UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC_TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DGE 1314
COURSE	: PHYSICS
SEMESTER/SESSION	: 1-2022/2023 (APRIL)
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **3** 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, raise up your hands and ask the invigilator.

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

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

INSTRUCTION: ANSWER ALL THE QUESTIONS

QUESTION 1

a) Define scalar and vector quantities (4 Marks)

b) A car travel at speed of 30 m/s accelerating to 40 m/s in 5 second, calculate the average acceleration of the car in m/s^2 and in $km/minutes^2$ (4 Marks)

c) A ball is released at initial speed of 5 m/s from a height of 200 m above ground level. Neglect the effects of air resistance

i. Calculate velocity of the ball two seconds after it is dropped (3 Marks)

ii. Calculate time it takes for the ball to strike the ground (3 Marks)

iii. Calculate velocity of the ball just before it strikes the ground (3 Marks)

d) The following data (Table 1) from experiment, describe the velocity of an object along the x-axis as a function of time

V (ms^{-1})	0	16	24	25	21	16	9
t (s, second)	0	2	4	5	7	8	9

Table 1

i. Represent data from table 1 by plotting V vs t plot (use graph paper) (9 marks)

ii. Calculate instantaneous acceleration at t = 3 s , t = 5 s, t = 7 s and t = 9 s from the plot (8 marks)

iii. Calculate total displacement from the plot (use rectangular area estimation) (8 marks)

e) A ball is thrown at an angle of 30° from horizontal with initial speed of 20 m/s. Calculate

i. Maximum height the ball will reached (4 marks)

ii. Time taken for the ball to reach its maximum distance (2 marks)

iii. Distance covered by the ball during the trajectory (2 marks)

QUESTION 2

a) Newton's has stated three (3) laws governed between force and mass in his famous Laws of motion. Define all three (3) of the laws. (6 Marks)

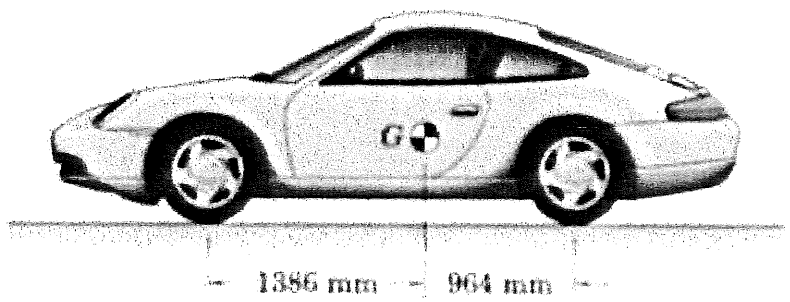

Figure 1

b) The mass center G of the 1400 kg car is shown in Figure 1. Calculate normal force under each tyre when the car is in equilibrium (10 Marks)

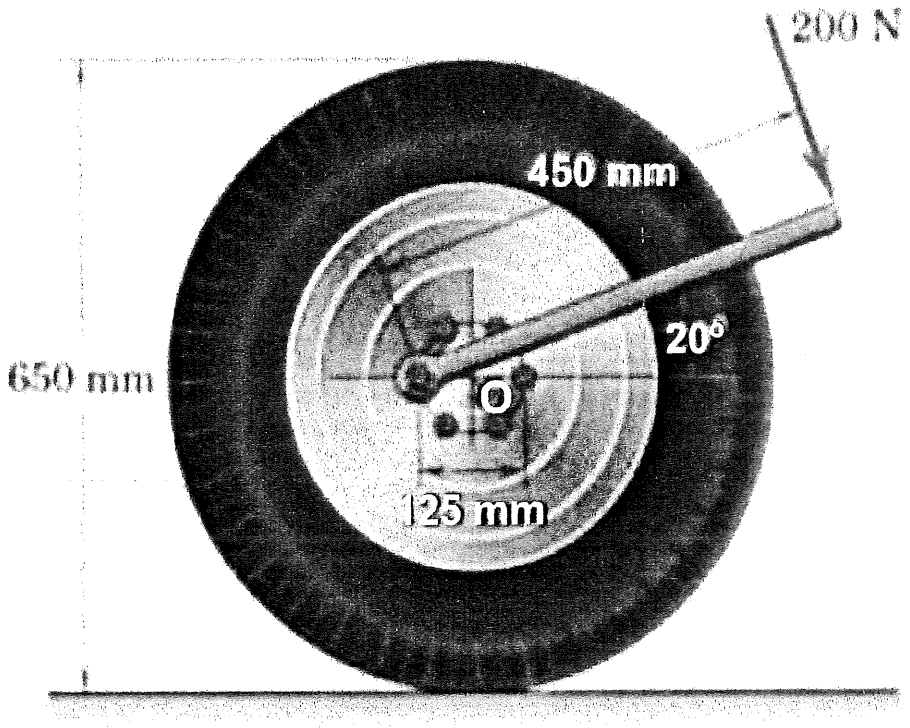

Figure 2

c) A force of 200 N is applied to the end of wrench to tightened a flange bolt which holds wheel of the axle (Figure 2). Calculate, moment produced by the wrench about the center O of the wheel (9 Marks)

QUESTION 3

a) Define Pascal's principle (2 Marks)

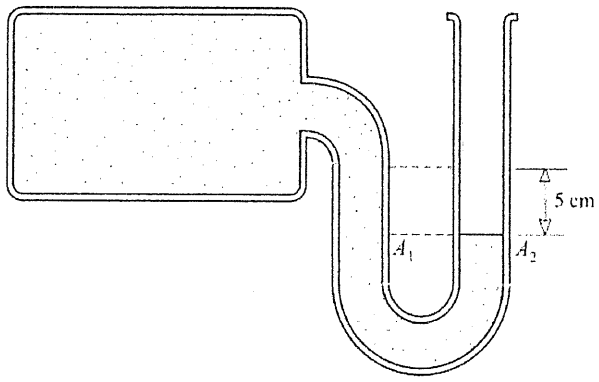

Figure 3

b) The U-tube device connected to the tank in Figure 3 is called a manometer. The mercury in the tube stands higher in one side than the other. Calculate the pressure in the tank in pascal and in millimetre mercury, given atmospheric pressure is 760 mm of mercury and density of mercury is 13600 kg/m^3

(5 Marks)

c) A 60-kg circular box, open at the top, has diameter of 1 m and 0.4 m height (fresh water density, ρ = 1000 kg/m^3)

i. Using Archimedes's principle, show that the box will float on the fresh water (4 Marks)

ii. Determine how deep will it sink in fresh water (5 Marks)

iii. Calculate the maximum load can be loaded into the box if the box is allowed to sink 60% from its height (5 Marks)

d) The density of foam is 100 kg/m^3. Calculate percentage of volume of the foam will float in fresh water (4 Marks)

**********END OF QUESTIONS**********

APPENDICES

Kinematic of constant acceleration

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

$$v = u + at$$

Thermal Energy

sensible heat

$$Q = mc\ \Delta T$$

Latent heat

$$Q = mL$$

Mechanics of fluid

Pascal principle

$$P = \rho gh$$

Bernoulli principle

$$P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$$

Poiseuille's Law

$$\text{rate of flow} = \frac{\Delta V}{\Delta t} = \frac{\pi R^4 (P_1 - P_2)}{8\eta L}$$