Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

II SEMESTER M.TECH.
END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: ADVANCED STRENGTH OF MATERIALS [CIE 5281]
(OPEN ELECTIVE)
REVISED CREDIT SYSTEM
(24/06/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- All Questions carry EQUAL marks.

1A.	A solid steel shaft elliptical in cross section is transmitting 13 kW power at 50 rpm. If the maximum shear stress is not to exceed 70 MPa, determine: (i) Lengths of major and minor axes, if major axis is 1.5 times the minor axis, (ii) angle of twist per meter length of the shaft. Take: G = 80 GN/m^2
1B.	Derive expressions for shear stress and angle of twist for a non-circular thin-walled section subjected to pure torsion.
2A.	Determine the shear center of a square box of wall thickness t and side 200 mm having a small cut on one of its sides as shown in FIG. Q2A.
2B.	For the beam loaded as shown in FIG. Q2B draw the SFD and BMD.
3A.	Draw the shear force, bending moment, and twisting moment diagrams for a cantilevered semi-circular beam subjected to a UDL w/m length over the entire span.
3B.	The cross section of a beam is an I-section of overall depth 200 mm, both flanges 100mm x10 mm thick each, and web 10 mm thick. Draw the shear stress and bending stress distribution diagrams if the section carries a shear force of 60 kN and bending moment of 20 kNm.
4A.	Determine the principal moments of inertia of the section shown in FIG. Q4A about axes passing through the centroid.
4B.	A crane hook is used to lift a load of 50 kN. The cross section at the principal diameter is rectangular, and the radius to the centroid of the section is 100 mm as shown in FIG. Q4B. Determine the resultant stresses that develop at points A and B.
5A.	A cantilevered beam of span 2m carries a point load of 100kN at its free end. The loading plane makes an angle of 1^o with the vertical principal axis as shown in FIG. Q5A. Determine: (i) stresses due to bending at the points A and B, (ii) orientation of the neutral axis, (iii) magnitude and direction of the resultant maximum deflection.
5B.	A shaft of hollow square section is of wall thickness of 5 mm, and the centerline of the wall forms a square of 250 mm side. This is to be replaced by a solid circular shaft of the same material and torsional stiffness. If the stress concentration factor K at the inner corners of the hollow square section is 1.6 and the twisting moment applied is kNm, find: (i) diameter of solid shaft, (ii) maximum shear stress in both shafts.

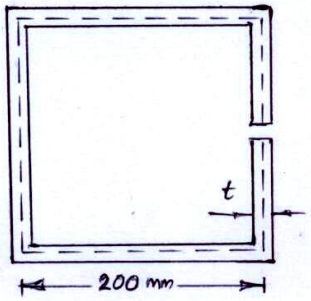

FIG. Q2A

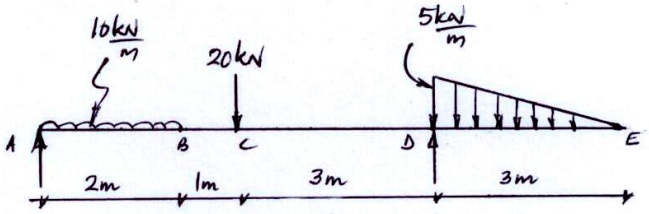

FIG. Q2B

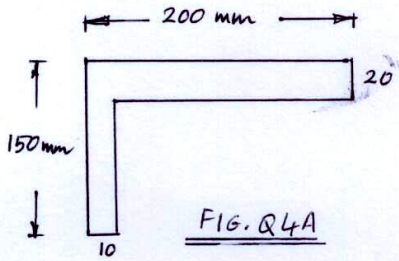

FIG. Q4A

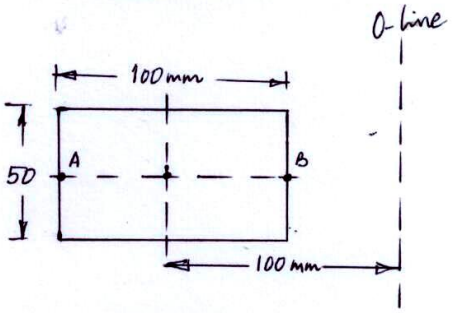

FIG. Q4B

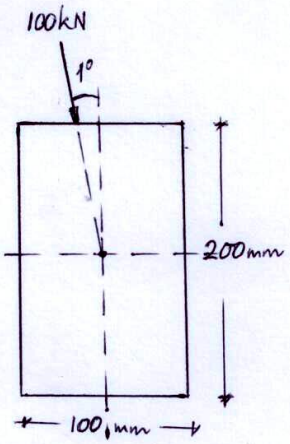

FIG. Q5A