2016

M.Sc. 2nd Seme. Examination

PHYSICS

PAPER—PHS-203

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Use separate Answer-scripts for Group-A & Group-B

Group—A

Answer Q. No. *1* and any *one* from the rest.

1. Answer any *five* questions : 5×2

(a) What is the difference between plasma state and ionised state ?

(b) Write the mechanism of plasma oscillation.

(c) What is Paschen's law ?

(d) States the process by which plasma oceurs in nature.

(e) Pointout the various methods (in electrical and optical) for the production of plasma in the laboratory.

(f) Symbolically discuss the Plasma parameters.

(g) What do you mean the following relation

$$\lambda_D = 69.0\left(\frac{T}{n_e}\right)^{\frac{1}{2}} \text{ in m}.$$

(h) State and discuss Lawson criterian.

2. Give the schematic diagram of photomultiplier tube type arrangement used for spectroscopic method.

How is the electron temperature in a plasma determined by such spectroscopic method ? 4+6

3. Draw a schematic diagram of exploding wire method use to produce ionization of a gas in the laboratory and show the current wave forms. Point out its application. 5+3+2

Group—B

Answer Q. No. *1* and any *one* from the rest.

1. Answer any *five* bits : 5×2

(a) What do you mean by 'ambipolar diffusion' ?

(b) Prove that refractive index of a plasma is given by

$$n^2 = 1 - \frac{w_p^{\,2}}{w^2}.$$

(c) What is Cherenkov effect ?

(d) What is resonance scattering ?

(e) Write down Lorentz force in covariant form and give a physical meaning of the fourth component of the force density four vector.

(f) Write down expressions for the magnetic scalar and vector potentials from which the following magnetic field can be derived :

$$\vec{B} = y\hat{i} + x\hat{j}.$$

(g) Prove that component T^{oo} (energy-momentum tensor for e.m. field) is given by

$$\frac{1}{8\pi}\left(\vec{E}^2 + \vec{B}^2\right).$$

(h) Write down Kramer-Kronig dispersion relation.

2. Deduce Boltzmann equation and Vlasov equation for plasma state of matter. 10

3. (a) Derive an expression for relativistic Larmor's formula.

(b) Show that when velocity and acceleration are parallel

$$\frac{dp}{d\Omega} = \frac{1}{4\pi\,\epsilon_0}\,\frac{q^2a^2}{4\pi c^3}\,\frac{\sin^2\theta}{(1-\beta\cos\theta)^5}$$

where θ is the angle between $\vec{v}$ and $\vec{r}-\vec{r}'$.

(c) Show that the direction in which the power radiated is maximum if 590 KeV electron is moving under conditions in (b) is given by $\theta_{max} = \cos^{-1}(0.79)$. 4+4+2

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