

Code: ME6T2

**III B.Tech - II Semester – Regular /Supplementary Examinations March 2018**

**DESIGN OF MACHINE MEMBERS-II  
(MECHANICAL ENGINEERING)**

Design data books are allowed.

Assume any missing data appropriately and state it clearly.

Duration: 3 hours

Max. Marks: 70

**PART – A**

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1.

- a) Define equivalent torsional moment and equivalent bending moment.
- b) What are the standard dimensions of sunk key with respect to the shaft diameter? Sketch the sunk key.
- c) What is the difference between rigid and flexible couplings?
- d) What is bearing characteristic number as applied to the journal bearing?
- e) Briefly explain the various types of belt drives.
- f) What are the types of failures in roller chain?
- g) What are the various stresses induced in wire rope?
- h) What are the required characteristics for bearing materials?
- i) Define i) Tip circle, ii) Root circle, iii) pitch circle.
- j) Write a short note on herringbone gears.
- k) What is the full involute gear tooth system?

## PART – B

Answer any *THREE* questions. All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of lap of the belt is  $180^\circ$  and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. 8 M

b) Design a muff coupling to connect two steel shafts transmitting 25 kW power at 360 rpm. The shaft and key are made of plain carbon steel 30C8 ( $S_{yt} = S_{yc} = 400 \text{ N/mm}^2$ ). The sleeve is made of grey cast iron FG 200 ( $S_{ut} = 200 \text{ N/mm}^2$ ). The factor safety for the shaft and key is 4. For sleeve, the factor of safety is 6 based on ultimate strength. 8 M

3. a) Design a journal bearing for a centrifugal pump from the following data:

Load on the journal = 20000 N;

Speed of the journal = 900 rpm;

Type of oil is SAE 10, for which the absolute viscosity at  $55^{\circ}\text{C} = 0.017 \text{ kg / m-s}$ ;

Ambient temperature of oil =  $15.5^{\circ}\text{C}$ ;

Maximum bearing pressure for the pump =  $1.5 \text{ N / mm}^2$ .

Calculate also the mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to  $10^{\circ}\text{C}$ . Heat dissipation coefficient =  $1232 \text{ W/m}^2/^{\circ}\text{C}$ . 8 M

b) Select a suitable ball bearing for this application. A single row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life  $L_{10h}$  of the bearing is 20,000 hr. The minimum acceptable diameter of the shaft is 75mm. 8 M

4. a) Explain with the help of neat sketches, the types of various flat belt drives. 4 M

- b) A V-belt drive is required for a 15 kW, 1440 rpm electric motor, which drives a centrifugal pump running at 360 rpm for a service of 24 hours per day. From space considerations, the centre distance should be approximately 1 m. Determine,
- i) Belt specifications;
  - ii) Number of belts; and
  - iii) Correct centre distance. 12 M

5. a) What is self locking screw? In what conditions, a power screw will become a self locking screw? 4 M

- b) A screw jack carries a load of 22 kN. Assuming the coefficient of friction between screw and nut as 0.15, design the screw and nut. Neglect collar friction and column action. The permissible compressive and shear stresses in the screw should not exceed 42 MPa and 28 MPa respectively. The shear stress in the nut should not exceed 21 MPa. The bearing pressure on the nut is  $14 \text{ N/mm}^2$ . Also determine the effort required at the handle of 200 mm length in order to raise and lower the load. What will be the efficiency of screw? 12 M

6. Design a helical gear drive to transmit the power of 20 h.p. speed ratio 6, pinion speed 1200 rpm, helix angle is  $25^\circ$ . Select suitable materials and design the gear. 16 M