D 51454 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCSS—PG)

Physics

PHY 1C 03—ELECTRODYNAMICS AND PLASMA PHYSICS

[2017 Syllabus Year]

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*
Each question carries weightage 1.

1. Explain the significance of displacement current.
2. Distinguish between a phasor and a vector ?
3. Explain the situation where the reflection and transmission co-efficients are real.
4. What is meant by the wave impedance of total field ?
5. Give the phase relationship between voltage and current waves in an infinitely long transmission line.
6. What is meant by the cut off frequency of a waveguide ?
7. Define a cavity resonator ?
8. Write down the expression for Minkwoski force on a charge q.
9. Show that the current density 4 - vector is divergenceless.
10. Give the criteria for plasmas.
11. Explain the term 'Larmor radius' ?
12. Write down the Fokker-Planck equation under coulomb collision.

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions.*
Each question carries weightage 6.

13. Define Poynting's vector ? Obtain the expressions for instantaneous and average power densities for time harmonic electromagnetic waves.
14. Derive the transmission line equations for a lossless parallel plate line supporting TEM waves ? Explain why waves along a lossy transmission line cannot be purely TEM.

Turn over

15. Derive Maxwell's equations in relativistic notation.

16. Obtain the fluid equations of motion for plasma. Give the significance of stress tensor.

(2 × 6 = 12 weightage)

Section C

Answer any **four** *questions.*
Each question carries weightage 3.

17. Find the potential inside and outside of a uniformly charged spherical shell of radius R ?

18. A parallel plate capacitor of capacitance $20\,\mu F$ is connected across an AC voltage source, $v = 5 \sin \pi t$. Determine (i) the displacement current in the capacitor, and (ii) the intensity of magnetic field at a distance 5 cm from the wire, in terms of time't' ?

19. A 5GHz, x - polarised uniform plane wave propagates in the +y direction in a nonmagnetic medium having a dielectric constant 1.5 and a loss tangent 0.001. Determine the intrinsic impedance, wavelength, phase velocity and group velocity of the wave in the medium ?

20. A transmission line of characteristic impedance, $R_0 = 75\,\Omega$, is to be matched to a load impedance, $Z_L = 50 + j\,,\, 10\,\Omega$, through a length l of another transmission line of characteristic impedance R_0. Determine the values of l and R_0 for matching ?

21. A straight wire along x-axis carries a charge density λ travelling in the +x direction at speed v. Construct the field tensor and the dual tensor at the point (y, 0, 0).

22. (a) A distant galaxy contains a cloud of protons and antiprotons, each with density 10^{11} /m^3 and temperature 100K. Determine the Debye length and the number of particles in a Debye sphere ?

(b) Find the cyclotron frequency of electrons in a perpendicular magnetic field of strength 3×10^{-4} T ?

(4 × 3 = 12 weightage)