Reg.No.										

प्रज्ञानं ब्रह्म

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – JUNE 2016

SUBJECT: STRENGTH OF MATERIALS (ME 124)

(BRANCH: AVI / MECH / IP)

WEDNESDAY, 15TH JUNE, 2016

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

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

1A) Derive the equation for maximum deflection of a cantilever beam carrying load varying linearly from zero at the free end to w per unit length at other end. (06)

1B) Draw the SFD and BMD for the beam carrying loads as shown in figure.1A. (08)

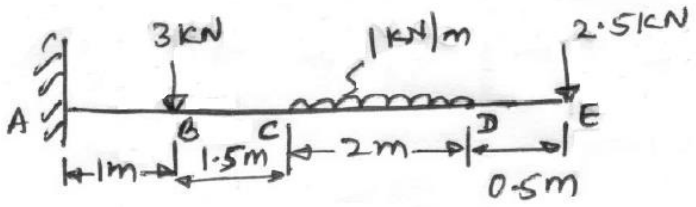

Figure.1A

1C) Define the following and write the related equations if any:
- a. Fatigue of a material
- b. Nominal stress
- c. Yield stress
- d. Bulk modulus
- e. Rigidity modulus
- f. FOS for brittle material (06)

2A) A cantilever of square section 200 mm x 200 mm, 2 m long just fails in flexure when a load of 12 kN is placed at its free end. A beam of the same material and having rectangular cross section 150 mm wide and 300 mm deep is simply supported over a span of 3 m. Calculate the minimum central concentrated load required to break the beam. (06)

2B) For a simply supported beam of span L subjected to an external clockwise moment M_o at a distance 'a' from the left support, obtain the shear force and bending moment at different points and plot the variation of SFD and BMD. (08)

2C) A timber beam of rectangular section supports a total load of 20 kN uniformly distributed over a span of 3.6 m. If depth of the beam section is twice the width and maximum stress is not to exceed 7 MPa, find the dimensions of the beam section. (06)

3A) Prove that a hollow shaft is stronger and stiffer than the solid shaft of the same

material, length and weight. (06)

3B) An I section beam 350 mm x 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the shear stress distribution across the section. (08)

3C) A thick metallic cylindrical shell of 150 mm internal diameter is required to withstand an internal pressure of 8 N/mm^2. Find the necessary thickness of the shell, if the permissible tensile stress in the section is 20 N/mm^2. (06)

4A) Define:
a. Crippling load
b. Slenderness ratio
c. Crushing load
d. Effective length of a column
e. Euler's formula
f. Short column (06)

4B) A solid shaft of 200 mm diameter has the same cross sectional area as a hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of
a. Power transmitted by both the shafts at the same angular velocity.
b. Angles of twist in equal lengths of these shafts, when stressed to the same intensity. (08)

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. (06)

5A) Explain the stress-strain behaviour and tensile fracture pattern of ductile and brittle materials with examples. (06)

5B) Draw the SFD and BMD for the overhanging beam carrying loads as shown in figure.5A. (08)

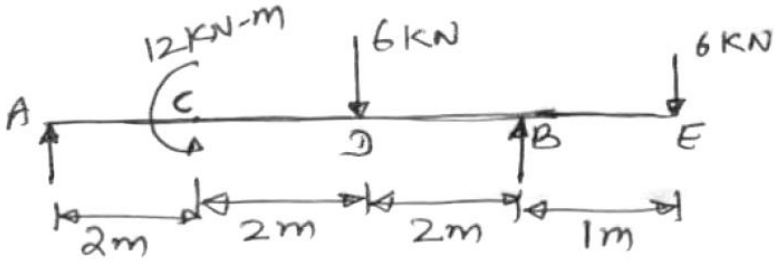

Figure.5A

5C) A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under pressure of 8 N/mm^2. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. (06)

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. (06)

6B) Derive the relationship between bending moment and radius of curvature for a beam subjected to moment M. (08)

6C) Write the Euler's formulae for different end conditions of the column. (06)

7A) Derive the equation for shear stress in a beam. (06)

7B) A T-section beam having flange of 200 mm x 50 mm at the top and web 50 mm x 200 mm is subjected to a vertical shear force of 100 kN. Calculate the shear stress at important points and draw shear stress distribution diagram. (08)

7C) A horizontal steel beam having uniform cross section is subjected to loading as shown in figure.7C. Calculate the deflections at the point of loading by Macaulay's method. Take E = 200 GPa and I = 160 x 10^6 mm^4. (06)

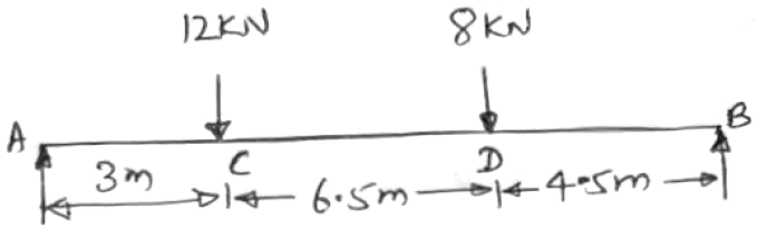

Figure.7C

8A) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under a tensile load of 60 kN. Find the buckling load for the tube when it is used as a column with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 5. (06)

8B) Derive the torsion equation for a circular shaft subjected to external torque T. (08)

8C) 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? (06)