Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**
BS1102

2nd Semester Back Examination 2017-18
PHYSICS - I
BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time : 3 Hours
Max Marks : 70
Q.CODE : C922

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer the following questions:** **(2 x 10)**

a) In a two slit interference with monochromatic light, fringes are obtained on a screen placed at same 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 slit is 10^{-3} m, calculate the wavelength of light used.

b) When two displacements represented by $y_1 = asin\omega t$ and $y_2 = bcos\omega t$ are superimposed the motion is
(i) Not a simple harmonic
(ii) Simple harmonic with amplitude $\frac{a}{b}$
(iii) Simple harmonic with amplitude $\frac{b}{a}$
(iv) Simple harmonic with amplitude $\sqrt{a^2+b^2}$

c) The equation of motion of a point particle of mass 0.1 kg executing SHM is given by$y = 0.1sin\left(4t+\frac{\pi}{4}\right)$; where 'y' is in meter and 't' is in second. Find the kinetic energy of the particle when it passes through the mean position.

d) If on rotating the analyzer the emergent light does not change in intensity ,then it is:
(i) either plane polarized or partially polarized;
(ii) either unpolarised or circularly polarized;
(iii) either partially polarized or elliptically polarized;
(iv) only circularly polarized.

e) The de-Broglie wavelength associated with a neutron is 1.4×10^{-10} m whose mass is 1.675×10^{-27} kg. Estimate the kinetic energy.

f) Calculate the minimum uncertainty in the velocity of an electron confined to a box of 10^{-8} m length. ($m_e = 9.1\times10^{-31}\ kg, \hbar = 1.05\times10^{-34}\ Js$)

g) Differentiate between interference and diffraction.

h) A particle is limited to the x-axis has the wave function $\phi(x) = bx^2$ between x = 0 and x = 2; the wave function $\phi(x) = 0$ elsewhere, Find the probability that the particle can be found between x = 1.0 and x = 1.5.

i) What is the physical significance of $\nabla . B = 0$; where B is the magnetic field.

j) State Gauss divergence theorem and write the mathematical form.

Q2 **a)** Write down the equation of motion for a damped harmonic oscillator of mass 'm' and obtain its solution in different condition. **(7)**

b) In a forced oscillation, if ω_0 is the natural frequency and ω is the forced frequency of oscillation, draw Amplitude-Frequency response graph for zero damping, low damping and high damping in a single plot. **(3)**

Q3 **a)** What is double refraction? Distinguish between ordinary ray and extraordinary ray. **(5)**

b) What is Fresnel's Biprism. With proper schematic diagram suggest a method to determine the wavelength of monochromatic light source. **(5)**

Q4 **a)** Write down the Maxwell's equations both in differential and integral form. **(5)**

b) Find the magnetic field B of the electromagnetic wave in free space if the components of the electric fields are $E_x = E_y = 0$and $E_z = E_0 cos kx sin \omega t$. **(5)**

Q5 **a)** What is plane diffraction grating? With necessary theory, explain how to determine the wavelength of a monochromatic light using plane diffraction grating. **(7)**

b) Find the directional derivative of $\phi = x^2yz + 2xz^2$ at (1, -1, -1). **(3)**

Q6 **a)** Explain the uncertainty principle. Taking typical size of the nucleus to be 2×10^{-14} m, show that electron cannot exist inside the nucleus. $(m_e = 9.1 \times 10^{-31}\ kg, \hbar = 1.05 \times 10^{-34}\ Js)$ **(6)**

b) Show that the expectation value of linear momentum for the wave function given by $\psi_n(x) = \begin{cases} A \sin\left(\frac{n\pi x}{a}\right) & 0 < x < a \\ 0 & otherwise \end{cases}$ is zero **(4)**

Q7 **a)** What is Nicol Prism? Discuss its principle and its use as a polarizer and analyzer. **(3)**

b) Derive pointing theorem and write its physical significance. **(5)**

c) A particle is in one-dimensional infinitely deep potential well of width L. Graphically show the probability density of the particle in the ground and first excited state. **(2)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Zone plate

b) Black body radiation spectrum

c) Displacement Current

d) Coupled Oscillation