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**Code No. : 13105**

# VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

## B.E. (CBCS) Civil Engg. III-Semester Main Examinations, December-2017

## Strength of Materials -I

Time: **3** hours Max. Marks: **70**

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

***Part-A (10 × 2 = 20 Marks)***

1. Define the terms: Elasticity, Young's Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus.
2. A rod is 5m long at a temperature of 27° C. Compute the expansion of the rod, when the temperature is raised to 105°C. If this expansion is prevented, find the stress induced in the material of the rod. Take E = $1.75\times10^5$ N/mm$^2$ and $\alpha = 12\times10^{-6}$/°C.
3. Define and explain the following terms: shear force, bending moment.
4. Draw the S.F. and B.M. diagrams for simply supported beam of length L which is subjected to point load W and a clockwise moment M at the center of the beam.
5. State the assumptions made in theory of simple bending of beams
6. Show that for a rectangular section, the maximum shear stress is 1.5 times the average shear stress.
7. Explain the procedure for computing the maximum and minimum stresses at the base of a rectangular column, when it is subjected to load which is eccentric to both the axes?
8. Explain the term "Theories of failure". Name any two important theories of failure.
9. List the expressions for the radial pressure and hoop stress at any point in case of a thick cylinder.
10. A thin spherical shell of 500mm internal diameter is subjected to an internal fluid pressure of 2.5 N/mm$^2$. If the permissible tensile stress in the shell material is 8 N/mm$^2$, find the necessary thickness of the shell.

***Part-B (5 × 10 = 50 Marks)***

***(All questions carry equal marks)***

11. a) A steel bar square in section of side 20 mm is subjected to an axial compressive load of 60 kN. Find the percentage change in volume if the bar is 500 mm long. What are the equal stresses that must be applied to the other two sides of the bar if the volumetric change is to be zero? E = 200 GPa and $\mu = 0.3$

    b) A solid brass cylinder 20 mm diameter is rigidly attached and surrounded by an aluminium tube of internal diameter 20 mm and thickness 5 mm. If the assembly is stress-free at 28°C, find the stresses in the two materials when the temperature rises to 90°C. For brass, E = 90 GPa and $\alpha = 20 \times 10^{-6}$/°C, and for aluminium E = 70 GPa and $\alpha = 23 \times 10^{-6}$/°C

12. a) An overhanging beam of 8 m span is supported at 2m from both left end and at the right end. It carries a uniformly distributed load 20 kN/m over a length of 6 m from the left end and a point load of 90 kN at the right end. Draw the shear force and bending moment diagrams. Find the location and magnitude of the maximum bending moment.

    b) Draw the shear force and bending moment diagram for the cantilever beam shown in **Fig.1.**

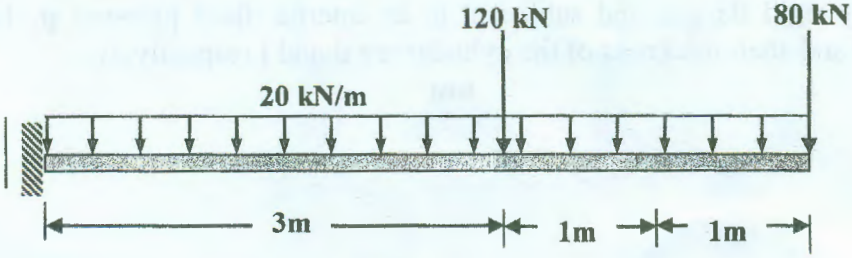


Fig. 1

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13. a) A simply supported beam of 5 m span carries a uniformly distributed load of 20kN/m over the entire span. The cross section of the beam is a T-section with flange dimensions 200mm×20mm and web dimensions 30mm× 350mm. Compute the maximum tensile and compressive stresses at the mid-span.

    b) A steel beam of symmetrical I-section has an overall depth of 650mm. The flanges have dimensions 250mm ×20mm. The beam section is subjected to a shear force of 300kN. Sketch the shear stress distribution across the section.

14. a) A short column of external diameter 500 mm and internal diameter 300 mm carries an eccentric load of 100 kN. Find the maximum eccentricity which the load can be applied without developing tension in the cross section.

    b) An element in a structure is subjected to a tensile stress of 120 MPa along with a shear stress of 50 MPa on the XY plane. Compute the principal stresses and maximum shear stress.

15. a) A thin cylindrical shell of 1500 mm diameter, 20 mm thick and 5 m long is subjected to internal fluid pressure of 2.5 N/mm$^2$. If E = 200 GPa and Poisson's ratio $\mu$ is 0.25, find the change in length, change in diameter and change in volume.

    b) A thick cylinder of internal radius 50 mm and outside diameter 100 mm is subjected to internal pressure of 50 MPa. Find the maximum hoop and radial stresses.

16. a) A solid steel bar 500 mm long and 70 mm diameter is placed inside an aluminium tube having 75 mm internal diameter and 90 mm outer diameter. An axial compression of 500 kN is applied to the bar and the cylinder through rigid cover plates. Find the stresses developed in the steel bar and the aluminium tube.

    b) Draw the shear force and bending moment diagram for the overhanging beam shown in **Fig. 2.**

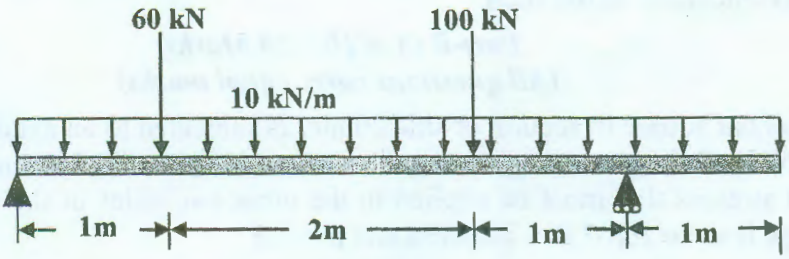


**Fig. 2**

17. Answer any ***two*** of the following:

    a) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 5 m. If shear force at a section of the beam is 65 kN, find the shear stress at a distance of 25 mm above the neutral axis.

    b) At a certain point in a strained material, the stresses on the two planes at right angles to each other are 40 N/mm$^2$ and 20 N/mm$^2$, both tensile. They are accompanied by a shear stress of 20 N/mm$^2$. Compute the location of principal planes and also find principal stresses.

    c) Derive an expression for hoop stress and longitudinal stress in a thin cylinder with ends closed by rigid flanges and subjected to an internal fluid pressure **p**. Take internal diameter and shell thickness of the cylinder are **d** and **t** respectively.

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