Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

LIFE A Constituent Institution of Manipal University

I SEMESTER B.TECH. END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: MECHANICS OF SOLIDS [CIE 1001]

REVISED CREDIT SYSTEM

(01/12/2016)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

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

1A.	A collar which may slide on a vertical rod is subjected to three forces as shown in Fig.1A. Determine (i) the value of ' α ' for which the resultant of three forces is horizontal, and (ii) the corresponding magnitude of resultant.	03	CO 1
1B.	Calculate the support reactions for a system loaded as shown in Fig.1B if tension in the cable 'BD' is 20 kN.	04	CO 1
1C.	Determine the force 'Q' required to stop motion of 500 N block shown in Fig.1C to left. Coefficient of friction for all contact surfaces is 0.3	05	CO 1
2A.	Explain i) principle of transmissibility ii) Free body diagram iii) Hinge and roller support	03	CO 1
2B.	Determine the second moment of area of shaded portion shown in Fig.2B with respect to its horizontal centroidal axis.	06	CO 2
3A.	A circular rod of varying cross-sections is subjected to an axial pull of 20 kN as shown in Fig.3A. Find the maximum stress developed at each section and total deformation of the bar. Take the values of 'E' for steel, aluminium and brass as 210 GPa, 70 GPa and 100 GPa respectively.	04	CO 3
3B.	Derive the relationship between modulus of elasticity, modulus of rigidity and Poisson's ratio.	05	CO 3
4 A .	A solid steel rod of 500 mm long and 70 mm diameter is placed inside an aluminium tube having 75 mm inside diameter and 100 mm outside diameter as shown in Fig. 4A. The aluminium tube is 0.15 mm longer than the steel rod. An axial pull of 600 kN is applied through a central hole made in the plates which rigidly covers the ends of the aluminium tube. Find the stresses developed in Steel rod and aluminium tube. Assume $E_S = 2.2 \times 10^5 \text{ N/mm}^2$, $E_{AI} = 0.78 \times 10^5 \text{ N/mm}^2$.	05	CO 3
4B.	A bar of steel and two bars of copper, each of the same area and length, with steel bar kept between copper bars have their ends rigidly connected together at a temperature of 15 °C. When the temperature is raised to 300 °C, length of this compound bar increases by 1.5 mm. Determine the length of the bars at 15 °C, if $E_s = 200$ GPa, $E_c = 110$ GPa, $\alpha_s = 12 \times 10^{-6}$ °C, $\alpha_c = 17.5 \times 10^{-6}$ °C.	05	CO 3
5A.	A thin cylindrical shell is 2 m long and 800 mm in internal diameter is subjected to an internal fluid pressure of 1 MPa. If wall thickness of the shell is 10 mm, find the hoop stress, longitudinal stress and maximum shear stress. Also, determine changes in the diameter, length and volume. Take young's modulus of the shell as 200 GPa and Poisson's ratio as 0.3.	03	CO 4
5B.	Draw SFD and BMD for the beam shown in Fig.5B. Locate the salient points.	07	CO 5

