III-SEM-MECH/AUTO/DIP.MECH/E&M/MECH(PT)/MECH(PROD)/ MECH(MNTN)/MECH(INDUS)/2019(W)/OLD

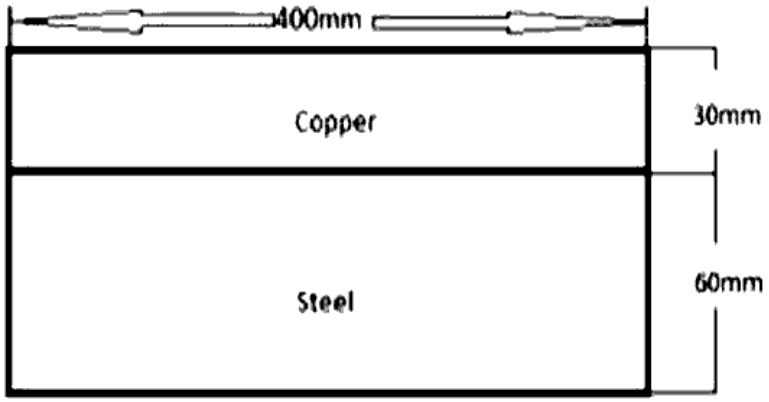
MET-301/MET-321- STRENGTH OF MATERIAL

Full Marks: 80 Time : 3 Hours

Answer any Five Questions including Q No. 1 & 2

Figures in the right hand margin indicates marks

1.	Answer ALL the Questions:	2X10
(a)	What do you mean by Impact Load?	
(b)	Define the terms "Creep" and "Fatigue".	
(c)	What do you understand by Poisson's Ratio?	
(d)	Define Principal Plane.	
(e)	What is meant by point of Contra-flexure?	
(f)	State the formula for critical buckling load.	
(g)	What do you mean by hoop stress and circumferential stress?	
(h)	Define Section Modulus.	
(i)	What is Torsional Rigidity?	
(j)	State the relationship for pure torsion.	
2.	Answer any SIX Questions:	5X6
(a)	Establish the relationship between the three Elastic Constant.	
(b)	The principal tensile stresses at a point across two perpendicular planes are $80N/mm^2$ and $40N/mm^2$. Find the normal stress, tangential stress, resultant stress and its obliquity on a plane at 30° with the major principal plane.	
(c)	Define Torsion? What are the general assumptions for pure torsion?	
(d)	Derive the relationship for simple bending.	
(e)	Consider a steel column of height 1m and Young's Modulus 200GPa is hinged on both ends. If its cross-sectional area is 10X20 mm^2, find out the lowest Euler's critical buckling load in N.	
(f)	Derive the expression for stress generated due to suddenly applied load.	
(g)	A circular shaft of 50mm diameter is required to transmit torque. Determine the maximum torque it can transmit, if the shear stress is not to exceed 40MPa?	
3.	Determine the Bending Moment and Shear Force for Uniformly Distributed Load acting on a simply supported beam. Also draw the Bending Moment diagram and Shear Force diagram.	10
4.	Derive the expression for hoop stress. A thin cylinder shell is having internal diameter of 1m and length 3m. Thickness of metal in the cylinder is 10mm. It is subjected to an internal pressure of 1.5MPa. Calculate the change in dimensions of the shell. Assume E as 200GPa and Poisson's ratio as 0.3.	10

5.	Derive the expression to determine the diameter of a hollow circular shaft subjected to pure torsion. In a torsion test, a hollow shaft of 50mm external diameter and 30mm internal diameter has an effective length of 0.2m. When applied with a torque of 1.6kN-m, the hollow shaft produces an angular twist of 0.4degrees. Assuming E= 200GPa, determine the Modulus of Rigidity and Poisson's Ratio.	10
6.	A copper flat of 60X30mm^2 is brazed to a mild steel flat of 60X60mm^2 as shown below in the Figure 1. The length of each flat is 400mm and the combination is heated through120°C. Assuming α_C =18.5X10^{-6} per °C, α_S=12X10^{-6} per °C, E_C=110GN/m^2, E_S=220GN/m^2, determine: a) Stress produced in each bar. b) Shear force which tends to rupture the brazing. c) Shear stress.  Figure 1	10
7.	Write short note on ant TWO: Mohr's Circle. Impact Testing. Types of beam and loading.	10