Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (NEW).EXAMINATION – WINTER 2016

Subject Code: 2162001 **Date: 26/10/2016**

Subject Name: Design of Mechanisms - I

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)** Explain the various failure modes, while designing a cotter for socket and spigot joint. Also draw the resisting areas wherever required. **07**

(b) Explain the design procedure in general. **07**

Q.2 **(a)** What is preferred numbers? What is basic series and derived series? Explain this with suitable example. **07**

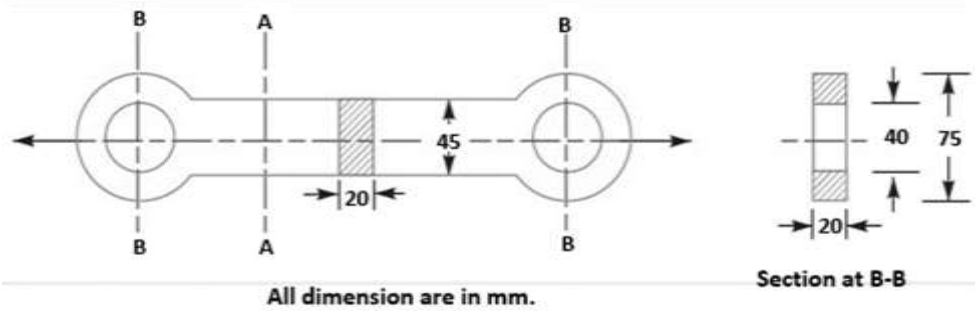
(b) Justify the use of Rankine's formula for short and long column. Derive it. **07**

OR

(b) What is the condition of self- locking of screws? Why efficiency of square threaded screw is less than 50%? **07**

Q.3 **(a)** What is mechanical advantage? Explain the design procedure of cranked lever. **07**

(b) A cast iron link, as shown in figure is required to transmit a steady tensile load of 50kN,find the tensile stress including the link material at sections A-A and B-B. **07**

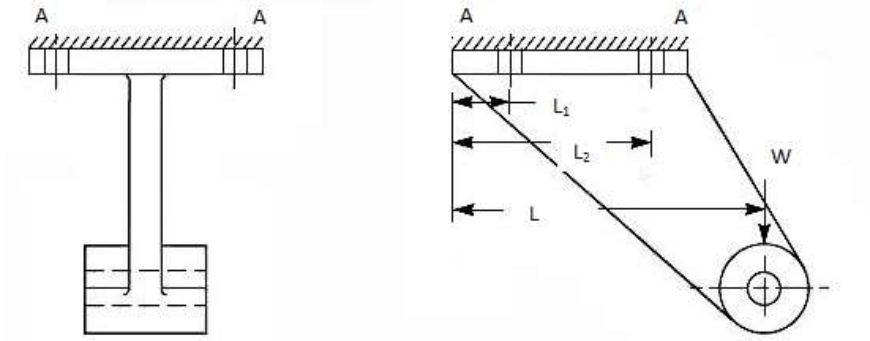


OR

Q.3 **(a)** Mention the various steps to design a push rod. **07**

(b) Explain the design procedure to design a lever of lever loaded safety valve. **07**

Q.4 **(a)** A bracket, as shown in Figure, supports a load of 30 kN by four bolts. Determine the size of bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. The distance are: $L_1 = 80mm, L_2 = 250mm, and\ L = 500mm.$ **07**



(b) What is hoop stress and longitudinal stress in case of thin cylinder? Derive the equations for change in Dimensions of a Thin Cylindrical Shell due to an Internal Pressure. **07**

OR

Q.4 (a) Derive the expression in case of composite spring. The expression must be in terms of spring index and inner and outer spring wire diameter. **07**

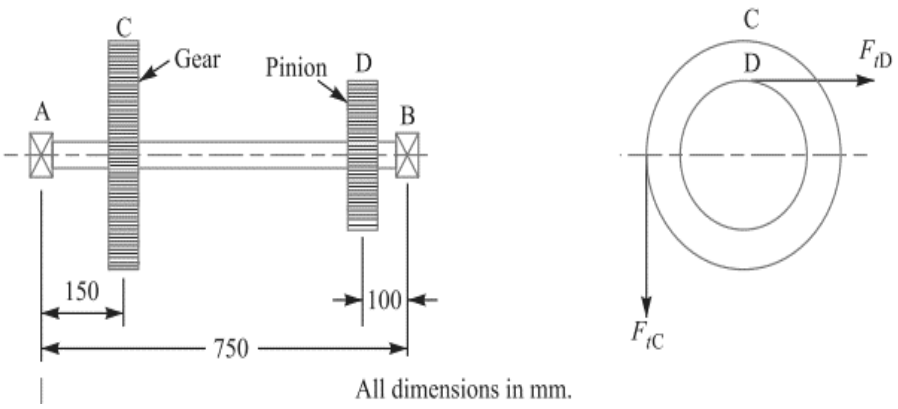
Q.4 (b) A hollow shaft is required to transmit 500 kW at 110 RPM, the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 metres not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is 3/8. Take modulus of rigidity as 84 GPa. **07**

Q.5 (a) Explain what you understand by Wahl's factor and state its importance in the design of helical springs. **07**

(b) A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Find the width and depth of the beam, if depth is twice that of width. **07**

OR

Q.5 Distinguish clearly, giving examples between pin, axle and shaft. A steel solid shaft transmitting 16 kW at 210 RPM is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion D having 150 mm diameter is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear C having 500 mm diameter is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft. **14**



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