**18002140**

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**Reg. No.....**

**Name.....**

# M.Sc. DEGREE (C.S.S.) EXAMINATION, DECEMBER 2018

## First Semester

Faculty of Science

Branch II : Physics–(A)–Pure Physics

PH1C03—ELECTRODYNAMICS

(2012 Admission onwards)

Time : Three Hours Maximum Weight : 30

### Part A

*Answer any* **six** *questions.*
*Each question carries* 1 *weight.*

1. State and explain Poynting theorem.
2. What is Maxwell's stress tensor ?
3. Write note on superposition of waves.
4. What are four-vector potentials ?
5. Show that anti-symmetry of a tensor is preserved by Lorentz transformation.
6. Show that plane wave solutions to Maxwell's equations in free space are transverse waves .
7. What are the essential differences between transmission line and ordinary electric network ?
8. State and explain Lorentz gauge condition.
9. What are Jefimenkos equations ?
10. What is meant by radiative reaction ?

$(6 \times 1 = 6)$

### Part B

*Answer any* **four** *questions.*
*Each question carries* 2 *weight.*

11. Obtain the equation of continuity from Lorentz gauge condition.
12. A uniformly charged sphere whose radius is $a$ and charge density $\rho$, rotates with a constant angular velocity $\omega$. Calculate the magnetic flux density **B** at the centre of the sphere.

**Turn over**

13. Show that $c^2 B^2 - E^2$ is invariant under Lorentz transformation.

14. The constitution parameter for aluminium are $\mu_r = 1, \varepsilon_r = 1$ and $\sigma = 3.54 \times 10^7$ mho/m. Find the skin depth in aluminium for the frequency 71.5 MHz.

15. A rectangular waveguide has a breadth 10cm. Find the wavelength for a signal of frequency 2.5GHz for the dominant mode.

16. An antenna of length L carries alternating current of angular frequency ω. Treating it as an oscillating dipole, determine the total power radiated.

(4 × 2 = 8)

## Part C

*Answer* **all** *questions.*
*Each question carries* 4 *weight.*

17. (a) Discuss the magnetostatic boundary conditions.

*Or*

(b) Describe the propagation of electromagnetic waves in a non-conducting medium.

18. (a) Derive Maxwell's equations in covariant four tensor form and give significance.

*Or*

(b) Discuss with necessary theory the behaviour of motion of charged particles in uniform electric and magnetic fields.

19. (a) Obtain the intensity of electric field at a point in the radiation zone emitted from an electric dipole.

*Or*

(b) Derive an expression for the rate of radiation of energy from an accelerated charge at low velocity.

20. (a) Discuss the propagation of electromagnetic waves in a rectangular waveguide in TE mode.

*Or*

(b) Explain in detail about radiation from a quarter wave monopole.

(4 × 4 = 16)