Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30147

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3301 – ELECTROMAGNETIC FIELDS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

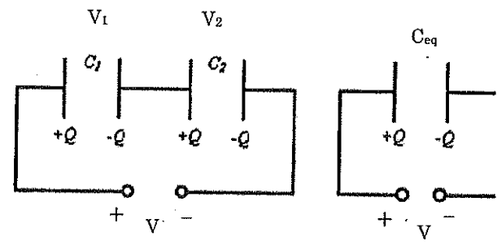
PART A — (10 × 2 = 20 marks)

1. State Divergence Theorem.

2. State Coulombs law.

3. Define potential difference with equation.

4. Formulate the total equivalent capacitance of two capacitor connected in series.



5. List the difference between Scalar and Vector Magnetic Potential.

6. State Ampere's circuital law.

7. Write the faraday's law equation for a moving charge in a constant magnetic field.

8. Write down the expression for electromotive force induced in the moving loop in static field B.

9. List the properties of uniform plane wave.

10. Outline the term 'skin depth'.

PART B — (5 × 13 = 65 marks)

11. (a) Calculate the electric field due to infinite line charge with charge density ρL.

Or

(b) Derive the potential due to

(i) Line charge (4)

(ii) Surface charge (4)

(iii) Volume charge (5)

12. (a) (i) Derive the boundary conditions for electric fields, between conductor and free space. (8)

(ii) Applying stokes theorem, derive continuity equation of current. (5)

Or

(b) (i) Derive the capacitance of a coaxial cable. (7)

(ii) Derive the capacitance of a spherical capacitor. (6)

13. (a) Find the total power passing through a circular disk of radius 5 cm in free space, given $\vec{H} = 0.2\, e^{-j\beta x}\vec{a}_z$.

Or

(b) Given electric field intensity in free space, $\vec{E} = \frac{50}{\rho}\cos(10^8 t - 10z)\vec{a}_\rho V/m$.

Find Magnetic flux density.

14. (a) Derive the Maxwell's equations both in integral and point forms.

Or

(b) Derive the displacement current from circuital analysis and from Ampere circuital law.

15. (a) Illustrate and derive poynting vector in integral and differential form.

Or

(b) Illustrate the propagation of uniform plane waves in two different medias with $(\varepsilon_1, \mu_1, \sigma_1)$ and $(\varepsilon_2, \mu_2, \sigma_2)$. Derive reflection coefficient and transmission coefficient of the wave, from the field components. (7+6)

PART C — (1 × 15 = 15 marks)

16. (a) In a material, for which $\sigma = 5.0\frac{s}{m}$ and $\varepsilon_r = 1$ and $\vec{E} = 250\sin 10^{10} t(V/m)$.

Find the conduction and displacement current densities, and the frequency at which both have equal magnitudes. (5+5+5)

Or

(b) If $V = \left[2x^2y + 20z - \frac{4}{x^2+y^2}\right]$ volts.

Evaluate $\vec{E}$ and $\vec{D}$ at point P (6,-2.5,3) (8+7)