QE-5330

M. Sc. (Sem. III) Examination,
December, 2023

PHYSICS

PAPER - 3.2

PHY-302

Classical Electrodynamics-II

Time Allowed : Three Hours

Maximum Marks : 70

Minimum Marks : 28

Note : This question paper contains three sections as under :

SECTION - A **Max. Marks 10**

This section shall have 01 compulsory question comprising 10 questions (maximum 20 words answer) taking two questions from each unit. Each question shall be of one mark and total marks of this section will be 10. This section is compulsory in the paper.

SECTION - B **Max. Marks 25**

This section will carry 25 marks with equally divided into five long answer type questions (answer about in 250 words). Students are instructed to attempt five questions by selecting one question from each unit.

SECTION - C **Max. Marks 35**

Will carry 35 marks with five long answer type questions comprising one complusory question (question no. 07) of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) and any two more questions (answer about in 400 words) out of remaining four questions.

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SECTION - A

1 (a) Define group velocity.

(b) What do you mean by casualty connection ?

(c) Explain characteristic frequency.

(d) What is Debye length ?

(e) What are hydromagnetic waves ?

(f) Differentiate warm and hot plasmas.

(g) What do you mean by quasi-free charges ?

(h) What is average power per unit solid angle in Thomson scattering of radiation ?

(i) Define line breadth and level shift of an oscillator.

(j) Define radioactive reaction force.

SECTION - B

UNIT - I

2 Derive Kramer-Kronig relations.

OR

Establish Maxwells equations for the propagation of EM waves in a conducting medium and show that the wave penetrates the conducting medium to a depth δ.

UNIT - II

3 Discuss Debye shielding distance and obtain required expression for it.

OR

Discuss the conditions for plasma oscillations and obtain the formula for plasma frequency.

UNIT - III

4 Derive the general equation for the velocity of magneto-hydrodynamic waves.

OR

Explain conditions for existence of plasma and give account of different types of instabilities in the Pinch plasma.

UNIT - IV

5 Deduce Larmor's formula and its relativistic generalization.

OR

Find the total power radiated by an accelerated charge.

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UNIT - V

6 Discuss the difficulties with the Abraham-Lorentz model of self force.

OR

Discuss the radiation damping and determine the radiation damping force.

SECTION - C

7 (a) Show that critical frequency for propagation of EM waves in plasma is given as $f_c = 9\sqrt{n_0}$, where n_0 is the number of electrons/m^3. Calculate the plasma frequency and maximum penetration depth for a plasma containing 10^{18} electrons/m^3. **10**

(b) Discuss the effect of magnetic field on plasma dispersion characteristics. **5**

8 Obtain Thomson formula for scattering of radiation by a free charge. **10**

9 (a) Discuss integro-differential equation of motion including radiation damping. **5**

(b) Describe one component and multicomponent fluids in detail. **5**

10 (a) What is cyclotron ? Write its limitations. Deduce the relation for calculating cyclotron frequency. **6**

(b) Discuss Cherenkov radiations. **4**

11 Write short notes on the following :

(i) Linear and non-linear phenomena.

(ii) Hydronamic and velocity space.

(iii) Electron and ion temperature.

(iv) Pinch effect.

$2\frac{1}{2} \times 4 = 10$

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