Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2017/JAN 2018

SUBJECT: STRENGTH OF MATERIALS [MTE 2102]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed

1A Determine the diameter of a solid shaft which will transmit 440 kW at 280 RPM. The angle of twist must not exceed 1° per meter length and the maximum torsional shear stress is to be limited to 40 N/mm^2. Assume G= 84 kN/mm^2 **05**

1B A 250 mm X 50 mm bar of rectangular cross section of length 500 mm is made of plain carbon steel (Yield strength = 380 N/mm^2, E=207 GN/m^2). The 2 ends of the bar are hinged and the factor of safety is 2.5. The bar is subjected to an axial compressive force. **05**

a. Determine the slenderness ratio
b. Which of the 2 equations is to be used? Johnson's or Euler's?
c. What is the safe compressive force for the bar?

2 A A shaft is loaded by 200 Nm twisting moment and 100 Nm bending moment. The shaft is made from steel with allowable shear stress of 100 MPa and tensile stress of 180 MPa. Determine the shaft diameter using maximum shear stress theory **05**

2B A material is loaded as shown in Fig Q2B. Determine the principal stresses, principal planes, maximum shear stress and angle of plane of maximum shear stress. **05**

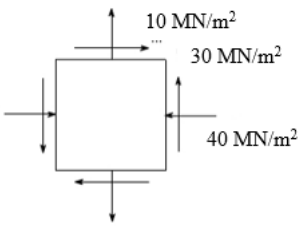

Fig Q2B

3A. A rod of 50 mm diameter made of steel with yield stress of 294 N/mm^2 is subjected to a bending moment of 1.95 kNm. Find the magnitude of torque that has to be applied to cause failure of rod according to maximum shear stress theory. **05**

3B. A simply supported beam of 6m span is subjected to a concentrated load of 18 kN at 4m from right support. Calculate **05**

a. Position and value of maximum deflection
b. Slope at midpoint
c. Deflection at load point

4A A column of hollow rectangular cross section made of steel (Yield strength = 400 N/mm^2, E=207 GN/m^2) is shown. End fixity coefficients can be taken as 1.5 and 1 for bending about long and short axes respectively. Length of column is 1 m. Determine the load capacity of the column from buckling consideration. **05**

4B A 250 mm depth and 150 mm width rectangular beam is subjected to a maximum bending moment of 750 kNm. Determine: **06**

a. Maximum stress in the beam
b. Calculate the radius of curvature for the portion of the beam where bending is maximum
c. Value of stress at 65 mm from top surface of the beam

5A Compute the angle of twist of the free end relative to the fixed end of the steel bar shown in Fig Q5A. Take G=84 kN/mm^2 **04**

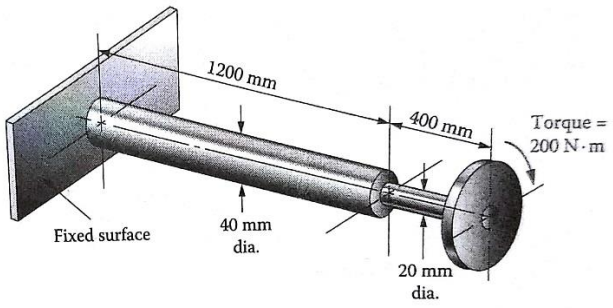

Fig Q5A

5B Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in a solid shaft of 100 mm diameter, 10 m long, transmitting 112.5 kW at 150 RPM. Take G= 82 kN/mm^2 **03**

5C. A hollow circular bar having an outside diameter twice the inside diameter is used as a beam. If the bar is subjected to a bending moment of 40kNm and the allowable stress in the beam is to be limited to 100MN/m2, find the inside diameter of the bar. **03**