

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) - EXAMINATION – SUMMER 2016****Subject Code:2152508****Date:09/05/2016****Subject Name:Design of Machine Elements****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 following terms. **07**
 (I) Notch sensitivity, (II) Surface finish factor, (III) Endurance limit, (IV) Size factor
- (b) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**
- Q.2** (a) Define the following terms: **07**
 (i) Spring Rate, (ii) Free Length, (iii) Solid Length, (iv) Spring Index, (v) Active and Inactive coil, (vi) Stress factor (vii) Nipping of Spring.
- (b) Design a helical compression spring for a maximum load of 1000 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. Take Wahl's factor, $K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$, Where C=Spring index. **07**
- OR**
- (b) What do you mean by overhauling and self locking screws? Show that the efficiency of self locking screw is less than 50% **07**
- Q.3** (a) Classify the Pressure vessels. **07**
 Explain (1) Circumferential or Hoop Stress. (2) Longitudinal Stress.
- (b) A Cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the tangential and radial stresses at the inner, middle (radius = 125 mm) and outer surfaces. **07**
- OR**
- Q.3** (a) An engine developing 45 kW at 1000 r.p.m. is fitted with a cone clutch built inside the fly wheel. The cone has a face angle of 12.5° and a maximum mean diameter of 500mm. The co-efficient of friction is 0.2. The normal pressure on the clutch face is not to exceed 0.1 N/mm². Determine (a) The face width required (b) The axial spring force necessary to engage the clutch. **07**
- (b) Describe with the help of a neat sketch the principal of operation of an internal expanding shoe brake. **07**
- Q.4** (a) Prove that the ratio of the driving tensions on the two sides of a pulley is **07**

$$\frac{T_1}{T_2} = e^{\mu\theta}$$
 where,
 T₁ = Tension in the tight side of the belt,
 T₂ = Tension in the slack side of the belt,
 Θ = Angle of contact in radians,
 μ = Coefficient of friction between the belt and the pulley.

- (b) Prove that the maximum fluctuation of energy $\Delta E = E * 2 C_s$ **07**
Where E is mean kinetic energy of the flywheel and C_s is coefficient of fluctuation of speed.

OR

- Q.4 (a)** Explain the phenomenon of interference in involute gears. What are the conditions to be satisfied in order to avoid interference? **07**

- (b) A helical cast steel gear with 30° helix angle has to transmit 35kw at 1500r.p.m. **07**
If the gear has 24 teeth, Determine necessary module, pitch circle diameter and face width for 20° full depth teeth. The static stress may be taken as 56 N/mm². The width of the face may be taken as 3 times The normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as $0.154 - \frac{0.912}{T_E}$, Where T_E represents the equal number of teeth.

- Q.5 (a)** Explain terms used in Bevel gear with neat sketch. **07**

- (b) A triple threaded worm has teeth of 6 mm module and pitch circle diameter of 50 mm. If the worm gear has 30 teeth of 14.5° and the coefficient of friction of the worm gearing is 0.05. Find 1.The lead angle of the worm, 2.Velocity ratio, 3.Centre distance and 4.Efficiency of the worm gearing. **07**

OR

- Q.5 (a)** Explain the terms used in Gears with sketch. **07**

- (b) Describe with the help of neat sketch, a centrifugal clutch and deduce an expression for the total frictional torque transmitted. How the shoes are designed for such a clutch? **07**
