VIT
Vellore Institute of Technology

Final Assessment Test – November 2019

Course: MEE1032 - Mechanics of Solids and Fluids
Class NBR(s): 1309
Slot: F1+TF1
Time: Three Hours
Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE

General Instructions: Assume suitable data if necessary. Give reasons for the assumptions.

Answer any TEN Questions
(10 X 10 = 100 Marks)

1. a) A 25 mm diameter bar when subjected to a force of 40 kN has an extension of 0.08 mm on a gauge length of 200 mm. If the diametrical reduction is 0.003 mm, find the values of E, G, K, Poisson's ratio (v). [5]

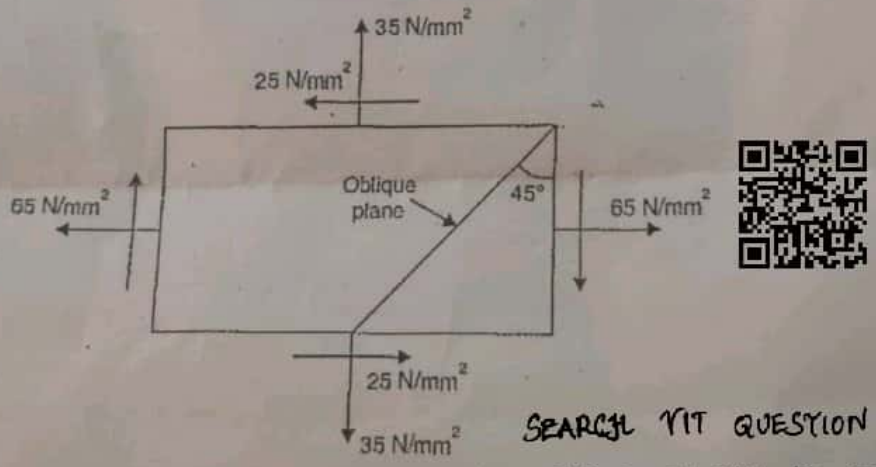
   b) Explain the following phenomenon. When a rod of a material is heated and its ends are held in position, there is no change in length (ΔL) and no apparent strain (ΔL/L), but there is stress in the material. [5]

2. a) Draw a typical stress-strain diagram for mild steel. Using the diagram, define proportional limit, elastic limit, yield stress, ultimate stress, and breaking stress. [7]

   b) What is centre of pressure? [3]

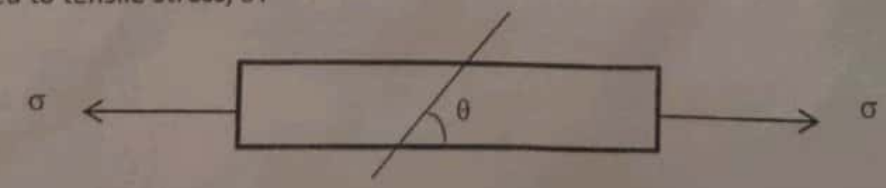
3. The lifting wire of a crane is 60 m long. Find the maximum load that can be lifted if the diameter of the wire is 10 mm, and the stress in the wire is limited to 100 N/mm^2. What is the extension of the wire under this load if E = 200 GPa?

4. A point in a strained material is subjected to stresses as shown in figure. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Check the answer analytically?



5. a) With schematic and formula's, explain five theories of failure. [7]

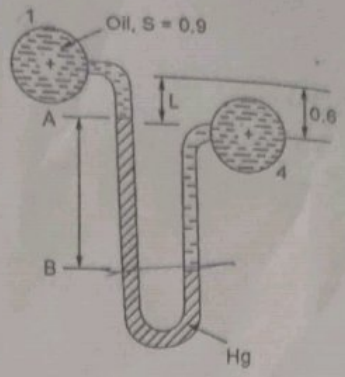
   b) Derive the formulae of normal and tangential stress on a plane inclined at an angle, θ for an uni-axial member subjected to tensile stress, σ. [3]



$\sigma_\theta = \sigma_x \cos^2\theta$

$\tau_\theta = \sigma \sin\theta \cos\theta$

6. For the manometer shown in figure, determine the manometric liquid level difference, AB. The pressure at point 1 and point 4 are 30 kPa and 120 kPa.



7. Determine the moment required to hold a circular gate of 4 m diameter, in the vertical wall of a reservoir, if the gate is hinged at (a) the mid diameter (b) at the top. The top of the gate is 8 m from the water surface.

8. Water flows at the rate of 600 litres/s through a horizontal venturimeter with diameter 0.5 m and 0.245 m. The pressure gauge fitted at the entry to the venturimeter reads 2 bar. Determine the throat gauge pressure. $A_1V_1 = A_2V_2$

9. Given the velocity components in a flow field as $u = x^2 - y^2$ and $v = -2xy$, determine the stream function and potential function for the flow.

10. A thin spherical shell has a diameter of 1.2 m, and is subjected to an internal pressure of 2.5 MPa. Determine the minimum thickness required if the stress is not to exceed 40 MPa. Find the increase in the diameter of the sphere, and the change in volume. E = 200 GPa and v= 0.3.

11. The details of a parallel pipe system for water flow are given below. If the frictional drop between the junctions is 15 m of water, determine the total flow rate?

No.	length, m	Diameter, m	Friction factor
1	800	0.2	0.022
2	1200	0.3	0.02
3	900	0.4	0.019

12. A pipe of 15 cm radius conveying 0.42 m^3/s of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.95 N/cm^2 and 22 N/cm^2.

13. a) An object weighs 20 N when fully submerged in water. The same object weighs 35 N when fully submerged in an oil of specific gravity 0.8. Determine its volume and density. [5]

b) Determine the metacentric height of a ship which displaces 5000 kN of water when it tilts by 6° due to the movement of 300 kN weight through 3 m from one side of centre line to the other. [5]

$MB = \frac{I}{V} - GB$ ⇔⇔⇔

Vol = Vol of H_2O displaced

$\rho = M/\forall V$

M = Mass of ~~Vol~~ H_2O displaced

M = ~~2000~~ 81 35-20