

LIFE A Constituent Institution of Manipal University

I SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2017

SUBJECT: MECHANICS OF SOLIDS [CIE 1001]

REVISED CREDIT SYSTEM (27/12/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Find the support reactions at A and E for the beam loaded as shown in Fig. 1.	5
1B.	Find the magnitude, direction and position of the resultant force of the system of forces shown in Fig. 2 with respect to 'A'.	5
2A.	Determine the centroid of the hatched portion of the lamina shown in Fig. 3 with respect to the axis 'Y-Y' marked.	5
2B.	Determine the magnitude of the horizontal force 'P' to be applied on the ladder at its base as shown in Fig. 4 to prevent the ladder from slipping action. Consider the coefficient of friction between the wall and the ladder as 0.30 and that between the ground and the ladder as 0.35.	5
3A.	Prove that in a state of simple shear, direct shear is equal to complementary shear.	5
3B.	A composite bar is rigidly fixed at A and B as shown in Fig. 5. Determine the stress developed in each material when the temperature is raised by 58 °C. Take $E_{Cu} = 100$ GPa, $E_{Al} = 70$ GPa, $\alpha_{Cu} = 18 \times 10^{-6}$ / °C and $\alpha_{Al} = 24 \times 10^{-6}$ / °C.	5
4A.	Determine the total extension and stress in each portion AB, BC and CD of the bar ABCD for the designated conditions as marked in Fig. 6 . Take $E = 210$ GPa.	5
4B.	The loads acting on a steel bar are as shown in Fig 7 . Determine, (a) Change in each dimension and change in volume of the bar; (b) What longitudinal force alone can produce same longitudinal strain as in case (a)? Given $E=210$ GPa, $\mu=0.32$.	5
5A.	A cylindrical boiler is 700mm in diameter and 1800 mm in length. It is required to withstand a pressure of 1000 kPa. If the permissible tensile stress is 22 MPa, permissible shear stress is 10 MPa and permissible change in diameter is 0.25 mm, determine the minimum thickness of the metal required. Take $E = 90$ GPa and $\mu = 0.31$.	5
5B.	Draw the shear force and bending moment diagrams for the beam shown in Fig. 8 . Also, locate the point of contra flexure, if any.	5

