

BE (Mech), Sem- VIII, A.T. K.T.  
Machine Design - II

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22/06/15

**BHARATIYA VIDYA BHAVAN'S**  
**SARDAR PATEL COLLEGE OF ENGINEERING**

(An Autonomous Institution Affiliated to University of Mumbai)  
MUNSHI NAGAR, ANDHERI (WEST), MUMBAI- 400 058

**KT-EXAMINATION**

CLASS/SEM. B.E. (Mech) Sem VII  
SUBJECT: Machine Design II

Total Marks: 100

Duration: 4 Hour

Date: June 2015

- Attempt any FIVE out of seven questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Use of PSG data book is permitted.
- Assume suitable data if necessary.

*Master*

- a) Write a short note on Herringbone Gears. (4)
  - b) Explain with neat sketch the nature of forces acting on a bevel gear. What is virtual or formative bevel gear? (4)
  - c) A pair of  $20^\circ$  full depth spur gears used in a drilling tool consists of a 32 teeth pinion, rotating at 1400 rpm and transmitting power to a 64 teeth gear. The module is 6 mm. Assume suitable face width. Both gears are made of steel with ultimate tensile strength of 650 MPa. They are heat treated to a surface hardness of 320 BHN. Compute the bending and wear strength. Calculate the rated power that the gears can transmit, if service factor is 1.75 and factor of safety is 2.0. Use velocity factor to estimate the effective load. (12)
- a) Describe various considerations involved in design of two stage gear box. (4)
  - b) A pair of worm gears ( $20^\circ$  normal pressure angle) is designated as 1/40/10/10. The input speed of worm shaft is 800 rpm. The worm shaft rotates in both directions. The worm wheel is made of chill cast bronze with ultimate tensile strength of 350 MPa. The worm is hardened steel. Determine the maximum input power transmitting capacity based on beam and wear strength. Consider factor of safety as 2.5. Also calculate the temperature rise of lubricating oil. (16)
- a) A helical spring loaded cam rotates at 800 rpm with a translating roller follower. The cam profile is : (a) rise by 20 mm in  $160^\circ$ , constant acceleration curve; (b) dwell for  $20^\circ$ ; (c) fall same as rise and (d) dwell for  $20^\circ$ . There is no offset provided to the translation axis. The radii of base circle and roller are 48 mm and 14 mm respectively. Mass of follower linkage is 0.75 kg and external force on the system is constant 30 N. Calculate the following. (20)  
(i) Spring stiffness, (ii) roller pin diameter, (iii) maximum torque on cam shaft, (iv) pressure angle at the instant of maximum contact force acting on the cam.

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Machin Design - II

4. a) A self-aligning ball bearing is subjected to radial load of 3.9 kN and thrust force of 1.25 kN. The shaft rotates at 850 rpm. The expected life of bearing is 6000 hours. The minimum acceptable diameter of shaft is 50 mm. Select suitable bearing. Consider outer race as stationary. (8)
- b) The following data is given for a full hydrodynamic bearing. (12)  
Radial load = 23 kN  
Journal speed = 920 rpm  
Unit bearing pressure = 2.5 MPa  
L/D ratio = assume suitable  
Viscosity of lubricant = 20 cP  
Class of fit = H7e7  
Calculate (i) dimensions of bearing, (ii) minimum film thickness and (iii) requirement of oil flow.
5. a) A pair of bevel gears with 20° pressure angle consists of a 28 teeth pinion meshing with 42 teeth gear. The module is 5 mm and face width is 25 mm. The material for pinion and gear is steel with ultimate tensile strength of 850 MPa. The gear teeth are precision cut and surface hardness is 480 BHN. The pinion rotates at 450 rpm and receives 1.5 kW power from an electric motor. The starting torque of motor is 125% of the rated torque. Determine whether the gear design is safe. If yes, calculate the factor of safety against bending and pitting failure. Use Buckingham's equation to calculate dynamic load. (12)
- b) Write a short note on static and dynamic mechanical seals. Support your answer with neat sketches. (8)
6. a) Describe important components of a centrifugal pump with a neat sketch. Explain the factors involved in design of pump shaft, impeller, volute casing and selection of electric motor. (12)
- b) A deep groove ball bearing (model number 6415) is subjected to radial force of 32,000 N and an axial force of 14,000 N. The outer race is rotating at 1750 rpm and the inner race is held fixed. Calculate the life of bearing. (5)
- c) Compare between the hydrostatic and hydrodynamic bearings. (3)
7. a) Draw (freehand) two views of a snatch block assembly for an EOT crane and tag main components such as, rope, pulley, cross-block, hook, thrust bearing, side-plates, etc. Explain with necessary equations, the procedure used to select size of rope, hook and sheave for a given load capacity of snatch block. (12)
- b) Compare between the rolling contact and sliding contact bearings. (4)
- c) Discuss advantages and disadvantages of internal gears over the external gears. Briefly explain how the procedure for design of internal gears differs from the one for design of external gears. (4)

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