

**Roll No.**

**Total No. of Pages : 03**

**Total No. of Questions : 07**

**B.Tech.(ME) (2011 onwards) (Sem.-6)**  
**DESIGN OF MACHINE ELEMENTS-II**

**Subject Code : BTME-601**

**Paper ID : [A2361]**

**Time : 3 Hrs.**

**Max. Marks : 60**

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying TEN marks each and students has to attempt any FOUR questions.
3. All dimensions indicate in figures are in mm.

## SECTION-A

1. Write briefly :
  - (a) Mention four important types of gears and their applications
  - (b) What is Backlash in gear tooth?
  - (c) What is a self energizing block brake? When a block brake becomes self locking?
  - (d) Why is semi cone angle of cone clutch preferably taken as  $12.5^\circ$  ?
  - (e) Which correction factors are used to modify belt maximum stress?
  - (f) What is the advantage of pivoted shoe brake over fixed shoe brake?
  - (g) What is the polygonal action in roller chain? How will you reduce it?
  - (h) What is the curvature effect in a helical spring? How does it vary with spring index?
  - (i) Explain the difference between sliding contact and roller contact bearings.
  - (j) What types of stresses are developed in the rim of a flywheel during operation?

## SECTION-B

2. A single dry plate clutch is to be designed to transmit 7.5 kW at 900 r.p.m. Find:  
(a) Diameter of the shaft,

- (b) Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4.
- (c) Outer and inner radii of the clutch plate, and
- (d) Dimensions of the spring, assuming that the number of springs = 6 and spring index = 6. The allowable shear stress for the spring wire may be taken as 420 MPa.
3. A safety valve of 60 mm diameter is to blow off at a pressure of 1.2 N/mm<sup>2</sup>. It is held on its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm<sup>2</sup>. Calculate: (a). Diameter of the spring wire (b). Mean coil diameter (c). Number of active turns (d). Pitch of the coil.
4. (a) Explain the principle of working of hydrodynamic journal bearing with the help of a neat sketch.
- (b) What are commonly used materials for sliding contact bearings? State the desirable properties of materials used for sliding contact bearings.
5. It is required to design a chain drive to connect 5 kW, 1400 rpm electric motor to a drilling machine. The speed reduction is 3:1. The centre distance should be approximately 500 mm.
- (a) Select a proper roller chain for the drive.
- (b) Determine the number of chain links.
- (c) Specify the correct centre distance between the axes of sprockets.
6. A helical cast steel gear with 25° helix angle has to transmit 35 kW at 2000 rpm. If the gear has 25 teeth, find the necessary module, pitch diameter, face width and end thrust on the gear for 20° full depth involute teeth. The static stress for cast steel may be taken as 100 MPa. The face width may be taken as 3 times the normal pitch. The tooth form factor is given by the expression

$$y = 0.154 - \frac{0.912}{T_E},$$

where  $T_E$  represents the equivalent number of teeth. The velocity factor is given

by  $C_v = \frac{6}{6 + v}$ , where  $v$  is the peripheral speed of the gear in m/s.

7. Figure shows a brake with only one shoe, being applied by a 1.5-kN force. Four seconds after force  $F$  is applied, the drum comes to a stop. During this time the drum makes 110 revolutions. Use the short-shoe approximation and an estimated coefficient of friction of 0.35.

- (a) What is the magnitude of the torque developed by the brake?  
(b) How much work does the brake do in bringing the drum to a stop?  
(c) What is the average braking power during the 4-second interval?

