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Question Paper Code : 11242

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Fourth Semester

Electronics and Communication Engineering

EC3452 – ELECTROMAGNETIC FIELDS

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(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the transformation from spherical (r, θ, ϕ) to rectangular coordinates.
2. State the conditions for the vector F to be solenoidal.
3. State Gauss law for electric fields.
4. Give the relation between electric field intensity (E) and electric flux density (D).
5. What is Biot-Savart's Law?
6. Define energy density in a magnetic field.
7. Write the Maxwell's equation derived from Faraday's law.
8. State the general wave equation in terms of electric and magnetic fields.
9. What is the value of intrinsic impedance for free space?
10. Differentiate attenuation constant and phase constant.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Illustrate divergence of a vector and derive divergence theorem.

Or

- (b) Obtain the expressions for differential area and volume element in cylindrical coordinate system.

12. (a) Illustrate the electric field due to

- (i) infinitely long, charged conductor using Gauss law. (7)
 (ii) Uniformly charged circular disc using Gauss law. (6)

Or

- (b) What are the boundary condition for electric field and derive the conditions between two mediums mentioned below.

- (i) Dielectric 1 and Dielectric 2. (7)
 (ii) Dielectric and Conductor. (3)
 (iii) Dielectric and Free space. (3)

13. (a) (i) Estimate the expression for inductance of a toroidal coil carrying current I , with N turns and the radius of toroid ' r '. (7)
 (ii) Formulate the expression for inductance of a coaxial cable. (6)

Or

- (b) Derive the equations for magnetic field intensity and magnetic flux density at the center of the square current loop using Biot-Savart's law.

14. (a) Write in detail about uniform plane waves and derive the wave equation.

Or

- (b) Derive Maxwell's equation in point form and integral form.

15. (a) Determine the intrinsic impedance, wavelength, attenuation, phase, and propagation constant for electromagnetic waves in any medium.

Or

- (b) Illustrate the reflection coefficient of normal incidence at a plane dielectric boundary.

PART C — (1 × 15 = 15 marks)

16. (a) Calculate β and H in a medium characterized by $\sigma = 0$, $\mu = \mu_0$, $\epsilon = 4\epsilon_0$ and $E = 20 \sin(10^8 t - \beta z) \hat{a}_y$ V/m.

Or

- (b) Given $B = (10/r) \hat{a}_r + r \cos \theta \hat{a}_\theta + a \hat{\phi}$. Then find B in

(i) Cartesian at $(-3, 4, 0)$

(ii) Cylindrical systems at $(5, \pi/2, -2)$.

(7+8)

