

CBCS SCHEME

21MT34

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Third Semester B.E. Degree Examination, Jan./Feb. 2023

Mechanics of Solids and Fluids

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- Derive an expression for extension of uniformly tapering circular bar. (10 Marks)
 - Define
 - Tensile strain
 - Compressive strain
 - Shear strain
 - Poisson's ratio
 - Hook's law

OR

- A stepped bar is subjected to an external load as shown in Fig.Q2(a). Calculate the change in length of bar. Take $E = 200$ MPa for steel, $E = 70$ MPa for Aluminium, $E = 100$ MPa for copper.

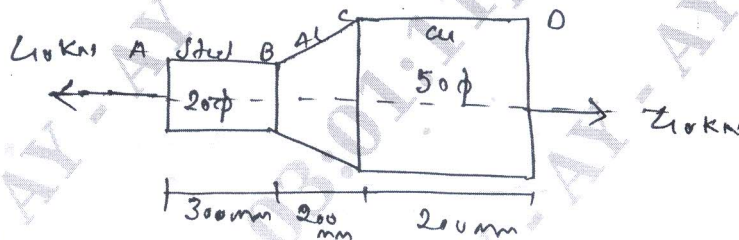


Fig.Q2(a)

- Derive the expression for stepped bar with cross section varying in steps. (10 Marks)

Module-2

- Derive an expression for element subjected to biaxial direct stresses. (10 Marks)
 - The direct stress acting at a point in a strained material is as shown in Fig Q3(b). Find the normal, tangential and resultant stresses on a plane 30° to the plane of major principal stresses; find the obliquity of resultant stress also.

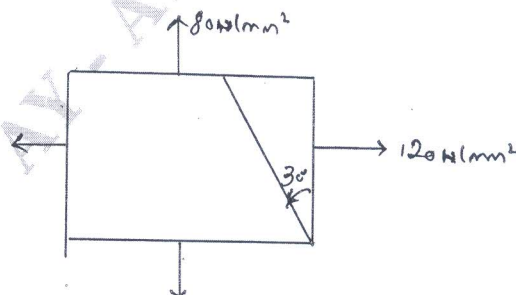


Fig Q3(b)

(10 Marks)

OR

- 4 a. At a certain point in a strained material, the stress condition is shown in Fig Q4(a), find
- The normal and shear stress on the inclined plane AB
 - Principal stresses and principal planes
 - Maximum shear stress

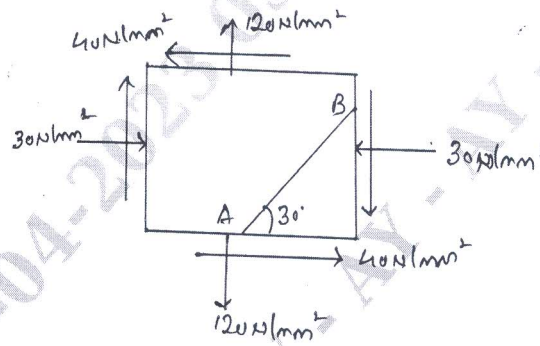


Fig Q4(a)

(10 Marks)

- b. Define Principal Plane and explain principal stresses and also explain the sign conventions with necessary diagrams. (05 Marks)
- c. The direct stresses at a point in a strained material are 100N/mm^2 compressive and 60N/mm^2 tensile as shown in fig. Q4(c). Find the stresses on the plane AC. (05 Marks)

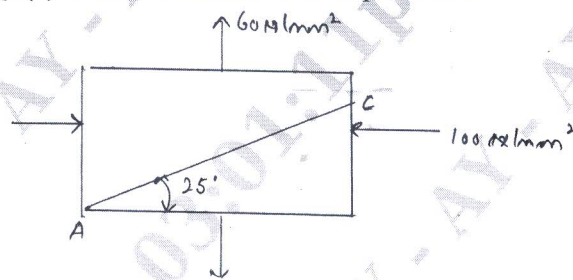


Fig. Q4(c)

Module-3

- 5 a. Derive the expression for torsional equation. (10 Marks)
- b. Find the diameter of shaft required to transmit 60kW at 150 rpm if the maximum torque is 25% more than mean torque for a maximum shear stress of 60MPa. Find angle of twist in a length of 4m. Take $G = 80\text{GPa}$. (10 Marks)

OR

- 6 a. Derive Rankine Gordon's formula. (10 Marks)
- b. Find the Euler's crippling load for Hollow cylinder. Steel column of 40mm external diameter and 4mm thick. The length of column is 2.5mm and is hinged at both ends. Also compute Rankin's crippling load using constant 335 MPa and $1/7500$. Take $E = 205\text{GPa}$. (10 Marks)

Module-4

- 7 a. Explain the properties of fluid. (06 Marks)
- b. Explain types of fluid with neat diagram (06 Marks)
- c. State and derive Pascal's law. (08 Marks)

OR

- 8 a. Explain pressure variation in a fluid at rest. (10 Marks)
b. Explain total pressure and center of pressure on a vertical plane submerged in a liquid. (10 Marks)

Module-5

- 9 a. Explain the types of fluid flow. (10 Marks)
b. Derive the equation of continuity and obtain an expression for continuity. (10 Marks)

OR

- 10 a. With a neat diagram, explain orifice meter with expression. (10 Marks)
b. An orifice with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge which is fitted upstream and downstream of the orifice meter gives reading of 19.62 N/cm^2 and 9.81 N/cm^2 . The coefficient of discharge for the orifice meter is 0.6, find the discharge of water through pipe. (05 Marks)
c. The pitot static tube placed in the center of a 300 mm pipe line has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through a pipe if the pressure difference between two orifice 60 mm of water. Take coefficient of pitot tube as $C_v = 0.98$. (05 Marks)
