

**VIT**

Vellore Institute of Technology

**Final Assessment Test - November 2019**

Course: MEE1032 - Mechanics of Solids and Fluids

Class NBR(s): 2248

Time: Three Hours

Slot: D1+TD1

Max. Marks: 100

**KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE****General Instruction: Assume missing data suitably****Answer any FIVE Questions****(5 X 20 = 100 Marks)**

1. A round steel rod supported in a recess is surrounded by a co-axial brass tube as shown in Fig. 1. The level off the upper end of the rod is 0.08 mm below that of the tube. Determine [20]
- the magnitude of the maximum permissible axial load which can be applied to a rigid plate resting on the top of the tube, the permissible values of the compressive stresses are 105 MPa for steel and 75 MPa for brass
  - the amount by which the tube is shortened by a load if the compressive stresses in the steel and the brass are the same
- Take  $E_s = 210$  GPa and  $E_b = 105$  GPa.

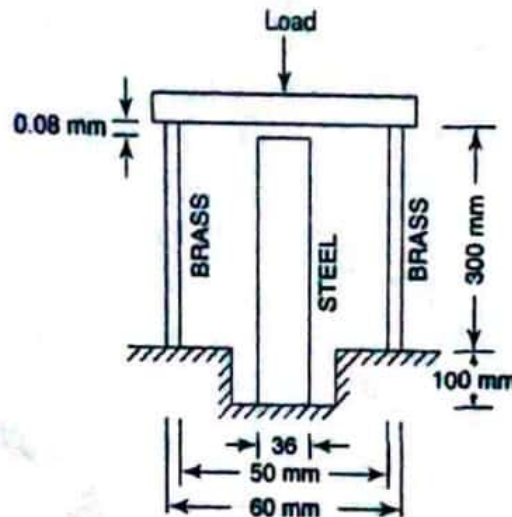


Fig. 1

2. The state of stress at a point is as shown in Fig. 2. Using Mohr's circle method, determine (i) the magnitude of the principal stresses and the inclination of the principal planes. (ii) the maximum shear stress and the plane on which it acts. (iii) the normal and tangential stress on a plane inclined at  $30^\circ$  with the vertical plane. [20]

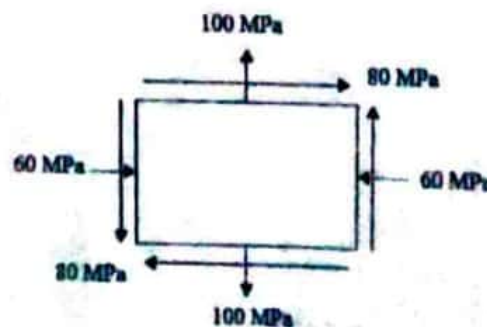


Fig. 2



SEARCH VIT QUESTION PAPERS  
ON TELEGRAM TO JOIN

3. a) A timber beam of rectangular section of length 8 m is simply supported. The beam carries a U.D.L of 12 kN/m run over the entire length. If the depth is two times the width and the stress in the timber is not to exceed  $8 \text{ N/mm}^2$ , find the suitable dimensions of the section. [10]
- b) A hollow shaft, having an inside diameter 60 % of its outer diameter is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material, if the material to be used is also same. [10]
4. a) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 r.p.m. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1 m. [10]
- b) A differential manometer is connected at two points A and B of two pipes as shown in Fig. 3. The pipe A contains a liquid of sp. gr. = 1.5 while pipe B contains a liquid of sp. gr. = 0.9. The pressure at A and B are  $1 \text{ kgf/cm}^2$  and  $1.8 \text{ kgf/cm}^2$  respectively. Find the difference in mercury level in the differential manometer. [10]

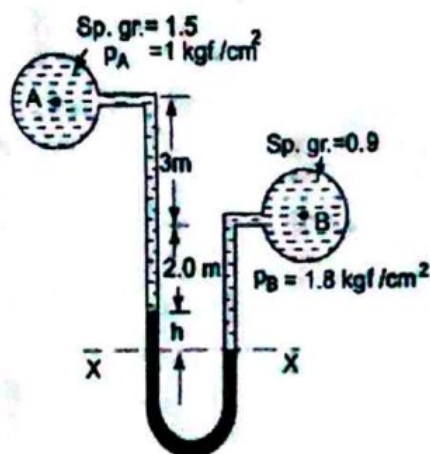


Fig. 3

5. a) What is metacentre? Derive an expression for metacentric height of a floating body. [10]
- b) A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is  $2\text{m} \times 1\text{m} \times 0.8\text{m}$ . [10]

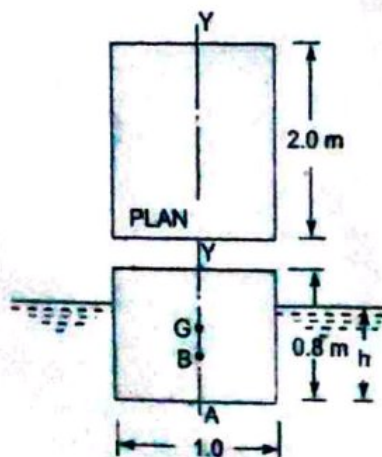


Fig. 4



6. a) Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches as shown in Fig. 5. Branch CD carries one third of the flow in AB. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD, and the diameter of CE. [15]

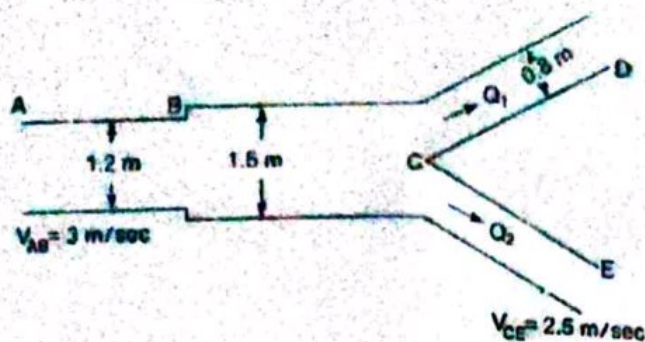


Fig.5

- b) The velocity vector in a fluid flow is  $V = 4x^3i - 10x^2yj + 2tk$ . [5]

Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time  $t=1$ .

7. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take  $f = 0.01$  for both sections of the pipe. [20]

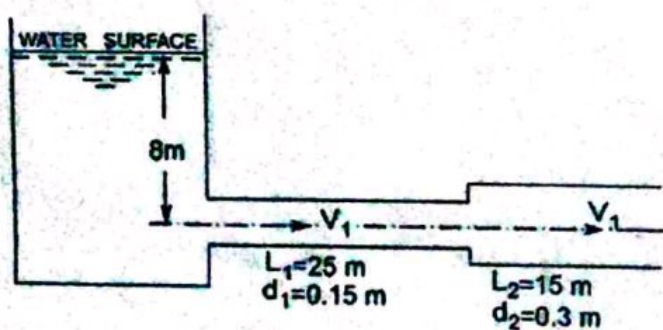


Fig.6

