GENERAL CERTIFICATE OF EDUCATION BOARD General Certificate of Education Examination

Pure Maths With Mechs 3 0765

JUNE 2022

ADVANCED LEVEL

Subject Title	Pure Mathematics with Mechanics
Paper No.	Paper 31000 about the party gard example of
Subject Code No.	0765

Three hours

Full marks may be obtained for answers to ALL questions.

All questions carry equal marks.

You are reminded of the necessity for good English and orderly presentation in your answers.

Mathematical formulae booklet published by the GCE Board are allowed.

In calculations, you are advised to show all the steps in your working, giving the answer at each stage.

Calculators are allowed.

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Start each question on a fresh page.

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are recording the figure of a contract of the first three contracts.

1. The position vector **r** of a particle of mass 3 kg at time t seconds is given by maintaining a non-zero by maintaining $r = [(3 \sin 2t)i + (4 \cos 2t)j)] m.$ Pure Maths With Mecha 3 Find when $t = \frac{n}{2}$ (6 marks) (a) the magnitude of the momentum of the particle, (4 marks) (b) the force acting on the particle, 2505 18 (3 marks) (c) the power developed by the particle. object litte Pure Mathematics with Mechanic A body P of mass 10 kg, lying on a smooth plane inclined at 30° to the horizontal, is connected to -2. (i) another body Q, of mass 20 kg, by a light inextensible string which passes over a fixed smooth pulley at the top of the plane. The system is released from rest when Q is hanging vertically. Given that the coefficient of friction between P and the plane is $\frac{2}{5}$, find (5 marks) (a) the acceleration of P, (2 marks) (b) the tension in the string, (2 marks) (c) the magnitude of the force exerted by the string on the pulley. (ii) A particle moves in a circle of radius 2 m with an acceleration of $\frac{8\pi^2}{81}$ m s⁻². Find its angular displacement in 3 s. (Take g as 10 m s^{-2}) considered the perceived that and Deptish and orderly presentation in your s 3. Sphere A of mass 2 kg moving with speed 4 m s⁻¹ along a horizontal smooth surface collides directly with sphere B of mass 8 kg initially at rest. Given that the coefficient of restitution between A and B is $\frac{1}{2}$, calculate state the vectorial classical provided and vaccinate and the vectorial value of the vectorial value and vectorial value of the vectorial value of value of the vectorial value of v (7 marks) (a) the velocities of A and B after impact and comment on the result, (2 marks) (b) the the magnitude of the impulse experience by A due to the impact, (4 marks) (c) the total loss of kinetic energy due to the impact.

- 4. (i) An elastic string AB, of natural length 1 m, has a particle of mass 2 kg attached to the end B and the end A is attached to a fixed point. When the system is in equilibrium with B hanging vertically below A, the length of the loaded string is 1.2 m.. Calculate the work that must be done in stretching the loaded string from a length of 1.5 m to a length of 1.75 m.
 (6 marks)
 - (ii). A car of mass 1000 kg moves along a straight horizontal road. The engine works at a constant rate of 50 kW against a constant resistance of magnitude 5000 N to the motion of the car.

(a) Find the maximum speed of the car.

(3 marks)

(b) If the speed v of the car is not maximum, show that the acceleration a of the car is given by

 $a = \frac{50 - 5v}{v}. ag{4 marks}$

5. A particle P is projected from a point O on a horizontal plane at time t = 0 with velocity (5i + 5√3 j) m s⁻¹, where i and j are are unit vectors along Ox and Oy respectively. Find,
(a) the cartesian equation of the trajectory of P,
(b) the maximum height which P attains above the horizontal plane through O,
(c) the distance of P from the point O when t = 2 s.
(4 marks)
(5 marks)
(4 marks)

(Take g as 10 m s^{-2})

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6. (i) Forces F₁ = (-i + 2j + k) N and F₂ = (3i + 6k) N act through the point with position vectors r₁ = (i - j + 3k) m and r₂ = (-3i + j - 2k) m respectively. Show that the lines of action of these forces intersect and find the position vector of their point of intersection.

(ii) The acceleration of a particle starting from rest is $\frac{10}{v}$ m s⁻², where v is the speed of the particle at time t seconds.

Find the speed of the particle when t = 5.

(3 marks)

7.

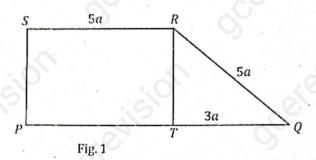


Fig. 1 shows a uniform lamina in the form of a trapezium where QR = RS = 5a and TQ = 3a.

(a) Find the distances from PS and PQ of the centre of mass of the lamina.

(11 marks)

If the lamina is freely suspended from S,

(b) calculate the tangent of the angle the edge PS makes with the vertical.

(2 marks)

8 (i) Two events A and B are such that $P(A) = \frac{3}{5}$, $P(A \cup B) = \frac{7}{10}$ and $P(A \cap B') = \frac{3}{10}$.

Find P(B) (5 marks)

(ii) At lunch time, a man can choose at random from three restaurants X, Y or Z to have lunch with probabilities 0.5, 0.1 and 0.4 respectively. His choice will be ready at X, Y and Z for lunch (L) with probabilities 0.25, 0.3 and 0.2 respectively.

Find the probability that

(a) the man will have lunch,

(3 marks)

(b) the man will not have lunch,

(2 marks)

(c) Y is chosen given that man will have lunch.

(3 marks)

GO BACK AND CHECK YOUR WORK