Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-IV Examination-Nov/Dec-2011

Subject code: 140605 Date: 02/12/2011

Subject Name: Advanced Strength of Materials

Time: 02.30 pm -5.00 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)** Using Castigliano's first theorem, determine the deflection and rotation of the over hanging end A of the beam loaded as shown in Fig.-(1). **07**

(b) A 600 mm x 210mm R.S.B. is freely supported at the ends over a span of 8 m. Construct the deflection influence line for the section at 2m from the rigid end, given I for the section = 7.29 x 10^8 mm^4 and E = 2 x 10^5 N/mm^2. Three equal point loads of 80 kN each, spaced 2 m apart, between consecutive loads cross the beam form left to right. Calculate the defection at this section when the leading load is on it. **07**

Q.2 **(a)** Two similar round bars A and B are each 30 cm long as shown in Fig.-(2). The bar A receives and axial blow, which produces a maximum stress of 2000 kg/cm^2. Find the maximum stress produced by the same blow on the bar B. If the bar B is also stressed to 2000 kg/cm^2, determine the ratio of energies stored by the bars B and A. **07**

(b) A square pin is required to resist a pull of 40 kN and shear force at 15 kN. Derive a suitable section according to strain energy theory. Maximum tensile stress is 350 MPa and Poisson's ration is 0.3. Take a factor of safety of 3.0. **07**

OR

(b) A thin spherical shell has 400 mm diameter and wall thickness t. It is subjected to internal pressure of 5 MPa. The material has yield strength of 265 MPa. Determine thickness of the shell as per distortion energy theory of failure. Take factor safety of 2.5. **07**

Q.3 **(a)** A close coiled helical spring is to carry a load of 10 kg and the mean coil diameter is to be 8 times that of the wire diameter. Calculate these diameters, if the maximum stress is to be 1 t/m^2. **07**

(b) A vehicle weight 40 kN and running at 1.5 meter per second has to be brought to rest by a buffer spring. Find the number of spring of 20 coils each required t absorb the energy of motion during a compression of 250 mm. Each spring is made of 20mm diameter rod forming a coil of 200 mm mean diameter. Take G = 85 GPa. **07**

OR

Q.3 **(a)** A flat spring of rectangular section wire 10 m x 0.5 mm has a length of 300 cm. If the maximum bending stress is limited to 600 MPa. Find : (a) maximum couple that can be exerted at the spindle, (b) maximum bending moment in the spring. (c) the number of turns required to wind up the spring. Take E = 200 GN/m^2. **07**

(b) A cantilever type laminated spring (quaterelleptic) has a span of 0.5 m. If each leaf be 8 mm thick and 72 mm wide, Find the number of leaves so that the spring deflects 60 mm under an end load of 3 kN. Determine maximum bending stress at this load. Also determine the height form which this load may be allowed to fall so that maximum bending stress induced is 700 N/mm^2. Take E = 2 x 10^5 N/mm^2. **07**

Q.4 **(a)** A cast iron pipe of 40 cm internal diameter and 10 cm thickness carries water under a pressure of 80 kg/cm^2. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. **07**

(b) Write comparison between thin shell and thick shell theory. **07**

OR

Q.4 **(a)** State and explain Lame's theorem. **07**

(b) The maximum stress permitted in a thick cylinder, radii 8 cm, is 12 cm, is 20 N/mm^2, the external pressure is 6 N/mm^2, what internal pressure can be applied? Plot curves showing the variation of hoop and radial stresses through the material. **07**

Q.5 **(a)** A crane hook carries a load of 10 kN, the centre line of load being at a horizontal distance of 40 mm form the inside edge of a horizontal section through the centre of curvature, the centre of curvature being is load line. The horizontal section is a trapezium whose parallel sides are 15 mm and 25 mm and height is 35 mm. Find the stresses developed in the hook. **07**

(b) Write comparison of bending of straight members and bending of curved members. . **07**

OR

Q.5 **(a)** 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**

(b) A uniform thickness flat disc of 800 mm in diameter is shrunk fitted on a solid steel shaft of 160 mm diameter. The shrink fit pressure is 100 MPa. Calculate: (i) Interference allowance, (ii) RPM at which disc will loosen on the shaft, (iii) Stress at the inner radius at half the speed at (ii). **07**

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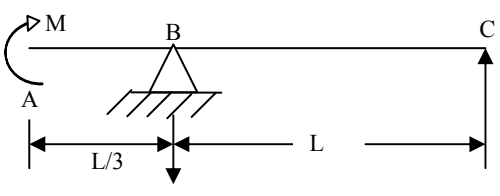
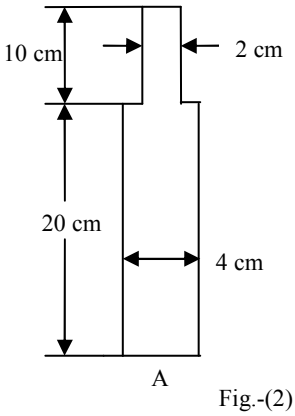


Fig.-(1) Q.1(a)



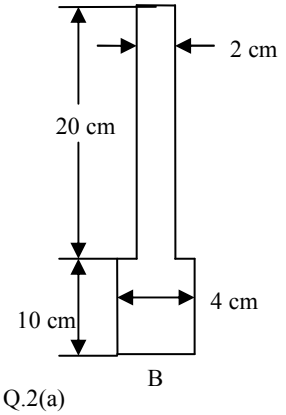


Fig.-(2) Q.2(a)