Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent institution of MAHE, Manipal)

II SEMESTER B.TECH.

END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT MECHANICS OF SOLIDS [CIE 1001]

REVISED CREDIT SYSTEM

(28/ 04/ 2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Determine the resultant of force system acting on a steel plate ABCD shown in **Fig.Q.1A.** Locate the resultant with respect to 'A'.	**5**	**CO1**
1B.	State and prove Varignon's theorem (scalar formulation).	**3**	**CO1**
1C.	Explain principle of transmissibility.	**2**	**CO1**
2A.	Determine the support reactions of a beam loaded as shown in **Fig. Q. 2A**.	**5**	**CO1**
2B.	Determine force 'P' required to start the 500 N wedge shown in **Fig. Q. 2B** to right. Take ϕ=20° for all contact surfaces.	**5**	**CO1**
3A.	Determine the moment of inertia of a shaded area shown in **Fig. Q. 3A** with respect to vertical centroidal axis.	**5**	**CO2**
3B.	Derive an expression for the deformation of a circular tapered bar whose diameter increases gradually from 'd_1' to 'd_2' over a length 'l' subjected to an axial load 'P'.	**3**	**CO3**
3C.	Define: a) Poisson's ratio b) Bulk Modulus	**2**	**CO3**
4A.	A steel bar is of 60 mm x 60 mm square in section and is 180 mm long. It is subjected to a tensile load of 300 kN along its length and tensile loads of 750 kN and 600 kN on its lateral faces as shown in **Fig, Q. 4A**. Find the change in dimensions of the bar and change in volume. Consider E = 200 GPa and μ = 0.3.	**5**	**CO3**
4B.	A compound bar is made up of a mild steel rod 6 mm diameter, which is centrally positioned in a copper tube of internal diameter 24 mm and thickness 3 mm. Both steel rod and copper tube are of same length 500 and are rigidly connected at their ends. If the compound bar is subjected to an axial tensile load of 40 kN, find the stresses & deformation in steel and copper. Consider Ec= 100 GPa, Es =200 GPa.	**3**	**CO3**
4C.	A steel rail of 12.6 m long is laid at a temperature of 27°C, Estimate the free expansion of rail when temperature is raised to 48°C. Also determine the stress developed in rail if no expansion gap is provided. Take α = 12 x 10^{-6}/°C and E=200GPa.	**2**	**CO3**

5A.	A thin cylindrical shell of length 2 m and 800 mm internal diameter is subjected to an internal fluid pressure of 1.2 MPa. If thickness of the shell is 10 mm, determine the circumferential stress, longitudinal stress, change in diameter, change in length and change in volume. Consider E=200 GPa and μ= 0.3.	**4**	**CO4**
5B.	Draw the shear force and bending moment diagrams for a beam loaded as shown in **Fig. Q. 5B**.	**6**	**CO7**

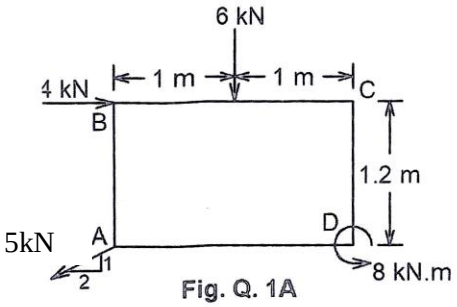

Fig. Q. 1A

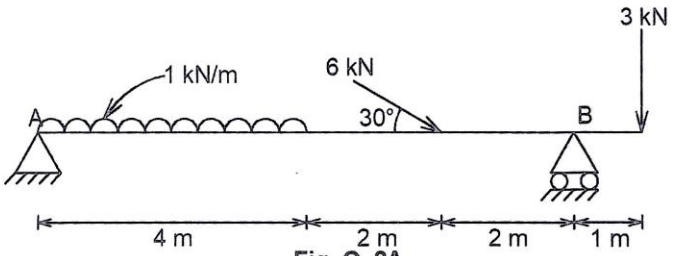

Fig. Q. 2A

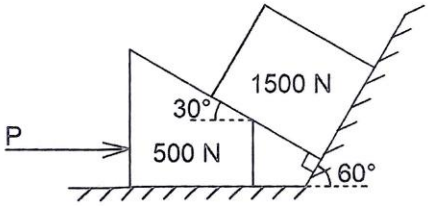

Fig. Q. 2B

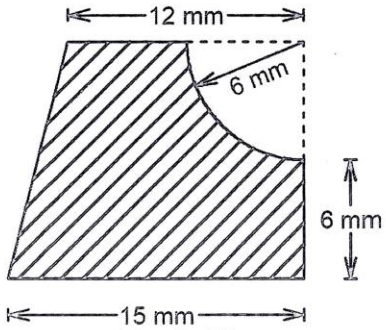

Fig. Q. 3A

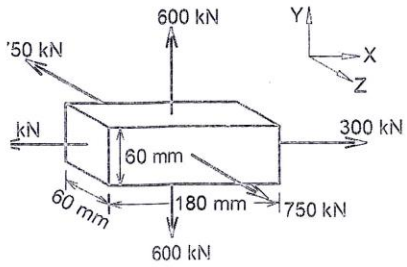

Fig. Q. 4A

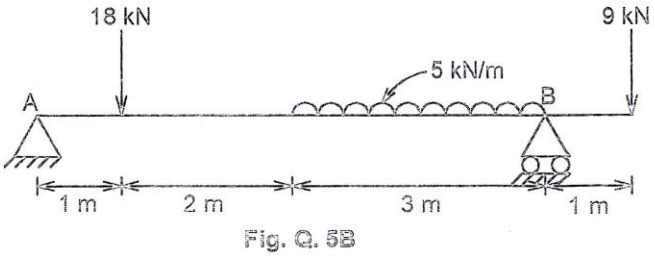

Fig. Q. 5B