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BAS-001

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00064

June, 2017

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **six** questions in all. Question no. **1** is **compulsory**. Use of scientific calculator is permitted.*

Physical Constants :

$c = 3 \times 10^8 \text{ ms}^{-1}$,

$h = 6{\cdot}6 \times 10^{-34} \text{ Js}$

$e = 1{\cdot}6 \times 10^{-19} \text{ C}$;

$m_e = 9{\cdot}11 \times 10^{-31} \text{ kg}$

$m_p = 1{\cdot}67 \times 10^{-27} \text{ kg}$;

1 amu = 931 MeV

1. Attempt any ***five*** questions of the following : *5×4=20*

(a) The body of a freight car weighs 222·5 kN when empty and is observed to settle 75 mm during the loading of 267 kN of cargo. What period of vertical vibration will the car have on its springs (i) when loaded; and (ii) when empty ?

(b) An electron in a hydrogen like atom is in an excited state. It has a total energy of −3·4 eV. Calculate the

(i) kinetic energy, and

(ii) de Broglie wavelength of the electron.

(c) An electron in Bohr's hydrogen atom has energy of −3·4 eV. What is the angular momentum of the electron ?

(d) Two bodies M and N of equal masses are suspended from two separate massless springs of spring constant K_1 and K_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, then find out the ratio of the amplitude of M to that of N.

(e) The mean life of a meson is 2×10^{-8} sec. Calculate the mean life of the meson moving with a velocity of 0·8c, where c is the velocity of light.

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

2. (a) The two springs shown in Figure 1 have a spring constant K = 178 N/m and the attached ball has the weight W = 4·45 N. If the ball is initially displaced 25 mm to the right, find the period of oscillation of the ball and the velocity with which it passes through its middle position. Neglect friction.

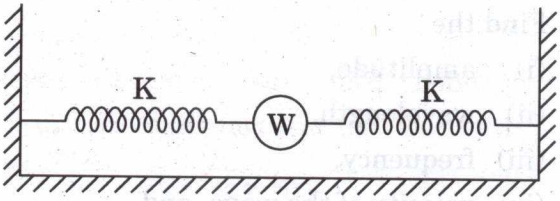

Figure 1

(b) A vibrating system consists of weight W = 9·81 kN, a spring stiffness 20 kN/cm and a dash pot with coefficient 0·071 kN/cm/sec. as shown in Figure 2.

Find the

(i) damping factor,

(ii) logarithmic decrement, and

(iii) ratio of any two consecutive amplitudes. *5+5*

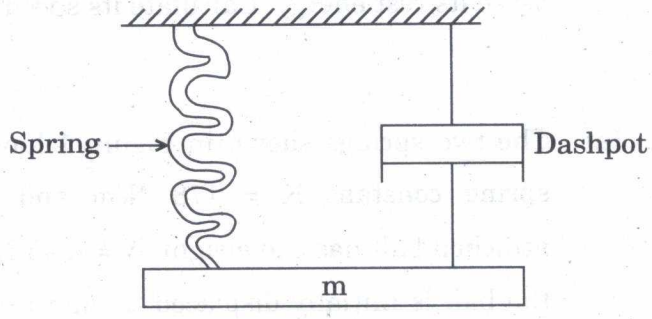

Figure 2

3. (a) A plane progressive wave is represented by the equation

$$y = 0{\cdot}5 \sin (314t - 12{\cdot}56x).$$

Here, x and y are expressed in metres, and t in seconds.

Find the

(i) amplitude,

(ii) wavelength,

(iii) frequency,

(iv) velocity of the wave, and

(v) the difference in phase between two points in the path of the wave situated 7·5 m apart.

(b) How many orders will be visible if the wavelength of the incident radiation is 5893 Å and the number of lines on the grating is 2540/inch ? *5+5*

4. (a) Ultraviolet light of wavelengths 800 Å and 700 Å when allowed to fall on hydrogen atoms in their ground state is found to liberate electrons with kinetic energy 1·8 eV and 4·0 eV respectively. Find the value of Planck's constant.

(b) Both the equations

$$y_1 = A \sin \omega t \text{ and}$$

$$y_2 = \frac{A}{2} \sin \omega t + \frac{A}{2} \cos \omega t$$

represent SHM.

Compute the ratio of the amplitude of the two motions. *5+5*

5. (a) Describe in brief the working of Ruby Laser. Explain the properties of Ruby Laser.

(b) In the Bohr model of the hydrogen atom, compute the ratio of the kinetic energy to the total energy of the electron in a quantum state n. *5+5*

6. (a) Discuss the phenomenon of Fraunhofer diffraction of a single slit and obtain the condition for first minimum in the diffraction pattern. Also, obtain the linear distance of first minima from central maximum.

(b) A proton and an alpha particle having the same kinetic energy are in turn allowed to pass through a uniform magnetic field perpendicular to their direction of motion. Compare the radii of the paths of the proton and the alpha particle. *5+5*

7. (a) In Young's double slit experiment, the slits are separated by 0·24 mm. The screen is 1·2 m away from the slits. The fringe width is 0·3 cm. Calculate the wavelength of light used in the experiment.

(b) In Young's double slit experiment, while using a source of light of wavelength 5000 Å, the fringe width obtained is 0·6 cm. If the distance between the slits and the screen is reduced to half, calculate the new fringe width. *5+5*