

**B. Sc. Semester – VI**  
**PHYSICS Paper CC-604**

27 AUG 2020

: નોંધ :

૧. દરેક પ્રશ્નનો [a] અથવા [a(i)] અને [a(ii)] જ લખવાના રહેશે.

Sub code : 21839

૨. પ્રશ્ન : ૧[a] અથવા ૧[a(i)] અને ૧[a(ii)] તથા ૨[a] અથવા ૨[a(i)] અને ૨[a(ii)] ના 14 માર્ક્સ ના બદલે ૧૮ માર્ક્સ રહેશે.

૩. પ્રશ્ન : ૩[a] અથવા ૩[a(i)] અને ૩[a(ii)] તથા ૪[a] અથવા ૪[a(i)] અને ૪[a(ii)] ના 14 માર્ક્સ ના બદલે ૧૭ માર્ક્સ રહેશે.

૪. દરેક પ્રશ્નનો પ્રશ્ન નં ૧(b), પ્રશ્ન નં ૨(b), પ્રશ્ન નં ૩(b) તથા પ્રશ્ન નં ૪(b) (ટુંકા પ્રશ્નો) વિદ્યાર્થીએ લખવાના નથી.

**Q-1**

(A). Derive equation of motion for the plane electromagnetic waves propagating in conducting media. Also derive formula of phase velocity of wave and refractive index of medium. (14)

**OR**

(A).

(i). Prove that there exist an electromagnetic waves in free space and they propagate with velocity of light C. (07)

(ii). Prove that the tangential component of electric field intensity is continuous across boundary. (07)

(B). Give answer of the following in short: (Any Four) (04)

1. State Maxwell's equation in differential form.

2. Why  $\vec{\nabla} \cdot \vec{B} = 0$ ?

3. What is the dimension of ratio between amplitudes of E and H?

4. What is the value of characteristic impedance of free space?

5. Define uniform plane wave.

6. Write the formula of refractive index of conducting medium.

**Q-2.**

(A) Explain the principle of light transmission in optical fiber. Derive the formula for the Numerical aperture (NA) and explain acceptance angle and acceptance cone. (14)

**OR**

(A).

(i). Explain about dispersion effect in optical fiber. (07)

(ii). Explain various modes of propagation in optical fiber. (07)

(B). Give answer of the following in short: (Any Four) (04)

1. Define Acceptance angle of fiber.

2. Define fiber index profile.

3. State types of different mode of propagation of waves in fiber.

4. In which type of fiber hybrid mode of propagation of wave is possible?

5. Which are the fundamental mechanisms responsible for the losses in fiber?
6. On what factor scattering loss of waves depends?

**Q-3.**

- (A). Discuss the Drude Model of free electron gas and its application to derive thermal Conductivity of metals. (14)

**OR**

- (A).  
 (i). Discuss the Sommerfeld's theory of free electron gas in a one dimensional box. (07)

- (ii). Discuss Kronig Penny model for the behavior of electrons in periodic potential. What are its consequences? (07)

- (B). Give answer of the following in short: **(Any Three)** (03)

1. What restrain the conduction electron to remain inside the metal at room temperature?
2. What are the successes of the Drude-Lorentz theory?
3. How much is the electronic specific heat with the metal containing N free electrons?
4. For metal exhibiting superconductivity, resistivity disappear in the temperature range.....

(a)  $T < 0 < T_c$     (b)  $0 < T < T_c$     (c)  $0 > T > T_c$     (d)  $T_c < 0 < T$

5. The formula relating the thermal conductivity (k) and electrical conductivity ( $\sigma$ ) is .....

(a)  $\frac{k}{\sigma T} = \text{constant}$

(b)  $\frac{k}{\sigma T^2} = \text{constant}$

(c)  $\frac{\sigma}{kT} = \text{constant}$

(d)  $\frac{\sigma}{kT^2} = \text{constant}$

**Q-4.**

- (A). Explain coherent scattering and derive equation of scattered power. (14)

**OR**

- (A).  
 (i). Write a note on Auger effect. (07)

- (ii). Write Moseley's law and explain it on the basis of Bohr's atom model. (07)

- (B). Give answer of the following in short: **(Any Three)** (03)

1. State types of scattering of X rays.
2. What is the dimension of scattering cross section?
3. State Mosley's law.
4. Define Auger effect.
5. Define non radiative transition.