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Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2022

Fourth Semester

Core Course—ELECTRICITY AND ELECTRO DYNAMICS

(Common for B.Sc. Physics Model I, B.Sc. Physics Model II, B.Sc. Physics EEM, B.Sc. Physics—Instrumentation)

[2013—2016 Admissions]

Time : Three Hours Maximum Marks : 60

Part A

Answer **all** *questions.*
Each questions carries 1 *mark.*

Fill in the blanks :

1. The rms and mean value is the same in the case of ————.
2. If a source is delivering maximum power' to load; then efficiency of the circuit is ————.
3. Maxwell's equation predicts the propagation of ———— through free space with the velocity of light.
4. Ballistic galvanometer is used to measure ————.
5. A sinusoidal current has an r.m.s. value of 10 V. Its peak-to-peak value is ————.
6. ———— vector is the power flow whose direction is the same as the direction of wave propagation.
7. Gauss's law in point form states $\nabla \cdot \bar{D} =$ ————.
8. In a delta network, each element has value R. the value of each element in an equivalent star network will be ————.

(8 × 1 = 8)

Part B

Answer any **six** *questions.*
Each question carries 2 *marks.*

9. What is the difference between r.m.s. and average values of a sine voltage ?
10. State and explain Superposition theorem.

Turn over

11. Explain the resonance in LCR circuits.

12. What is Laplace equation ?

13. Define work done and obtain the line integral to calculate the work done in moving a point charge Q in an electric field E.

14. Explain the concept of scalar and vector magnetic potentials.

15. Explain reflection of plane wave at boundaries.

16. What are the boundary conditions when the uniform plane wave is normally incident on a boundary between two media ?

17. Two linearly polarized waves at right angles are combined. Under what conditions, this will result in another linearly polarized wave ?

18. Write Maxwell's equation in source free region.

(6 × 2 = 12)

Part C

Answer any **four** *questions.*

Each question carries 4 *marks.*

19. An alternating e.m.f. of 200 V, 50 Hz is applied to a capacitor in series with a 20 V, 5 W lamp. Find the capacitance.

20. A TV antenna has a Thevenin voltage of 20 mV and a Thevenin resistance of 300 Ω. When the receiver is matched to the antenna, what is the power transferred to the receiver ?

21. The successive deflections to the right and left of the mean position in the case of a BG are 25.0, 24.9 and 24.8 respectively. Calculate the logarithmic decrement.

22. Two identical line charges of ρ_L = 10 μC/m lie on the x and y axes. Calculate $\bar{D}$ at point (2, 2, 2).

23. In a plane EM wave, the electric field oscillates with an amplitude 48 Vm^{-1} and frequency 2×10^{10}Hz. Find the wavelength and the average energy density in the magnetic field.

24. Calculate the value of Poynting vector at the surface of sun if the power radiated by sun is 3.8×10^{26} Watts while its radius is 7×10^{8} m.

(4 × 4 = 16)

Part D

Answer any **two** *questions.*
Each question carries 12 *marks.*

25. Explain the propagation of monochromatic plane waves in vacuum.

26. State and prove Gauss theorem. Use it to find the electric field due to a charged spherical conductor.

27. 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.

28. The Q factor of a RLC circuit is 5 at its resonance frequency of 1 kHz. Assuming the power dissipation of 250 W when the current drawn is 1 A, find the circuit parameters. Determine the BW of the circuit. Explain resonance and Q of an RLC circuit with related equations.

(2 × 12 = 24)