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

Question Paper Code : 90183

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Fourth Semester
Electronics and Communication Engineering
EC 8451 – ELECTROMAGNETIC FIELDS
(Common to Electronics and Telecommunication Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

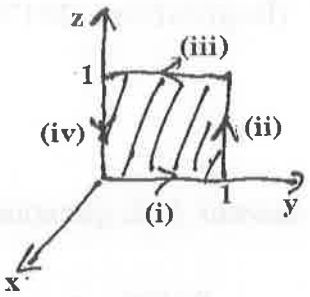
1. State the fundamental theorem of divergence.
2. Write the volume integral to find the volume of a sphere of radius R.
3. An infinite plane carries a uniform surface change σ. Find its electric field.
4. Write Poisson's equation.
5. Define Lorentz force law and give its expression.
6. Write divergence and curl of magnetic field.
7. State Faraday's law.
8. Find the ratio of conduction current density to displacement current density interms of conductivity and angular frequency.
9. What is meant by group velocity ?
10. Find the skin depth at frequency 1.6 MHz in Aluminum, where conductivity $\sigma = 38.2$ Ms/m and $\mu_r = 1$.

PART – B (5×13=65 Marks)

11. a) Let $T = xy^2$ and take a point 'a' to be the origin (0, 0, 0) and 'b' the point (2, 1, 0). Check the fundamental theorem of gradients. **(13)**

(OR)

b) Suppose $v = (2xz + 3y^2)\hat{y} + (4yz^2)\hat{z}$. Check Stoke's theorem for the square surface shown in the figure. **(13)**



12. a) Define electric displacement and discuss electrostatic boundary conditions. **(13)**

(OR)

b) State Coulomb's law and Gauss's law. Define electric potential. Write the relation between charge density, electric potential and electric field. **(13)**

13. a) Find the magnetic field at a distance 's' from a long straight wire carrying a steady current I by using Biot Savart law and Ampere's law. **(13)**

(OR)

b) Derive the expression of energy in magnetic fields. **(13)**

14. a) Write Maxwell's equations in integral and differential forms. **(13)**

(OR)

b) Derive the wave equations for electric and magnetic fields. **(13)**

15. a) Derive and state Poynting's theorem. **(13)**

(OR)

b) Discuss the reflection and transmission of wave at normal incidence. **(13)**

PART – C (1×15=15 Marks)

16. a) The electric field intensity of a linearly polarized uniform plane wave propagating in the +z direction in seawater is $\vec{E} = \hat{i}\, 100\cos(10^7 \pi t) \left(\frac{V}{m}\right)$ at $z = 0$. $\epsilon_r = 72$, $\mu_r = 1$ and $\sigma = 4$ (s/m). Determine the attenuation constant, phase constant, intrinsic impedance, phase velocity, wave length and skin depth. Find the distance at which the amplitude of $\vec{E}$ is 1% of its value at $z = 0$. **(15)**

(OR)

b) Two long coaxial cylindrical metal tubes (inner radius a, outer b) stand vertically in a tank of dielectric oil (susceptibility χ_e) (mass density ρ). The inner one is maintained at potential V and the outer one is grounded. To what height does the oil rise in the space between the tubes ? **(15)**
