

Code: ME6T2

III B.Tech - II Semester – Regular Examinations – April 2016

**DESIGN OF MACHINE MEMBERS-II
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1.

a) A hollow shaft has greater strength and stiffness than that of a solid of equal weight. Explain. 4 M

b) The engine of a ship develops 440KW and transmits the power by a horizontal propeller shaft which runs at 120 r.p.m. It is proposed to design a hollow propeller shaft with inner diameter as 0.6 of the outer diameter. Considering torsion alone, calculate the diameter of the propeller shaft if stress in the material is not to exceed 63 MPa and also the angular twist over a length of 2.5 m is not to be more than 1° . The modulus of rigidity of the shaft material is 80 GPa. 10 M

2. A marine type flange coupling is used to transmit 3.75 MW at 150 r.p.m. the allowable shear stress in the shaft and bolts may be taken as 50 MPa. Determine the shaft diameter and bolts diameter. And draw neat diagram of marine type of flange coupling. 14 M

3.

a) What is meant by hydrodynamic lubrication? 4 M

b) A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N and 600 r.p.m. If the room temperature is 20°C , what should be the viscosity of oil to limit the bearing surface temperature to 60°C ? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on the projected area of bearing is $210\text{ W/m}^2/^{\circ}\text{C}$. 10 M

4. The ball bearings are to be selected for an application in which the radial load is 2000 N during 90 percent of the time and 8000 N during the remaining 10 percent. The shaft is to rotate at 150 r.p.m. Determine the minimum value of the basic dynamic load rating for 5000 hours of operation with not more than 10 percent failures. 14 M

5. A flat belt, 8 mm thick and 100 mm wide transmits power between two pulleys, running at 1600 m/min. The mass of the belt is 0.9 kg/m length. The angle of lap in the smaller pulley is 165° and the coefficient of friction between the belt and pulleys is 0.3. If the maximum permissible stress in the belt is 2 MN/m^2 , find 14 M

a) Maximum power transmitted, and

b) Initial tension in the belt.

6. A screw jack carries a load of 22 kN. Assuming the coefficient of friction between screw and nut as 0.15, design the screw and nut. Neglect collar friction and column action. The permissible compressive and shear stresses in the screw should not exceed 42 MPa and 28 MPa respectively. The shear stress in the nut should not exceed 21 MPa. The bearing pressure on the nut is 14 N/mm^2 . Also determine the effort required at the handle of 200 mm length in order to raise and lower the load. What will be the efficiency of screw? 14 M
7. A motor shaft rotating at 1440 r.p.m. has to transmit 15 kW to a low speed shaft rotating at 500 r.p.m. The teeth are 20° involute with 25 teeth on the pinion. Both the pinion and gear are made of cast iron with a maximum safe stress of 56 MPa. A safe stress of 35 MPa may be taken for the shaft on which the gear is mounted. Design and sketch the spur gear drive to suit the above conditions. The starting torque may be assumed as 1.25 times the running torque. 14 M
8. A pair of helical gears with 30° helix angle is used to transmit 15 kW at 10000 r.p.m. of the pinion. The velocity ratio is 4: 1. Both the gears are to be made of hardened steel of static strength 100 N/mm^2 . The gears are 20° stub and the pinion is to have 24 teeth. The face width may be taken as 14 times the module. Find the module and face width from the standpoint of strength and check the gears for wear. 14 M