Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

II SEMESTER B.TECH

END SEMESTER EXAMINATIONS, JUN 2019

SUBJECT: MECHANICS OF SOLIDS [CIE 1051]

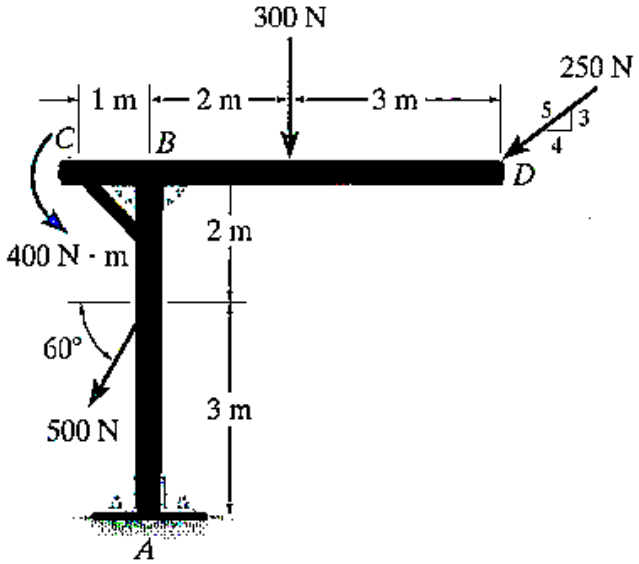
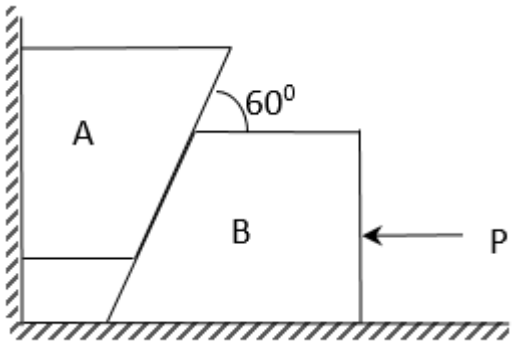
REVISED CREDIT SYSTEM

(/06/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

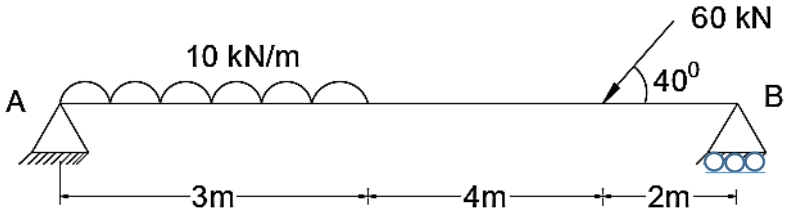
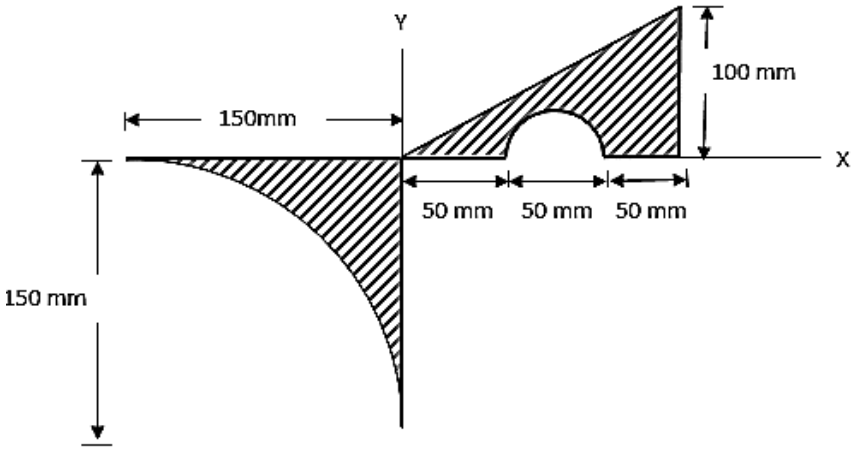
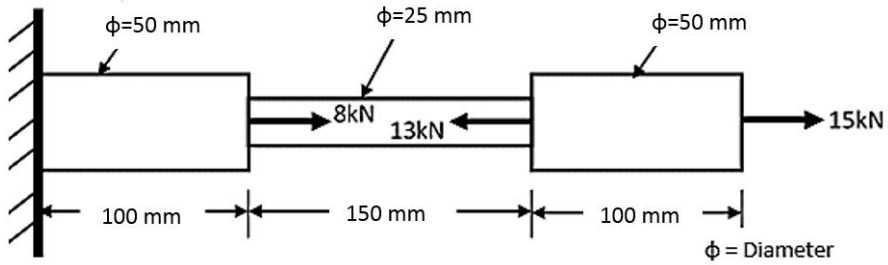
	Questions	Marks	CO
1A.	Define couple and state any three characteristics of it.	**02**	**01**
1B.	Locate the resultant of a force system shown in the figure with respect to A. 	**04**	**01**
1C.	Block A of weight 500 N and block B of weight 1000 N are positioned as shown in the figure. Find minimum value of force P required to keep the system in equilibrium. Take coefficient of friction between floor and block as 0.25, between wall and block as 0.3 and between blocks as 0.2. 	**04**	**02**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

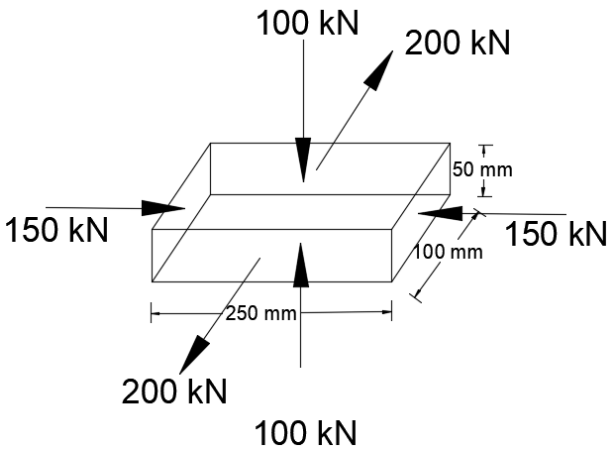
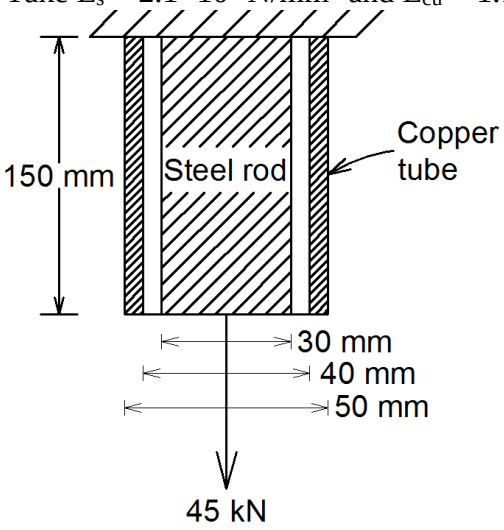
2A.	State any four laws of dry friction.	**02**	**02**
2B.	Determine the support reactions for the beam shown in the figure. 	**03**	**02**
2C.	Locate the centroid of a shaded area w.r.t. to X axis shown in the figure. 	**05**	**03**
3A.	Determine the moment of inertia for quarter circular area of radius 'R' about its base by direct integration.	**03**	**03**
3B.	A stepped rod of circular section is axially loaded at different points as shown in the figure. Calculate modulus of elasticity, if the total extension of the bar is 0.01mm. 	**04**	**04**
3C.	Draw typical stress-strain curve for ductile material subjected to tensile test and mark salient points.	**03**	**04**
4A.	A rectangular bar of cross section (100 mm × 50 mm) is 250 mm long. It is loaded with normal forces as shown in the figure. Calculate change in length, breadth, thickness and volume. Take E = 180 GPa and μ = 0.35.	**04**	**04**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

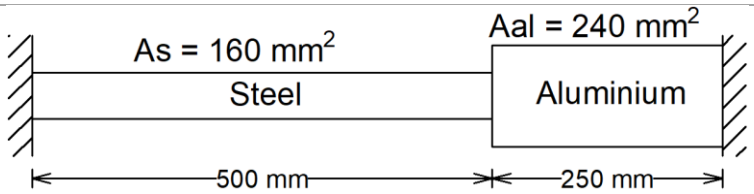
MANIPAL

(A constituent unit of MAHE, Manipal)

			
4B.	A thin cylinder of 1 m long has an internal diameter 230 mm and 5 mm thick wall. The change in internal volume is 12.0 x10^{-6} m^3 when filled with a liquid at pressure 'p'. If E = 200 GN/m^2 and μ= 0.25, determine the hoop and longitudinal stresses.	**03**	**04**
4C.	Show that in a state of simple shear for a square element of unit thickness, magnitude of diagonal normal stress is equal to the magnitude of applied shear stress.	**03**	**04**
5A.	A compound bar is made up of a steel rod of 30 mm diameter enclosed centrally in a hollow copper tube of external diameter 50 mm and internal diameter 40 mm as shown in the figure. The compound bar is fastened rigidly at the ends. The bar is now subjected to an axial pull of 45 kN. If the length of composite bar is 150 mm, determine: (i) The stresses developed in the rod and tube (ii) Deformation of each material Take $E_s = 2.1\times10^5$ N/mm^2 and $E_{cu} = 1.1 \times 10^5$ N/mm^2. 	**04**	**05**
5B.	A compound bar is made up of steel and aluminium and is held between two rigid supports as shown in the figure. The bars are stress free at a temperature of 42°C. What will be the stresses in two materials when the temperature increases to 66°C. Take E_{al} = 70 GPa, E_s = 200 GPa, $\alpha_{al} = 24 \times 10^{-6}$ /°C, $\alpha_s = 12 \times 10^{-6}$ /°C, A_s = 160 mm^2 and A_{al} = 240 mm^2.	**03**	**05**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

			
5C.	A 1m long uniform circular bar section is rigidly fixed between two supports at its ends. If the temperature is raised by 45°C, calculate the maximum stress in the bar if one of the support yields by 0.08mm. Take E= 200 GPa, $\alpha=12\times10^{-6}$/°C.	**03**	**05**