國立高雄大學 101 學年度轉學招生考試試題(轉二年級)

科目：普通物理學
考試時間：80 分鐘
系所：應用物理學系(無組別)、化學工程及材料工程學系(無組別)
本科原始成績：100 分
是否使用計算機：是

1. An object attached to the end of a string swings in a vertical circle (R = 1 m), as shown in Figure 1. At an instant when θ = 30°, the speed of the object is 5 m/s and the tension in the string has a magnitude of 20 N. What is the mass of the object? [10p]

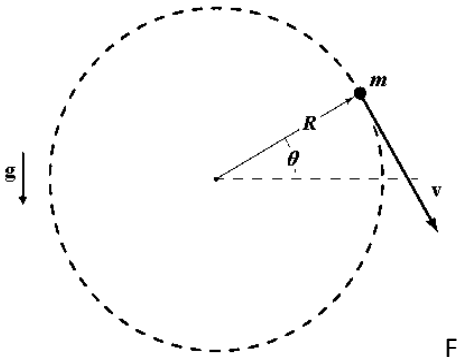


Figure 1.

2. A 3.0-kg mass sliding on a frictionless surface has a velocity of 5.0 m/s east when it undergoes a one-dimensional inelastic collision with a 2.0-kg mass that has an initial velocity of 2.0 m/s west. After the collision the 3.0-kg mass has a velocity of 1.0 m/s east. How much kinetic energy does the two-mass system lose during the collision? [15p]

3. The rigid object shown in Figure 2, is rotated about an axis perpendicular to the paper and through point P. The total kinetic energy of the object as it rotates is equal to 2.0 J. If M = 1.5 kg and L = 0.50 m, what is the angular velocity of the object? Neglect the mass of the connecting rods and treat the masses as particles. [15p]

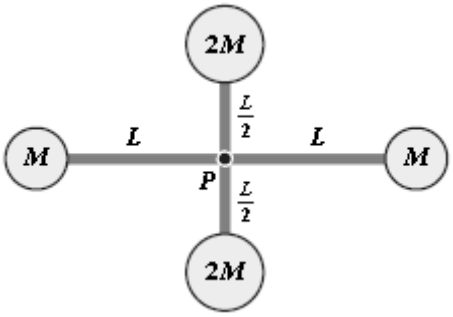


Figure 2

4. For the wave described by y = 0.02 sin (kx) at t = 0 s, the first maximum at a positive x coordinate occurs where x = 4 m. Where on the positive x axis does the second maximum occur? [10p]

5. During an adiabatic compression, a volume of air decreases to 1/2 its original size. Calculate its final pressure if its original pressure was 0.5 atm. (Assume the air behaves like an ideal gas with ratio of heat capacities γ = 1.67) [10p]

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6. A long nonconducting cylinder (radius = 6.0 mm) has a nonuniform volume charge density given by αr^2, where α = 9 mC/m^5 and *r* is the distance from the axis of the cylinder. What is the magnitude of the electric field at a point 2.0 mm from the axis? [15p]

7. A loop of wire (resistance = 2.0 mΩ) is positioned as shown with respect to a long wire which carries a current (Figure 3). If *d* = 2.0 cm, *D* = 10.0 cm, and *L* = 3.0 m, what current is induced in the loop at an instant when the current in the wire is increasing at a rate of 100 A/s? [15p]

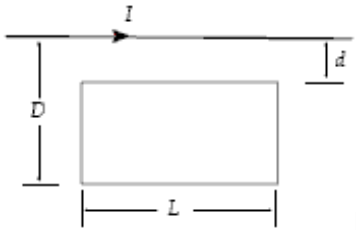


Figure 3

8. The mercury spectrum has a green line at 546 nm, and an ultraviolet line at 365 nm. What is the first order angular separation between the two spectral lines obtained with a diffraction grating with 10000 rulings/cm? [10p]

背面尚有試題

國立高雄大學 101 學年度轉學招生考試試題(轉二年級)

科目：微積分
考試時間：80 分鐘

系所：
應用物理學系(無組別)
本科原始成績：100 分

是否使用計算機：是

Please show your calculations for each question.

1. (10 %) $\frac{d}{dx}[\arctan(\tan x)]=?$

2. (10 %) $\int_0^1 \frac{dx}{2\sqrt{3-x}\sqrt{x+1}}=?$

3. (10 %) $\int \frac{dx}{\sec x \tan x}=?$

4. (10 %) Find the particular solution of the differential equation $x\frac{dy}{dx}=\sqrt{x^2-9}, x\geq 3, y(3)=1.$

5. (10 %) Determine the convergence or divergence of the series, $a_1=\frac{1}{3}, a_{n+1}=(1+\frac{1}{n})a_n.$

6. (10 %) Determine a power series, centered at 0, for the function $f(x)=\ln(1+x)$. And identify the interval of convergence.

7. (10 %) Find the center, foci, and vertices of the hyperbola $x^2-9y^2+2x-5y-80=0$, and sketch its graph.

8. (10 %) Find the points of horizontal tangency (if any) to the polar curve $r=2\csc\theta+3$.

9. (10 %) Convert the rectangular equation $x^2+y^2+z^2-2z=0$ to an equation in (a) cylindrical coordinates and (b) spherical coordinates.

10. (10 %) A television camera weight 120 pounds is supported by a tripod, as shown in the figure. Represent the force exerted on each leg of the tripod as a vector.

