Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 140605 **Date: 30-12-2013**

Subject Name: Advanced Strength of Materials

Time: 02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Draw neat and clean diagram of shear stress distribution in Hollow Rectangular, Hollow circular and L section.	**03**
	(b)	Define and explain shear center.	**04**
	(c)	A simply supported beam having span 3.6 m is subjected to a UDL of 20 kN/m over right half span. The cross-section of beam is I section having flanges 120mmx10mm and web 200mmx15mm. Draw shear stress distribution across the depth of cross-section marking the values at salient points.	**07**
Q.2	**(a)**	Explain given failure theories (i) Maximum Principal stress theory (ii) Maximum strain energy theory.	**07**
	(b)	A rivet is subjected to an axial pull of 20 kN along with a transverse shear force of 4 kN. Using factor of safety 4 design the diameter of rivet using 1. Maximum shear stress theory 2. Strain energy theory Take poisson's ratio 0.3 and stress at elastic limit as 240 MPa.	**07**
		OR	
	(b)	Using distortion energy theory, design thickness of a thin spherical shell which has 360mm diameter and subjected to internal pressure of 6 MPa. The yield strength of shell material is 300 MPa. Take factor of safety as 3.	**07**
Q.3	**(a)**	A propped cantilever beam having span L is fixed at end A and simply supported at end B. It is loaded by a point load P at center. Find out the reaction at B using Castigliano's theorem.	**07**
	(b)	Find out uniformly distributed load which can be safely applied to a cantilever beam having span 2m. The beam has T shaped cross section having equal dimensions of web and flange as 200mm width and 20mm thickness. The allowable shear stress in beam material is 40MPa.	**07**
		OR	
Q.3	**(a)**	Derive the formulae for maximum bending stress and deflection of a semi elliptical leaf-spring	**07**
	(b)	A closed coil spring is to be cast such that its mean diameter is 16 times that of wire diameter. The spring has to carry static load of 1200N. Find the diameter of wire and mean diameter of spring if maximum shear stress allowed in spring material is 84 N/mm^2. Find the number of coils if spring stiffness is 64 N/mm and shear modulus of spring material is 90 GPa.	**07**
Q.4	**(a)**	A thick cylindrical shell having internal and external diameters of 180 mm and 420 mm respectively is subjected to internal fluid pressure of 10 MPa. Find the maximum and minimum hoop stresses in the cylinder material and sketch the stress distribution diagram.	**07**
	(b)	Stating assumptions derive Lame's equations to find longitudinal and hoop stresses for thick cylinder subjected to internal pressure.	**07**
		OR	
Q.4	**(a)**	Derive the expression for stresses in hollow disc rotating with the uniform	**07**

angular velocity.

(b) Determine the intensities of principal stresses for a flat steel disc of uniform thickness and 2m in diameter, rotating with the uniform angular velocity of 4400 r.p.m. Take density of material 78 kN/m^3 and Poisson's Ratio = 0.3 **07**

Q.5 **(a)** A curved beam circular in cross-section having radius of 20mm is subjected to pure bending of 400 Nm. The mean radius of curvature is 50mm. Find maximum bending compressive stress and maximum bending tensile stress. Also plot the variation of the bending stress across the section. **07**

(b) A hook made up of solid circular section having 25 mm diameter with radius of curvature of its central axis 75 mm carries a load of 7.5 kN. Calculate maximum stresses in hook material. **07**

OR

Q.5 **(a)** A cantilever beam of length 3m is subjected to UDL of 12 kN/m on its entire span along with a point load of 27 kN at its free end. Find the deflection at the free end using Castigliano's theorem. Take flexural rigidity EI as constant **07**

(b) A wire having 3 mm diameter and 400mm long is hanged freely from a ceiling. The wire has a collar at the bottom end. A weight of 20N is dropped on the collar through a height of 100mm. Find the maximum value of instantaneous stress developed in the wire. E=210GPa. **07**

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