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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEMESTER-III(Equivalency).EXAMINATION – WINTER 2016

Subject Code: 140605 **Date:13/01/2017**

Subject Name: 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) Fill in the blanks **07**

1. Maximum strain energy which can be stored in a body at elastic limit is called _____.
   (a) Proof resilience, (b) Modulus of Resilience, (c) Resilience
2. The stress due to suddenly applied load as compared to the stress due to the same load gradually applied to the same rod is _____.
   (a) Half, (b) same, (c) double
3. The shear stress is maximum at the neutral axis for a rectangular section and is given by, Maximum shear stress = _____ times average shear stress.
   (a) 1.5, (b) 1.33, (c) 0.5
4. The strain energy of constant thickness & constant width cantilever single leaf spring is _____.
   (a) Volume. $\sigma^2/18E$, (b) Volume. $18E/\sigma^2$, (c) Volume.$18\sigma^2/E$
5. The maximum bending stress of flat spiral spring is _____.
   (a) $bt^2/12M$, (b) $12M/bt^2$, (c) $12b/M\,t^2$
6. The ratio of thickness (t) to internal diameter (d) of thick shell is _____.
   (a) > 1/60, (b) > 1/40, (c) >1/20
7. In curved beam the stress is always zero at _____.
   (a) Bottom of section, (b) Neutral axis, (c) Centroidal axis

(b) Derive the equation of strain energy due to impact loading. **07**

Q.2(a) A weight of 3kN is dropped on to a collar at the lower end of vertical bar 3.5m long and 26mm in diameter. Calculate the maximum height of drop if the maximum instantaneous stress is not to exceed 130 N/mm^2. What is the corresponding instantaneous elongation? Take $E = 2 \times 10^5\ N/mm^2$. **07**

(b) Determine reactions at the support and draw shear force and bending moment diagram for a beam shown in figure 1. (Use Castigliano's second theorem) **07**

OR

(b) Determine reactions at the support in a plane frame shown in figure 2. (Use Castigliano's second theorem.) **07**

Q.3(a) A steel bolt is subjected to a direct pull of 20kN and transverse shear force 15 kN. Calculate the diameter of the bolt using following theories. **07**

1. Maximum principal stress theory
2. Maximum shear stress theory.

Take yield point stress for steel as 250MPa and factor of safety as 2. The Poisson's ratio may be taken as 0.3.

(b) Explain maximum principal strain theory. (ST. Venant's theory) **07**

OR

Q.3(a) A steel rivet is subjected to a tensile load of 15kN and transverse shear force of 4kN. Find the diameter of rivet according to the following theories. **07**

1. Maximum shear stress theory.
2. Distortion energy theory.

Take yield point stress for steel as 200MPa and factor of safety as 2.5. The Poisson's ratio may be taken as 0.25.

(b) A mild steel shaft is subjected to a torque of 5kN.m and a bending moment of 3kN.m. Calculate the diameter of the shaft required if the yield stress of the material is 200MPa and factor of safety is 2. Use principal stress theory. **07**

Q.4(a) A semi elliptic leaf spring 1m long is required to carry a central point load of 10kN. If the central deflection is not to exceed 30mm and the bending stress is not greater than 200MPa, determine thickness, width and number of plates. **07**
Also compute the radius, to which the plates should be curved. Assume width of the plates equal to 12 times its thickness and $E = 2 \times 10^5$ N/mm^2.

(b) A curved beam of circular cross section of 60mm diameter is subjected to pure bending moment of 500N.m. The mean radius of curvature is 50 mm. Calculate maximum tensile and compressive stresses. Also find the position of neutral axis. **07**

OR

Q.4(a) Explain the Lame's theory of thick cylindrical shell. **07**

(b) A curved beam of rectangular section 30 x 60mm is subjected to a pure bending moment of 550N.m. mean radius of curvature is 50 mm. Calculate the maximum and minimum stresses. Also find the position of neutral axis. **07**

Q.5(a) Derive the equation of shear stress distribution for a beam section. **07**

(b) Figure 3 shows a beam cross section subjected to a maximum shear force of 250kN. Sketch the shear stress distribution diagram. Find shear stress value at important points. **07**

OR

Q.5(a) A flywheel with a thin rim of 1m diameter is made of steel with density 7000kg/m^3. What is the maximum speed at which it may be rotated without exceeding 250MPa and how much is the decrease in width and increase in diameter at this speed? Take $E = 2.1 \times 10^5$ MPa. **07**

(b) Define the shear center with sketch and explain its importance. **07**

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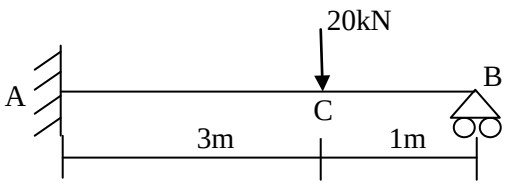
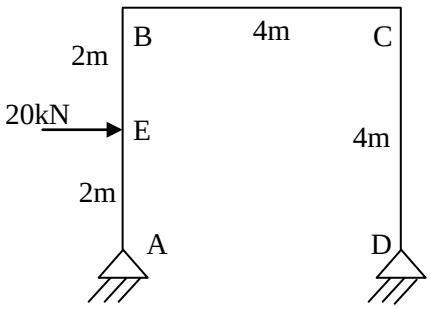


(EI constant)

Figure (1), Q. – 2 (b)



(EI constant)

Figure (2), OR Q. – 2 (b)

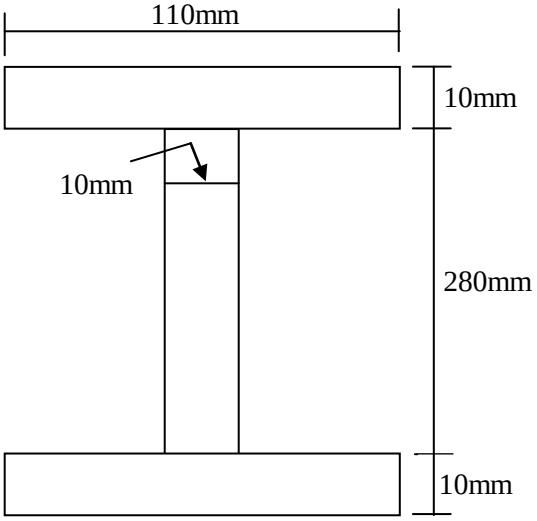


Figure 3

Q.5 (b)