Hall Ticket Number:

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Code No. : 13148 S

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Civil Engg.) III-Semester Supplementary Examinations, August-2022

Strength of Materials-I

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

*Note: Answer allquestions 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.	Derive the relationship between modulus of elasticity and bulk modulus of a material.	2	1	1	1
2.	An axial pull of 30 kN is acting on a bar consisting of three uniform sections of 40 cm, 30 cm and 20 cm with diameters of 3cm, 5cm and 8 cm respectively. If the Modulus of Elasticity is 200 GPa, determine the total extension of the bar.	2	1	1	1
3.	Draw SF and BM diagram for simply supported beam of span l carrying u.d.l of w/m over the entire length. Calculate the maximum bending moment.	2	1	2	1
4.	A cantilever beam is 3 m long and carries a uniformly distributed load of 15 kN/m. Draw the SF and BM diagrams for the beam.	2	1	2	1
5.	A rectangular beam 300 mm deep is simply supported over a span of 3 m and subjected to udl over the entire length. If the bending stress is limited to 100 MPa, find the udl. Take I = 7 x 10^6 mm^4	2	2	3	1
6.	A rectangular beam 100 mm width and 200 mm depth is subjected to a shear force of 20 kN. Find the maximum shear stress.	2	1	3	1
7.	Write a short note on Mohr's circle of stresses.	2	1	4	1
8.	A rectangular column of width 150 mm and thickness of 100 mm carries a point load of 140 kN at an eccentricity of 12 mm. What are the maximum and minimum stresses at the base of the column?	2	2	4	1
9.	Define thin and thick cylinders. Write an expression for the radial pressure and hoop stress at any point in case of a thick cylinder.	2	1	5	1
10.	Write an expression for the change in volume, change in length and change in diameter of a thin cylindrical shell subjected to internal fluid pressure.	2	1	5	1
	Part-B (5×8 = 40 Marks)				
11. a)	A bar of steel is 50 mm x 50 mm in section and is 150 mm long. It is subjected to a compressive load of 200 kN along the longitudinal axis and tensile loads of 500 kN and 400 kN on the lateral faces. Find the change in the dimensions of the bar and change in volume. Take E = 2 x 10^5MPa and v = 0.3.	4	2	1	2

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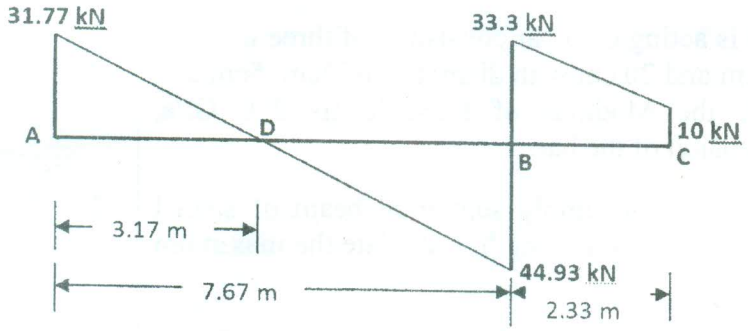
b)	A steel tube 50 mm external diameter and 3 mm thick encloses centrally a solid copper bar of 35 mm diameter. The bar and the tube are rigidly connected together at the ends at a temperature of 30° C. Find the stresses in each metal when temperature is raised to 180° C. Also find the increase in length if the original length of the assembly is 350 mm. E_s = 200 GPa, E_c= 100 GPa, $\alpha_s = 1.08 \times 10^{-5}$ per° C, $\alpha_c = 1.7 \times 10^{-5}$ per° C	4	2	1	2
12. a)	The Shear Force Diagram for a simply supported beam with one side overhang is shown in Fig.1. Find the loading on the beam and draw the loading and bending moment diagrams and also find the point of contra flexure.	4	4	2	2
	 Fig.1 SFD				
b)	A cantilever of length 6 m carries two point loads of 2kN and 3kN at a distance of 1 m and 6 m from the fixed end respectively. In addition to this the beam is also carries a uniformly distributed load of 1 kN/m over a length of 2 m at a distance of 3 m from fixed end. 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 15 kN at a distance of 3 m from left support. The cross section of the beam is I – section has an overall depth of 175 mm. Each flange is 100 mm wide and 15 mm thick and the web is 10 mm thick. Determine the tensile and compressive strength at a section which is at a distance of 3.25 m from the left support.	4	4	3	2
b)	A simply supported beam of I – section has an overall depth of 175 mm. It carries a point load of 40 kN at the midpoint on a simply supported beam of span 2.5 m. Each flange is 100 mm wide and 15 mm thick and the web is 10 mm thick. Find the shear stress at neutral axis and also draw the shear stress distribution.	4	3	3	2
14. a)	A short column of external diameter 50 cm and internal diameter 30 cm carries a load of 80 kN with an eccentricity of 150 mm. Calculate the maximum and minimum stresses in the section.	4	2	4	2
b)	The stresses at a point is given by normal stress of 100 N/mm^2 (compressive) along x – axis, 60 N/mm^2 (tensile) along y-axis and shear stress of -30 N/mm^2. Find the principal stresses and planes on which they act. Draw the Mohr's circle for the stress system.	4	3	4	2

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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 = 200 GPa, find 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)	Find the thickness of metal required for a cylindrical shell of internal diameter 120 mm to withstand an internal pressure of 40 MPa. The maximum hoop stress is not to exceed 130 MPa.	4	3	5	2
16. a)	A reinforced short concrete column 250 mm x 250 mm in section is reinforced with 8 steel bars. The total area of steel bars is 2500 mm^2. The column carries a load of 390 kN. If the modulus of elasticity for steel is 15 times that of concrete, find the stresses in concrete and steel.	4	3	1	2
b)	A simply supported beam of length 6 m, carries a uniformly distributed load of 2 kN/m over a length of 2 m from left end. There is a clockwise couple of 1500 Nm applied at the centre of the beam. Draw the shear force and bending moment diagrams for the beam and also find the magnitude and location of maximum bending moment.	4	4	2	2
17.	Answer any ***two*** of the following:				
a)	A T – section is made up of two planks of wood, 300 mm x 20 mm and 200 mm x 20 mm, with larger of the plank kept horizontal. If the permissible stresses in tension and compression are 8 MPa and 12 MPa. Find the maximum load the beam can carry as a simply supported beam subjected to u d l over the entire beam. Length of the beam is 3 m.	4	3	3	2
b)	At a point in a beam the normal stress along its length is 75 N/mm^2. The shear stress at that point is 25 N/mm^2. Find the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also find the principal stresses and planes on which they act.	4	3	4	2
c)	A thin cylinder made of copper is wounded by a steel wire 1.6 mm diameter. The diameter of the cylinder is 200 mm and the wall thickness is 5 mm. The initial tension in the wire is 85 MPa. Determine the internal pressure that can be allowed in the cylinder, if the allowable hoop stress in the cylinder is limited to 42.5 MPa. Take Es = 200 GPa and Ec = 80 MPa and Poisson's ratio of the cylinder is 0.25.	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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