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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination December 2022 (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.

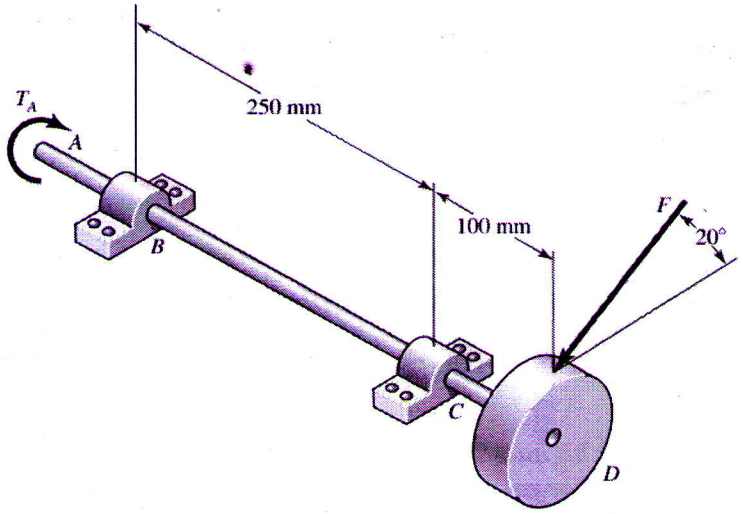
		Marks
1	What is the advantage of having I section in connecting rods?	(3)
2	Explain strength-based design and rigidity-based design.	(3)
3	Explain uniform wear theory and uniform pressure theory in friction clutches.	(3)
4	What do you mean by self-locking and self-energizing in brakes?	(3)
5	Distinguish between hydrostatic and hydrodynamic bearings.	(3)
6	Define (i) bearing characteristic number (ii) Sommerfeld number.	(3)
7	What is Lewi's form factor? How does it vary with number of teeth on gear?	(3)
8	Define virtual number of teeth in helical gears.	(3)
9	How will you estimate the wear strength of bevel gear?	(3)
10	List the demerits of worm gear drive over other gear drives.	(3)

PART B

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

Module I

11	The rotating solid steel shaft is simply supported by bearings at points B and C and is driven by a gear (not shown) which meshes with the spur gear at D, which has a 150-mm pitch diameter. The force F from the drive gear acts at a pressure angle of 20°. The shaft transmits a torque to point A of $T_A = 340$ N · m. The shaft is machined from steel with yield tensile strength, $\sigma_y = 420$ MPa and ultimate tensile strength, $\sigma_{ut} = 560$ MPa. Using a factor of safety of 2.5, determine the minimum allowable diameter of the 250-mm section of the shaft based on maximum normal stress.	(14)

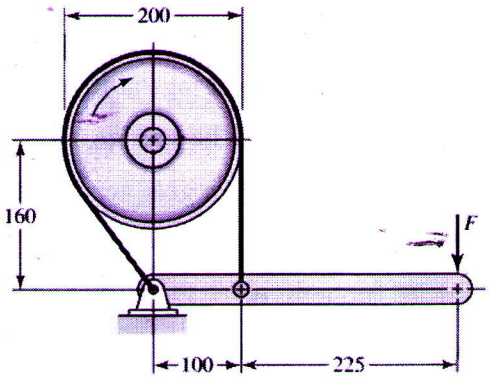


OR

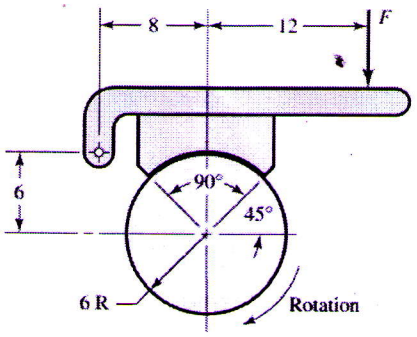
12 Design a belt drive to transmit 30 hp at 740 rpm to an aluminium rolling machine, the speed ratio being 3. The distance between the pulleys is 3 m. Diameter of the rolling machine pulley is 1.2 m. (14)

Module II

13 a) The brake shown in the figure (with dimensions in mm) has a coefficient of friction of 0.30 with an angle of contact of 270° and is to operate using a maximum force F of 400 N. If the band width is 50 mm, find the band tensions and the braking torque. (8)



b) The block-type hand brake shown in the figure (with dimensions in cm) has a face width of 12.5 mm and a mean coefficient of friction of 0.25. For an estimated actuating force of 900 N, find the maximum pressure on the shoe and find the braking torque (6)



OR

14 a) A hydraulically operated multi disk plate clutch has an effective disk outer diameter of 6.5 cm and an inner diameter of 4 cm. The coefficient of friction is 0.24, and the limiting pressure is 0.3N/mm^2. There are six planes of sliding present. Using the uniform wear model, estimate the axial force F and the torque T. (8)

b) Derive an expression for the axial force and torque in the case of a cone clutch assuming uniform wear theory. (6)

Module III

15 Select a suitable deep groove ball bearing for supporting a radial load 20 kN and axial load of 6 kN for a life of 4000 hours at 1000 rpm. Select from series 63. Calculate expected life of the selected bearing. (14)

OR

16 Design a suitable journal bearing for a centrifugal pump using the following data: Load on the bearing = 8 kN, diameter of the journal = 80 mm, speed = 1440 rpm, at the working temperature 75°C. Calculate cooling requirements, if any. (14)

Module IV

17 Design a pair of spur gear to transmit 10 kW at a pinion speed of 2000 rpm. The driven gear is to run at 500 rpm. Selecting suitable materials, decide upon the dimensions of the gear pair. (14)

OR

18 Design a pair of helical gears to transmit 10 kW at 1000 rpm of the pinion. A speed reduction ratio of 5 is required. Give the details in a table and show the nomenclature in a neat sketch. (14)

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 Determine the dimensions of a pair of worm and worm wheel for transmitting 2 kW at a worm speed of 1200 rpm. The desired ratio is about 12. Choosing proper materials decide all the dimensions. (14)

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