Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – NOV. 2017

SUBJECT: STRENGTH OF MATERIALS (ME 124)

(BRANCH: MECH. / AVI. /MET.)

Tuesday, 21 November 2017

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**

1A. Derive the equation for maximum deflection of a cantilever beam carrying moment at the free end.

1B. Draw the SFD and BMD for the beam as shown in Figure.1B.

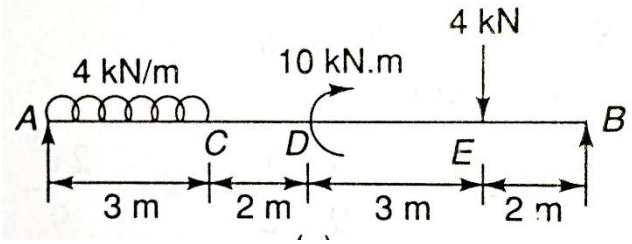

Figure.1B

1C. Define the following and write the related equations if any:

a. Factor of safety
b. Endurance limit
c. Modulus of Elasticity
d. Bulk modulus
e. Rigidity modulus
f. Fatigue

(6+8+6)

2A. A simply supported beam has an I-section with top flange 80 mm X 40 mm and bottom flange 160 mm X 40 mm. The web is 20 mm wide and 120 mm deep. Find the UDL which can be carried over a 6 m span if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension.

2B. For a cantilever beam of span L subjected to a uniformly varying load, derive the expressions for shear force and bending moment and plot the SFD and BMD.

2C. Compare the moment of resistance of 3 beams of equal weight with the following specifications:

a. I-section with the depth of web ,depth of each flange and the width of web in terms of width b of the flanges being 1.7 b ,0.15 b and 0.1 b respectively.
b. Rectangular section of depth equal to twice the width
c. Solid circular section.

(6+8+6)

3A. Compare the weights of equal lengths of a solid shaft and a hollow shaft to transmit a given torque for the same maximum stress if the inside diameter of the shaft is three fourth of the outside diameter.

3B. A T-section beam with flange 120 mm x 20 mm at the top and web 20 mm x 140 mm is subjected to a shear force of 140 kN. Draw shear stress distribution across the depth and mark values at salient points.

3C. A thick pipe of 200 mm internal radius and 100 mm thickness is required to withstand an internal pressure of 80 N/mm^2. Find the maximum and minimum hoop stresses across the section. Also sketch the radial and hoop stress distribution across the section. **(6+8+6)**

4A. Define:

a. Strut
b. Slenderness ratio
c. Crushing load
d. Effective length of a column
e. Crippling load
f. Short column

4B. Determine the diameter of the solid shaft which will transmit 440 kW at 280 rpm. The angle of twist must not exceed one degree per meter length and the maximum torsional shear stress is to be limited to 40 MPa. Assume modulus of rigidity as 0.84 MPa.

4C. A simply supported beam of 8 m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left hand end. Find the deflection under each load. Assume $E=2x10^5$ MPa and $I=180x10^6$ mm^4. **(6+8+6)**

5A. Define:

a. Proportional limit
b. Elastic limit
c. Lower yield point
d. Upper yield point
e. Ultimate tensile strength
f. Gauge length

5B. Draw the SFD and BMD for the overhanging beam shown in figure.5A. Indicate the point of contraflexure.

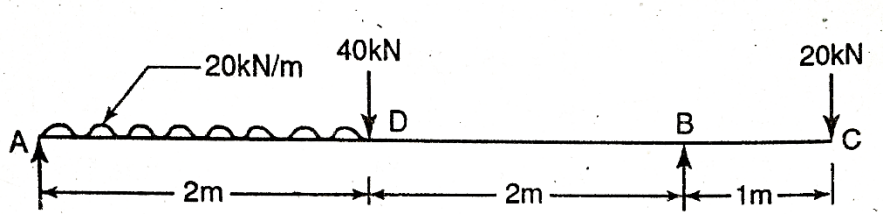

Figure.5A

5C. A thick pipe of 300 mm outer diameter and 50 mm thickness is subjected to an internal pressure of 12 N/mm^2. What minimum external pressure can be applied so that the tensile stress in the metal shall not exceed 16 MPa? **(6+8+6)**

6A. A hollow cylinder has outside diameter of 200 mm and thickness of 20 mm. It is 4.5 m long and is fixed at both the ends. Calculate the safe load by Rankine's formula using a factor of safety of 2.5.Find the ratio of Euler's to Rankine's loads. Take $E=1x10^5$ MPa and Rankine's constant =1/1600 for both ends pinned and σ_c = 550 MPa.

6B. Derive the relationship between bending moment and radius of curvature for a beam subjected to moment M.

6C. Write the Euler's formulae for different end conditions of the column. **(6+8+6)**

7A. Derive the equation for shear stress in a beam.

7B. A T-section beam with flange 100 mm x 12 mm at the top and web 12 mm x 88 mm is subjected to a shear force of 20 kN. Draw shear stress distribution across the depth and mark values at salient points.

7C. A simply supported beam of 6 m span is subjected to a concentrated load of 18 kN at 4 m from left support. By using Macaulay's method, Calculate-

i. The position and value of maximum deflection
ii. Slope at mid span
iii. Deflection at the point of loading. Assume E=200 GPa and $I=15 x10^6$ mm^4 **(6+8+6)**

8A. A straight cylindrical bar of 15 mm diameter and 1.2 m long is freely supported at its two ends in a horizontal position. It is loaded with a concentrated load of 100 N at the centre when the central deflection is observed to be 5 mm. If placed in the vertical position and loaded vertically, what load would cause it to buckle? Also find the ratio of the maximum stress in the 2 cases.

8B. Derive the torsion equation for a circular shaft subjected to external torque T.

8C. A thick pipe of 160 mm internal diameter is subjected to an internal pressure of 40 MPa. What is the thickness required so that the allowable stress in the material shall not exceed 120 MPa? **(6+8+6)**