E 1368 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2015

Fourth Semester

Core Course—ELECTRICITY AND ELECTRO DYNAMICS

(For the programme : B.Sc. Physics—Model I, B.Sc. Physics—Model II, B.Sc. Physics—EEM, B.Sc. Physics—Instrumentation)

[2013 Admissions]

Time : Three Hours Maximum : 60 Marks

Candidates can use Clark's tables and scientific non-programmable calculators.

Part A

Answer **all** *questions.*
1 *mark each.*

1. The rms value and mean value is the same in the case of ————.
2. Three unequal impedances are connected in star in a 3-phase system. The sum of three line currents will be ————.
3. The growth and decay of current in an RL circuit is ————.
4. Electric lines of force start in a ———— charge and end on a ———— charge.
5. The electric flux density $\bar{D}$ is related to the electric field intensity $\bar{E}$ as ————.
6. Gauss's law in point form states $\nabla \cdot \bar{D}$ = ————.
7. In a linearly polarised uniform plane wave ———— and ———— are perpendicular to each other and also perpendicular to the direction of propagation.
8. ———— vector is the power flow whose direction is the same as the direction of wave propagation.

(8 × 1 = 8)

Part B

Answer any **six** *questions.*
2 *marks each.*

9. Define time constants of RC circuit and RL circuit and give their significance.
10. State maximum power transfer theorem and discuss its practical significance.
11. What are the advantages of AC polyphase supply system over single phase system ?
12. Define divergence and explain its physical meaning.
13. Define work done and obtain the line integral to calculate the work done in moving a point charge Q in an electric field $\bar{E}$.

Turn over

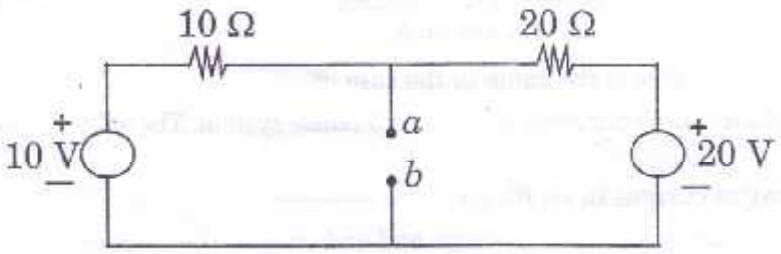
14. Prove that if the path selected is such that it is always perpendicular to $\bar{E}$, the work done is zero.
15. Explain the concept of scalar and vector magnetic potentials.
16. State the boundary conditions for the tangential components of electric and magnetic fields at the interface between two dielectrics.
17. Two linearly polarized waves at right angles are combined. Under what condition, this will result in another linearly polarized wave ?
18. State and explain Poynting theorem.

(6 × 2 = 12)

Part C

Answer any **four** *questions.*
4 marks each.

19. Find Norton equivalent for the following circuit with respect to terminals ab :



20. Three non-inductive resistances each of 50 Ω are connected in star across 400 V, 3 phase AC supply. Calculate the current through each. Also calculate the current if they are connected in delta across the same supply.
21. Calculate the $\bar{D}$ at (4, 0, 3) due to a point charge – 15.734 mc at (4, 0, 0) and a line charge 9.427 mc/m along the Y-axis.
22. A point charge of 15 nc is situated at the origin and another point charge of –12 nc is located at the point (3, 3, 3) m. Calculate the potential at the point (0, –3, –3).
23. A circular loop located on $x^2 + y^2 = 9, z = 0$ carries a direct current of 10 A along $\bar{a}_\phi$. Determine $\bar{H}$ at point (0, 0, 5) and (0, 0, –5).
24. What is a uniform plane wave ? What are the boundary conditions, when such a plane wave is normally incident on a boundary between two media ?

(4 × 4 = 16)

Part D

Answer any **two** *questions.*
12 marks each.

25. Enumerate various methods for 3-phase power measurement, and describe, with neat circuit diagram, two-wattmeter method for 3-phase power measurement. Also obtain a relation to find the power factor.

26. (a) State and prove Gauss's law.

    (b) Derive Laplace and Poisson's equations.

27. Derive Maxwell's equation in the differential form from Gauss's law. Explain the practical significance.

28. Derive the electromagnetic wave equations in a conducting medium.

$(2 \times 12 = 24)$