Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B. TECH (MECHANICAL / I&P ENGINEERING)

END SEMESTER MAKEUP EXAMINATIONS, DECEMBER-2018

SUBJECT: STRENGTH OF MATERIALS [MME 2103]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ***ALL*** the questions.
- Additional data, if any required, may be appropriately assumed.
- Assumptions made must be clearly mentioned.

1A. Draw engineering and true stress strain diagram for a typical ductile material. Indicate all the salient features on the diagram. 02 M

1B. Establish a relationship between bending moment, shear force and rate of loading for a beam. 03 M

1C. For the beam configuration shown in figure 1.C, plot the shear force and bending moment distribution diagram. Also determine the location of point of contra flexure if any. 05 M

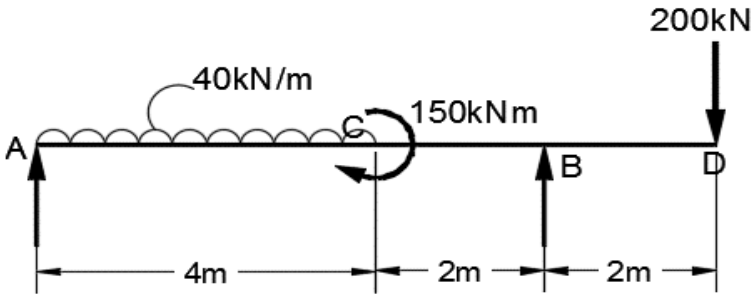

Figure 1. C

2A. Define: i) Shear Modulus ii) Modulus of Resilience 02 M

2B. A cantilever beam is made-up of symmetric I cross section of overall depth 300 mm, flanges of 150 mm wide. The thickness of flanges and web is 30 mm. The beam carries uniformly distributed load of w kN/m throughout the span. If the maximum bending stress developed is 4 times the shear stress, determine the length of the beam. 03 M

2C. A plane element is subjected to 120 N/mm^2 compressive stresses along horizontal X-direction, 80 N/mm^2 compressive stresses along vertical Y-direction and negative shear stresses of 60 N/mm^2 on each side of the plane. Determine the principal stresses, maximum shear stress and corresponding inclinations of the planes. Also, determine the resultant stress on the plane of maximum shear stress. Use any one approach (Analytical OR Graphical). 05 M

3A. Discuss the limitations of Euler's theory of buckling in columns. 02 M

3B. A solid shaft of 30 mm diameter, made of steel (Rigidity modulus 80 GPa) and 1 m length is rigidly fixed at both ends. A twisting moment of 600 Nm is applied at 250 mm from left end. Determine: 03 M

i) Reaction torque at the fixed ends.
ii) Maximum shear stress developed in the shaft.
iii) Angle of twist at the point where torque is applied.

3C. Determine the location and magnitude of maximum deflection in a simply supported beam of span length L, subjected to uniformly varying load from left to right end. Use direct integration method. 05 M

4A. A hollow rectangular cast iron column is 4 m long with one end fixed and other end hinged. Determine Rankine's critical load that the column can carry safely assuming FOS of 5. The hollow rectangular section has width 100 mm and depth 200 mm. Take E = 168 GPa, σ_C = 550 MPa, and a = 1/1600. 02 M

4B. Derive the deflection equation in the form 03 M

$$EI\frac{d^2y}{dx^2} = M$$

4 C Find the diameter of solid circular shaft, required to transmit 180 kW power at 360 rpm. The maximum permissible shear stress is 70 MPa and angle of twist is not to exceed one degree in length of 2.5 m. The maximum torque experienced by the shaft is 40% more than the mean torque. Take modulus of rigidity as 100 GPa. Also, find the dimensions of hollow shaft, if the inner diameter is 0.8 times the outer diameter and replaced for solid shaft. 05 M

5A. Write a note on: i) Torsional Rigidity ii) Flexural Rigidity 02 M

5B. Derive the expression for shear stresses developed in beams. Also, state the assumptions. 04 M

5C. A thick cylinder of external and internal diameters of 300 mm and 180 mm is subjected to an internal pressure of 42 MPa and external pressure of 6 MPa. Determine the stresses in the material. If the external pressure is doubled, what internal pressure can be maintained without exceeding the previously determined maximum stress? 04 M

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