

B.TECH. DEGREE EXAMINATION, DECEMBER 2012**Eighth Semester**

Branch : Mechanical Engineering

MACHINE DESIGN AND DRAWING – II (M)

(Supplementary / Mercy Chance)

Time : Three Hours

Maximum : 100 Marks

*Answer any two questions from Part A and Part B.**Design databook is permitted.**Missing data may be assumed.***Part A**

1. (a) What is Lewis form factor? How does it vary with number of teeth on gear?
- (b) A pair of spur gear 20° full depth involute teeth is to be designed RPM of input shaft is 1000 and it receives 8 kW power. The speed of gear shaft is reduced to 250 r.p.m. Pinion and shaft are made of steel with $\sigma_{gp} = 600$ MPa. Service factor is 1.5 and factor of safety is 2.

(5 + 20 = 25 marks)

2. (a) What are merits and demerits of helical gears over spur gears?
- (b) A pair of helical gears with speed ratio 2.6 is to be designed. Following data is given :

Speed of pinion = 520 r.p.m.

Power to be transmitted = 8 kW.

Gear surfaces are heat treated to 400 B HN.

Service factor = 1.5.

Factor of safety = 2.

 σ_{yp} of material = 600 MPa.

Design the drive.

(5 + 20 = 25 marks)

Or

Turn over

3. (a) What is the difference between velocity factor for a bevel gear teeth cut on milling machine and bevel gear teeth generated on a machine?
- (b) A pair of bevel gear with $Z_p = 25$, $Z_g = 50$ has module of 5 mm. and face width of 40 mm. Ultimate strength of gear material is 450 MPa. Determine beam strength of gear. Suggest suitable hardness of gears.
4. (a) What are the most commonly used materials for worm and gear wheel?
- (b) A worm and worm wheel set is designated by 2/54/10/8. The effective surface area of gear housing is 1.8 m^2 and heat transfer coefficient is $16 \text{ W/m}^2 \text{ }^\circ\text{C}$. If the ambient temperature 25° C . Work shaft runs at 1000 r.p.m. Power transmitted through worm is 4 kW then what is the rise in temperature of lubricating oil.

(5 + 20 = 25 marks)

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[2 × 25 = 50 marks]

Part B

5. (a) What is the difference between thick film and thin film lubrication?
- (b) The following data is given for a 360° hydrodynamic bearing

Radial load = 3.6 kN

Journal diameter = 55 mm

Bearing length = 27.5 mm

Radial clearance = 0.05 mm

Viscosity of lubricant = 25 CP.

Sommerfeld number of bearing is 0.0923.

Determine (i) Journal speed ; (ii) Coefficient of friction ; (iii) Power loss in friction ; (iv) Flow requirement ; (v) Temperature rise.

(5 + 20 = 25 marks)

6. A single row deep groove ball bearing has a dynamic load capacity of 12,400 N and operates at the following cycle :

- (a) Radial load 4,000 N at 500 r.p.m. for 25% of time.
- (b) Radial load of 8,000 N at 600 r.p.m. for 25% of time.
- (c) Radial load of 6,000 N at 720 r.p.m. for 50% of time.

Calculate the life of the bearing.

(25 marks)

7. (a) Explain how $L_{50} = 5 L_{90}$ for a ball bearing.
(b) A ball bearing carries a radial load of 3.5 kN and is to be designed for 6,000 hours of operation at 1400 r.p.m. with a reliability of 98%. Select the bearing.

(5 + 20 = 25 marks)

8. Design an impeller of a centrifugal pump to lift water from a sump to a reservoir with the following data :

Discharge = 50 litres/sec.

Suction head = 2.5 m

Delivery head = 9.5 m

Length of suction pipe (total) = 8 m.

Length of delivery pipe = 50 m.

Number of bends in delivery branch = 1

Number of bends in suction branch = 1

Specific speed = 1000 r.p.m.

Suction pipe diameter = 15 cm.

Delivery pipe diameter = 20 cm.

Design should include (a) Total head ; (b) Speed of impeller ; (c) Impeller diameters and breadths at inlet and outlet ; (d) Inlet and exit angles of vane.

Take number of vanes as 6 and manometric efficiency as 80%, coefficient of friction = .007.

(25 marks)

[2 × 25 = 50 marks]