

Machine Design-II
(ME-302, MAY 2007)

Time: 3 Hrs
Max Marks: 60

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) In the context of V-belt, explain the significance of B 3251.
b) What do you understand by elastic creep in belt drive?
c) What are the advantages of chain drives over belt and rope drives?
d) Differentiate between beam strength and endurance strength of a gear tooth.
e) What do you understand by virtual number of teeth in the context of helical gear?
f) What is nipping of leaf springs?
g) State the condition of self locking for a differential band brake.
h) Multi-plate clutches are wet clutches, while single-plate clutches are dry clutches. Justify the statement.
i) What do you mean by hydrodynamic lubrication?
j) Define coefficient of fluctuation of speed in a flywheel.

Section-B

2. A pair of straight bevel gears consists of a 30-teeth pinion meshing with a 45-teeth gear. The module and the face width are 6 mm and 50 mm respectively. The pinion as well as gear is made of steel with permissible bending stress 200 MPa. Calculate the beam strength of the tooth.
3. Design a suitable flat belt drive for a compressor running at 720 rpm and driven by a 25 KW, 1440 rpm motor. Space is available for a centre distance of 3 m. The belt is open type.
4. Design a close coil helical spring for a boiler safety valve which is required to blow off steam at the pressure of 1.5 MPa. The diameter of the valve is 50 mm. The initial compression of the spring is 40 mm and the lift is limited to 20 mm.
5. The radial load acting on a ball bearing is 2500 N for the first five revolutions and reduces to 1500 N for the next ten revolutions. The load variation then repeats itself. The expected life of the bearing is 20 million revolutions. Determine the dynamic load carrying capacity of the bearing.
6. A machine is driven by a motor which exerts a constant torque. The resisting torque of the machine increases uniformly from 500 N-m to 1500 N-m through a 360° rotation of the driving shaft and drops suddenly to 500 N-m again at the beginning of the next revolution. The mean angular velocity of the machine is 30 rad/s and the coefficient of speed fluctuations is 0.2. A solid circular steel disk, 25 mm thick, is used as flywheel. The mass density of steel is 7800 kg/m^3 and Poisson's is 0.3. Calculate the outer diameter of the flywheel disk and the maximum stress induced in it.

Section-C

7. Design a worm gear speed reducer to transmit 22.5 KW at 1440 rpm. The desired speed ratio is 24:1 and efficiency 85%. Assume that the worm is made of hardened steel and gear of phosphor bronze.
8. a) A single plate (one side) clutch can transmit 718 Nm torque. Calculate the inner diameter of friction lining using uniform pressure theory using following parameters: $D_o = 300 \text{ mm}$, $\mu = 0.25$ and $p_{\max} = 825 \text{ k Pa}$. Check the capacity of clutch using uniform assumption.
b) Discuss polygonal effect in chain drive. How could it be produced?
9. a) A 6 x 19 wire rope with fiber core and tensile designation 1420 is used to raise a load. The nominal diameter of the wire rope and the sheave diameter are 10 and 450 mm respectively. Assuming long life [$p/\sigma_{ut} = 0.0015$] on the basis of fatigue consideration, determine the maximum load (including the weight of wire rope) that the wire can carry.
b) Define computer-aided design. List its advantages and applications.