6. (a) Determine the diameter of a solid shaft which will transmit 300 KN at 250 rpm. The maximum shear stress should not exceed 30 N/mm2 and twist should not be more than 10 in a shaft length 2m. Take modulus of rigidity = 1×105 N/mm^2.

(b) The stiffness of the closed coil helical spring at mean diameter 20cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 KN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18cm.

Take C = 8×10^4 N/mm^2.

7. A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under pressure of 3 N/mm^2. The diameter of the cylinder is 25cm and length is 75 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take E =2.1×105 N/mm^2 and 1/m = 0.286.

8. The maximum stress permitted in a thick cylinder of internal and external radii 250 mm and 450 mm respectively is 25 N/mm^2. If the external pressure is 15 N/mm^2. Find the internal pressure that can be applied.

[03 – 2112]

II/IV B.E. DEGREE EXAMINATION

First Semester

Mechanical Engineering

MECHANICS OF SOLIDS – I

(Common with M.S. Mech. Engg.)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What are the Elastic Constants?

(b) Define crippling load.

(c) What is Polar Modulus?

(d) Write down the equation for Wahl factor.

(e) What are springs? Name the two important types.

(f) What is called Twisting moment?

(g) What are the advantages of Macaulay method over the double integration method, for finding the slope and deflections of beams?

2. (a) The extension in a rectangular steel bar of length 400mm and thickness 10 mm is found to 0.21 mm The bar tapers uniformly in width from 100mm to 50mm. If E for the bar is 2×10^5 N/mm^2, Determine the axial load on the bar.

(b) A stepped axial member, constrained between two rigid fixed supports A and B, is subjected to an axial force, P at C and rise in temperature, 1000 C as shown in the figure.1. Draw

(i) the axial thrust diagram

(ii) Stress diagram along the length, if $2A_1 = A_2 = 200$ mm^2 if E = 200 GPa and linear coefficient of expansion, $\alpha = 12 \times 10^{-12}$ mm/°C.

(a) At a point in a strained material, the principal stresses are 200 N/mm^2 (T) and 60 N/mm^2 (C). Determine the direction and magnitude in a plane inclined at 600 to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point?

(b) What do you mean by strain energy and resilience and proof resilience explain them.

4. (a) A Simply supported beam 6 metre span carries udl of 20 KN/m for left half of span and two point loads of 25 KN end 35 KN at 4 m and 5 m from left support. Find maximum SF and BM and their location drawing SF and BM diagrams.

(b) A beam of uniform section 10 m long carries a udl of KN/m for the entire length and a concentrated load of 10 K at right end. The beam is freely supported at the left end. Find the position of the second support so that the maximum bending moment in the beam is as minimum as possible. Also compute the maximum bending moment.

5. (a) Three planks of each 50 × 200 mm timber are built up to a symmetrical I section for a beam. The maximum shear force over the beam is 4KN. Propose an alternate rectangular section of the same material so that the maximum shear stress developed is same in both sections. Assume then width of the section to be 2/3 of the depth.

(b) A beam of length of 6 m is simply supported at its ends. It carries a uniformly distributed load of 10 KN/m as shown in figure. Determine the deflection of the beam at its mid-point and also the position and the maximum deflection.
Take EI = 4.5×10^8 N/mm^2.