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

Question Paper Code : X10361

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
AND APRIL/MAY 2021
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 Stokes theorem.
2. State Helmholtz's theorem.
3. State Coulomb's law for electric field.
4. Two point charges –1nC and 3nC are located at (0, 0, 0), and (1, 0, 0) respectively. Find the Electric Field Intensity of the system.
5. A current density K = 20a^x A/m flows in the y = 0 plane through the region $-5 < z < 5$ m and $-\infty < x < \infty$. Find $\hat{H}$ at P(0, 10, 0) in free space.
6. State Biot Savart's law.
7. What is displacement current ?
8. State Faraday's law.
9. Define Poynting vector.
10. A sinusoidal electrical intensity of amplitude 250 V/m and frequency 1 GHz exists in a lossy dielectric medium that has a relative permittivity of 2.5 and loss tangent of 0.001. Find the effective conductivity of the lossy medium.

PART – B **(5×13=65 Marks)**

11. a) i) Give the Cartesian coordinates of the point C($\rho = 4$, $\varphi = -65^0$, $z = 2$). **(4)**
ii) Give the cylindrical coordinates of the point D($x = -3.1$, $y = 2.6$, $z = 3$). **(4)**
iii) Specify the distance from C to D. **(5)**

(OR)

b) i) Find the div D at the Point P(2, 3, –1) if $D = (2xy - y^2)a_z + (x^2z - 2xy)a_y + x^2 y a_z$ C/m^2. **(6)**

ii) Given vectors M = –10ax + 4ay – 8az and N = 8ax + 7ay + –2az. Find (a) Unit vector in direction –M + 2N (b) Magnitude of 5az + N – 3M. **(7)**

12. a) Find the electrostatic field intensity $\bar{E}$ produced at the point P(1, 5, 4) in free space due to the following static charge distributions :

i) A uniform line charge with a charge density of 150 nC/m is located along X-axis. **(6)**

ii) A uniformly charged sheet with a charge density of 25 nC/m^2 is located in the plane z = –1. **(7)**

(OR)

b) Derive the boundary conditions of the normal and tangential components of electric field at the interface of dielectric and free space.

13. a) Consider an infinitely long coaxial transmission line and obtain the expressions for magnetic field intensity ($\hat{H}$) everywhere using Ampere's circuit law.

(OR)

b) Determine the necessary boundary conditions between two different magnetic media $\mu 1$ and $\mu 2$.

14. a) Illustrate the inconsistency of Ampere's circuital law for time varying fields, and what is the remedial solution proposed by Maxwell ? Also give the differential form representation of all the four Maxwell's equations.

(OR)

b) i) Derive wave equation from Maxwell's equation. **(6)**

ii) Write Faraday's law in differential and integral forms and explain Faraday's experiments. **(7)**

15. a) What is uniform plane wave ? Derive the relationship between E and H in a uniform plane wave.

(OR)

b) Derive expressions for instantaneous, average and complex pointing vectors.

PART – C **(1×15=15 Marks)**

16. a) Analyze the wave behavior at boundaries under oblique incidence and derive the Brewster's angle.

(OR)

b) i) Determine the expression of self inductance for a solenoid having inner radius 'a' and outer radius 'b'. **(7)**

ii) Calculate the self inductance of a solenoid having 500 turns about a cylindrical core of 2 cm radius in which $\mu r = 50$ for $0 < \rho < 0.5$ cm. **(8)**

———————