Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

III SEMESTER B.TECH (MECHANICAL/IP ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: STRENGTH OF MATERIALS [MME 2103]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Draw the shear force and bending moment diagram for a beam subjected to forces as shown in Fig.1a. Also find the point of contraflexure and magnitude of maximum bending moment. **06**

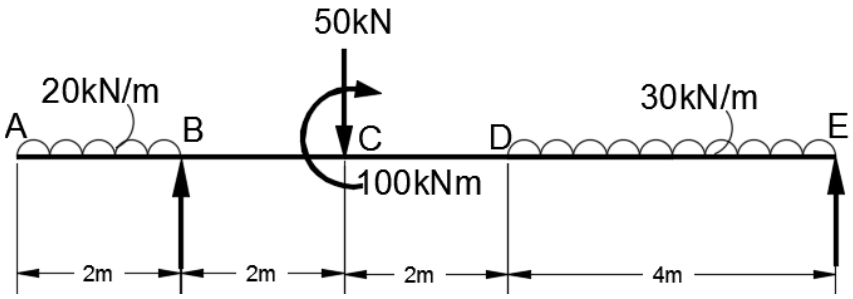


Fig. 1a

1B. Derive an expression for shearing stress developed in a beam. List all the assumptions made. **04**

2A. Derive an equation for maximum deflection and slope of a simply supported beam having uniformely distributed load on its entire span. **03**

2B. Define the following i) Moment of resistance ii) Section modulus **02**

2C. A simply supported beam is subjected to the loads as shown in Fig 2c. Determine the maximum deflection induced in the beam using Macaulay's method. Take the flexural rigidity as $1 \times 10^5 kN.m^2$. **05**

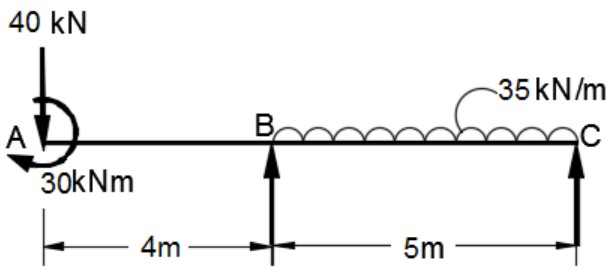
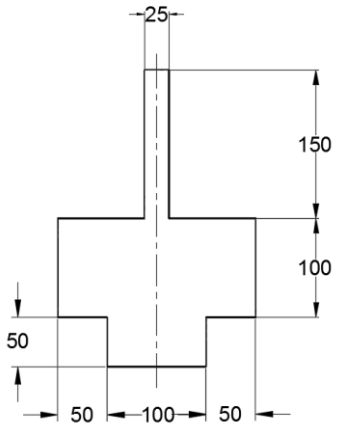


Fig. 2c

3A. The internal and external diameters of a cylinder are 300mm and 500mm respectively. It is subjected to an external pressure of 4 MPa. Find the internal pressure that can be applied if the permissible stress in the cylinder is limited to 13 MPa. Sketch the variation of hoop stress and radial stress across the thickness of the cylinder. **03**

3B. Define the following i) Slenderness ratio ii) Torsional Rigidity **02**

3C. The cross section of a conveyor beam is as shown in Fig 3c. The beam is subjected to a bending moment. Determine the maximum permissible bending moment a) for bottom flange in tension b) for bottom flange in compression. Safe bending stresses of the material in tension and compression are 30N/mm^2 and 150 N/mm^2 respectively **05**



All dimensions are in mm

Fig 3c

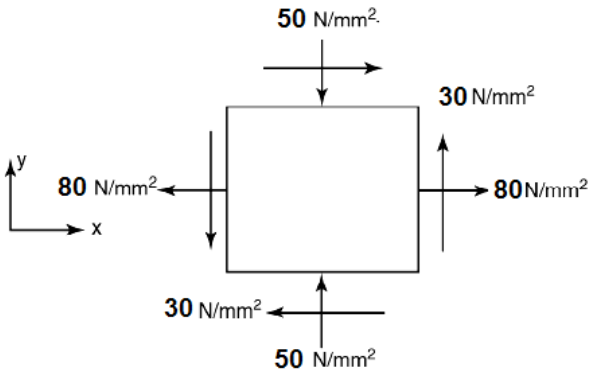


Fig 4a

4A. A plane element is subjected to stresses as shown in Fig 4a obtain the principal stresses, maximum shear stress and their planes using **06**

i) Mohr's Circle method (**Use graph sheet**)
ii) Analytical method

4B. Derive an equation for torsion of a shaft. List all the assumptions made in the theory of pure torsion. **04**

5A. Draw the stress-strain characteristics of mild steel and mark the salient points on the curve. **02**

5B. A solid shaft 6.5m long is securely fixed at each ends. The torque of 91N.m is applied to the shaft at a section 2.5 m from one end. Find the fixing torques set up at the ends of the shaft. If the diameter of the shaft is 35mm, find the maximum shear stresses in the two portions. Also find the angle of twist. Take G=8.4 x 10^4 N/mm^2. **05**

5C. A column of rectangular section has the width 180mm, depth 280mm. When the column is used as simply supported beam with UDL of 30 kN/m, maximum deflection at mid span is 2mm. Calculate the length of the beam. Determine the safe load the column can carry when both of its ends are hinged. Take factor of safety as 4 and Young's modulus as 210 GPa. **03**

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