SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | | **Total number of pages:[2]**

B.Tech. || ME || 4th Semester

Strength of Materials-II

Subject Code: BTME-401A|401 (RG|RP)

Paper ID: M|18

Time allowed: 3 Hrs (2011 batch onwards) **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (10×2marks)

1. (a) What do you mean by Energy of Dilation?
   (b) State Maxwell-Betti's reciprocal work theorem.
   (c) Obtain the ratio of hoop stress and axial stress in a thin cylinder?
   (d) Differentiate closed coiled helical spring from open coiled helical spring?
   (e) What do you understand by overlap in leaf spring?
   (f) What is the nature of distribution of bending stress across the section of a curved beam with large initial curvature? Also draw the stress distribution.
   (g) What do you mean by shear center?
   (h) Write two applications of thick cylinders?
   (i) Draw the shape of yield locus of Tresca theory?
   (j) Obtain the ratio of maximum radial and hoop stresses in a solid rotating disk.

Section B (5×8 marks)

2. A semi-elliptic leaf spring with 5 leaves and the length of 600mm is to absorb 600 Joules of energy without exceeding bending stress of 800MPa and deflection of 50mm. Determine the width and thickness of the leaves. Also calculate the length of each leaf. Take E = 210 GPa

OR

Derive the Winkler-Bach formula to estimate the bending stress in a curved beam subjected to bending moment 'M'. (CO1)

3. What is the importance of disk of uniform strength? Also derive the formula for estimating the thickness (t) of such a disk at any radius (r), density (ρ) and rotating at ω *rad/sec*.

OR

Derive an expression for locating the shear center in a thin channel section of mean height 'h', thickness 't' and length of flange 'b', subjected to shear force 'V'.

(CO2)

4. The section of a cantilever of length L is tapered so that moment of inertia of its section varies uniformly from I_0 at the support to the zero at the free end. A load W is applied at the free end. Obtain the downward deflection of the free end by assuming he material to be homogeneous and Young's modulus E.

OR

A hollow shaft with ratio of its diameters as $\sqrt{3}$ transmits $4000kW$ at 120 *rpm* when the energy stored is 2000 J/m^3 of material. Calculate the shaft diameters if G = $100GPa$. (CO3)

5. A solid circular shaft is required to carry a torque of 40 *kNm* and a bending moment of 30 *kNm*. If yield stress of the shaft material is 250 *MPa* in tension, find the minimum required diameter of the shaft according to von-Mises Theory. Take a factor of safety = 2.5.

OR

A mild steel shaft of 50*mm* diameter is subjected to a bending moment of 2 *kNm* and a torque "T". If yield point strength of steel in tension is 210 *MPa*, find the maximum value of the torque without causing yielding of the shaft material according to Tresca theory. (CO4)

6. Derive the formula of change in length, change in diameter and change in volume of a closed end thin cylinder subjected to internal pressure.

OR

Derive the Lame's formula for a thick cylinder of inner radius r_i and outer radius r_o, subjected to internal pressure 'p_i' and external pressure 'p_o'. Also write the assumptions made in deriving the formula. (CO5)

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