Reg. No. :

Question Paper Code : X 20479

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021
Third Semester
Electrical and Electronics Engineering
EE 6302 – ELECTROMAGNETIC THEORY
(Regulations 2013)
Common to : PTEE 6302 – Electromagnetic Theory for Electrical and Electronics Engineering
B.E. (Part-Time) Second Semester – (Regulations 2014)

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. Find the capacitance of an isolated spherical shell of radius a.
4. Find the magnitude of D for a dielectric material in which E = 0.15 MV/m and ε_r = 5.25.
5. What is the mutual inductance of the two inductively coupled coils with self inductance of 25 mH and 100 mH ?
6. What is the practical significance of Lorentz's Force ?
7. Define mutual inductance and self inductance.
8. Distinguish between transformer emf and motional emf.
9. What is Skin depth ?
10. Write poynting vector.

PART – B **(5×13=65 Marks)**

11. a) i) Verify the divergence theorem for a vector field $D = 3x^2a_x + (3y + z)a_y + (3z - x)a_z$ in the region bounded by the cylinder $x^2 + y^2 = 9$ and the planes $x = 0$, $y = 0$, $z = 0$ and $z = 2$. **(10)**

ii) A novel printing technique is based upon electrostatic deflection principle. Justify. **(3)**

(OR)

b) i) State and prove Coulomb's Law. **(5)**

ii) Obtain an expression for electric field intensity due to a uniformly charged line of length 'I'. **(8)**

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) Develop an expression for the magnetic field intensity at any point on the line through the centre at a distance 'h' m from the centre and perpendicular to the plane of a circular loop (in XY plane) of radius 'a' m and carrying a current I Ampere in the anti-clockwise direction. **(7)**

ii) Find the magnetic field intensity at Point P(1.5, 2, 3) caused by a current filament of 24 Ampere in the a_z direction on the z axis and extending from $z = 0$ to $z = 6$. **(6)**

(OR)

b) i) Deduce the point form of Ampere's circuital law. **(7)**

ii) Determine the torque on a rectangular loop (a m × b m) carrying current I and placed in a uniform magnetic field. **(6)**

14. a) Derive the set of Maxwell's equations with solutions in integral form from fundamental laws for a good conductor.

(OR)

b) i) Explain the relation between field theory and circuit theory and thus obtain an expression for ohm's law. **(7)**

ii) Compare and explain in detail conduction and displacement currents. **(6)**

15. a) Derive the expression for electromagnetic wave equation for conducting and perfect dielectric medium. **(13)**

(OR)

b) A 6580 MHz uniform plane wave is propagating in a material medium of $\varepsilon_r = 2.25$. If the amplitude of the electric field intensity of lossless medium is 500 V/m. Calculate the phase constant, propagation constant, velocity, wavelength and intrinsic impedance. **(13)**

PART – C **(1×15=15 Marks)**

16. a) A plane wave travelling in +z direction in free space (z < 0) is normally incident at z = 0 on a conductor (z > 0) for which $\sigma = 61.7$ MS/m, $\mu_r = 1$. The free space E wave has a frequency f = 1.5 MHz and an amplitude of 1.0 V/m at the interface it is given by $E(0, t) = 1.0 \sin 2\pi f t a_y$ (V/m). Analyse the wave and predict magnetic wave H(z, t) at z > 0. **(15)**

(OR)

b) Given that $A = 30e^{-r}\,\overset{\rho}{a}_r - 2z\,\overset{\rho}{a}_z$ in cylindrical coordinates, evaluate both sides of divergence theorem for the volume enclosed by r = 2, z = 0 and z = 5. **(15)**
