[03 – 4115]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

DESIGN OF MACHINE ELEMENTS – II

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 Compulsory.

Answer any FOUR from the rest.

All questions carry equal marks.

Answer to Question No. 1 must be at one place.

Data books are not allowed.

1. (a) State the two important reasons for adopting involute for gear tooth people.

(b) What is pressure angle in of gear tooth?

(c) What is an oil seal?

(d) Why splines are used in mechanical clutchs?

(e) What is a radial bearing and thrust bearing?

(f) What is bearing modulus?

(g) Enumerates four application of composite materials.

2. It is required to design a pair of spur gears with 20° full depth involute teeth consisting of 20 teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1440 rpm electric motor. The starting torque of motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe 410 ($\sigma_{ult} = 410$ mPA) while the gear is made of gray cast iron FG 200 ($\sigma_{ult} = 200$ mPA). The factor of safety is 1.5. Design the gears based on Lewis equation and using velocity factor to account for the dynamic load.

3. 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 21 and 28 respectively. The pressure angle is 20°. The pinion shaft is connected to an electric motor developing. 8 kW rated power at 1600 rpm. The service factor can be taken as 1.5. The pinion and the gear are made of steel ($\sigma_{ult} = 750$ mPA) and heat treated to a surface hardness of 380 BHN. The gears are machined by a manufacturing process, that limits the error between meshing teeth to 10 mm. The module and fall width as 4 mm and 20 mm respectively. Determine the factor of safety for bending as well as for pitting.

4. An single plate clutch in designed to transect 10 kW. Power at 2000 rpm. The equivalent mass and radius of gyration of the input shaft are 20 kg and 75 mm respectively. The equivalent mass and radius of gyration of the output shaft are 35 kg and 125 m respectively. Calculate :

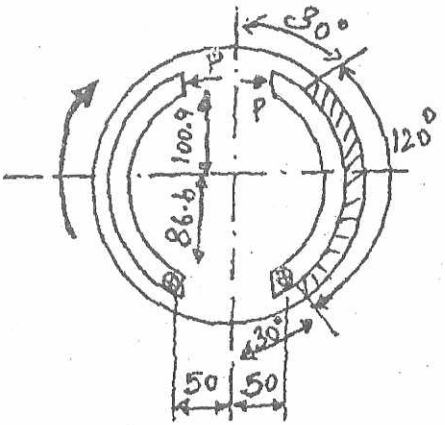
   (a) The time required to bring the output shaft to the rated speed from rest

   (b) The heat generated during the clutching operation.

5. An automotive type internal expanding double shoe brake is shown in the figure. The fall width of the friction lining is 40 mm and the maximum intensity of normal pressure is limited to 1 N/mm^2. The coefficient of friction is 0.32. The angle θ_1 can be assumed to be zero calculate

(a) The actuating force P

(b) The torque absorbing capacity of the brake.



6. Following data in given for a 360° hydrodynamic bearing :

Radial load = 3.2 kal

Journal speed = 1490 rpm

Journal diameter = 50 mm

Bearing length = 60 mm

Radial clearance = 0.05 mm

Viscosity of lubricant = 25 cp.

Assuming the total heat generated in the bearing is carried by total oil flow in the bearing calculate :

(a) Coefficient of friction

(b) Power lost in friction

(c) Minimum oil film thickness

(d) Flow requirement in liters/min.

(e) Temp-rise.

7. A ball bearing is operating on a work cycle consisting of three parts - a radial load of 3500 N at 1400 rpm for one quarter cycle, a radial load of 5000 N at 720 rpm of one half cycle and radial load of 2500 N at 1440 rpm for the remaining cycle. The expected life of the bearing is 10,000 hr calculate the dynamic load carrying capacity of the bearing.

8. A four stroke disel engine has the following specifications Brake power = 5 kW, speed = 1200 rpm; Indicated mean effective pressure = 0.35 N/mm^2; mechanical efficiency = 80% :

Determine :

(a) Bore and then length of the cylinder

(b) Thickness of the cylinder head

(c) Size of the studs for the cylinder head.