01324

B.TECH. IN AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2010

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) A body is vibrating with S.H.M of amplitude 15 cm and frequency 4 Hz. Compute :

(i) the maximum value of acceleration and velocity,

(ii) the acceleration and velocity when the particle is 9 cm from the mean position,

(iii) time required to move from the mean position to a point 12 cm away from it.

(b) A body of mass m kg is placed on a horizontal platform which is moving up and down simple harmonically with an amplitude of 2 cm. What may be the maximum frequency of oscillation so that the body may not be detached from the platform ?

(c) Two straight and narrow parallel slits 0.3 cm apart are illuminated by a monochromatic source of wavelength 5.9×10^{-5} cm. Fringes are obtained at a distance of 30 cm from the slit. Find the width of the fringes.

(d) A beam of light is incident on a glass plate at an angle of $58°6'$ and the reflected beam is found to be completely plane polarised. Find the refractive index of glass.

(e) The total energy of a particle is equal to its rest energy. Calculate its speed.

(f) A plane progressive wave is represented by the equation :

$$y = 0.5 \sin (314\,t - 12.56\,x).$$

Here x and y are expressed in metre, and t in second.

Find :

(i) amplitude

(ii) wavelength

(iii) frequency,

(iv) velocity of the wave, and

(v) difference in phase between two points in the path of the wave situated 7.5 m apart.

2. (a) A proton and an electron have the same speed. Which has longer wavelength ? Justify your answer. **3+3+4**

(b) A particle with a mean proper life time of 2×10^{-6} sec. moves through the laboratory with a speed of 0.9c. Calculate its life time as measured by an observer in the laboratory.

(c) Determine the amplitude and maximum velocity of a particle which executes simple harmonic motion with a maximum acceleration of 6.5 m/s^2 and a frequency of 8 Hz.

3. (a) The wavelength of the second line of the Balmer series in the Hydrogen spectrum is 4861 $\mathring{A}$. Calculate the wavelength of the first line. **3+3+4**

(b) Calculate the de-Broglie wavelength of neutron whose energy is 1 eV.

(c) The critical angle of light in a certain substance is 45°. What is the polarizing angle ?

4. (a) The velocity of a particle increases by 1%. What is the percentage increase of its momentum if $\frac{v}{C} = 0.7$? **3+3+4**

(b) The wavelength of the first spectral line of Balmer series in hydrogen spectrum is 6560 $\mathring{A}$. Calculate the wavelength of second spectral line of Lyman series. Ionisation energy of hydrogen atom is 13.6 eV.

(c) The period of vibration of the system as shown in figure 1 is observed to be 0.2 sec. After the spring of constant K_2=3.5 kN/m is removed and block A is connected to the spring of constant K_1, the period is observed to be 0.12 sec.

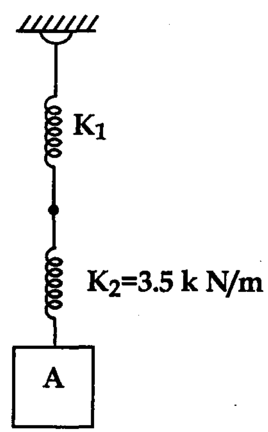

Figure - 1

Determine :

(i) the constant K_1 of the remaining spring, and

(ii) the mass of block A.

5. (a) Calculate the K.E. and P.E. of electron in the first orbit of hydrogen atom. **3+3+4**

Given :

$e = 1.6 \times 10^{-19}$ C and $r = 0.53 \times 10^{-10}$ m.

(b) A metal surface, when illuminated with light of wavelength 3333 Å, emits electrons with energy upto 0.6 eV and when illuminated with light of wavelength 2400 Å it emits electrons with energy upto 2.04 eV. Calculate planck's constant and the work function of the metal.

(c) Light of wave length 5000 Å falls on a sensitive plate with photoelectric work function = 1.90 eV,

Find :

(i) energy of the photon in eV

(ii) Kinetic energy of the photoelectrons emitted, and

(iii) stopping potential.

6. (a) Calculate the de Broglie wavelength of an α particle of mass 6.62×10^{-27} kg moving with a velocity of 8×10^4 ms^{-1}. **3+3+4**

(b) Calculate the energy in electron volt of an electron wave of $\lambda = 3 \times 10^{-2}$m.

(c) In young's double slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm, determine the wavelength of light used in the experiment.

7. (a) If the uncertainty in position of an electron is 4×10^{-10} m, calculate the uncertainty in momentum. **3+3+4**

(b) Describe in brief the Gas Laser (He - Ne Laser).

(c) A ray of light is incident on the surface of a glass plate of refractive index 1.536 at the polarising angle. Calculate the angle of refraction.

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.