TB154415A

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017
SEMESTER IV – CORE COURSE (PHYSICS)
PH4B04TB - ELECTRICITY AND ELECTRODYNAMICS

Time: Three Hours **Maximum Marks : 60**

PART A

I Answer all questions. Each question carries 1 mark

1. Define charge and current sensitivity of a Ballistic Galvanometer.
2. State and explain Thevenin's theorem.
3. What is capacitative reactance?
4. Give the divergence and curl of an electrostatic field.
5. Write Maxwell's equations in free space.

$(5\times1=5)$

PART B

II Answer any five questions. Each question carries 2 marks

6. Define time constant. What is the time constant for an LC circuit?
7. Distinguish between accepter circuits and rejector circuits.
8. Prove that the current in an inductance lags behind the applied e.m.f. by $\pi/2$.
9. Derive Poisson's equation and Laplace equation.
10. Is superposition principle applicable for electrostatic energies? Justify your answer.
11. What are the basic properties of conductors?
12. How will the second Maxwell's equation change if the magnetic monopolics exist?
13. Derive the momentum of a plane electromagnetic wave.

$(5\times2=10)$

PART C

III Answer any five questions. Each question carries 5 marks

14. An inductance of 500 mH and a resistance of 5 Ω are connected in series with an e.m.f. of 10 volts. Find the final current. If the cell is removed and the two terminals are connected together find the current after 0.05 seconds.

15. A steady e.m.f. of 20 volt is applied to a series circuit containing 5 Ω resistance and 1 H inductance. Calculate the current flowing in the coil after 0.2 s.

16. A circuit consists of a non-inductive resistance of 50 Ω, and inductance of 0.3 H and a capacitor of 40 µF in series and is supplied with 200 volts at 50 Hz. Find the impedance, the current, current lag and the power in the circuit.

17. When 10^{-8} C charge is passed through a B.G. the throw is 15cm. If the period of oscillation is 6 s find the current required for a steady deflection of 20cm.

18. Electric field in a region of space is $\mathbf{E} = 5x\,\hat{\imath} + 6y\,\hat{\jmath} + 3z\,\hat{k}$. Find the divergence and curl of the field. Also find the volume charge density.

19. Find the magnetic induction due to a toroid carrying a current at points inside and outside the toroid.

20. What is Poynting's vector? State and prove Poynting's theorem.

21. From Maxwell's equations, derive the boundary conditions on electric and magnetic fields at the interface between two dielectric media.

$(5\times5=25)$

PART D

IV   Answer any two questions. Each question carries 10 marks

22. Describe the construction and working of a moving coil ballistic galvanometer. Derive the expression for the ballistic reduction factor.

23. Discuss the discharge of a capacitor through an inductance and resistance. Hence obtain the condition for oscillation.

24. Derive the expression for the energy of a point charge distribution and a continuous charge distribution.

25. Obtain Maxwell's equations in point form from the fundamental laws of electricity and magnetism.

$(2\times10=20)$