

Mech

College of Engineering, Pune
(T.Y.B. Tech.)- (MECHANICAL)
(ME-311)- (Machine Design-II)

Date-04/5/2013
 Academic Year: 2012- 13

Timing: 3 hrs
 Max. Marks: 50

END SEM EXAM

Instructions:

1. All questions are compulsory
2. Assume suitable data if necessary.
3. Figures to the right indicate full marks.
4. Use of only non-programmable calculator is allowed.

Q.1	Answer any four	12
	A. Sketch different arrangements of worm gear reducer.	
	B. With neat sketch explain straddle mounting of bevel pinion and gear. State advantages and disadvantages of straddle mounting.	
	C. Write the desirable properties of gear material. State different materials used for manufacturing of gears with their advantages and disadvantages.	
	D. Sketch the force analysis for helical gear and find the relation between transverse and normal pressure angle for helical gear.	
	E. What is dynamic load on gears? State the factors on which the dynamic load depends and explain the methods of estimation of dynamic load on spur gear tooth.	
Q. 2	A pair of worm gear is designated as 2/52/10/4 transmits 10 kW power from an electric motor rotating at 720 r.p.m. to a machine. The worm is right hand and rotates in clockwise direction, when viewed from right side. Sketch the arrangement and show the component of tooth forces. The coefficient of friction between worm and worm gear is 0.04 and normal pressure angle is 20° . The coefficient of heat transfer may be taken as $20 \text{ W/m}^2 \text{ }^{\circ}\text{C}$. The rise in temperature of lubricating oil above the atmospheric temperature is 50°C . Determine	07

	<p>i Component of tooth forces acting on worm and worm gear; ii Efficiency of worm gear pair; and iii Minimum required effective surface area of worm gear box.</p> <p>Is the drive self locking? Comment. Assume worm is above the worm gear.</p>															
Q. 3	<p>A pair of straight bevel gear consists of 18 teeth pinion rotating at 1500 r.p.m. meshing with a gear rotating at 600 r.p.m. The axes of pinion and gear intersect at right angles. The tooth system is 20° full-depth involute. The module is 4 mm, while the face width is 35 mm. The gear pair is made of plain carbon steel 55C8, with ultimate tensile stress, 720 N/mm^2 and is heat treated to a surface hardness of 400 BHN. The service factor and factor of safety are 1.75 and 1.5 respectively. Considering velocity factor accounts for dynamic load; determine :</p> <p>i Beam strength ii Wear strength iii Maximum static load that gear pair can transmit iv Rated power that gear pair can transmit</p> <p>Use the following data:</p> <p>Lewis form factor, Y' :</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Z'</td> <td>18</td> <td>19</td> <td>20</td> <td>21</td> <td>43</td> <td>50</td> </tr> <tr> <td>Y'</td> <td>0.3079</td> <td>0.3142</td> <td>0.3204</td> <td>0.3267</td> <td>0.3958</td> <td>0.4084</td> </tr> </table> <p>Load stress factor, $K = 0.16[\text{BHN}/100]^2 \text{ N/mm}^2$</p> <p>Velocity factor, $K_v = \frac{6}{6+V}$</p>	Z'	18	19	20	21	43	50	Y'	0.3079	0.3142	0.3204	0.3267	0.3958	0.4084	06
Z'	18	19	20	21	43	50										
Y'	0.3079	0.3142	0.3204	0.3267	0.3958	0.4084										
Q.4	Answer any one from following.															
	A. Write short note on Weibull distribution.	03														
	B. Explain causes of stress concentration.	03														
Q.5	<p>A single- row deep groove ball bearing operates with the following work cycle. If expected life of the bearing is 28000 hours with a reliability of 80 %, calculate the basic dynamic load rating capacity of the bearing so that it can be selected from a standard manufacturer's catalogue.</p>	06														

Element Time %	Radial Load kN	Axial Load kN	Radial Factor	Axial Factor	Race Rotating	Service Factor
30	2.8	1.2	0.56	1.4	Inner	1.75
40	5.3	1	0.56	1.6	Outer	1.35
Remaining	NIL	NIL	--	--	outer	--

OR

Q.5

Derive Petroff's equation.

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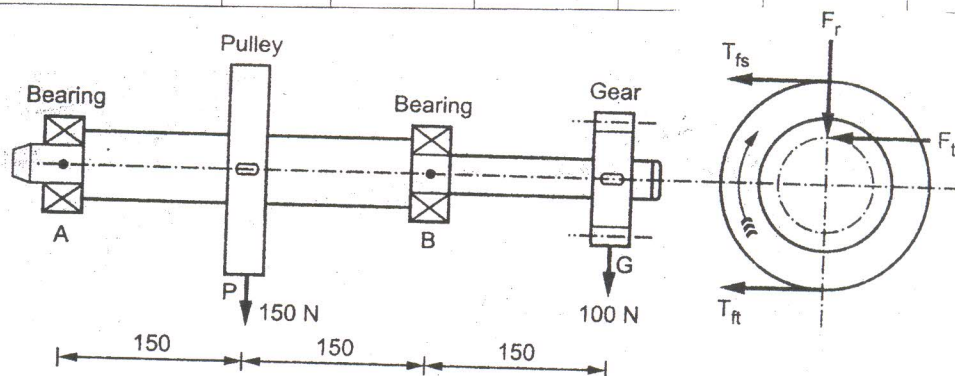
Q.6

The overhung counter shaft is supported at A and B by two single deep groove ball bearings. The shaft receives 8 kW at 1000 rpm. Through a flat belt pulley 'P' and transmits power through a spur gear 'G'. The shaft diameter at A and B are 17 mm and 35 mm respectively. The load factor is 1.4. If the expected rating life is 50,000 hours, select the bearing from manufacturers catalogue using following data:

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- Diameter of pulley = 250 mm
- Pitch circle diameter of gear = 150 mm
- Coefficient of friction between belt and pulley = 0.25
- Angle of lap for belt = 180°
- Weight of pulley = 150 N
- Weight of Gear = 100 N
- Gear pressure angle = 20°

Bearing No.	6003	6203	6303	6403	6007	6207
Basic dynamic capacity 'C' kN	6.05	9.56	13.50	22.9	15.9	25.50



Q.7	<p>Following Data is given for a 360° hydrodynamic bearing:-</p> <ul style="list-style-type: none">• Radial load =10 kN• Journal speed=1440 rpm• Unit bearing pressure =1000 kPa• Clearance ratio(r/c)=800• Viscosity of lubricant =30 mPa-s• Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing. Calculate:<ol style="list-style-type: none">1. Dimensions of bearing2. Coefficient of friction3. Power lost in friction4. Total flow of oil5. Side leakage6. Temperature rise <p>(Hint: Assume $l/d = 1$; Interpolate the data if required)</p>	08
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