

BSC. PART - II EXAMINATION - 2018

PHYSICS HONOURS PAPER IV

Answer five questions in all selecting two questions from Group - B and C each. Group - A (Q. No. 1) is compulsory.

Group - A

1. Choose the correct answers for all the following questions out of the given alternatives for each of them.

(i) If P_1 and P_2 are the true and apparent powers of an a.c. circuit respectively, the power factor is :

- (a) P_1/P_2 (b) $\frac{P_2}{P_1}$ (c) $(P_1 + P_2)$ (d) $(P_1 - P_2)$

(ii) The energy of an electron in the n th Orbit varies as :

- (a) n (b) $\frac{1}{n^2}$ (c) $\frac{1}{n}$ (d) n^2

(iii) De Santy's bridge is used to measure the :

- (a) Self inductance of a coil (b) Capacitance of a capacitor
(c) Resistance of a coil (d) Admittance of an a.c. circuit

(iv) The orbital angular momentum of the electron is given by P_l :

- (a) $h[l(l+1)]^{1/2}$ (b) $h[l(l-1)]^{1/2}$ (c) $h[l(l+1)]$ (d) $h[l(l-1)]$

(v) Pure rotational spectra of molecules lie in :

- (a) Infrared region (b) Far infrared region
(c) Visible range (d) Ultraviolet region

(vi) In an electromagnetic field, we have :

- (a) $\vec{E} \cdot \vec{B} = 0$ (b) $\vec{E} \times \vec{B} = 0$ (c) $\vec{E} + \vec{B} = 0$ (d) $\frac{\vec{E}}{B} = 0$

(vii) Lorentz gauge transformation is given by :

- (a) $\text{div } \phi = \frac{-\delta A}{\delta t}$ (b) $\text{div } \phi = \frac{\delta A}{\delta t}$ (c) $\text{grad } \phi = \frac{-\delta A}{\delta t}$ (d) None of the above

(viii) Time Constant of a circuit containing a capacitance C and resistance R is given by :

- (a) CR (b) $\frac{1}{CR}$ (c) $\frac{C}{R}$ (d) $\frac{R}{C}$

(ix) Poynting vectors is given by \vec{p} :

- (a) $\vec{E} \times \vec{H}$ (b) $\vec{E} \times \vec{B}$ (c) $\vec{E} \times \vec{\nabla} \times \vec{H}$ (d) $\vec{H} \times \vec{\nabla} \times \vec{E}$

(x) The scattering of light with change in frequency is known as :

- (a) Thomson scattering (b) Rayleigh scattering
(c) Raman effect (d) Zeeman effects

GROUP - B

- Derive Bragg's Law for scattering of x-rays by a crystal. Describe an experiment for the determination of wavelength of x-rays.
- What is Compton effect? Deduce an expression for the Compton shift. How is it verified experimentally?
- Mention different quantum numbers of an atom. Explain how these quantum numbers interpret the configuration of the atom.
- Obtain an expression for current in an a.c. circuit containing resistance, inductance, and capacitances in series. Also discuss the case of resonance.

GROUP-C

6. Discuss the propagation of plan electromagnetic waves in a conducting medium and explain the term penetration depth.
7. Prove the laws of reflection and refraction of light on a plane surface on the basis of electromagnetic theory.
8. What is Raman effect ? Give the mathematical theory of Raman effect and describe an experimental arrangement for studying it.
9. Define Scalar potential (ϕ) and vector potential (\vec{A}) for an e.m. field. Show that under suitable conditions, they satisfy the following inhomogeneous equations:

$$(i) \nabla \times \vec{A} = -\mu_0 \vec{J}$$

$$(ii) \nabla^2 \phi = -\frac{\rho}{\epsilon_0} \text{ Where } \nabla^2 \equiv \text{de Alembertian operator} = \nabla^2 - \frac{1}{C^2} \frac{\partial^2}{\partial t^2}; \vec{J} = \text{current density and } \rho = \text{volume density of charge}$$

OR, Write short notes on any two of the following :

- (a) Rotational spectra of diatomic molecules
- (b) Franck Condon principle
- (c) Electronic band system
- (d) Radiation pressure