Code: ME6T2

III B.Tech - II Semester – Regular Examinations – May 2017

DESIGN OF MACHINE MEMBERS-II
(MECHANICAL ENGINEERING)

Assume any missing data and state it appropriately.

Duration: 3 hours   Max. Marks: 70

PART – A

Answer *all* the questions.   All questions carry equal marks

                                                                11x 2 = 22 M

1.
   a) Distinguish clearly, giving examples between pin, axle and shaft.
   b) Discuss the function of a coupling. Give at least three practical applications.
   c) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. Explain.
   d) What is meant by hydrodynamic lubrication?
   e) How do you express the life of a bearing? What is an average or median life?
   f) How are ends of belts joined? For horizontal belts which side (tight or slack) of the belt should run on the top and why?
   g) What is the groove angle of the pulley for *V*-belt drive?
   h) Write any two uses of wire ropes.
   i) Explain the self locking condition in power screws.
   j) What condition must be satisfied in order that a pair of spur gears may have a constant velocity ratio?
   k) Explain the following terms used in helical gears: (i) Helix angle; (ii) normal pitch; and (iii) axial pitch.

PART – B

Answer any *THREE* questions. All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10,000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.   6 M

   b) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: Shear stress for shaft, bolt and key material = 40 MPa.
   Crushing stress for bolt and key = 80 MPa
   Shear stress for cast iron = 8 MPa, Draw a neat sketch of the coupling.   10 M

3. a) A journal bearing is to be designed for a centrifugal pump for the following data : Load on the journal = 12 kN; Diameter of the journal = 75 mm; Speed = 1440 r.p.m; Atmospheric temperature of the oil = 16°C; Operating temperature of the oil = 60°C; Absolute viscosity of oil at 60°C = 0.023 kg/m-s. Give a systematic design of the bearing.   8 M

   b) The rolling contact ball bearings are to be selected to support the overhung countershaft. The shaft speed is 720

r.p.m. The bearings are to have 99% reliability corresponding to a life of 24,000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability. **8 M**

4. a) A leather belt 9 mm × 250 mm is used to drive a cast iron pulley 900 mm in diameter at 336 r.p.m. If the active arc on the smaller pulley is 120° and the stress in tight side is 2 MPa, find the power capacity of the belt. The density of leather may be taken as 980 kg/m^3, and the coefficient of friction of leather on cast iron is 0.35. **8 M**

   b) A V-belt is driven on a flat pulley and a V-pulley. The drive transmits 20 kW from a 250 mm diameter V-pulley operating at 1800 r.p.m. to a 900 mm diameter flat pulley. The centre distance is 1 m, the angle of groove 40° and μ = 0.2. If density of belting is 1110 kg/m^3 and allowable stress is 2.1 MPa for belt material, what will be the number of belts required if C-size V-belts having 230 mm^2 cross-sectional areas are used. **8 M**

5. a) Under what circumstances a fiber rope and a wire rope is used? What are the advantages of a wire rope over fiber rope? **4 M**

   b) The mean diameter of the square threaded screw having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through

a distance of 170 mm. Find the work done in lifting the
load and the efficiency of the screw, when
i. The load rotates with the screw, and
ii. The load rests on the loose head which does not rotate
   with the screw.
         The external and internal diameter of the bearing surface
of the loose head is 60 mm and 10 mm respectively. The
coefficient of friction for the screw and the bearing surface may
be taken as 0.08.   8 M

c) Discuss the construction of wire rops.   4 M

6. a) Bronze spur pinion rotating at 600 r.p.m. drives a cast iron
   spur gear at a transmission ratio of 4:1. The allowable static
   stresses for the bronze pinion and cast iron gear are 84 MPa
   and 105 MPa respectively.
   The pinion has 16 standard 20° full depth involute teeth of
   module 8 mm. The face width of both the gears is 90 mm. Find
   the power that can be transmitted from the standpoint of
   strength.   8 M

   b) A pair of helical gears with 30° helix angle is used to transmit 15
   kW at 10,000 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.   8 M