Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(Constituent Institute of Manipal University, Manipal)

III SEMESTER, B.TECH. (MECHANICAL/IP ENGINEERING)
END SEMESTER EXAMINATION – NOV/DEC 2015

SUBJECT: STRENGTH OF MATERIALS (MME-2103)
(REVISED CREDIT SYSTEM)

Time: 3 Hours. **[03 – 12 – 2015]** **MAX.MARKS: 50**

Instructions to Candidates:

- Answer **ALL** questions.
- Assume missing data, if any, suitably.
- Sketches for Q1(a), Q2(b) and Q5(b) are given page 2 of 2.

1(a) A beam AB of 4 m span is simply supported at the ends and is loaded as shown in figure Q1(a). Determine the deflection at C and slope at end A. Use Macaulay's method. Take $E=2\times10^5$ N/mm² and I=1000 cm^4. (04)

1(b) 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)

1(c) Derive the expression for shear force in a simply supported beam with uniformly varying load along its length and draw the shear force diagram. (03)

2(a) Define the following.
i. Proof Resilience
ii. Slenderness ratio
iii. Poisson's ratio (03)

2(b) The shear force acting on section of a beam is 50 kN. The section of a beam is as shown in the fig.Q2(b). Determine maximum shear stress on the section. (03)

2(c) Derive the differential equation for deflection of a beam with necessary sketches. (04)

3(a) Draw neat sketches and derive the expression showing the relationship between bending stress in a beam and radius of curvature. (03)

3(b) Differentiate between the following
i. Torsional Rigidity and Flexural rigidity
ii. Polar Modulus and Section modulus
iii. Long column and Short column (03)

3c) Compare the crippling loads given by Euler's and Rankine's formulae for a tubular steel column 2.5 m long, having outer and inner diameters 40 mm and 30 mm respectively fixed at both ends. Take the crushing stress as 330 MPa, the Rankine's constant = 1/7500 and E = 200 GPa. For what length of the column does Euler formula cease to apply? (04)

4(a) The stresses at a point across two perpendicular planes are 75 MPa (tensile) and 35 MPa (tensile). Find the normal, tangential and resultant stress and its obliquity on a plane at 20^0 with major plane, using analytical method. (04)

4(b) Two solid shafts AC and BC of aluminium and steel are rigidly fastened together at C and attached to rigid supports at A and B. Shaft AC is 75 mm in diameter and 2 m in length. Shaft BC is 55 mm in diameter and 1 m in length. A torque of 200 N-m is applied at the junction C. Compute the maximum shearing stresses in each material. What is the angle of twist at the junction? Take G(Aluminium)=$3x10^4$ N/mm^2 and G(Steel)=9 x 10^4 N/mm^2. (04)

4(c) Draw the stress-strain characteristics of mild steel and mark the salient points. (02)

5(a) A solid circular shaft has to transmit a power of 1000kW at 120 rpm. Find the diameter of the shaft if the shear stress of the material must not exceed 80 N/mm². The maximum torque 1.25 times the mean. What percentage of saving material would be obtained if the shaft is replaced by the hollow one whose internal diameter is 0.6 times its external diameter, the length, material and maximum shearing stress being same? (03)

5(b) Compute the shear force and bending moments for the beam loaded as shown in fig Q5(b) and plot the SFD and BMD. Also mention the point of maximum bending moment and point of contra-flexure if any. (05)

5(c) Define the following.
i. Principal stress
ii. Mohr's circle (02)

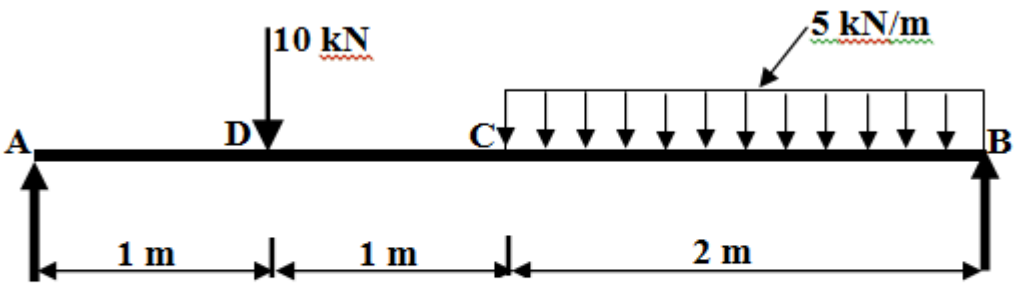

Fig. Q1(a)

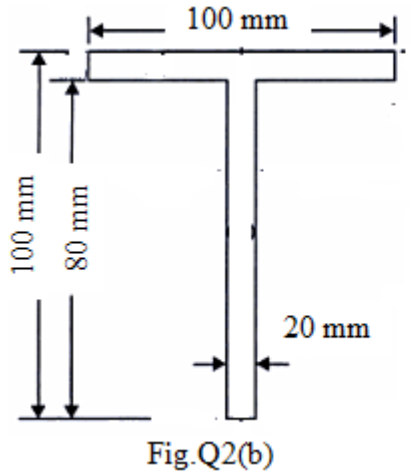

Fig.Q2(b)

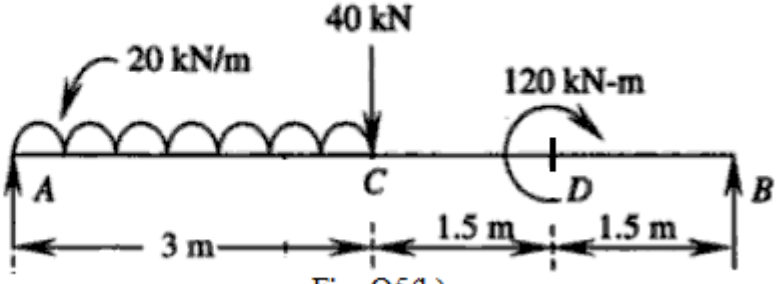

Fig. Q5(b)