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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 140201 **Date: 08/06/2017**

Subject Name: Mechanics of Deformable Bodies

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)** A hollow shaft having diameter ratio 0.8 transmits 500 kW with angular velocity of 25 rad/sec. Determine the external diameter of the shaft if the shear strain due to torsion is not to exceed 0.001. The maximum torque is likely to exceed mean-torque by 20%. Take G = 80 kN/mm^2 . **07**

(b) Explain stress distribution in column and Derive equation for maximum and minimum stress in rectangular section. **07**

Q.2 **(a)** Explain following terms for cylindrical shaft: **07**

(i) Twisting moment (ii) Angle of twist (iii) Torsional rigidity.

(b) A rectangular column section ABCD having side AB = CD = 400 mm and BC = AD = 300 mm carries a compressive load of 300 kN at corner B. Find stress at each corner A, B, C & D and draw stress – distribution diagram for each side. **07**

OR

(b) A short column rectangular section 250 mm X 200 mm is subjected to a load of 400 kN at a point 50mm from longer side and 100 mm from shorter side. Find maximum and minimum stresses in the column. **07**

Q.3 **(a)** A beam simply supported over a span of 6m is carrying a point load 50 kN at 1.20 m from right hand support. Find the position and amount of maximum deflection. Also calculate deflection at mid span. Take EI = 20,000 kN.m^2. **07**

(b) A beam of span 4 m is simply supported at the ends and loaded as shown in fig. Using Macaulay's method, determine the slope at end A and deflection under C. Take EI= 2 X 10^3 kN.m^2. **07**

OR

Q.3 **(a)** A rectangular retaining wall section is 2 m wide, It retains water up to full height. Find minimum height required for following : **07**

(a) When it is just at the point of overturning.
(b) When it is just on the point of sliding.
(c) If no tensile stress is produced at the base of section.

The density of wall material & water is 22 kN/m^3 and 10 kN/m^3 respectively and take co-efficient of friction as 0.5.

(b) A steel beam is loaded as shown in figure. P = 50 kN and M_A = 150 kN.m. Determine slope and deflection at end C. Take E = 200 kN/mm^2, I = 390 X 10^6 mm^4. The spring at B has a stiffness of 4 kN. **07**

Q.4 **(a)** Derive an equation for euler's crippling load when both ends of the column are hinged and also write down the assumptions of euler's formula. **07**

(b) An 'I' section has 260 mm depth and 120 mm width. Thickness of flange and web is 10mm. It is used as a column with one end fixed and other hinged. Using Euler's formula determine safe load. E = 2 X 10^5 N/mm^2 , F.O.S. = 3. Length of column is 8.0 m. **07**

OR

Q.4 **(a)** Write down Graphical methods for locating principal axes and explain briefly any one method. **07**

(b) A beam circular in plan is loaded with uniformly distributed load of 140 kN/m inclusive of self weight. The radius of the beam is 5 m. The beam is supported by six symmetrically placed columns. Draw S.F., B.M. and T.M. diagram for one of the spans. **07**

Q.5 **(a)** A curved beam of circular cross section of 40 mm diameter is subjected to pure bending moment of 400 N.m. The mean radius of curvature is 50 mm. Calculate maximum tensile and compressive stresses. Also find the position of neutral axis. **07**

(b) A central horizontal section of a hook is a symmetrical trapezium 60 mm deep, the inner width being 60 mm and the outer width being 30 mm. Estimate the extreme intensities of stress when the hook carries a load of 27 kN, the load line passing 40 mm from the inside edge of the section and centre of section of curvature being in the load line. Also, plot the stress distribution across the section. **07**

OR

Q.5 **(a)** Write down various types of welded joints with brief explanation and give difference between riveted and welded joints. **07**

(b) A single riveted double cover butt joint in plate 16 mm thick is made with 23.5 mm finished diameter rivets at a pitch of 100 mm. If the allowable tensile stress 150 N/mm^2, bearing stress 300 N/mm^2 and shearing stress 100 N/mm^2, find efficiency of the joint. **07**

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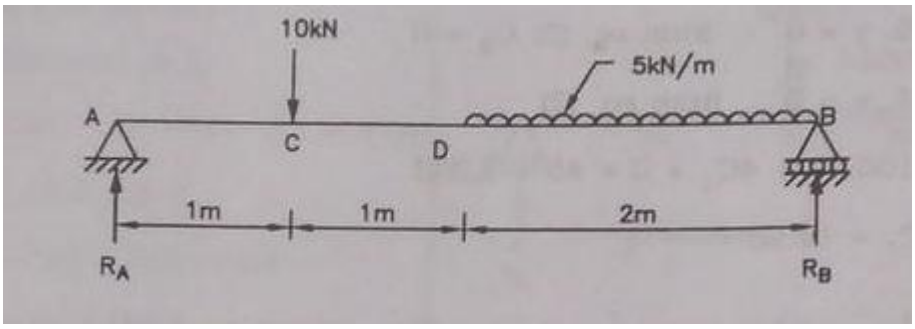
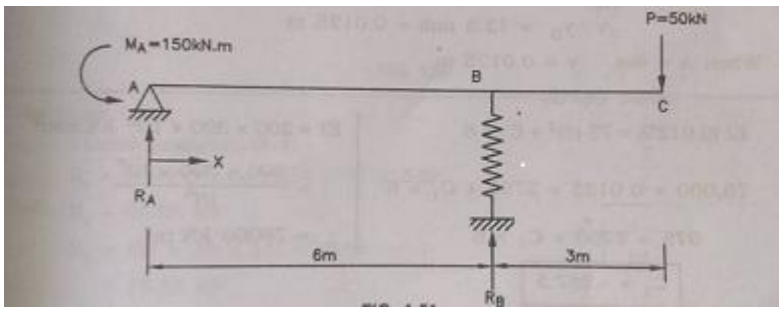


Q :- 3 (b)



Q :- 3 (b) (OR)