

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2162001

Date:17/05/2016

Subject Name: Design of Mechanisms - I

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.

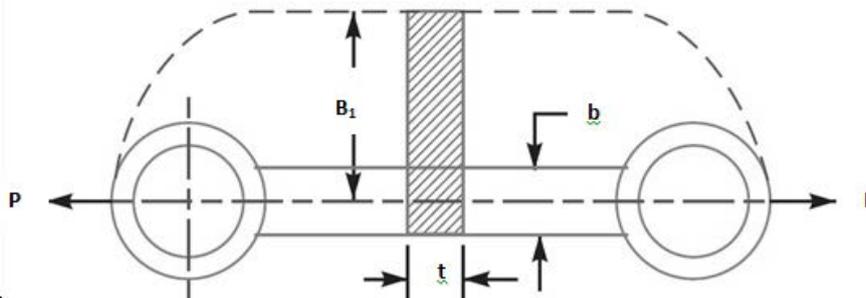
- Q.1** (a) Explain the various failure modes, while designing a pin for knuckle joint. Also draw the resisting areas wherever required. **07**
- (b) Explain the stress concentration? Suggest the remedies for reducing it by stating various cases. **07**

- Q.2** (a) Write a short note on Factor of Safety and preferred numbers. **07**
- (b) Explain the various steps of generalized design procedure. **07**

OR

- (b) Derive the expression for lowering the load by square threaded screws. **07**

- Q.3** (a) What is principal stress? Explain various theories of failure. **07**
- (b) A mild steel link, as shown in fig by full lines, transmits a pull of 80 kN. Find the dimensions b and t if $b=3t$. Assume the permissible tensile stress as 70 MPa. If the original link is replaced by an unsymmetrical one, as shown by dotted lines in fig, having the same thickness t , find the depth b_1 , using the same permissible stress as before. **07**

**OR**

- Q.3** (a) What is slenderness ratio? What are end fixity coefficients? Explain various cases of it by stating the value of coefficient. **07**
- (b) Explain Euler's column theory with assumptions and limitations. **07**

- Q.4** (a) Briefly explain the hoop and longitudinal stresses in context of thin cylinder. **04**
- (b) Design a complete spigot and socket type cotter joint for following data: **10**
 $P = 30$ KN, Allowable tensile stress = 80 MPa. Shear stress is equal to $4/5$ of allowable tensile stress, Permissible crushing stress = 120 MPa. Cotter is safe in bending.

OR

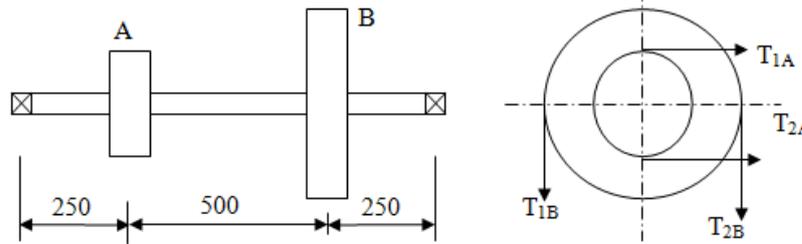
- Q.4** (a) Explain the bolts of uniform strength. State various methodologies to **07**

obtain the uniform strength.

- Q.4 (b)** Design a helical compression spring for a maximum load of 1500 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm². **07**

- Q.5 (a)** Mention the various failures during key design. Explain it with a simple case and sketches. **04**

- (b)** A line shaft carries two pulleys A and B as shown in the following figure. **10**
 The diameter of pulley A is 360 mm, and that of pulley B is 500 mm. The maximum tension in either belt is 2.5 kN and the ratio of tensions for both pulleys belt drive is 2.5:1. The shaft is made of 45C8 steel having ultimate tensile stress = 630 MPa and yield point tensile stress = 380 MPa. Take f.o.s. 3. The pulleys are keyed to the shaft. If the shock and fatigue factors are $k_t = 1$ and $k_m = 1.5$, find the diameter of the shaft.



OR

- Q.5 (a)** A right angled bell lever is used to raise a load of 8 kN at the end of shorter arm, which is 150 mm long. The mechanical advantage of the lever is 1.8. If the allowable stresses for lever and pin are $\sigma_t = 100$ N/mm² and $\tau = 80$ N/mm², $P_b = 20$ MPa for pin, design the lever completely. Take l/d for pin = 1.25 and use concept of interchangeability. Given $t = 3/8 h$. **07**

- (b)** What is mechanical advantage? Explain various types of levers in context of mechanical advantage with sketches. **07**
