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BAS-001

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00033

December, 2018

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

Note : *Question no.* ***1*** *is* ***compulsory****. Attempt any* ***five*** *questions from questions no.* ***2*** *to* ***9****. Assume missing data if any. Use of scientific calculator is permitted.*

1. (a) A particle executes SHM of a period of 31·4 sec and amplitude 5 cm. Calculate maximum velocity and maximum acceleration. *3*

(b) Define Simple Harmonic Motion. *3*

(c) Define Relaxation time and Quality factor of a damped harmonic oscillator. *3*

(d) Calculate the frequency of the radio waves transmitted by a station if the wavelength of the wave is 300 m and also calculate its time period. *3*

(e) Define Interference. *3*

(f) Define Heisenberg Uncertainty Principle and Pauli's Exclusion Principle. 3

(g) In a Newton's ring experiment, Newton's rings are observed in reflected light of $\lambda = 5{\cdot}9 \times 10^{-5}$ cm. The diameter of the 10^{th} dark fringe is 0·5 cm. Find the radius of curvature of lens and thickness of air film. 3

(h) Define Superposition of waves. 3

(i) Define Spontaneous emission and Induced absorption. 3

(j) Green light of wavelength 5100 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 200 cm away is 2 cm, find the slit separation. 3

(k) Write any three limitations of Bohr's atomic model. 3

(l) The wavelength of the second line of the Balmer Series in the hydrogen spectrum is 4861 Å. Calculate the wavelength of the first line. 3

(m) Define frame of reference and name the two types of reference frames. 3

(n) If 1 kg of a substance is fully converted into energy, how much energy is produced ? 3

(o) At what speed is a particle moving, if the mass is equal to two times the rest mass ? 3

2. Figure 1 shows a body 'P' resting on a smooth table between two firm supports A, B and controlled by two massless springs. If mass of P is 0·050 kg and the force constant of the two springs are 3 N/m and 2 N/m, deduce

(i) The frequency of small oscillations of 'P',

(ii) The energy of oscillation for amplitude 0·004 m,

(iii) The velocity of body 'P' when it passes through its mean position. *5*

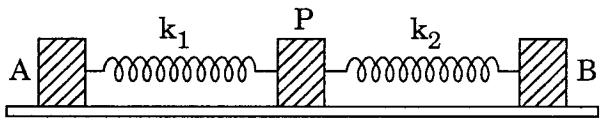

Figure 1

3. For a wave equation $y = a \sin(\omega t - kx)$, prove that $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$. *5*

4. Deduce the formula for relativistic variation of mass with velocity. Briefly explain its significance. *5*

5. Explain the working of He-Ne laser with a neat diagram. *5*

6. (a) Light of wavelength 5500 Å from a narrow slit is incident on a double slit. The overall separation of 5 fringes on a screen 200 cm away is 1 cm. Calculate (i) slit separation, and (ii) the fringe width. *3*

(b) On placing a thin sheet of mica of thickness 12×10^{-5} cm in the path of the interfering beam in a biprism arrangement, it is found that the central bright band is shifted to a distance equal to the width of a bright fringe. Calculate the refractive index of mica. ($\lambda = 6 \times 10^{-5}$ cm) *2*

7. Derive Schrodinger's time dependent equation. *5*

8. What is pile of plates ? Indicate how it can be used to obtain plane polarized light. *5*

9. Using the physical constants given below, calculate the following for a hydrogen atom : *5*

(a) Velocity of an electron in ground state

(b) Radius of Bohr's orbit in ground state

(c) Rydberg constant

$e = 1{\cdot}6 \times 10^{-19}$ coulomb; $M = 9{\cdot}1 \times 10^{-31}$ kg

$h = 6{\cdot}6 \times 10^{-34}$ J-s; $c = 3 \times 10^{8}$ m/s.

$\varepsilon_0 = 8{\cdot}86 \times 10^{-12}$ $C^2/N\text{-}m^2$