

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY-JUNE 2019

Branch: *Mechanical Engineering*

Stream(s):

1. *Machine Design*
2. *Translational Engineering*

01ME6112 Design of Power Transmission Elements

Answer *any two full* questions from *each* part

Limit answers to the required points.

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

Max. Marks: 60

Duration: 3 hours

PART A

1. Design an open type flat belt drive for a centrifugal compressor which is driven by an electric motor of 25kW and 1440 rpm. The maximum centre to centre distance available is 3m and the speed should be reduced to half the original speed at the compressor. (9)
2. Design a multiple V- belt drive for a centrifugal pump running at 340 rpm driven by a 100kW motor running at 1440 rpm. The drive is to work for at least 20 hrs every day and the centre distance between the shafts is 1.2m (9)
3. Design a chain drive to actuate a compressor that works for 8 hrs a day by a 10 kW electric motor at 960 rpm. The compressor speed is to be 350 rpm. Motor is mounted on an auxiliary bed and minimum centre distance should be 0.5 m. (9)

PART B

4. Determine the diameter of a solid shaft used for transmitting 15kW at 200 rpm to two gears and is supported by two end bearings 750 mm apart. A pinion having 30 teeth and 5 mm module is keyed in at 100 mm to the left of right end bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located at 150 mm to the right of left end bearing and receives power from below. Assume allowable shear stress to be 54 MPa. (9)
5. A non metallic pinion drives a cast iron gear. The pinion transmits 5 kW at 700 rpm to the gear. Design the gear drive to work under smooth load if the velocity ratio is 3 and the teeth are 20° full depth. Assume allowable shear stress for pinion to be 40 N/mm² (9)

6. Design a helical gear drive to transmit a power of 15 kW at 1440 rpm using C45 made gears (Allowable shear stress = 180 N/mm^2 , $E = 2 \times 10^5 \text{ N/mm}^2$). The pressure angle is 20° and helix angle is 15° and the speed reduction required is 3 (9)

PART C

7. A bevel gear drive with pinion rotates at 500 rpm and receives 2.5 kW power from the electric motor pair. The pressure angle is 20 and consists of a 20 teeth pinion meshing with a 30 teeth gear. The module is 4 mm, while the face width is 20 mm. The material for the pinion and gear is steel 50C4 ($\sigma_{ut} = 750 \text{ N/mm}^2$). The gear teeth are lapped and ground and the surface hardness is 400 BHN. The starting torque of the motor is 150% of the rated torque. Determine the factor of safety against bending failure and against pitting failure. (12)
8. A hardened steel worm transmits 12 kW at 1440 rpm to phosphor bronze gear. The speed of the worm wheel should be $60 \pm 3\%$ rpm. Design the worm gear drive if 82% efficiency is desired. (12)
9. A six speed gear box is required to provide output speeds in the range of 125 to 400 rpm with a step ratio of 1.25 and transmit a power of 5 kW at 710 rpm. Draw the speed diagram and kinematics diagram. Determine the number of teeth for the gears. (12)