

**B.TECH SEM – VI (2007 COURSE) (MECHANICAL ENGG.) :**

**WINTER - 2017**

**SUBJECT: MACHINE DESIGN – II**

Day: **Tuesday**  
Date: **21/11/2017**

**W-2017-2525**

**10.00 AM TO 02.00 PM**  
Time:  
Max. Marks: 80

**N.B.:**

- 1) **Q. No. 1 and Q. No. 5 are COMPULSORY.** Out of the remaining attempt any **TWO** questions from each section.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SEPARATE** answer book.

**SECTION-I**

- Q.1** a) Explain advantages and disadvantages of metal cutting process. **(05)**
- b) What are the advantages of Gear drive over belt drive? **(05)**
- c) Draw a neat sketch of “components of tooth force” in helical gear. **(04)**
- Q.2** a) What are the factors one has to consider while designing a casting components explain with suitable example? **(07)**
- b) Explain the following factor in Design for manufacturing and assembly **(06)**  
(DFMA).  
i) Reduce the part count  
ii) Use of modular design  
iii) Eliminate fasteners
- Q.3** Design a pair of spur gears with  $20^\circ$  full depth involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10kw, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4:1. The pinion as well as the gear are made of plain carbon steel 40C8 ( $\sigma_{ut} = 600N/mm^2$ ). The factor of safety may be taken as 1.5. Compute dimensions of gears and suggest suitable surface hardness for the gears. Consider No of teeth on pinion = 18, Lewis form factor  $Y = 0.308$ ,  $b/m = 10$ ,  $C_s$  (Service factor) = 1.5. **(13)**
- Q.4** A helical gear pair consists of 18 teeth pinion meshing with 100 teeth gear. The pinion rotates at 800rpm. The normal pressure angle is  $22^\circ$ , while the helix angle is  $27^\circ$ . The face width is 45 mm and the normal module is 5mm. The pinion as well as the gear is made of steel 40C8,  $S_{ut} = 650N/mm^2$  and heat treated to a surface hardness of 250 BHN. The service factor and the factor of safety are 2 and 2.5 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. Take Lewis form factor  $Y = 0.3475$ . **(13)**

**P. T. O.**

**SECTION-II**

- Q.5** a) What are the advantages and disadvantages of Taper per roller bearing? **(04)**
- b) What is coefficient of friction on what factor it depends? **(04)**
- c) Compare between rolling and sliding contact bearing. **(06)**

- Q.6** Following data is given for a 360° hydrodynamic bearing **(13)**  
 Radial load = 15kN  
 Journal speed = 1500 rpm, unit bearing pressure = 1200kPa.  
 Clearance ratio (r/c) = 800, viscosity of lubricant = 40m Pas. Assume that the total heat generated in the bearing is carried by the total oil flow in the bearing,  
 $\left(\frac{l}{d} = 1\right)$ ,  $CFV$  (coefficient of friction variable) = 8.93,  $FV$  (flow variable) = 3.64.  
 Assume coefficient of friction(f) = 0.117, Calculate  
 i) Dimensions of bearing,  
 ii) Coefficient of friction,  
 iii) Power lost in friction  
 iv) Total flow of oil,  
 v) Side leakage,  
 vi) Temperature rise.

- Q.7** A single row deep groove ball bearing is subjected to a 40 seconds work cycle **(13)**  
 that consists of following two parts.

	<b>Part I</b>	<b>Part - II</b>
Duration (s)	12	24
Radial load ( kN)	44	15
Axial load (kN)	13	7
Speed (rpm)	750	1440

The static and dynamic load capacities of ball bearing are 50 and 70kN respectively. Calculate the expected type of the bearings in hours.

Assume  $e = 0.37$  for  $\frac{f_a}{f_r} < e$  and  $e = 0.31$  for  $\frac{f_a}{f_r} > e$   $X = 1, Y = 0$ .

- Q.8** a) Explain Adhesive and Abrasive wear with suitable example. **(10)**
- b) What is rolling friction? **(05)**

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