Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree 7th semester (S,FE) Exam April 2025 (2019 Scheme)

Course Code: MET401

Course Name: DESIGN OF MACHINE ELEMENTS

Max. Marks: 100 **Duration: 3 Hours**

Use of Approved Design Data handbook permitted

PART A

Answer all questions, each carries 3 marks. Marks

1	What do you understand by torsional rigidity and lateral rigidity?	(3)
2	Why I-section is popular in automobile engine connecting rods?	(3)
3	What is self-energizing band brakes and self-locking band brakes?	(3)
4	Give the reason why clutches are usually designed on the basis of uniform wear theory.	(3)
5	Differentiate hydro-dynamic and hydrostatic lubrication.	(3)
6	What are the four parts of a ball bearing and materials used to develop these parts?	(3)
7	When pinion and gear are made of different materials, which component is to be designed? Why?	(3)
8	What is the main disadvantage of a single helical gear? What is the remedy?	(3)
9	How will you classify bevel gears on the basis of pitch angle?	(3)
10	Give the reason why usually worm and worm wheels are not made of same material.	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	A power transmission shaft is supported in bearings 2 m apart and carries a pulley weighing 1 kN at its midpoint and it receives power by a belt drive under mild shock operating conditions. The shaft transmits power to another machine by means of a flexible coupling just outside the right bearing. The power transmitted is 20 kW at 110 rpm. The ratio of belt tensions is 3:1and the maximum belt tension is limited to 2.5 kN. Estimate the size of the shaft if the permissible stress in shear is 50 MPa. Also, calculate the twist in the shaft if the modulus of rigidity is 80 GPa.	(14)

OR

12 Design a flat belt drive for a fan running at 360 rpm which is driven by a 10 kW, 1440 rpm motor. The motor pulley diameter is 100 mm. The belt drive is open type and the space available for centre to centre distance is 2 m approximately. (14)

Module II

13 A simple band brake as shown in Figure 1 is to be designed to absorb a power of 30 kW at a rated speed of 750 rpm. Determine

i) The effort required to stop clockwise rotation of the brake drum.

ii) The effort required to stop counter clockwise rotation of the brake drum

iii) The dimensions of the rectangular cross-section of the brake lever assuming its depth to be twice the width.

iv) The dimensions of the cross-section of the band assuming its width to be ten times the thickness. (14)

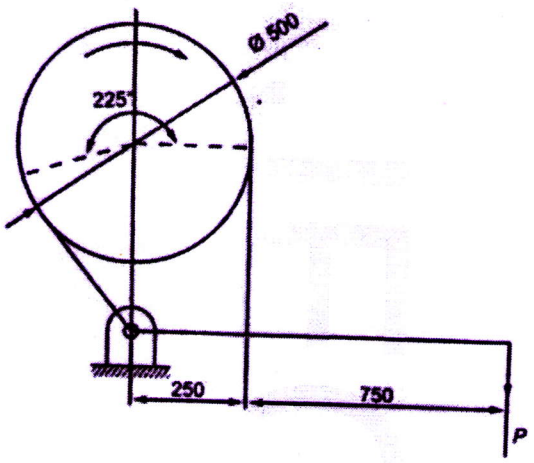

Figure-1

OR

14 The following data are given for a dry single plate clutch:

Power = 18.65 kW, speed = 1500 rpm, number of springs = 6, ratio of mean radius to radial with = 4.5

Find:

i) Mean radius and width of friction surfaces

ii) Dimensions of clutch plate

iii) Dimensions of springs (14)

Module III

15 Design a journal bearing to support a load of 5.5 kN at 650 rpm using hardened steel journal bronze backed babbitt bearing. The diameter of journal is 90 mm and the bearing is lubricated by oil rings. Consider room temperature as 22^0 C and oil temperature as 85^0 C. (14)

OR

16 Select a suitable deep groove ball bearing for supporting a radial load of 10 kN and an axial load of 3 kN for a life of 4000 hours at 800 rpm. Select from SKF series 63. Calculate the expected life of the selected bearing. (14)

Module IV

17 A pair of spur gears has to transmit 20 kW from a shaft rotating at 1300 rpm to a parallel shaft which is to rotate at 325 rpm. The material for pinion is steel with allowable static stress 200 MPa and the material for the gear is cast Iron with allowable static stress 120 MPa. Design the gears assuming the gear tooth as 20^0 full depth involute system. (14)

OR

18 Design a helical gear drive to transmit a power of 34 kW from a shaft running at 2700 rpm to the driver shaft running at 600 rpm. The pressure angle and helix angle are respectively 14.5^0 and 20^0. The material of both the pinion and gear are of C45 steel. (14)

Module V

19 A pair of straight tooth bevel gears at right angles is to transmit 5 kW at 1200 rpm of the pinion. The diameter of the pinion is 80 mm and the velocity ratio is 3.5. Assuming 20^0 involute gear tooth design the bevel gears. Both the pinion and gear are made of cast iron material. (14)

OR

20 Design a worm drive for a speed reducer to transmit 30 kW at a worm speed of 600 rpm. The required velocity ratio is 25:1. The worm is made of C30 heat treated steel and the worm wheel is made of phosphor bronze. The service conditions are intermittent operations with medium shock loads. (14)

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