Total No. of Questions : 6] **SEAT No. :**

P481

[Total No. of Pages : 3

TE/Insem/APR - 7
T.E. (Mech.)
DESIGN OF MACHINE ELEMENTS - II
(2012 Pattern) (Semester - II)

Time : 1½ Hour] ***[Max. Marks : 30***

Instructions to the candidates :

1) ***Answer any 3 questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) In Gear speed reducer, why is the diameter of an output shaft is greater than input shaft. **[4]**

b) A pair of spur gears with 20° pressure angle, consists of 25 teeth pinion meshing with 60 teeth gear. The module is 5 mm, while the face width is 45 mm. The pinion rotates at 500 rpm. The gears are made of steel & heat treated to a surface hardness of 220 BHN. Assume that dynamic load is accounted by means of velocity factor. The service factor and factor of safety are 1.75 & 2 respectively. **[6]**

Calculate :-

i) Wear strength

ii) Static load that gears can transmit without pitting.

iii) Rated power that can be transmitted by gears.

OR

Q2) A spur pinion having 20 teeth having S_{ut} = 580 MPa is to be mesh with gear having 85 teeth (S_{ut} = 260 MPa). The pinion is connected to motor running at 1440 rpm electric motor having a power of 15 kW. The starting torque is twice the rated torque. The tooth system is 20° full depth involute. The face width is 12 times module for which load distribution factor is 1.4. The gears are machined to meet the specification of grade 7. Assume C.e = 240 N/mm.

P.T.O.

a) Assuming FOS for bending as 1.5, Design the gear pair by using velocity factor $\left(C_v = \frac{6}{6+v}\right)$ and Buckingham's equation for dynamic load.

b) If the FOS required against pitting failure is 2.0 specify the surface hardness. **[10]**

Q3) a) Derive the expression for beam strength of straight bevel gear. **[4]**

b) A pair of parallel helical gears consists of 20 teeth pinion meshing with 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle is 25°. The face width is 40 mm & normal module is 4 mm. The pinion & gear having S_{ut} = 600 MPa & BHN of 300. The service factor and FOS are 1.5 & 2 respectively. Assume Barth's factor for dynamic load calculate power transmitting capacity of gears.**[6]**

OR

Q4) A pair of straight bevel gears mounted on shafts which are intersecting at right angles, consists of 24 teeth pinion meshing with 32 teeth gear. The pinion is connected to electric motor having rated power of 12.5 kW. The motor shaft running at 1440 rpm having starting torque 150% rated torque. The pressure angle is 20°. Both gears are made of case hardened steel having S_{ut} = 750 N/mm^2. The teeths are generated & finished by grinding & lapping process to meet the specification of grade - 3. The FOS is assumed to be 2 in preliminary stages. e = 125 microns calculate **[10]**

a) Beam strength by assuming velocity factor v = 7.5 m/s.

b) Calculate gear dimensions.

c) Correct FOS on account of Buckingham's equation.

d) Specify surface Hardness.

Q5) a) Why ball and roller bearings called as "antifriction Bearings". **[2]**

b) A ball bearing is subjected to radial force of 2500 N and axial force of 1000 N. The dynamic load carrying capacity of bearing is 7350 N. The values of X & Y factors are 0.56 & 1.6 respectively. The shaft is rotating at 720 rpm. Calculate the Life of Bearing. **[8]**

OR

Q6) A single-row deep groove ball bearing subjected to a radial force of 8 kN and thrust force of 3 kN. The values of X & Y factors are 0.6 & 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of the shaft is 75 mm. Bearing No. 6315 having C = 112000 N is selected for this application.

a) Estimate the life of this bearing with 90% reliability.

b) Estimate the reliability for 20000 hrs. life. **[10]**

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