Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (OLD) - EXAMINATION – SUMMER 2018

Subject Code:140605 Date:15/05/2018

Subject Name:Institute Elective-1(Advanced Strength Of Materials)

Time:10:30 AM to 01:00 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)** Define: Proof resilience, Shear center, Modulus of resilience, Strain energy. **04**

(b) State and prove Castigillonos first Theorem. **03**

(c) A uniform metal bar of rectangular section 60mm × 20mm is of length 2.5m. Find the Strain energy stored in the bar when a load of 200 kN is gradually applied to it. If the elastic limit of the metal with which the bar is made is 160 N/mm^2, also find proof resilience and modulus of resilience **07**

Q.2 **(a)** Using Castigliano's theorem, determine the reaction RB at end B, for a propped cantilever beam as shown in fig.-1. Take EI = constant. **07**

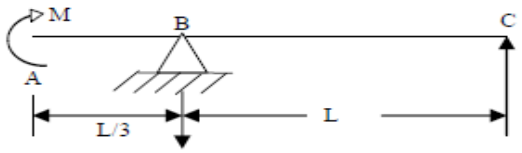

Fig. 1

(b) A circular shaft of 80 mm diameter is subjected to combined bending and twisting moments, the bending moment being four times the twisting moment. Find the allowable twisting moment according to (i) maximum principal stress theory, (ii) maximum shear stress theory, and (iii) distortion energy theory. Given, the stress at the elastic limit is 4 N/mm^2 and the factor of safety is 3. **07**

OR

(b) A bolt is subjected to an axial pull of 12 kN together with a transverse shear force of 6 kN. Determine the diameter of the bolt according to (i) maximum shear stress theory, and (ii) maximum strain theory, (iii) strain energy theory, and (v) shear strain energy theory. Given, the stress at the elastic limit is 300 N/mm^2, the factor of safety is 3 and Poisson's ratio 0.3 **07**

Q.3 **(a)** What are the types of spring? Derive the formulae for open coiled helical springs for axial loaded only. **07**

(b) An open-coiled helical spring made from wire of circular cross section is required to carry a load of 100 N. The wire diameter is 8 mm & the mean coil radius is 40 mm. If the helix angle of the spring is 30° and no. of turns is 12, calculate: (i) Axial deflection, (ii) Angular rotation of the free end with respect to fixed end of the spring, (iii) intensity of shear stress and (iv) bending stress. Take G = 80GPa **07**

OR

Q.3 **(a)** A crane hook curved to an internal diameter of 70 mm carries a load of 90 kN. The cross section of crane is symmetrical trapezium with top width 80 mm (concave side), bottom width 30 mm and depth 70 mm. Determine the maximum stresses in cross section. **07**

(b) A laminated steel spring simply supported at ends with span of 0.75m is centrally loaded with a load of 7.5 kN. The central deflection under the above load is not to exceed 50mm and the maximum stress is to be 400 MPa, determine; (i) width of plate (ii) thickness of plate (iii) number of plates (iv) the radius to which plates should be bent so that the spring become straight under the given 7.5 kN load. Assume width= 12 x thickness and E= 200 GPa **07**

Q.4 **(a)** Write assumptions made in theory of Lame's equation, State Lame's equation Derive Lame's equations to find longitudinal and hoop stresses for thick cylinder subjected to internal pressure **07**

(b) The internal fluid pressure in a cylindrical shell is 6 MPa. The external and internal diameters of the shell are respectively 400mm and 200 mm. find the maximum and minimum hoop stress in the cylinder material. Also sketch the radial stress distribution and circumferential stress distribution across the section. **07**

OR

Q.4 **(a)** Derive Winkler Bach formula for bending of curved beams of large curvature **07**

(b) A hook has a triangular section with base 40 mm and height 50 mm. the base of triangle is toward the center of curvature and at a center of curvature and at a distance 30 mm. the load of 40 kN is applied along a line 40 mm from the inner edge of the shank, compute the stress on the inner and outer fibers **07**

Q.5 **(a)** Locate the position of shear centre for thin I-section as shown in figure. 2 below **04**

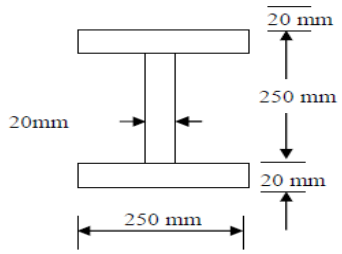

Fig. 2

(b) A flywheel rim of 6m mean diameter is rotated so that maximum hoop stress in the material is 8 MPa. If density of the material of fly wheel is 6000 kg/m^3 , find the allowable speed neglecting arm effect. **03**

(c) A flat steel disc of uniform thickness and of 1 m diameter rotates at 2400 r.p.m if the disc has a central hole 250 mm diameter. Determine the intensities of principal stresses. Take density=7.85 * 10^{-5}N/mm^2 and m=3 **07**

OR

Q.5 **(a)** Give example of rotating thin ring, and uniform rotating thin disc **04**

(b) Give example of rotating thin ring, and uniform rotating thin disc **03**

(c) A beam of triangular cross section having base width of 100 mm and height of 150 mm is subjected to a shear force of 150 kN. Find the value of maximum shear stress, and sketch the shear stress distribution along the depth of beam **07**

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