

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	:	BMT 3093
COURSE TITLE	:	MACHINE DESIGN
SEMESTER/SESSION:		2 – 2022/2023
DURATION	:	3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **all** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, rise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 3 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- a) Define terms "EFFORT" and "LOAD" in designing a machine (5 marks)
- b) In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is 150° . The smaller pulley has a radius of 200 mm and rotates at 500 rpm. Solve the power in kW transmitted by the belt. (10 marks)
- c) Power is transmitted using a V-belt drive. The belt is 20 mm deep and the maximum width is 20 mm. If the mass of the belt is 0.35 kg per meter length and the maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140° . Given $\mu = 0.15$. (10 marks)

QUESTION 2

- a) State the definition of gears and type of gears in designing a machine. (5 marks)
- b) The load on the lever is 2 kN and acts 20 mm from the fulcrum. The effort is 200 mm from the fulcrum. Assuming 100% efficiency, find the effort. (10 marks)
- c) A pulley is 50% efficient. Compute:
- The effort required to lift 12 kN if there are 6 lengths of rope between the blocks, if the dead weight of the pulleys and hook is 500 N. (5 marks)
 - What would the effort be then with the dead weight take into consideration? (5 marks)

QUESTION 3

- a) A clutch is a device for connecting and disconnecting the drive between two coaxial shafts. Describe two (2) forms of clutches. (5 marks)
- b) Suppose there are 100 teeth on gear A and 50 teeth on gear B. Determine how many revolution of gear B turns when gear A rotates through three revolutions. (10 marks)
- c) An open belt running over two pulleys of 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 4 kW from the smaller pulley that rotates at 300 rev/min. Given the coefficient of friction between the belt and the pulley is 0.3. Determine:
- The tension in both sides, T_1 , T_2 (5 marks)
 - The initial belt tension, T_0 (5 marks)

QUESTION 4

- a) Describe how belt is used as mechanical power transmission elements. (5 marks)
- b) A gear box has an input speed of 2000 rev/min clockwise and an output speed of 500 rev/min anticlockwise. The input power is 50 kW and the efficiency is 60%. Determine the following:
- The input torque (2 marks)
 - The output power (2 marks)
 - The output torque (3 marks)
 - The holding torque (3 marks)
- c) A gear box must produce an output power and torque of 55 kW and 75 Nm when the input shaft rotates at 1200 rev/min. Solve the following:
- The gear ratio (5 marks)
 - The input power assuming an efficiency of 60% (5 marks)

.....End of question.....

