B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00943   **June, 2018**

BIEE-005 : ELECTROMAGNETIC THEORY

Time : 3 hours   *Maximum Marks : 70*

Note : Attempt any five questions. All questions carry equal marks. Use of scientific calculator is allowed.

1. (a) State and explain "Coulomb's Law". Also explain its physical significances and applications. Mention its limitations.   7

    (b) State and explain "Gauss's Theorem". What are the advantages and disadvantages of this theorem ? Mention its applications.   7

2. (a) Point charges 5 nC and – 2 nC are located at (2, 0, 4) and (– 3, 0, 5), respectively.

    (i) Determine the force on a 1 nC point charge located at (1, – 3, 7).

    (ii) Find the electric field E at (1, – 3, 7).   7

(b) If $D = (2y^2 + z)\hat{a}_x + 4xy\hat{a}_y + x\hat{a}_z$ C/m^2, find

(i) the volume charge density at $(-1, 0, 3)$.

(ii) the flux through the cube defined by $0 \le x \le 1, \ 0 \le y \le 1, \ 0 \le z \le 1$.

(iii) the total charge enclosed by the cube.   7

3. (a) State and explain "Ampere's Circuital Law". What are the advantages and disadvantages of this law ?   7

(b) Explain Laplace's equation in the spherical co-ordinates system. Also mention its significances and limitations.   7

4. (a) A point charge of 5 nC is located at $(-3, 4, 0)$, while line $y = 1, z = 1$ carries uniform charge 2 nC/m.

(i) If $V = 0$ at $O(0, 0, 0)$, find V at $A(5, 0, 1)$.

(ii) If $V = 100$ V at $B(1, 2, 1)$, find V at $C(-2, 5, 3)$.

(iii) If $V = -5$ V at O, find V_{BC}.   7

(b) State and explain the "Continuity Equations". What are the limitations and significances of these equations ?   7

5. (a) State and explain "Biot Savart's Law". What are the limitations and significances of this law ? 7

(b) What do you mean by "Vector Magnetic Potential" ? What are the limitations and significances of this potential ? 7

6. (a) Explain "Magnetic Flux Density". What are the importances of magnetic flux density ? Also mention its limitations. 7

(b) Write short notes on the following : 7

(i) Perpendicular Polarization

(ii) Parallel Polarization

7. (a) In a lossless dielectric medium for which $\eta = 60\,\pi$, $\mu_r = 1$, and

$$\bar{H} = -0.1 \cos(\omega t - z)\,\hat{a}_x +$$
$$0.5 \sin(\omega t - z)\hat{a}_y \text{ A/m,}$$

Calculate ε_r, ω and $\bar{E}$. 7

(b) A plane wave propagating through a medium with $\varepsilon_r = 8$, $\mu_r = 2$ has $\bar{E} = 0.5\,e^{-z/3}.\sin(10^8 t - \beta z)\hat{a}_x$ V/m. Determine the following : 7

(i) β

(ii) Wave velocity

(iii) Loss tangent

(iv) $\bar{H}$ field

(v) Intrinsic impedance