B. E. 6th Semester (Mech. Engg.) Examination,

May–2011

MACHINE DESIGN-II

Paper–ME-304-E

Time allowed : 4 hours] *[Maximum marks : 100*

Note : *Attempt any **five** questions. All questions carry equal marks.*

1. A shaft rotating at constant speed is subjected to stationary equivalent radial load of 3KN for 10 per cent of time, 2 KN for 20 per cent of time 1 KN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for bearing is 20 millions of revolutions at 95% reliability, calculate the dynamic load rating. 20

2. A shaft is supported on bearings A and B 800 mm apart. A 20° straight tooth spur gear having 600 mm pitch diameter is located 200 mm to the right of the left hand bearing A, and a pulley of 700 mm diameter is mounted 250 mm towards the left of the bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel

and weighs 2000 N the maximum belt tension is 3000N and the tension ratio is 3:1. Determine the diameter of shaft, if the allowable shear stress of the material is 60 MPa. 20

3. (a) Explain design considerations for casting, forging and machining. 10

(b) Explain the following terms:

(i) Endurance limit

(ii) Factor of safety

(iii) Miner's equation. 10

4. (a) What do you mean by reliability of bearing, write the necessary relation ? 5

(b) Following data is given for 360° hydrodynamic bearing –

(i) Radial load = 3200N

(ii) Journal speed = 1490 r.p.m

(iii) Journal diameter = 50mm

(iv) Bearing length = 50mm

(v) Radial clearance = 0.05 mm

(vi) Viscosity = 25 centipoise

Calculate : (i) Co-efficient of friction

(ii) Power lost in friction

(iii) Minimum oil film thickness

(iv) Temp. rise

(v) Flow requirement in litre per minute. 15

5. Design a close coiled helical compression spring for a service load ranging from 2760N to 3260N. The axial deflection of spring for this load range is 8 mm. Assume a spring index of 4. The permissible shear stress intensity is 460 MPa and modulus of Rigidity, G = 84 KN /mm^2. Neglect the effect of stress concentration. Also draw the sketch of designed spring showing all details. 20

6. A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 r.p.m. The normal pressure angle is 20°, while the helix angle is 25°. The face width is 40mm and the normal module is 4mm. The pinion as well as the gear are made of steel 40CB (S_{ut} = 600N/mm^2) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively.

Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. 20

7. A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between shafts is to be 500mm. The speed of electric motor is 900 rpm and the speed of compressor shaft is desired to be 200 rpm. The torque to be transmitted is 5000 N-m. The starting torque is 25% more than the normal torque. Determine (1) Module and face width of gears using 20 degree stub teeth (2) Number of teeth and pitch circle diameter of each gear. Assume suitable values for velocity and Lewis factor. 20

8. Discuss the following with diagrams :

(i) Fatigue failure from fluctuating stressed and reversed stress.

(ii) S-N curve and endurance limit for steel

(iii) Notch sensitivity

(iv) Difference between Rigidity and strength criterion of design of shafts. 4×5=20