Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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II SEMESTER B.TECH

END SEMESTER EXAMINATIONS, APR/MAY 2019

SUBJECT: MECHANICS OF SOLIDS [CIE 1051]

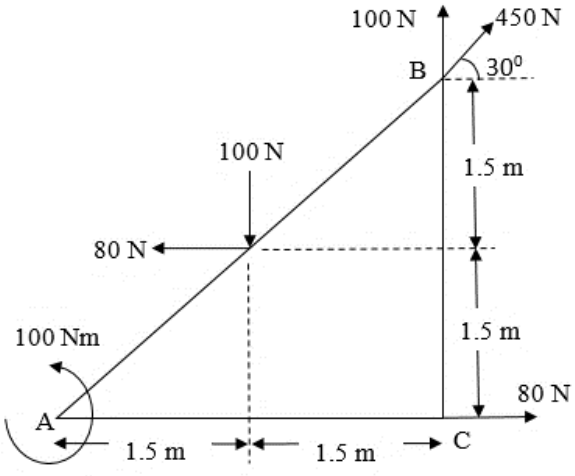
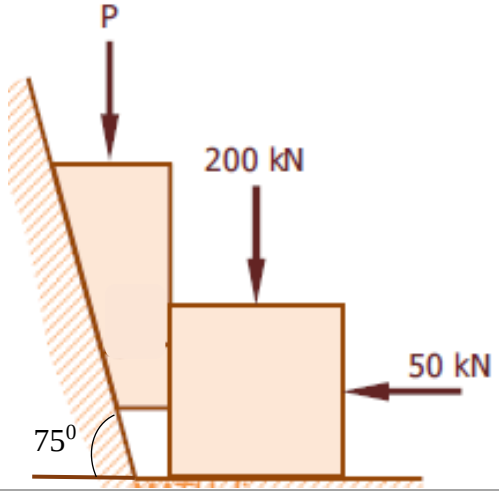
REVISED CREDIT SYSTEM

(06/04/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

	Questions	Marks	CO
1A.	Explain the following and illustrate with neat sketches a) Principle of transmissibility b) Varignon's theorem	**02**	**01**
1B.	Locate the resultant of a force system shown in the figure with respect to C. 	**04**	**01**
1C.	Determine the minimum value of force P required to drive the wedge shown in the figure. The angle of friction for all surfaces in contact is 15°. 	**04**	**02**

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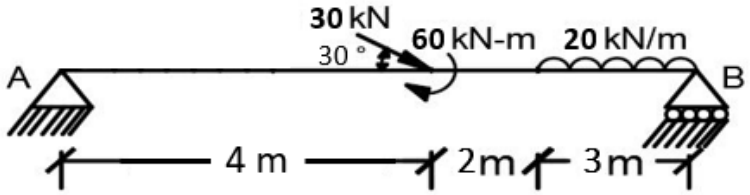
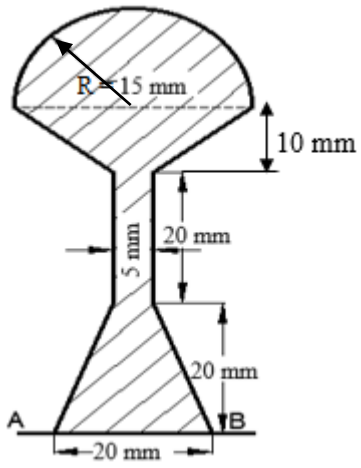
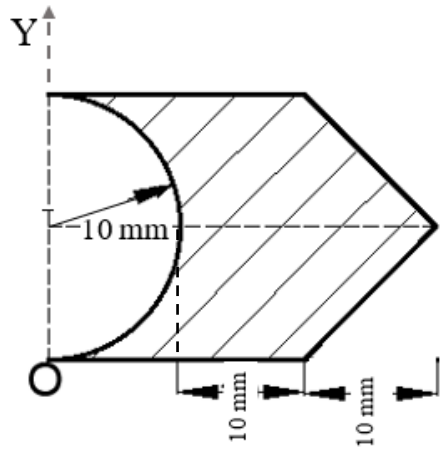
2A.	Define the following terms and illustrate with neat sketches i) Free body diagram ii) Static friction	**02**	**02**
2B.	Determine the support reactions for the beam shown in the Figure. 	**03**	**02**
2C.	Determine moment of inertia about an axis AB shown in the figure. 	**05**	**03**
3A.	Determine the centroid of a hatched area with respect to axis OY shown. 	**03**	**03**
3B.	Derive an expression for elongation of a tapered bar subjected to an axial tensile load 'P'. The flat has uniform thickness 't' and width varies uniformly from b_1 to b_2 ($b_1 < b_2$) along its length L.	**04**	**04**
3C.	The diameter of a specimen is found to reduce by 0.004 mm when subjected to a tensile force of 19 kN. The initial diameter of the specimen is 20 mm and modulus of rigidity is 40 GPa. Determine the values of E and μ.	**03**	**04**

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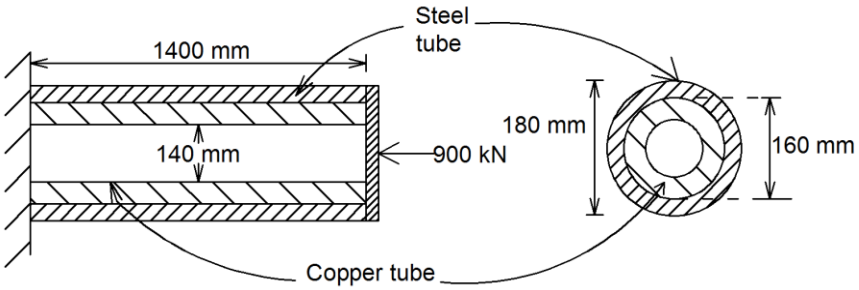
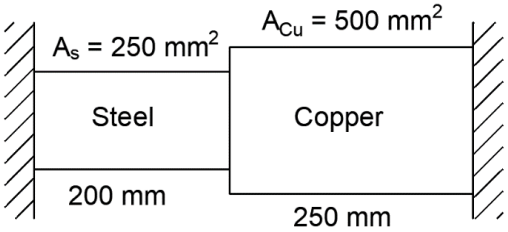
4A.	A bar of 200 mm long and 20 mm square cross section is subjected to an axial compressive load of 50 kN in longitudinal direction. The modulus of elasticity of the material is 150 GPa and Poisson's ratio is 0.30. Find the change in length, if expansions in lateral directions are prevented by the application of uniform lateral external pressure of suitable intensity.	**04**	**04**
4B.	A thin cylinder of 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MN/m^2. Determine the change in internal diameter, change in length, and change in volume. Take E = 200 GN/m^2, $\mu = 0.3$.	**03**	**04**
4C.	Obtain the relationship between bulk modulus (K) and modulus of elasticity (E).	**03**	**04**
5A.	A compound tube consists of a copper tube 160 mm external diameter and 140 mm internal diameter is enclosed inside a steel tube of 180 mm external diameter and 160 mm internal diameter as shown. If the compound tube carries an axial load of 900 kN, find the stresses developed and the deformation in each tube. Take $E_s = 2 \times 10^5$ N/mm^2 and $E_{cu} = 1 \times 10^5$ N/mm^2 	**04**	**05**
5B.	A bar is composed of two segments as shown in figure. Find the stress developed in each material when the temperature is raised by 60°C when the supports are perfectly rigid. Take E_s = 200 GPa, E_{Cu} = 100 GPa, $\alpha_s = 12 \times 10^{-6}$/°C, $\alpha_{cu} = 18 \times 10^{-6}$/°C. 	**04**	**05**
5C.	A rail track is to be constructed using steel rails of 20 m long. What minimum expansion gap is to be provided so that thermal stresses in rails should not exceed 70 N/mm^2 when the rails experience maximum rise in temperature of 40^0C during peak hours? Given $\alpha = 15 \times 10^{-6}$/°C and E = 210 GPa.	**02**	**05**