# VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA

## Odd Mid Semester Examination for Academic Session 2025-26

COURSE NAME: UG SEMESTER: 3rd Semester

BRANCH NAME: Mechanical Engineering

SUBJECT NAME: Mechanics of Deformable Solids (ME 1201)

FULL MARKS: 30 TIME: 90 Minutes

Answer **All** Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. |2 × 3|

a) What is Principle of Superposition? Where is it applicable? CO1

b) Express the shear stress equation in simple tension. Why the maximum value of shear stress is half of the applied stress at $45^0$? CO2

c) Express the relation between load, shear force and bending moment of a beam CO3

Q2. |8|

A *1.5 m* long steel bar is having uniform diameter of *40 mm* for a length of *1 m*. In the next *0.5 m* its diameter gradually reduces from *40 mm* to *20 mm* as shown in the ***Fig.1***. Determine the elongation of this bar when subjected an axial tensile load of *160 kN*. Take $E = 200\ GPa$. CO1

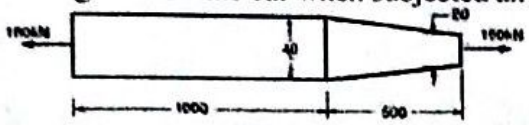


Fig.1

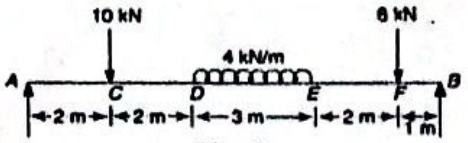


Fig. 2

OR

A specimen of steel having *25 mm* diameter with a gauge length of *200 mm* is tested to destruction. It has an extension of *0.16 mm* under a load of *80 kN* and the load at elastic limit is *160 kN*. The maximum load is *180 kN*. The total extension at fracture is *56 mm* and diameter at crack is *18 mm*. Find (i) stress at elastic limit, (ii) Young's modulus, (iii) percentage of elongation, (iv) parentage of reduction of area, (v) ultimate tensile stress. CO1

Q3. |8|

At a cross-section of a beam there is a longitudinal bending stress of $120\ N/mm^2$ (tensile) and a transverse shear stress of $50\ N/mm^2$. Find from the first principle, find the resultant stress in magnitude and direction on a plane inclined at $30^0$ to the longitudinal axis. There is no normal stress on the longitudinal plane. CO2

OR

The principal stresses at a point in a strained material are *126 MPa (tensile)* and *63 MPa (tensile)*. Using Mohr's circle determine the magnitude and direction of resultant stress on a plane inclined at $30^0$ to the direction of smaller principal stress. Also find the maximum obliquity of the resultant stress and its magnitude. CO2

Q4. |8|

A *10 m* long simply supported beam carries two point loads of *10 kN* and *6 kN* at *2 m* and *9 m* respectively from the left end as shown in the ***Fig. 2***. It also has a uniformly distributed load of *4 kN/m* run for the length between *4 m* and *7 m* from the left end. Draw the shear force and bending moment diagram and also find the maximum bending moment. CO3

OR

Draw the shear force and bending moment diagrams for a *6 m* long simply supported beam that carries a point load of *12 kN* and a clockwise couple at *2 m* from the left hand side as shown in the ***Fig.3***. CO3

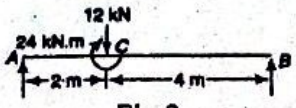


Fig.3

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