is reinforced with steel bars with a total area of 2800 mm^2. The column carries a load of 400 kN. If the modulus of elasticity for steel is 15 times that of concrete, **compute** the stresses in concrete and steel.	4	3	1	2
b)	A simply supported beam of span 4m is subjected to a uniformly distributed load of 20kN/m over the entire span. The cross section is rectangular with a width of 250mm and depth of 400mm. **Compute** the bending stress at the mid-span.	4	4	2	2
17.	Answer any ***two*** of the following:				
a)	A cantilever beam of span 3m is made up of T-section and carries a point load of 60kN at the free end. The flange is 250mm wide and 20mm thick while the web is 20mm wide and 180mm deep. **Compute** the bending stresses at the fixed end of the beam.	4	3	3	2
b)	At a point in a beam the normal stress along its length is 70 N/mm^2. The shear stress at that point is 25 N/mm^2. **Compute** the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also **compute** the principal stresses and planes on which they act.	4	3	4	2
c)	A thin cylinder of diameter 220mm and thickness 10mm is subjected to an internal fluid pressure of 8N/mm^2. **Compute** the circumferential and longitudinal stresses in the cross section of the cylinder.	4	4	5	2

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

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	30%
iii)	Blooms Taxonomy Level – 3 & 4	50%

*****