

Machine Design-II
(ME-302, Dec-07)

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

Section-A

1. a) What is power rating of a belt?
b) Why the semi cone angle is set between 10 to 15° in cone clutches?
c) In the context of wire rope explain the meaning of 6 x 17.
d) Why a helical gear is relatively stronger than a spur gear for the same normal pitch, pitch diameter and number of teeth?
e) What do you understand by formative or equivalent number of teeth for bevel gear?
f) What is curvature effect in helical springs?
g) What is self-energizing and self locking brake?
h) Discuss the pattern of wear of friction lining in the context of plate clutch.
i) What is rated life of a ball bearing?
j) What types of stresses are produced in a flywheel?

Section-B

2. A gear drive is required to transmit a maximum power of 22.5 KW. The velocity ratio is 1:2 and rpm of pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The allowable static stress for the gear/pinion material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find module of the gear.
3. Design a V-belt drive to connect a 7.5 KW, 1440 rpm induction motor to a fan, running at approximately 480 rpm, for a service of 24 hrs per day. Space is available for a centre of about 1 m.
4. A laminated spring of an automobile is to carry a load of 5 KN. The span is 1000 mm and width of the clamp is 60 mm. Design the spring. In all eight leaves are used out of which two are main leaves and remaining graduated leaves.
5. A 360° hydrodynamic bearing operates under the following conditions:
Radial load = 50 KN; Journal diameter = 150 mm; Bearing length = 150 mm; Radial clearance = 0.15 mm; Minimum film thickness = 0.03 mm; Viscosity of lubricant = 8 c.p.
What is the minimum speed of operation for the journal to work under hydrodynamic conditions?
6. It is required to design a chain drive to connect a 10 KW, 1440 rpm electric motor to a centrifugal pump running at 720 rpm. The services conditions involve moderate shock. Select a suitable roller chain and give list of its specification.

Section-C

7. A pair of bevel gears is required to transmit 10 KW power at 500rpm from a motor shaft to a machine shaft. the speed reduction in 3:1 and the shafts are inclined at 60°. the pinion is to have 24teeth with pressure angle 20° and is to be made of cast steel having strength of 75 MPa. The gear is to be made of cast iron with static stress of 55 MPa. The pinion is mounted midway on the shaft which is supported between two bearings having span of 200 mm. Design the gear.
8. (a) Design a cone clutch with leather facing and cast iron mating surface to transmit 15 KW at 750 rpm. The mean diameter is limited to 250 mm and the slope of the face is to be 15°. the clutch is to work under oily conditions.
(b) What are the various phases in the design process where CAD can be of help and how?
9. A cast iron flywheel of 1.2 m diameter is to be designed for a four stroke engine which develops 75 KW at 300 rpm. The total fluctuation of speed may be limited to 5% of mean speed. The work done during the working stroke is 1.4 times the average work done during the whole cycle. The peripheral speed is limited to 30m/s. Assume allowable shear stress for the shaft and key as 40 MPa and for cast iron in tension as 20 MPa. The arms are elliptical in cross-section with major axis as twice the minor axis. There are 6 arms. Design the flywheel.