2016

M.Sc. 1st Semester Examination

PHYSICS

PAPER—PHS-103

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 bits : 2×5

(a) Mention the processes by which energy is lost from plasma in the form of radiation. 2

(b) Prove that $\left(\vec{E}.\vec{B}\right)$ is covariant under Lorentz transformations. 2

(c) What is ambipolar diffusion ?

(d) Define the distribution function in phase space under Kinetic theory.

(e) An antenna radiates a power of 100 KW at 40 MHz. Estimate the strength of its electric field at a distance of 40 km from the source. 2

(f) What is Lienard Wichert potentials ? 2

(g) What is Cherenkov radiation ? Write the conditions for emission of Cherenkov radiation. 2

(h) Show that the charge measured in S'-frame is the same as that is S-frame, while the charge density is not. 2

2. (a) Show that the loss of energy by cyclotron radiation is propertional to T_e^2. Where T_e is the electron temperature. 4

(b) Deduce Vlasov equation for plasma. 4

(c) From Boltzmann equation show that the number of each type of particle of the plasma is conserved. 2

3. (a) What do you mean by dipolar radiation ? 1

(b) Treating the electric dipole to be equivalent to an accelerated charge, calculate the dipole moment amplitude (p_0) in terms of charge (q) and acceleration (a) of the accelerated charge. 4

(c) Deduce Marwell's field equations in terms of electromagnetic field tensor. 5

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Group—B

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

1. Answer any *five* questions : 5×2

(a) Name four methods to prepare thin film.

(b) What do you mean by optical lithography ?

(c) What is c-gun ?

(d) What is the working energy of TEM ? What kind of information one can get from TEM images ?

(e) What is radio active nucleus ? Name one instrument which uses radio active nucleus.

(f) What do you mean by nuclear magnetic resonance ?

(g) Name different level of vacuum with proper pressure range and pressure gunge.

(h) What are the information one can get from XRD and XPS ?

2. (a) Give a schematic illustration of SEM instrument showing the major component of it.

(b) Explain the basic idea of STM. Why the tip is needed to be atomicaly sharp and conducting in nature ?

(c) Match the following pair :

(a) LEED	(i) Film thickness
(b) RAMAN	(ii) Surface structure
(c) Nutron seattering	(iii) Vibrational band
(d) R.B.S	(iv) Magnetic phase

4+4+2

3. (a) Describe the VLS technique of one dimensional growth.

(b) What is the difference between "bottom up" approach and "top-down" approach of materials synthesis ? Give example.

(c) Write a short note on any one of the following :
(i) CVD (ii) Sol-Gel. 3+3+4