

Total No. of Questions : 10]

SEAT No. :

**P3573**

[Total No. of Pages : 4

**[5560] - 517**

**T. E. (Mechanical)**

**DESIGN OF MACHINE ELEMENTS - II**

**(2015 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q No.1 or Q No.2, Q No.3 or Q No.4, Q No.5 or Q No.6, Q No.7 or Q No.8, Q No.9 or Q No.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** What are the considerations while selecting the facewidth for a gear tooth? **[3]**

b) A pair of involute spur gears consisting a 20 teeth pinion meshing with 40 teeth gear Both the gears are made of steel with ultimate tensile strength 480 MPa. The static load on pinion is 1234 N while the dynamic load on the gears is 936 N. The service factor may be taken as 1.5. Both the gears are hardened to 400 BHN. Taking lewis form factor of 0.32 for pinion, module 3 mm and face width twelve times the module determine the factor of safety in bending and pitting. **[7]**

OR

**Q2) a)** What is bevel factor? Explain the significance of the same. **[4]**

b) A pair of parallel helical gears made of plain carbon steel consists of a 20 teeth pinion and 60 teeth gear. The material for pinion and gear have ultimate tensile strength 720 N/mm<sup>2</sup>. The normal module of the gear is 3 and face width 32 mm. Find the static load and power transmitted by this pair based on lewis equation, consider service factor 1.5 and factor of safety 2, barth factor 0.623 & lewis form factor 0.32. **[6]**

**P.T.O.**

- Q3) a)** Derive an expression for virtual number of teeth on a helical gear. [4]
- b)** A pair of straight teeth bevel has a 20 teeth pinion meshing with a 36 teeth gear and transmitting power at right angles. Pinion receives power 3 KW at 1500 rpm. Gears are made of steel with ultimate tensile strength 400 MPa. Determine the factor of safety based on Lewis equation taking Barth factor 0.33712, service factor 1.5 and bevel factor 0.72265, Lewis form factor 0.342. Gears have a module 4 mm and face width 32 mm. [6]

OR

- Q4) a)** Describe following terms (Any two): [4]
- i) Static load carrying capacity
  - ii) Dynamic load carrying capacity
  - iii) Rated life of bearing
- b)** A single row - deep groove ball bearing is subjected to a radial load of 5 kN and thrust load of 2 kN. The radial and thrust factors may be taken as 0.56 and 1.5 respectively. The shaft rotates at 1500 rpm. The diameter of the shaft 75 mm and bearing 6315 with  $c = 112000$  N is selected for this application. Estimate. [6]
- i) Life of bearing with 90% reliability
  - ii) Reliability for 20000 hours life.

- Q5) a)** Explain single and double enveloping worm with neat sketch. [6]
- b)** A worm gear box with an effective surface area of  $1.5 \text{ m}^2$  is operating in still air with a heat transfer coefficient of  $15 \text{ W/m}^2 \text{ }^\circ\text{C}$ . The temperature rise of the lubricating oil above the atmospheric temperature is limited to  $50 \text{ }^\circ\text{C}$ . The worm gears are designated as 1/40/10/4. The worm shaft is rotating at 1440 rpm and normal pressure angle is  $20^\circ$ . Calculate the Power transmitting capacity based on the thermal considerations and the forces acting on a worm and worm gear teeth. [10]

OR

- Q6) a)** What is irreversibility of worm gear drives? How it is achieved? [4]
- b)** A pair of worm and worm wheel is designated as 2/52/10/4. Worm receives 5 kW Power at 720 rpm. The coefficient of friction may be taken as 0.03 and the pressure angle is  $20^\circ$ . Calculate the tangential, axial and radial components of the resultant gear tooth force acting on the worm wheel. If worm rotates in counter clockwise direction seen from left worm is situated below worm gear. Represent the directions of the tooth forces on a neat sketch. [12]

- Q7) a)** Explain the selection of flat belt from manufacturer's catalogue. **[8]**
- b)** The following data is given for an open type v belt drive.
- Diameter of driving pulley 50 mm  
Diameter of driven pulley 300 mm  
Centre distance 1m  
groove angle  $40^\circ$ , mass of belt 0.25 kg/m.  
Maximum permissible tension 750N.  
Coefficient of friction 0.18  
Calculate the maximum power transmitted by the belt and corresponding belt velocity Neglect power losses. **[10]**

OR

- Q8) a)** Describe various types of chains along with the neat sketch, applications. **[6]**
- b)** Explain following. **[12]**
- i) Belt tensioning methods  
ii) Wire rope construction  
iii) Ribbed v belts
- Q9) a)** Describe various desirable properties of bearing materials. **[4]**
- b)** The following data is given for a  $360^\circ$  hydrodynamic bearing. **[12]**
- Radial load 3.2 kN  
Journal speed 1500 rpm  
Diameter of journal 50 mm  
Length of bearing 50 mm  
Radial clearance 0.05 mm  
Viscosity of lubricant 30 cp.  
Assuming that the total heat generated is carried away by the lubricant calculate
- i) Coefficient of friction  
ii) Power lost in friction  
iii) Minimum oil film thickness  
iv) Flow requirement in litres / min  
v) Temperature rise  
Use Table 1 data

OR

**Q10) a)** Following data is given for 360° hydrodynamic bearing **[12]**

Radial load 8 kN

Journal speed 1200rpm

Journal diameter and 60 mm

length of bearing

Minimum oil film thickness 0.009 mm

The class of fit is H > e > (fine) running fit specify the viscosity of the lubricant for this application. Use the data from Table 1

TABLE 1

$\frac{1}{d}$	$\epsilon$	$\frac{ho}{c}$	s	$\left(\frac{r}{c}\right)f$	$\frac{Q}{rcn_s l}$	$\frac{Qs}{Q}$
	0.4	0.6	0.264	5.79	3.99	0.497
	0.6	0.4	0.121	3.22	4.33	0.680
	0.8	0.2	0.0446	1.70	4.62	0.842

**b)** Explain various bearing design parameters. **[4]**

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