淡江大學九十學年度碩士班招生考試試題

系別：物理學系

科目：古 典 物 理

准帶項目請打「○」否則打「×」	
計算機	字典

本試題共 / 頁

1. Two semi-infinite grounded conducting planes meet at right angles. In the region between them, there is a point charge q, situated as shown in Fig.1.
   (a) Set up the image configuration - what charges do you need, and where should they be located ?
   (b) What is the force on q ?

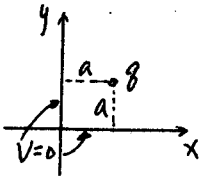

Fig. 1

2. The motion of a charged particle in uniform and perpendicular E and B fields. The particle of charge q starts from rest at the origin in a region where
   E = Ey and B = Bz
   (a) Find two simultaneous differential equations of Vx and Vy.
   (b) Find the location of the particle as a function of time from the origin, i.e.x(t) and y(t), set
   $\omega_C = qB/m$, this is the cyclotron frequency.

3. Suppose you have two infinite straight line charges λ (charge per unit length), a distance d apart, moving along at a constant speed v, as shown in Fig.2. How fast would v have to be in order for the magnetic attraction to balance the electrical repulsion ?

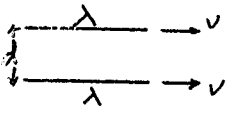

Fig. 2

4. A gasoline internal combustion engine can be approximated by the cycle shown in Fig.3. Assume an ideal gas and use a compression ratio by 4:1 ($V_4 = 4V_1$). Assume that $P_2=3P_1$.
   (a) Determine the pressure and temperature of each of the vertex points of the P-V diagram in terms of P_1, T_1 and the ratio of specific heats (i.e. Cp/Cv = γ) of the gas.
   (b) What is the efficiency of the cycle ?

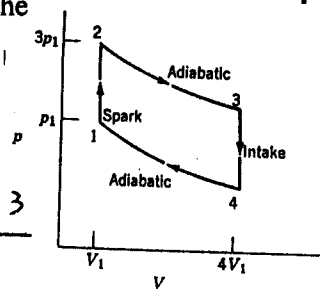

Fig 3

5. A particle of mass m is constrained to move on the inside surface of a smooth cone of half-angle α (see Fig.4). The particle is subject to a gravitational force.
   (a) Determine a set of generalized coordinates and determine the constraints.
   (b) Find the Lagrange's equations of motion for coordinate r.
   (c) Find the constant radius R of the circle when the particle is rotating about its vertical symmetry axis with angular velocity ω.

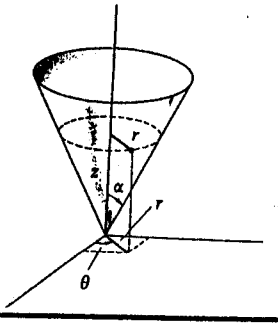

Fig.4