No. of Printed Pages : 6

BAS-001

01774

B.TECH. IN AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2011

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

Note : *Question No. **1** is **Compulsory**. Attempt **any five** questions from question No. **2** to **7**. Use of calculator is permitted.*

1. Answer ***any five*** of the following : **5x4=20**

(a) Determine the maximum velocity and maximum acceleration of a particle which executes simple harmonic motion with an amplitude of 400 mm and a period of 1.4 sec.

(b) A mass M is attached to a spring which oscillates with a period of 2 sec. If the mass is increased by 2 kg, the period increases by 1 sec. Find the initial mass M, assuming that Hooke's law is obeyed.

(c) The threshold frequency for a certain metal is 3.3×10^{14} Hz. If the light of frequency 8.2×10^{14} Hz is incident on the metal, calculate the cut off voltage for photoelectric emission.

(d) A displacement wave is represented by

$y = 0.34 \cos(3000\ t + 0.74\ x)$

where x, y and t are in mm and seconds respectively.

Determine

(i) amplitude

(ii) frequency and angular frequency

(iii) period and initial phase

Deduce also the amplitude of particle velocity and particle acceleration.

(e) The rest mass of an electron is 9.1×10^{-31} kg. What will be its mass if it were moving with

$\left(\frac{4}{5}\right)^{th}$ speed of light ?

(f) Find the kinetic energy and velocity of proton associated with the de-Broglie's wavelength of 0.2865 Å.

2. (a) A proton and an electron have the same kinetic energy. Which has larger wave length ? Justify your answer. **3+3+4**

(b) A certain process requires 10^{-6} sec to occur in an atom at rest in laboratory. How much time will this process require to an observer in the laboratory, when the atom is moving with a speed of 5×10^7 m/sec ?

(c) A particle executes uniform circular motion. Show that the foot of the perpendicular drawn from its position to a diameter of the circle executes Simple Harmonic Motion.

3. (a) A charged particle accelerated by a potential difference (p.d) of 200 V has a de Broglie wavelength equal to 0.0202 Å. Find the mass of this particle and say which particle is it ? **3+3+4**

(b) What is the speed of a particle (expressed as a fraction of c) such that the total energy is ten times the rest energy ?

(c) A ray of light is incident on the surface of a transparent plate of refractive index $\sqrt{3}$ at the polarizing angle. Calculate the angle of refraction of the ray.

4. (a) The velocity of a particle increases by 1%. What is the percentage increase of its momentum if $v/c = 0.99$? **3+3+4**

(b) Describe in brief the applications of LASER.

(c)

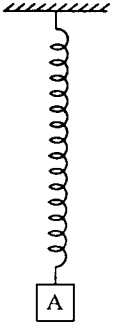

Figure - 1

A 1.4 kg block is supported as shown in Figure - 1 by a spring of constant k = 400 N/m. The block is in its equilibrium position when it is struck from below by a hammer which imparts to the block an upward velocity of 2.5 m/s.

Determine :

(i) the time required for the block to move 60 mm upward, and

(ii) the corresponding velocity and acceleration of the block.

5. (a) Calculate the frequency associated with a photon of energy 3.3×10^{-20} J. **3+3+4**

(b) Photoelectrons are emitted with a maximum speed of 7×10^5 ms^{-1} from a surface when light of frequency 8×10^{14} Hz falls on it. What is the threshold frequency of the surface ?

(c) A ray of light strikes a glass plate at an angle of 57.5°. If the reflected and refracted rays are perpendicular to each other, find the refractive index of glass.

6. (a) Calculate the de-Broglie's wavelength of an electron moving with a velocity $\frac{3}{5}C$. 3+3+4

(b) The wavelength of first member of Balmer series of hydrogen is 6563 $\mathring{A}$. Calculate the wavelength of the second member.

(c) In Young's experiment, two slits are 0.2 mm apart. The interference fringes for light of wavelength 6000 $\mathring{A}$ are formed on a screen 80 cm away.

(i) How far is the second bright fringe from the central image ?

(ii) How far is the second dark fringe from the central fringe ?

7. (a) Assume that an electron is inside an atom of radius 10^{-15} m, using uncertainty principle, estimate the kinetic energy of electron in electron volts. 3+3+4

(b) Describe in brief the Ruby LASER.

(c) A photon of wavelength 3310 Å falls on a photo cathode and an electron of energy 3×10^{-19} J is ejected. If the wavelength of the incident photon is changed to 5000 Å, the energy of the ejected electron is 7.91×10^{-20} J. Calculate the value of Planck's constant and threshold wavelength of the photon.

Physical Constants : $c = 3 \times 10^{8}$ ms^{-1}

$h = 6.6 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$g = 9.8$ ms^{-2}

1 amu = 931 MeV

mass of electron $= 9.11 \times 10^{-31}$ kg

mass of proton $= 1.67 \times 10^{-27}$ kg.