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

Question Paper Code : 71765

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third Semester

Electrical and Electronics Engineering

EE 6302 — ELECTROMAGNETIC THEORY

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the sources of electromagnetic fields?
2. State Stoke's theorem.
3. The electric potential near the origin of a system of co-ordinates is $V = 5x^2 + 8y^2 + 10z^2$. Find the electric field at (1,2,3).
4. What is a conservative field?
5. What is vector magnetic potential?
6. Define Biot-Savart's law.
7. Find the emf induced in a conductor of length 1m moving with a velocity of 100 m/s perpendicular to a field of 1 Tesla.
8. Differentiate transformer and motional emf.
9. Find the velocity of a plane wave in a lossless medium having a relative permitivity 2 and relative permeability of unity.
10. What is skin depth?

PART B — (5 × 13 = 65 marks)

11. (a) (i) State and prove Gauss divergence theorem. (6)

(ii) Derive an expression for electric field intensity due to infinite line charge using Coulomb's law. (7)

Or

(b) Evaluate D and E in all regions for a concentric spherical shell containing charge Q on it. Assume the charge distributions are infinite in extent. (13)

12. (a) (i) Derive the electric potential due an uniformly charged infinite line with uniform charge distribution. (8)

(ii) Obtain the electric potential due to electric dipole. (5)

Or

(b) (i) Derive the electrostatic boundary conditions. (8)

(ii) Derive the expression for capacitance of a parallel plate capacitor. (5)

13. (a) (i) Obtain an expression for the magnetic field intensity due to straight finite conductor carrying current I amperes using Biot Savart's law. (8)

(ii) State and prove Ampere's law. (5)

Or

(b) (i) State and prove magnetic boundary conditions. (7)

(ii) Find the torque about y-axis for the two conductors of length 'l' carrying current in opposite directions separated by a fixed distance 'w' in an uniform magnetic field in x-direction. (6)

14. (a) Derive the Maxwell's equations both in integral and point forms. (13)

Or

(b) (i) Explain the relation between field theory and circuit theory in detail. (6)

(ii) A circular loop conductor having a radius of 0.15m is placed in X-Y plane. This loop consists of a resistance of $20\,\Omega$. If the magnetic flux density is B= 0.5 $\sin 10^3 \vec{a}_x$ Tesla, Find the current through the loop. (7)

15. (a) Deduce the equation of the propagation of the plane electromagnetic waves in free space. (13)

Or

(b) State and prove Poynting theorem. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Given that $D = 5r^2/4\,\vec{a}_r\ C/m^2$. Evaluate both the sides of divergence theorem for the volume enclosed by $r = 4m$ and $\theta = \pi/4$. (15)

Or

(b) A free space – silver interface has E (incident) = 100 V/m on the free space side. The frequency is 15 MHz and the silver constants are $\varepsilon_r - \mu_r = 1, \sigma = 61.7$ MS/m. Determine E (reflected) and E (transmitted) at the interface. (15)
