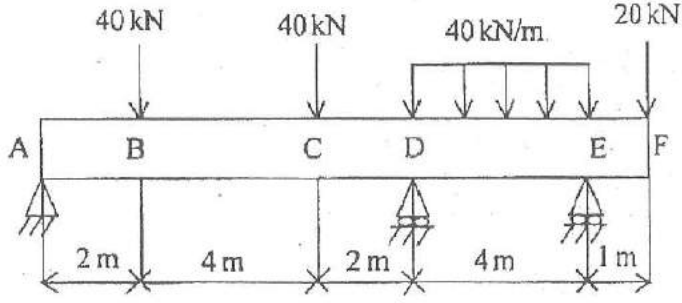
7. (a) Determine the value of p^2 for the rectangular section of a bar of large initial curvature. (5)

(b) A curved bar of rectangular section of 30 mm width, 40 mm depth and mean radius of curvature of 60 mm is initially unstressed. If a bending moment of 400 Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surfaces and sketch a diagram to show the variation of stress across the section. Also find the position of neural axis. (9)

8. Analyse the continuous beam loaded as shown in figure below and draw the shear force and bending moment diagram for the beam. (14)



[03 – 3111]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

MECHANICS OF SOLIDS – II

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. Answer the following : $(7 \times 2 = 14)$

   (a) Classify the columns based on the mode of Support Conditions

   (b) Write the Lame's equations and show the distribution of normal radial and tangential normal stresses across the thickness of the cylinder.

   (c) Write any two advantages and disadvantages of fixed beams.

(d) When the crane hook lifts a load heavier in weight, where the maximum stress is induced in the section? What is its nature?

(e) Write the general three-moment equation and explain the terms used in the equation.

(f) What are the assumptions in Euler's theory?

(g) For a curved bar of rectangular section of 20 mm width, 60 mm depth and mean radius of curvature of 60 mm, determine the position of neutral axis.

2. (a) Derive the Lame's equations from the differential equation governing the radial displacement of the cylindrical surface of radius "r" in a cylinder of inside radius r_i under inside pressure p_i and outside radius r_o under external pressure p_o. (6)

(b) A pipe of 400 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 8 MPa. Find the maximum and minimum hoop stresses across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. (8)

3. Derive the expressions for radial and circumferential stresses in a rotating disc of uniform thickness. (14)

4. (a) Derive the relation for maximum stress in the column with initial curvature carrying an axial thrust P. (8)

(b) A metal column of external diameter 300 mm and thickness 20 mm carries a load of 400 kN at an eccentricity of 50 mm. Determine the maximum and minimum stresses in the column if its length is 5 m and both ends of the column are fixed. Take E = 95 GPa. (6)

5. A fixed beam carries a uniformly varying load from zero at the left end to "w" N/m length at the right end. Formulate the equations for support reactions and fixed end moments. Draw the shear force and bending moment diagrams also. (14)

6. (a) Show that an approximate value of critical load for a long column can be obtained by assuming a deflected shape due to a lateral uniformly distributed load. (7)

(b) Compare the Euler crippling loads of two columns: one of solid circular section and the second of hollow circular section of internal diameter 70% of the external diameter if they are of same material, same length, same area and same end conditions. (7)