

**R09**

Code No: 56019

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech III Year II Semester Examinations, May - 2016**

**DESIGN OF MACHINE MEMBERS – II**

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

----

- 1.a) What are the desirable properties of a good bearing material? What are the different materials used for bearings?
- b) The following data is given for a full hydrodynamic bearing:  
Radial load = 25 kN; journal speed = 900 rpm; unit bearing pressure = 2.5 MPa;  
(l/d) ratio = 1; viscosity of lubricant = 20 cP; class of fit =  $H_{7e7}$   
Calculate (i) Dimensions of the bearing  
(ii) Minimum oil film thickness  
(iii) Requirement of oil flow [5+10]
2. A single row deep groove ball bearing No. 6002 is subjected to an axial thrust load of 1000 N and a radial load of 2000 N. Find the expected life that 50% of the bearings will complete under this condition. [15]
3. The cylinder of a four-stroke diesel engine has the following specifications:  
Brake power = 5 kW; speed = 500 rpm; indicated mean effective pressure = 0.45 MPa  
Make suitable assumptions and calculate:  
a) Bore and length of the cylinder liner  
b) Thickness of the cylinder liner  
c) Thickness of the cylinder head  
d) Size, number and pitch of studs. [4+4+4+3]
4. A V-belt drive is required for a 15 kW, 1440 rpm electric motor, which drives a centrifugal pump running at 360 rpm for a service of 24 hours per day. From space considerations, the centre distance should be approximately 1 m. Determine  
a) Belt specifications  
b) Number of belts  
c) Correct centre distance and  
d) Pulley diameters. [4+4+4+3]
5. It is required to design a pair of spur gears with  $20^\circ$  full-depth involute teeth consisting of a 20- teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 25 kW, 1440 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe410, while the gear is made of grey cast iron FG 200. The factor of safety is 2. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. [15]

6. A pair of straight bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on the pinion and gear are 30 and 45 respectively. The pressure angle is  $20^\circ$ . The pinion shaft is connected to an electric motor developing 18 kW rated power at 500 rpm. The service factor can be taken as 1.5. The pinion and the gear are made of steel ( $S_{ut} = 570 \text{ N/mm}^2$ ) and heat treated to a surface hardness of 350 BHN. The gears are manufactured in such a way that the error between two meshing teeth is limited to  $20 \mu\text{m}$ . The module and face width are 6 mm and 50 mm respectively. Determine the factor of safety against bending as well as pitting. [15]
7. A 40 kN capacity screw jack consists of a square-threaded steel screw meshing with a bronze nut. The nominal diameter is 50 mm and the pitch is 8 mm. The permissible bearing pressure at the threads is  $10 \text{ N/mm}^2$ . Calculate:  
a) The length of the nut  
b) The transverse shear stress in the nut. [7+8]
8. A pair of worm gears is designated as 1/40/10/4. The input speed of the worm shaft is 800 rpm. The worm wheel is made of phosphor bronze (sand cast), while the worm of case hardened steel 10C4. Determine the power transmitting capacity based on wear strength. [15]

---ooOoo---