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BAS-001

B.Tech. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

00386

June, 2015

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

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

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

(a) Equation of a transverse wave travelling in a rope is given by

$$y = 5 \sin (4{\cdot}0\, t - 0{\cdot}02\, x),$$

where y and x are expressed in cm and time in seconds.

Calculate :

(i) The amplitude, frequency and wavelength of the wave

(ii) The maximum transverse speed.

(b) Photoelectric threshold of silver is $\lambda = 3800$ Å. ultra-violet light of $\lambda = 2600$ Å is incident on silver surface.

Calculate :

(i) The value of work function in Joules

(ii) Maximum kinetic energy of the emitted photo electrons.

(c) The acceleration due to gravity on the surface of the moon is $1{\cdot}7\ ms^{-2}$. What is the time-period of a simple pendulum on the moon, if its time-period on the Earth is 3·5 sec ? Take g on Earth = $9{\cdot}8\ ms^{-2}$.

(d) What is the nature of waves used in RADAR ? How does RADAR help in determining the distance of a distant object ?

(e) Two coherent sources, whose intensity ratio is 81 : 1, produce interference fringes on a screen. Calculate the ratio of intensity of maxima and minima in the fringe system.

(f) A 44·5 N weight is suspended by a helical spring having a constant K = 890 N/m. Neglecting the mass of the spring, find the period τ for small amplitude of vertical vibration.

2. (a) A particle moves in a straight line with SHM of period 2 secs. If it starts from rest at a distance of 13 cm from the centre of path, show that the greatest velocity and the velocity acquired by it when it has just described 8 cm, are respectively 13π cm/sec and 12π cm/sec.

(b) A body is vibrating with SHM 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.

(c) A body of mass m kg is placed on a horizontal platfrom which is moving up and down simple harmonically with an amplitude of 2 cm. What may be the maximum frequency of oscillations so that the body may not be detached from the platform ? *3+3+4=10*

3. (a) In a Young's double-slit experiment, the slits are separated by 0·03 cm and the screen is placed 1·5 m away. The distance between the central fringe and the fourth fringe is 1 cm. Determine the wavelength of light used in the experiment.

(b) Ultra-violet 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.

(c) A metal surface when illuminated with light of wavelength 3330 Å, emits electrons with energy up to 0·6 eV and when illuminated with light of wavelength 2400 Å, it emits electrons with energy up to 2·04 eV. Calculate Planck's constant and the work function of the metal. *3+3+4=10*

4. (a) What is meant by 'beats' ?

(b) State the postulate of Niels Bohr which explains the concept of stationary orbits.

(c) What is the expanded form of 'LASER' ?

(d) State the postulates of the special theory of relativity. *2+3+2+3=10*

5. (a) Determine the speed of sound waves in water and find the wavelength of a wave having a frequency of 242 Hz.

Take $B_{water} = 2 \times 10^9$ Pa.

(b) Two simple harmonic motions are represented by the following equations :

$$y_1 = 10 \sin \frac{\pi}{4}(12\,t + 1);$$

$$y_2 = 5\,(\sin 3\,\pi\,t + \sqrt{3} \cos \pi\,t)$$

Find out the ratio of their amplitudes. What are the time-periods of the two motions ?

(c) A stone dropped from the top of a tower 300 m high into the water of a pond near the base of the tower generates a high splash. When is the splash heard at the top ? Given that the speed of sound in air is 340 m/sec, and $g = 9{\cdot}8$ m/sec^2. *3+3+4=10*

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

(b) In a Young's double-slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5} m. If the distance between the slits is 10^{-3} m, calculate the wavelength of the light used.

(c) For a given medium, the polarizing angle is 60°. What will be the critical angle for this medium ? *3+3+4=10*

7. (a) An observer notices two particles moving away from him in two opposite directions, each with a velocity c/2 relative to him. What is the velocity of one particle relative to the other ?

(b) The photoelectric threshold wavelength of a metal is 2762 Å.

Calculate :

(i) The maximum velocity of the electron

(ii) The stopping potential, when the silver surface is illuminated with ultra-violet light of wavelength 2000 Å.

(c) A mass of 0·5 kg connected to a light spring of stiffness 20 N/m, oscillates on a horizontal frictionless track.

Calculate :

(i) Total energy of the system and the maximum speed of the mass if the amplitude of motion is 3 cm.

(ii) Compute kinetic and potential energies of the system at the maximum velocity.

3+3+4=10

Physical Constants :

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

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

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

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

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

1 amu = 931 MeV