

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (S, FE) / S7 (PT) (S) Examination May 2024 (2019 Scheme)

**Course Code: MET401****Course Name: DESIGN OF MACHINE ELEMENTS****Max. Marks: 100****Duration: 3 Hours****PART A***Answer all questions, each carries 3 marks.*

		Marks
1	Which theories of failure are applicable for shafts? Why?	(3)
2	What is the advantage of having I section in connecting rods?	(3)
3	Why heat-dissipation is necessary in clutches?	(3)
4	What is a self-actuating or self-energizing brake?	(3)
5	Enumerate any two advantages and disadvantages of rolling-contact bearings over sliding contact bearings.	(3)
6	Why are ball and roller bearings called antifriction bearings?	(3)
7	What is the stub involute gear tooth system?	(3)
8	State advantages of helical gears over spur gears.	(3)
9	How will you estimate the wear strength of bevel gear?	(3)
10	Why is the efficiency of worm gear drive low?	(3)

PART B*Answer any one full question from each module, each carries 14 marks.***Module I**

- 11 A shaft supporting two pulleys at free end and supported on two bearings. The shaft transmits 7.5 kW power at 360 rpm from pulley 1 to pulley 2. The diameter of pulley 1 and pulley 2 are 250 mm and 500 mm respectively. The mass of the pulley 1 and pulley 2 are 10 kg and 30 kg respectively. The belt tensions act vertically downward and ratio of belt tensions on tight side to slack side for each pulley is 2.5: 1. The shaft material yield strength is 380 MPa and factor safety is 3. Length of the shaft is 1000 mm and distance between the pulley and bearings are 250 mm. Determine the diameter of the shaft. (14)

OR

- 12 Design a flat belt drive for a flour mill which is driven by a 55 kW, 1200 rpm electrical motor. The motor pulley is of 400 mm diameter and that the driven (14)

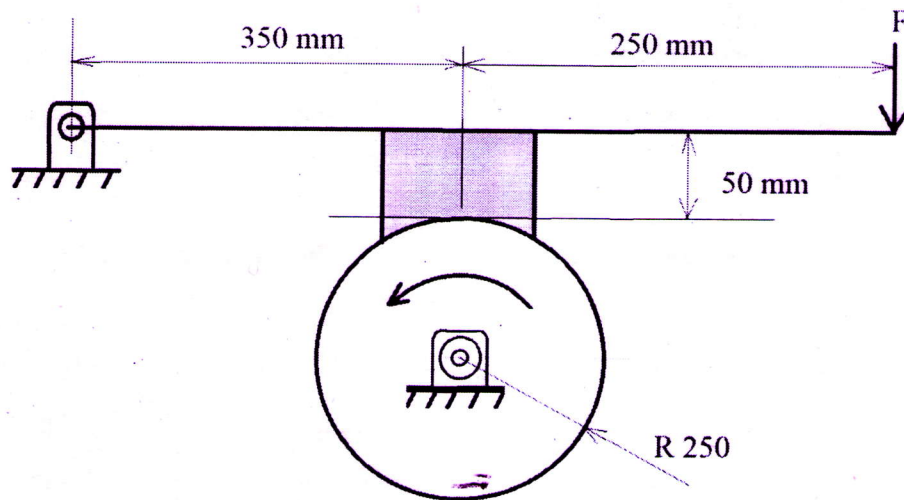
pulley is 1200 mm in diameter. The centre distance is 3 m ., assuming a service factor of 1.2 .

Module II

- 13 a) A multi - plate disc clutch of steel on bronze category is to transmit 5 kW at 800 rpm . The inner diameter of contact = 90 mm and the outer diameter of contact = 150 mm . The wet coefficient of friction = 0.14 . The average allowable maximum pressure = 0.35 MPa . Assume uniform wear theory and determine
 (i). Number of steel and bronze discs
 (ii). Axial force required.
- b) Derive the expression for the torque carrying capacity of centrifugal clutch. (7)

OR

- 14 A single short block brake has drum radius of 250 mm with torque capacity of 300 N-m as shown in figure below rotates at 120 rpm . Assume coefficient of friction is 0.35 and intensity of pressure is 1.2 MPa . Take length of the block is twice the width. Calculate: (i) The actuating force and the hinge point reactions, (ii) The rate of heat generation, and (iii) The dimensions of the block. (14)



Module III

- 15 Design a full journal bearing subjected to 15 kN at 1200 rpm . The bearing temperature is 55°C and ambient temperature is 32°C . The journal diameter is 100 mm and l/d ratio is 1.5 . Check whether artificial cooling is required or not. (14)

OR

- 16 a) Calculate the expected life of the bearing in hours for a single-row deep groove ball bearing. The dynamic load capacity is 42000 N and operates on the following work cycle: (7)

Sl. No	Load (N)	Speed (rpm)	Time (%)
1	5500	500	25
2	12000	800	50
3	8000	500	25

- b) A ball bearing SKF 6212 is subjected to an axial force of 13 kN and a radial load of 28 kN. Find the L_{10} life and L_{50} life in hours. (7)

Module IV

- 17 An electric motor is to be connected to a reciprocating pump through a gear pair. The gears are overhanging their shafts. Motor speed = 1440 rpm, speed reduction ratio = 5, Motor power = 37 kW. Both the pinion and gear are made of steel with a maximum safe stress of 200 N/mm². The gear to have 20° pressure angle. Design a spur gear drive to suit the above condition. (14)

OR

- 18 Design a pair of helical gear for continuous operation. Both gears are made of Cast Iron Grade 20. The design data are: (14)
Power: 35 kW; Speed of pinion: 1500 rpm ; Number of teeth on pinion : 24; Pressure angle : 20° FDI; helix angle : 30°; speed reduction : 3: 1. Assume the starting torque is 20 % greater than the mean torque.

Module V

- 19 A pair of bevel gears is required to transmit 30 kW at 500 rpm. The output shaft is running at 200 rpm and is at right angles to the input shaft. The gear is of cast iron and the pinion of cast steel. Design the gears. (14)

OR

- 20 Design a worm gear drive to transmit a power of 23 kW. The worm speed is 1440 rpm and the speed of the wheel is 60 rpm. The drive should have a minimum efficiency of 80% and above. (14)
