Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

III SEMESTER B.TECH (MECHANICAL/I&P ENGG.) END SEMESTER MAKE-UP EXAMINATIONS, DECEMBER 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 **05**

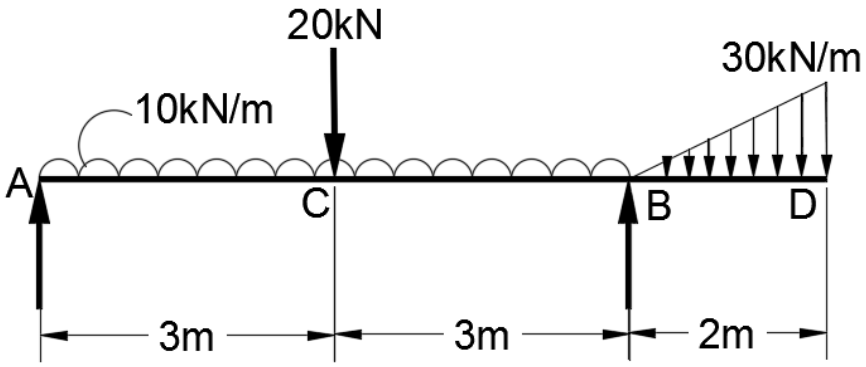

Fig 1a

1B. Derive an expression relating bending moment, bending stress and radius of curvature for a straight beam subjected to pure bending, list all the assumptions made. **05**

2A. Define the following **05**

I. Slenderness ratio
II. Torsional rigidity
III. Endurance limit
IV. Polar modulus
V. Poisson's ratio

2B. A cantilever beam with unsymmetrical I section is 2m long and the beam is subjected to UDL of 20 kN/m. I section has upper flange of 180mm X 10mm, lower flange of 100mm X 10mm, and web of 10mm X 220mm. Plot the shear stress distribution **05**

3A. A cantilever is subjected to the loads as shown in Fig.3a. Determine the deflections induced at point A and point C. Take E=210 GPa, I=40 x 10^{-5} m^4 **05**

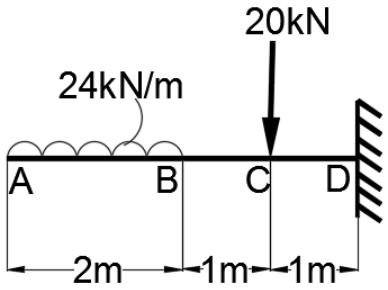

Fig. 3a

3B. A solid shaft has 50mm diameter. Determine the inner and outer diameters of a hollow shaft such that its area of cross section is same as that of solid shaft. The inner diameter of hollow shaft is 0.8 times its outer diameter. Compare the torsional strengths and torsional stiffnesses of solid shaft and hollow shaft. Consider the length and the material are same in both cases **05**

4A. Derive an expression for differential equation of deflection **05**

4B. A thin cylindrical shell is 4m long and is having 1.2m internal diameter and 18mm thickness is subjected to an internal fluid pressure of 1.5 N/mm^2. Calculate the maximum intensity of shear stress induced in the shell **03**

4C. Write the Euler's crippling load expressions for 4 major end condition of columns **02**

5A. Two mutually perpendicular planes of an element of a material are subjected to direct stresses of 10.5 MN/m^2 (tensile) and 3.5 MN/m^2 (compressive) and shear stress of 7 MN/m^2. **05**

Find

I. The magnitude and direction of principal stresses

II. Magnitude of the normal and shear stresses on a plane on which the shear stress is maximum using **Analytical Method**

5B. A T-section having top flange of 150mm x 20mm, web of width 20mm and overall depth 120mm is used as a strut. Its length is 4m with hinged at its both ends. Calculate the Euler's crippling load, if Young's modulus is 200GPa **03**

5C. Explain the meaning of i) Shear force ii) Bending Moment **02**

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