

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
MACHINE DESIGN**

**( Common to Mechanical Engineering and Production Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

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1. (a) Suggest a bearing to take up combined heavy axial and radial loads.  
(b) A 150 mm diameter shaft supporting a load of 10 kW has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. The diametral clearance of the bearing is 0.0015 mm. The absolute viscosity of the oil at the operating temperature is 11 centipoise. Check whether hydrodynamic lubrication will prevail or not. Find the power loss, heat generated and heat dissipated. [4+12]
2. (a) What do you understand by dynamic load capacity and static load capacity of a bearing?  
(b) The operating schedule of a ball bearing is as follows. Radial load of 1650 N at 2000 rpm for 5% of lifetime Radial load of 1140 N at 3300 rpm for 15% of time Radial load of 560 N at 1750 rpm for 35% of time and Radial load of 445 N at 2200 rpm for 45% of time The inner ring rotates and loads are steady. The life is to be 10 years at 2 hours per day operation. Select a suitable ball bearing. [4+12]
3. Enumerate the design procedure for the connecting rod section considering it as a simple compression or tension member subjected to fluctuating load. [16]
4. A crank shaft of the center crank type is to be designed for a diesel engine developing 7.5 KW on break at 1200 rpm .The crank shaft is forged type and has to carry 2 fly wheels of 500N each on either side of the main bearing. The plane of rotation of each wheel is 100mm from the centerline of adjacent bearing. The maximum load on the connecting rod is 35 KN. The length of the stroke of piston is 160mm and the length of the connecting rod is 320mm.The maximum torque is experienced in crankshaft when the crank turns  $30^0$  from I.D.C position. The maximum permissible stress in crank pin, web and shaft should not exceed 60 N/sq.mm. The safe limit for the bearing stress, the crank pin and main bearing is 800 N/sq.mm design the crank shaft. [16]
5. (a) Classify various types of springs with sketches and give their applications?  
(b) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 Mpa and modulus of rigidity  $84kN/mm^2$  , find the axial load which the spring can carry and the deflection per active turn. [8+8]

6. (a) Prove that the centrifugal tension must be  $1/3$ rd of the max. tension for max. power transmission
- (b) Design a cross belt drive having 1.5 m center distance between the two pulleys. The diameter of bigger and smaller pulleys are 'D' and 'd' respectively. The smaller pulley rotates at 1000 r.p.m. and the bigger pulley at 500 r.p.m. The flat belt is 6 mm thick and transmits 7.5 kW power at belt speed of 13 m/s approximately. The coefficient of belt friction is 0.3 and the density of belt material is  $950 \text{ kg/m}^3$ . The permissible tensile stress for the belt material is 1.75 MPa. [6+10]
7. It is desired to determine the proportions of spur gear drive to transmit 8KW from a shaft rotating at 1200rpm to a low speed shaft, with a reduction of 3:1. Assume that the teeth are  $20^\circ$  full depth involute, with 24 teeth on pinion. The pinion is to be of 40C8 Steel and gear of 30C8 steel. Assume that the stalling torque is 130 percent of rated torque. [16]
8. Design a trunk type CI piston for an IC engine having a diameter of 100mm and a length of 150 mm. The maximum pressure is 3.5 Mpa. Maximum permissible tension for CI for the design head thickness is 30 Mpa and for the piston pin material 45 Mpa, bearing pressure for the piston should not exceed 20 Mpa. [16]

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