APJ Abdul Kalam Technological University   D

II semester M.Tech Degree Examination May-2016
Branch: Machine Design
01ME6112 Design of Power Transmission Elements

(2015 Scheme)

Time: 3 hours   Max Marks: 60

*Answer **any two** questions from each PART.*

Use of data book is permitted. Any data not given may be suitably assumed.

PART A

1. A four-cylinder diesel engine running at 2000 rpm developing 50 kW is being used to drive a medium duty agricultural machine running at 890 rpm. The centre distance between the pulley centres is approximately 75 cm. The expected use is less than 10 hours per day. Using a V- belt drive select suitable pulley diameters and determine the type and number of belts required.   (9)

2. In a mine, 100 kW power is transmitted from an induction motor running at 720 rpm to a hoist drive shaft with a reduction ratio of 4 through a chain drive. The motor shaft diameter is 60mm and the hoist drive shaft diameter is 120mm. The motor starting load is 1.5 times the nominal load. Design a suitable chain drive.   (9)

3. A single plate clutch, both side being effective is required to connect a machine shaft to a driver shaft which runs at 500 rpm .The moment of inertia of the rotating parts of the machine is $1 kgm^2$. The inner and the outer radii of the friction discs are 50 mm and 100mm respectively. Assuming uniform pressure of $0.1 N/mm^2$ and $\mu = 0.25$, determine the time taken for the machine to reach full speed when the clutch is suddenly engaged. Also determine the power transmitted by the clutch, the energy dissipated during the clutch slip and the energy supplied to the machine during engagement.   (9)

PART B

4. A shaft is subjected to a bending moment of 15 N-m and transmits 5kW at 500 rpm. The permissible shear stress for shaft material is 40 N/mm^2 and tensile stress (permissible) is 58 N/mm^2. Find the suitable diameter of shaft so that max. shear stress and max. tensile stress induced in the shaft is within permissible limit. (9)

5. A motor shaft rotating at 1500 rpm has to transmit 15kW to a low speed shaft with a speed reduction of 3:1. Assume starting torque to be 25% higher than the running torque. The teeth are 20° involutes with 25 teeth on the pinion. Both the pinion and gear are made of C45 steel. Design a spur gear drive to suit the above conditions. (9)

6. Two helical gears are used in a speed reducer that is driven by an IC engine. The rated power of the speed reducer is 75kW at a pinion speed of 1200rpm. The speed ratio is 3 to 1. Assuming medium shock condition and 24 hours operation, find the module, face width, number of teeth in each gear and the material and heat treatment requirement if the teeth are 20° full depth in normal plane based on AGMA principles. (9)

PART C

7. Design a bevel gear drive based on AGMA principles, to transmit 3.5 kW power at 200 rpm. The shaft angle is 90°. Speed ratio desired is 4. The prime mover is induction motor and the driven side is connected to a belt conveyor. (12)

8. Design a worm gear drive based on AGMA principles, to transmit 22.5 kW power at a worm speed of 1440 rpm, velocity ratio 24:1. Minimum efficiency required is 85%. Assume the worm and wheel is made of steel and sand cast bronze respectively and initial sliding velocity as 3 m/s. (12)

9. Design the layout of a 12 speed gear box for a milling machine having an output of speeds ranging from 180 to 2000 rpm. Power is applied to the gear box from a 6 kW induction motor at 1440 rpm. Choose standard step ratio and construct the speed diagram. Decide upon the various reduction ratios and number of teeth on each gear wheel sketch the arrangement of the gear box. (12