UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET		
COURSE CODE	:	BMT 3093
COURSE	:	MACHINE DESIGN
SEMESTER/SESSION:		2 – 2024/2025
DURATION	:	3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **all** questions.
2. All answers should be written in the 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 4 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Define terms "EFFORT" and "LOAD" 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 100 mm from the fulcrum. Assuming 100% efficiency, calculate the effort. (10 marks)

c) A pulley is 50% efficient. Compute:

i. 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)

ii. What would the effort be then with the dead weight take into consideration? (5 marks)

QUESTION 2

a) Define and explain the concept for each case:

i. Normal stress (4 marks)
ii. Shear stress (3 marks)
iii. Bending stress (3 marks)

b) 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:

i. The gear ratio (8 marks)
ii. The input power assuming an efficiency of 60% (7 marks)

QUESTION 3

a) Describe how belt is used as mechanical power transmission elements. (5 marks)

b) Explain the gears and type of gears in designing a machine. (5 marks)

c) Explain the concept of welding and type of welding in designing a machine.

(5 marks)

d) Suppose there are 100 teeth on gear A and 10 teeth on gear B. Determine how many revolution of gear B turns when gear A rotates through three revolutions.

(10 marks)

QUESTION 4

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) Explain the mechanism and function of brake in designing a machine. (5 marks)

c) A gear box has an input speed of 1000 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:

i. The input torque (5 marks)
ii. The output power (5 marks)
iii. The output torque (5 marks)

.....END OF QUESTION.....

FORMULA

Force ratio = velocity ratio

Velocity ratio = effort / load

Force ratio = efficiency x VR

Gear ratio = input speed / output speed

Output power = $2\pi NT / 60$

Efficiency = output power / input power