B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2013 00985

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

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

1. Attempt *any five* questions from the following : 5x4=20

(a) Red light of wavelength 750nm enters a glass plate of refractive index 1.5. If the velocity of light in vacuum is

3×10^{-8} m s^{-1}. Calculate the following in glass :

(i) Frequency (ii) Velocity and

(iii) Wavelength of light.

(b) If 44.5 N tension produces an elongation of 25mm in a given spring, find the frequency of vibration of a 4.45 N weight suspended from the end of the spring.

(c) The two springs shown in Figure 1 have a spring constant $K = 178$ N/m each, and the attached ball has the weight $W = 4.45$ N. If the ball is initially displaced 25mm to the right, find the period of oscillation of the ball, and the velocity with which it passes through the middle position.

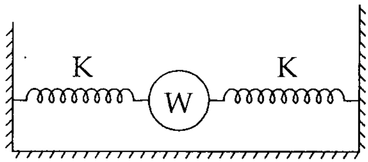

Figure - 1

(d) What is the wavelength of a beam of neutrons having ?

(i) an energy 0.025 eV ?

(ii) an electron and photon have a wavelength of $2\,\mathring{A}$, what are their momentum and energy ?

Given : mass of neutron $= 1.676 \times 10^{-27}$kg.

Planck's constant $= 6.625 \times 10^{-34}$ J.sec.

mass of electron $= 9.1 \times 10^{-31}$kg.

(e) Two identical springs are fixed at one end and masses M and 4M are suspended at their others ends as shown in figure. They are both stretched down from their mean position and let go simultaneously. What will be the value of spring constant K, if they are in the same phase every four seconds.

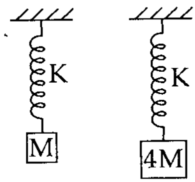

Figure - 2

(f) Explain the operation of Ruby Laser with neat diagram showing essential components.

2. (a) The kinetic energy of the particle in SHM when its displacement is 2 cm from the mean position is 0.4 J and its potential energy is 0.2 J. Calculate its amplitude. **3+3+4**

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

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

3\. (a) Two coherent sources whose intensity ratio is 81 : 1 produce interference fringes on a screen. Calculate the ratio of intensity of maximum and minimum in the fringe system. **3+3+4**

(b) Two tuning forks A and B sounded together give 8 beats per second. With an air resonance to be closed at one end, the two forks give resonance when the two air column are 32 cm and 33 cm respectively. Calculate the frequencies of the forks.

(c) State Heisenberg's uncertainty principle and explain it with the help of suitable examples.

4\. (a) Two straight and narrow parallel slits 0.3cm 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. **3+3+4**

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

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

5. (a) Calculate the De-broglie wavelength of neutron whose energy is 1 eV. **3+3+4**

Given :

mass of neutron $= 1.676 \times 10^{-27}$ kg

charge of electron $= 1.6 \times 10^{-19}$ C

Planck's constant $= 6.672 \times 10^{-34}$ J sec.

(b) How many electrons, protons, and neutrons are there in a nucleus of atomic number 11 and mass number 24 ?

(c) A proton and electron have the same speed, which has the longer wave length ?

6. (a) Calculate the De-broglie's wavelength of a proton whose kinetic energy is equal to the rest energy of an electron. Mass of proton is 1836 times greater than that of an electron. **3+3+4**

Given that : Velocity of light $= 3 \times 10^{8}$ m/s,

mass of electron $= 9.1 \times 10^{-31}$ kg,

Planck's constant $= 6.62 \times 10^{-34}$ J sec.

(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) Photo-electrons 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 ?

7. (a) What are the similarities, and dissimilarities between X-ray, laser, and ordinary light ?

(b) Why are X-ray and laser are so powerful than ordinary visible light ? **3+3+4**

(c) Describe the properties of laser. Also explain the practical application of laser.
