Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – NOV. / DEC. 2016

SUBJECT: STRENGTH OF MATERIALS (ME 124)

(BRANCH: MECH, AVI & IP)

Friday, 16 December 2016

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

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

1A) Derive the equation for maximum deflection of a simply supported beam carrying load varying linearly from zero at one end to w per unit length at other end.

1B) Draw the SFD and BMD for the overhanging beam carrying loads as shown in figure.1A. Also locate the point of contra flexure if any.

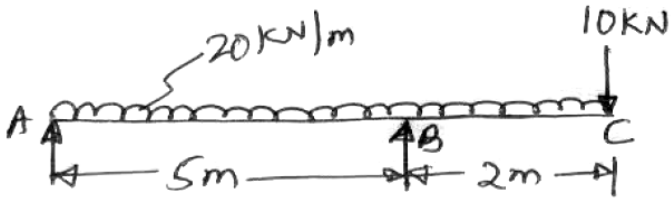

Figure.1A

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

a. Strain energy
b. True stress
c. Thermal stress
d. Hardness
e. Toughness
f. Hooke's law **(6+8+6)**

2A) A timber beam is freely supported on supports 6 m apart. It carries a UDL of 12 kN/m on entire span and a concentrated load of 9 kN at 2.5 m from the left support. If the stress in timber is not to exceed 8 N/mm^2, design a suitable section making depth twice the width.

2B) For a simply supported beam of span L subjected to an UDL of w/unit length over entire span obtain the equation for maximum bending moment and plot the nature of variation of SFD and BMD.

2C) A simply supported beam 4m long has the cross section shown in figure.2C. Find maximum UDL this beam can carry if the stresses in compression and tension are not to exceed 60 MPa and 30 MPa respectively. Plot the bending stress variation diagram across the cross section of the beam.

(6+8+6)

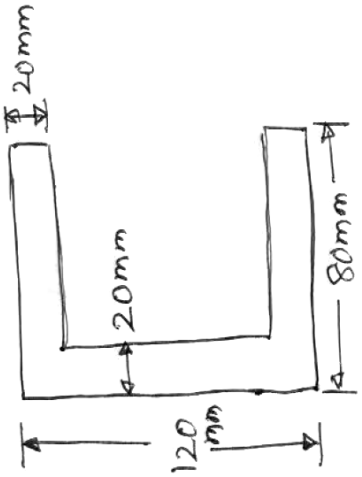

Figure.2C

3A) From the consideration of maximum shear stress compare the weight of solid shaft with that of a hollow one having the same length to transmit a given power at a given speed, if material used for both the shaft is same. Take inside diameter of hollow shaft as 0.6 times the outer diameter.

3B) A simply supported beam 120 mm wide and 180 mm deep is 6m long. It carries a UDL of 4 kN/m. Find the shear stress developed at horizontal layers 30 mm apart from top to bottom of the section for a shear force 1 m from left end of the beam. Plot shear stress variation diagram.

3C) A thick pipe of 400 mm internal diameter and 100 mm thick contains a fluid at a pressure of 80 N/mm^2. Find the maximum and minimum hoop stresses across the section. Also sketch the radial pressure and hoop stress distribution across the section.

(6+8+6)

4A) Define crippling load for a column. Write the Euler's formulae for different end conditions of the column.

4B) Determine the diameter of solid shaft which will transmit 440 kW at 280 rpm. The angle of twist must not exceed one degree per metre length and the maximum torsional shear stress is to be limited to 40 N/mm^2. Assume G = 84 kN/mm^2.

4C) Find the deflection at free end for a cantilever beam with W_1 = 20 kN acting at 2 m from fixed support and W_2 = 30 kN acting at free end. Take span = 3 m, E = $2x10^5$ N/mm^2 and I = $2x10^8$ mm^4.

(6+8+6)

5A) Explain the stress-strain behaviour and tensile fracture pattern of ductile and brittle materials with examples.

5B) Draw the SFD and BMD for the overhanging beam carrying loads as shown in figure.5B. Also locate the point of contra flexure if any.

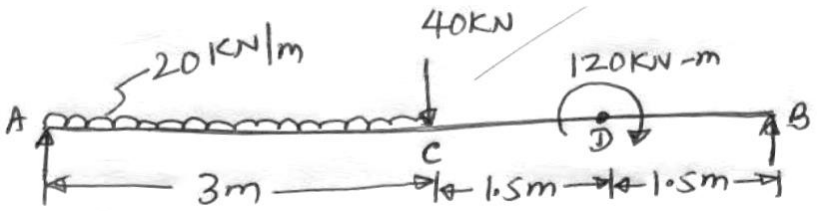

Figure.5B

5C) A thick pipe of 300 mm outer diameter and 200 mm internal diameter is subjected to an internal pressure of 12 MPa. What minimum external pressure can be applied so that the tensile stress in the metal shall not exceed 16 MPa?

(6+8+6)

6A) Compare the crippling load as found from Euler's formula and Rankine' formula for mild steel tube 3 m long and internal diameter 50 mm. Thickness of the metal is 25 mm. Both ends are pin jointed. Take σ_c = 300 MPa and a= 1/7500 and E = 210 kN/mm^2.

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

6C) Write the difference between:

a. Short column and Long column
b. Thick cylinder and thin cylinder
c. Euler formula and Rankine's formula

(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) Find Euler's load for a hollow cylindrical cast iron column 120 mm external diameter, 20 mm thick and 4.2 m long with hinged ends. For what length of the column does Euler's equation cannot be applied? Take E = 80 kN/mm^2 and $\sigma_{permissible}$ = 550 MPa.

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

8C) A thick cylinder of internal diameter 160 mm is subjected to an internal pressure 40 N/mm^2. If the allowable stress in the material is 120 N/mm^2, find the thickness required.

(6+8+6)