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**B.E. Vith Semester (CGPA)
Examination, 2017**

EF-214

**ELECTRONICS & COMMUN. ENGG.
(Electromagnetic Field and Waves)
Paper : EL-601**

Time : 3 Hours]

[Maximum Marks : 60

Note :- Attempt all questions. Each question carries equal marks.

1. Explain any *four* of the following :
 - (i) Divergence of a vector field
 - (ii) Poisson's equation
 - (iii) Magnetomotive force
 - (iv) Ampere's law
 - (v) Poynting vector

2. State and explain divergence theorem. Evaluate both sides of the divergence theorem for the electric flux density $D = 3xy \vec{a}_x + x^2 \vec{a}_y$, C/m² and the rectangular parallelepiped formed by the planes $x = 0$ and 2, $y = 0$ and 3 and $z = 0$ and 4.

Or

Explain spherical co-ordinate system. Given Cartesian co-ordinate vector :

$$A = y \vec{a}_x + x \vec{a}_y + \frac{x^2}{\sqrt{x^2 + y^2}} \vec{a}_z$$

transform into cylindrical co-ordinate system.

3. (a) Explain conservative and non-conservative field.
- (b) A uniform line charge of $16 \mu\text{C/m}$ is located along the line defined by $y = -2$, $z = 5$, and determine E at $P(1, 2, 3)$.

Or

State and explain Gauss law. A volume charge distribution is given by $\rho_v = 6r$ C/m³ in spherical co-ordinates. Find out D using Gauss law.

4. Define magnetic flux density. A current filament carrying a current 5 A placed along z-axis. Determine the flux crossing the portion of the plane $\phi = \pi/4$ defined by $0.01 < r < 1$ m and $0 < z < 2$ m.

Or

Explain Lorentz force equation and explain its significance. A radial field $H = \frac{2.4 \times 10^4}{r} \cos \phi \bar{a}_r$

A/m exists in free space. Determine the magnetic flux ϕ crossing the surface defined by $-\pi/4 < \phi < \pi/4$, $0 < z \leq 1$ m.

5. Explain Maxwell's equation in integral form. The electric field intensity \vec{E} is given as $\vec{E} = E_m \sin(\omega t - \beta z) \bar{a}_y$ in free space. Determine D, B and H.

Or

Explain the concept of displacement current in Maxwell's equation. A circular cross-section conductor of radius 2 mm carries a current $i_c = 5.5 \sin(4 \times 10^{10} t)$. Determine the amplitude of the displacement current density, if $\sigma = 35$ M s/m and $\epsilon_r = 1$.

6. (a) Explain elliptical and circular polarisation.
(b) Determine the skin depth δ at a frequency of 2.5 MHz in aluminium where $\sigma = 38.2$ MS/m and $\mu_r = 1$. Also determine γ and the wave velocity.

Or

Explain reflection of a plane wave. A uniform plane wave of an electric field with amplitude 300 Vm^{-1} is propagating along z-axis. If $\vec{E} = E \bar{a}_x$ and $\omega = 1 \text{ M rad s}^{-1}$, determine :

- (i) the frequency
- (ii) wavelength
- (iii) period
- (iv) the amplitude of H