



DAI-003-0494007

Seat No. _____

B. Sc. / M. Sc. (Applied Physics) (Sem. IV) (CBCS)

Examination

April - 2022

Paper-XVI : Electrodynamics & Plasma Physics

(New Course)

Faculty Code : 003

Subject Code : 0494007

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Attempt all the questions.
(2) Numbers in the right margin indicate marks.

1 Attempt any SEVEN short questions : (Two marks each) **14**

- (1) Write a statement and mathematical form of Coulomb's law.
- (2) Define Electrostatics. Also, note down its applications & importance.
- (3) Define PLASMA state of matter.
- (4) What is point charges? Discuss it in context of Coulomb's law.
- (5) What are plasma oscillations? Draw a well labelled diagram showing the mechanism of plasma oscillations.
- (6) Define line charge density and surface charge density.
- (7) What are three criteria for plasma?
- (8) Draw a well-labelled diagram of Debye effect in Plasma.
- (9) Draw a well-labelled diagram of Loss Cone.
- (10) Define dielectric constant and strength.

2 (A) Write answers of any TWO : **10**

- (1) Derive an expression of Maxwell's Equation: Ampere's Circuit Law.
- (2) Define Faraday's law in electrostatics. Also, derive relationship between electric field intensity and electric flux density.

- (3) Derive first Maxwell's equation: Conservative nature of electrostatic field.
- (4) Write a brief note on Coulomb's law with its applications and limitations.
- (B) Write answer of any **ONE** : 4
- (1) Write a short note on electric scalar potential.
- (2) Write a brief note on energy density in electrostatic field.
- 3** (A) Write answers of any **TWO** : **10**
- (1) Write mathematical expression of Poynting's theorem and explain each term with necessary figures.
- (2) Draw a neat figure explaining dielectric-dielectric boundary condition and explain it.
- (3) Enlist Maxwell's equations in final form. Explain its physical significant.
- (4) Write a note on Faraday's law of electromagnetic induction.
- (B) Write answer of any **ONE** : 4
- (1) State and explain Biot Savart's Law.
- (2) What is static Electric Field? Enlist different applications of it.
- 4** (A) Write answers of any **TWO** : **10**
- (1) Explain magnetic mirror effect in Plasma. Hence comment on invariance of μ .
- (2) Obtain a fluid equation for plasma and compare it with ordinary fluid equation.
- (3) Write a note on production of plasma.
- (4) Describe in detail various applications of plasma.
- (B) Write answer of any **ONE** : 4
- (1) Describe the effect of application of curved magnetic field on the motion of charged particle in plasma.
- (2) Using Debye effect in plasma, prove the diamagnetic nature of plasma.

5 (A) Write answers of any **TWO** : 10

- (1) "99 % of universe consists of Plasma naturally. We live in 1 % of universe, on Earth, where plasma do not occur naturally" Explain why?
- (2) Derive an expression for the plasma frequency (ω_p).
- (3) Describe the effect of GRAD B field applied perpendicular to B on the motion of plasma particle.
- (4) Explain magnetic mirror effect in Plasma. Hence, comment on invariance of μ .

(B) Write answers of any **ONE** : 4

- (1) Write a note on natural and artificial occurrence of Plasma.
- (2) Compute λ_D and N_D for the following
 - (a) a glow discharge with $n = 10^{16} \text{ m}^{-3}$ & $kT_e = 2\text{eV}$
 - (b) a θ - pinch with $n = 10^{23} \text{ m}^{-3}$ & $kT_e = 800 \text{ eV}$
