Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth semester B.Tech degree examinations, September 2020

Course Code: ME402
Course Name: Design of Machine Elements-II

Max. Marks: 100   Duration: 3 Hours

Use of design data book is permitted
Missing data may be suitably assumed
PART A
Answer any two full questions, each carries 15 marks.   Marks

1 a) Determine the main dimensions of a cone clutch faced with leather to   (12)
      transmit 30 kW at 750 rpm from an electric motor to an air compressor.
      Assume an over load factor of 1.75. Due to possibility of contamination of
      lining, a low value of coefficient of friction 0.2 is recommended.

   b) What is the principle of operation of a centrifugal clutch? What are its   (3)
      applications?

2 a) A bearing is to carry a radial load of 240 kgf and a thrust load of 130 kgf. (12)
      The load imposes light shock. The desired 90 % life is 10 hrs per day for 5
      years at 3000 rpm. (a) Select a deep groove ball bearing. (b) What is the
      probability of bearing surviving specified life?

   b) What is L_{10} and L_{50} life of ball bearing?   (3)

3 a) A journal bearing for a steam turbine is required to support a radial load of (12)
      270 kgf. The shaft diameter at the bearing is 60 mm. The speed of rotation is
      1800 rpm. Design the bearing. Design should clearly indicate requirement of
      artificial cooling.

   b) Discuss the significance of bearing modulus in the design of journal bearing? (3)

PART B
Answer any two full questions, each carries 15 marks.

4   Design a helical gearing to transmit 60 HP. The pinion runs at 6000 rpm.   (15)
      The speed ratio is 3. Check also the gear pair for safe endurance strength and
      surface durability based on the estimate of dynamic load from Buckingham's
      equation.

5   A pair of 20° full depth involute bevel gears is used to connect two shafts at (15)
      right angles having a velocity ratio 2.5: 1. The gear is made from cast steel
      and the pinion is from the forged steel. Pinion transmits 37.5 kW at 750 rpm.

Design the gear drive and check the design for dynamic and wear loads.

6   Design a worm gear drive to transmit 20 HP from worm at 1440 rpm to the   (15)
     worm wheel that should be rotated at $40 \pm 2\%$ rpm.

PART C
Answer any two full questions, each carries 20 marks.

7   a)   Design a V-belt drive to the following specifications. Power transmitted is   (17)
          20 kW, speed of the driving wheel is 1440 rpm, speed of the driven wheel is
          400 rpm, centre distance should not exceed 2500 mm, and the service of the
          equipment is 16 hrs/day.

     b)   How will you designate V belt?   (3)

8   a)   Design a chain drive to a compressor which receives power 15 HP from an   (17)
          electric motor running at 970 rpm. The compressor speed is being 330 rpm.
          The centre distance should be maximum 500 mm. The chain tension can be
          adjusted by shifting the motor on slides.

     b)   What is the reason for selecting even number of pitches or links for roller   (3)
          chain?

9   Design a connecting rod of a diesel engine for the following data.   (20)

     Cylinder bore = 85 mm

     Length of connecting rod = 350 mm

     Maximum gas pressure = 3 MPa

     Factor of safety against buckling failure = 5

     (l/d) ratio for piston pin bearing = 1.5

     (l/d) ratio for crank pin bearing = 1.25

     Allowable bearing pressure for piston pin bearing = 13MPa

     Allowable bearing pressure for crank pin bearing 11 MPa.

     Length of stroke = 140 mm

     Mass of reciprocating parts = 1.5 kg

     Engine speed = 2000 rpm

     Thickness of bearing bush = 3 mm

     Material of cap = 40 C8 (S_{yt} = 380 N/mm^2)

     Material of bolts=Alloy steel (S_{yt} =450N/mm^2)

     Factor of safety for cap and bolts = 4 and 5 respectively

     Density of connecting rod = 7800 kg/m^3.

<center>****</center>