Code: ME6T2

III B.Tech - II Semester – Regular /Supplementary Examinations March 2020

DESIGN OF MACHINE MEMBERS-II
(MECHANICAL ENGINEERING)

Design data books are allowed.
Assume any missing data appropriately and state it clearly.

Duration: 3 hours   Max. Marks: 70

PART – A

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

$$11x\ 2 = 22\ M$$

1.

a) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. Explain.

b) List types of keys and state their applications.

c) What is the function of a coupling? Give at least three practical applications.

d) Define the terms i) bearing characteristic number and ii) bearing modulus.

e) Differentiate between static and dynamic load carrying capacities of rolling contact bearings.

f) List out the factors to be considered in the selection of a belt drive.

g) Sketch the cross section of V-belt and label its important parts.

h) State the advantages and applications of wire ropes.

i) Why square threads are preferred over V-threads for power transmission?

j) Define the following terms associated with gears:
   i) Module   ii) Pressure angle

k) Explain the importance of Lewis equation in the design of gears.

<p style="text-align:center">PART – B</p>

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

<p style="text-align:right">3 x 16 = 48 M</p>

2. a) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.   6 M

   b) Design a typical rigid flange coupling for connecting a motor and a centrifugal pump shafts. The coupling needs to transmit 15 kW at 1000 rpm. The allowable shear stresses of the shaft, key and bolt materials are 60 MPa,50 MPa and 25 MPa respectively. The shear modulus of the shaft material may be taken as 84GPa. The angle of twist of the shaft should be limited to 1 degree in 20 times the shaft diameter.   10 M

3. a) Design a journal bearing for a centrifugal pump from the following data: Load on the journal is 20 kN, speed of the journal is 900 r.p.m, type of oil is SAE10 for which the

absolute viscocity at 55°C is 0.017 kg/m-s, ambient temperature of oil is 15.5°C and maximum bearing pressure for the pump is 1.5 N/mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Take Heat dissipation coefficient 1232 W/m^2/°C. **8 M**

b) Determine the dynamic load carrying capacity of a deep-groove ball bearing, with the least bore size, and which is required to resist a radial load of 4 kN, and an axial load of 3 kN. The shaft rotates at 1400 rpm. The bearing is required to be in operation for 12000 hours, with 90% reliability. **8 M**

4. a) Derive the condition for transmitting the maximum power in a flat belt drive and find the velocity of the belt for the maximum power. **6 M**

b) It is required to design a chain drive to connect 5 kW, 1400 rpm electric motor to a drilling machine. The speed reduction is 3:1. The centre distance should be approximately 500 mm. **10 M**
i) Select a proper roller chain for the drive
ii) Determine the number of chain links
iii) Specify the correct centre distance between the axes of sprockets..

5. a) Discuss about

    i) the factors for selecting appropriate wire rope and

    ii) the types of stresses induced in wire ropes.   6 M

  b) A square threaded screw is required to work against an axial force of 6.0 kN and has following dimensions: Major diameter d = 32 mm; pitch p = 4 mm with single start, μ = 0.08. Axial force rotates with the screw. Calculate

    (i) Torque required when screw moves against the load

    (ii) Torque required when screw moves in the same direction as the load.

    (iii) Efficiency of the screw.   10 M

6. a) What are the basic modes of gear tooth failure? Explain different causes of gear tooth failures and suggest possible remedies to avoid such failures.   6 M

  b) Design a pair of spur gears, which are required to transmit 45 kW at a pinion speed of 800 rpm. The velocity ratio is 3.5:1. The teeth are 20° full-depth involute with 18 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe static stress of 180 MPa.   10 M