D 10601 (Pages : 3) Name......................................

Reg. No...............................

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Electronics

ELE 5B 10—ELECTROMAGNETIC THEORY

(2019 Admissions)

Time : Two Hours and a Half Maximum : 80 Marks

Section A

Answer at least **ten** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 30.

1. Write equations to convert a point in Cartesian Co-ordinate System to a point in Cylindrical Co-ordinate System.

2. Write expression for the gradient of a scalar field in Cartesian Co-ordinate System.

3. State Divergence theorem.

4. What is meant by method of images ?

5. State Coulomb's Law.

6. Briefly explain the potential at a point and write an expression for the potential at a point P which is at a distance R from a charge Q.

7. What is magnetic dipole ?

8. What is Gauss's law in magnetostatics ?

9. State Kirchhoff's voltage law.

10. What is meant by TEM wave ?

11. What is conduction current ?

12. What is a uniform plane wave ?

Turn over

13. Express a vector $\vec{A}$ in Cartesian co-ordinate system and Cylindrical co-ordinate system.

14. Write equations for electrostatic energy density and magnetostatic energy density.

15. Define Magnetic field intensity $\vec{H}$.

$(10 \times 3 = 30 \text{ marks})$

Section B

Answer at least **five** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 30.

16. Explain the physical interpretation of divergence with examples.

17. Convert (7, 4, 3) from rectangular co-ordinates to spherical co-ordinates.

18. Derive Poisson's equation and Laplace's equation from Gauss's law.

19. If a charge of $2\,\mu\,C$ is located at $P_1\,(1, 0, 0)$ is placed in free space. Find the electric field strength at $P_2\,(0, 1, 0)$.

20. Derive the equation of continuity for time varying field.

21. State and prove the magnetostatic boundary condition that $\vec{H}$ must obey at the interface between two dielectric media.

22. Briefly explain the polarization of a uniform plane wave.

23. The amplitude of the magnetic field in a plane wave is 2 A/m. (a) determine the magnitude of the electric field for the plane wave in free space ; (b) Find the intrinsic impedance of the medium characterized by $\sigma = 0, \mu = \mu_0$ and $\varepsilon = 4\varepsilon_0$.

$(5 \times 6 = 30 \text{ marks})$

Section C

Answer any **two** *questions.*
Each question carries 10 *marks.*

24. Briefly explain Poynting's theorem. Derive an expression for the Poynting vector.

25. Derive Faraday's law and Ampere's law for time varying field.

26. Write expressions for divergence of a vector quantity in spherical co-ordinate system. Explain the physical significance of gradient and curl with examples.

27. A point charge $Q_1 = 3 \times 10^{-4}$ C is at (1, 2, 3) and a second charge, $Q_2 = -10^{-4}$C is at (2, 0, 5). Find the force on Q_2 due to Q_1 if they are in free space.

$(2 \times 10 = 20 \text{ marks})$