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VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Civil Engg.) III-Semester Supplementary Examinations, August-2023

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 rigidity modulus of a material.	2	1	1	1
2.	A bar of length 450 mm and cross section 30mm×30mm is subjected to an axial pull of 25kN. If the modulus of elasticity(E) 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 of W at the midspan.	2	2	2	2
4.	A cantilever beam is 2 m long and carries a uniformly distributed load of 25 kN/m. **Draw** the SF diagram for the beam.	2	2	2	2
5.	A rectangular beam 250 mm deep is simply supported over a span of 2 m and subjected to uniformly distributed load of w N/m run over the entire span. If the bending stress is limited to 100 N/mm^2, **compute** w. Take I = 8 x 10^6 mm^4	2	2	3	2
6.	A rectangular beam 120 mm width and 250 mm depth is subjected to a shear force of 25 kN. **Compute** the maximum shear stress.	2	2	3	2
7.	**Define** principal stress.	2	1	4	1
8.	A rectangular column of width 250 mm and thickness of 120 mm carries a point load of 150 kN at an eccentricity of 12 mm. **Compute** the maximum and minimum stresses at the base of the column?	2	1	4	2
9.	**State** the expression for circumferential stress and longitudinal stress of a thin cylindrical shell subjected to internal fluid pressure.	2	1	5	1
10.	**State** the expression 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 bar of steel is 60 mm×80 mm in section and is 250 mm long. It is subjected to a tensile load of 250 kN along the longitudinal axis and tensile loads of 200 kN and 150 kN on the lateral faces. **Compute** the change in the dimensions of the bar and change in volume. Take E = 2×10^5N/mm^2 and μ= 0.3.	4	3	1	2
b)	A steel tube 60 mm external diameter and 50mm internal diameter encloses centrally a solid copper bar of 40 mm diameter. The bar and the tube are rigidly connected together 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, $\alpha_c = 18 \times 10^{-6}$/° C	4	3	1	2
12. a)	A simply supported beam of span 4m is carrying a point load of 20kN at the midspan. **Draw** SF and BM diagrams and compute maximum bending moment.	4	4	2	2

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b)	A cantilever beam of span 4m carries point loads of 3kN and 4kN at a distance of 1m and 4m from the fixed end respectively. **Draw** the shear force and bending moment diagram.	4	3	2	2
13. a)	A simply supported beam of span 4 m carries a point load of 25 kN at the mid-span. The cross section of the beam is I-section. Each flange is 120 mm wide and 12 mm thick and the web is 10 mm thick and 150mm deep. **Compute** the bending stresses at a section which is at a distance of 1m from the left support.	4	4	3	2
b)	**Derive** the expression for shear stress across the depth of a rectangular section of dimensions B×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 200 mm carries a load of 60 kN with an eccentricity of 120 mm. **Compute** the maximum and minimum stresses in the section.	4	2	4	2
b)	The stresses at a point is given by normal stress of 120 N/mm^2 (tensile) along x-axis, 80 N/mm^2 (tensile) along y-axis and shear stress of 20 N/mm^2. **Compute** the principal stresses.	4	3	4	2
15. a)	A thin cylindrical pressure vessel has an internal diameter of 150 mm and a wall thickness of 5 mm. It is subjected to an internal pressure of 7 N/mm^2. If the cylinder is 900 mm long and E = 2×10^{5}N/mm^2, **compute** the stresses induced and also find the Poisson's ratio for the material if the change in volume under this pressure is 15,000 mm^3.	4	4	5	2
b)	**Compute** the thickness of metal required for a cylindrical shell of internal diameter 140 mm to withstand an internal pressure of 50 MPa. The maximum hoop stress is not to exceed 120 MPa.	4	3	5	2
16. a)	A reinforced short concrete column 300mm×300mm in section is reinforced with steel bars of area 3000 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 5m is subjected to a uniformly distributed load of 25kN/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 2m is made up of T-section and carries a point load of 20kN at the free end. The flange is 200mm 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 20 N/mm^2. **Compute** the stresses on a plane whose normal is inclined at 60° 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 250mm and thickness 12mm is subjected to an internal fluid pressure of 10N/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%

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