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

Question Paper Code : 20470

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

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. Transform the Cartesian coordinates x = 2, y = 1, z = 3 into spherical coordinates.

2. Prove that curl gradient is zero.

3. Write down the expression for electric field intensity due to various charge distributions.

4. Write Poisson and laplace equation for electric field.

5. State biot savart law.

6. Calculate force between two wires carrying current of 5 A and 10 A in the same direction are placed with their axis 5 cm apart.

7. Find the amplitude of displacement current density inside a capacitor where $\varepsilon r = 600$ and $D = 3*10^{-6} \sin (6*10^6 t - 3464x)a_z$ c/m^2.

8. State faraday's law.

9. State poynting theorem.

10. Write the relation between reflection coefficient and standing wave ratio.

PART B — (5 × 13 = 65 marks)

11. (a) Why coordinate systems are required? Explain in detail about various coordinates systems.

Or

(b) State and prove divergence and stokes theorem.

12. (a) Derive the expression for electric field intensity due to infinite sheet of charge.

Or

(b) Define electric, dipole and derive an expression for potential of a electric Dipole.

13. (a) State amperes law. Derive expression for magnetic field intensity due to solenoid, toroid and coaxial cable using amperes law.

Or

(b) Show that the inductance of the cable is $L = \mu\, l/2\pi \ln (b/a)$.

14. (a) Derive Maxwell equation in point form, integral form and phasor form/ Harmonically time varying field.

Or

(b) Derive the expression for electromagnetic wave equation for free space.

15. (a) Derive the expression for velocity of a wave when the wave propagates in dielectric medium.

Or

(b) Derive transmission and reflection coefficient for the plane waves that incident oblique on Dielectric boundary.

PART C — (1 × 15 = 15 marks)

16. (a) Four point charges of 5 μC are placed in free space at the point (2, 0,0) (–2, 0, 0), (0,2,0), (0,–2,0) m respectively. Determine force on point charge of 30 μC located at a point (0,0,2).

Or

(b) A capacitor is composed of two parallel sheets separated by a sheet of insulating material 3 mm thick and of relative permittivity $\varepsilon_r = 4$. The distance between plates is increased to allow the insertion of a second sheet 5 mm thick and of relevant permittivity ε_{r2}. If the capacitance so formed is 1/3 times of original capacitance calculate ε_{r2}.

06/05/19 AN

Reg. No. :

Question Paper Code : 80120

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electronics and Communication Engineering

EC 8451 – ELECTROMAGNETIC FIELDS

(Common to Electronics and Telecommunication Engineering)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write Stoke's theorem in integral form.

2. Define infinitesimal volume element in spherical polar coordinates.

3. Write coulomb's law.

4. Find the energy of a uniformly charged spherical shell of total charge q with a radius R.

5. Write Lorentz force equation.

6. Find the magnetic field a distance s from a long straight wire carrying a steady current I.

7. What is meant by displacement current?

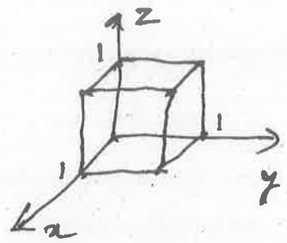
8. Write electromagnetic boundary conditions.

9. What is meant by Brewster's angle?

10. Define phase velocity and group velocity.

PART B — (5 × 13 = 65 marks)

11. (a) Check the divergence theorem using the function $V = y^2\hat{i} + (2xy + z^2)\hat{j} + (2yz)\hat{k}$ and the unit cube situated at the origin.



Or

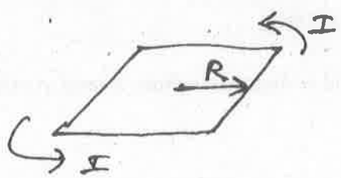
(b) Write the infinite simal displacement, surface and volume elements is spherical and cylindrical coordinates.

12. (a) Find the electric field a distance Z above the center of a square loop of side 'α' carrying uniform line charge λ.

Or

(b) Derive the expressions for the energy of a (i) point charge distribution (ii) continuous charge distributions.

13. (a) Find the magnetic field at the center of a square loop, which carries a steady current I. Let 'R' be the distance from center to side (fig.). Find the field at the center of an n-sided polygon, carrying a steady current I. Again, let R be the distance from the center to any side. Find the formula in the limit n (number of sides) tends to infinity.



Or

(b) Define (i) the mutual inductance between two circuits, and (ii) self inductance of a single coil. Also explain how the self inductance of a wire-wound inductor depends on its number of turns.

14. (a) Write Maxwell's equations in differential form and integral form. Examine them and give its physical interpretation.

Or

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

15. (a) Derive Poynting theorem.

Or

(b) Analyse the wave reflection and transmission at normal incidence at the boundary between two linear media.

PART C — (1 × 15 = 15 marks)

16. (a) A 1.8 KHz wave propagates in a medium characterized by $\mu_r = 1.6$, $\in r = 25$ and conductivity $\sigma = 2.5$ s/m. The electric field intensity in the region is given by $\vec{E} = 0.1e^{-\alpha z}\cos(2\pi f t - \beta z)\,\hat{i}$ V/m. Determine the attenuation constant, propagation constant, intrinsic impedance, phase velocity, skin depth, and wave length of the wave.

Or

(b) Two grounded conducting planes ($y = 0$ and $x = 0$) are intersecting at 90°. A charge of 100 nC is placed at (3, 4, 0). Find the electric potential and electric field intensity at (3, 5, 0).

20/11/19/7N

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)**

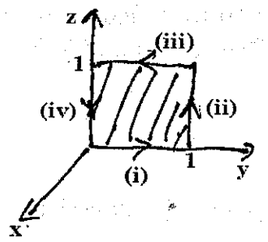
1. State the fundamental theorem of divergence.
2. Write the volume integral to find the volume of a sphere of radius R.
3. An infinite plane carries a uniform surface change σ. Find its electric field.
4. Write Poisson's equation.
5. Define Lorentz force law and give its expression.
6. Write divergence 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)**

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Question Paper Code : 57286

7/6/16 FN

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Electronics and Communication Engineering

EC 6403 – ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. State divergence theorem.
2. Define electric dipole.
3. Write the Laplace's equations in all the three coordinates.
4. What is dielectric polarization ?
5. Define magnetic vector and scalar potential.
6. A current of 3A flowing through an inductor of 100mH. What is the energy stored in inductor ?
7. Mention the force between too current elements.
8. Differentiate diamagnetic, paramagnetic and ferromagnetic material.
9. State Faraday's law of induction.
10. What is Poynting Vector ?

PART – B (5 × 16 = 80 Marks)

11. (a) Define the potential difference and electric field. Give the relation between potential and field intensity. Also Derive an expression for potential due to infinite uniformly charged line and also derive potential due to electric dipole. **(16)**

OR

(b) (i) State and prove Gauss law and explain any one of applications of Gauss law. **(8)**

(ii) Given two vectors $\vec{A} = 3\hat{a}_x + 4\hat{a}_y - 5\hat{a}_z$ and $\vec{B} = -6\hat{a}_x + 2\hat{a}_y + 45\hat{a}_z$, determine the unit vector normal to the plane containing the vectors $\vec{A}$ and $\vec{B}$. **(8)**

12. (a) (i) Derive the relationship between polarization and electric field intensity. **(8)**

(ii) Derive the capacitance of a spherical capacitor. **(8)**

OR

(b) (i) Derive the boundary conditions of the tangential and normal components of electric field at the interface of two mediums with dielectrics. **(10)**

(ii) If two parallel plates of area 4 m^2 are separated by a distance 6 mm, find the capacitance between these 2 plates. If a rubber sheet of 4 mm thick with $\varepsilon_r = 2.4$ is introduced in between the plates leaving a gap of 1 mm on both sides, determine the capacitance. **(6)**

13. (a) State Biot-Savart's law. Derive the expressions for magnetic field intensity and magnetic flux density at the centre of the square current loop of side *l*. Then determine the same for square loop of sides 5m carrying current of 10 A. **(16)**

OR

(b) Derive an expression for magnetic field due to an infinitely long coaxial cable. **(16)**

14. (a) (i) Derive the expression for force on a moving charge in a magnetic field and Lorentz force equation. **(8)**

(ii) Derive the inductance of a toroid. **(8)**

OR

(b) (i) Derive an expression for inductance of a solenoid. Calculate the inductance of solenoid, 8 cm in length, 2 cm in radius, having $\mu_r = 100$ and 1000 turns. **(8)**

(ii) Give the comparison between magnetic and electric circuits. **(8)**

15. (a) Derive the Maxwell's equation in differential and integral forms. **(16)**

OR

(b) Starting from Maxwell's equation, derive homogeneous vector Helmholtz's equation in phasorform. **(16)**

01/06/2017 FN

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

Question Paper Code : 71730

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

Fourth Semester

Electronics and Communication Engineering

EC 6403 — ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define gradient of a scalar field.
2. State divergence theorem.
3. Write the equation for energy stored in electrostatic field in terms of field quantities.
4. What is the practical application of method of images?
5. Define capacitance and capacitors.
6. An infinitesimal length of wire is located at (1, 0, 0) and carries a current $2A$ in the direction of unit vector a_z. Find the magnetic flux density B due to the current element at the field point (0, 2, 2),
7. Define skin depth.
8. Define dielectric strength.
9. Differentiate conduction current and displacement current.
10. List any two properties of uniform plane waves.

PART B — (5 × 13 = 65 marks)

11. (a) Given $D = 2rz^2 a_r + r\cos^2 \varphi a_z$. Prove divergence theorem. (13)

Or

(b) (i) Using gauss law find the electric filed intensity for the uniformly charged sphere of radius 'a' find the E everywhere. (8)

(ii) Derive the equation for scalar electric potential. (5)

12. (a) (i) Derive vector magnetic potential from BiotSavart law. (8)

(ii) Classify the materials based on magnetic properties. (5)

Or

(b) (i) Find the magnetic flux density for the infinite current sheet in the xy plane with current density $K = K_y a_y$ A/m current. (7)

(ii) Derive the equation to find the force between the two current elements. (6)

13. (a) Derive the boundary condition for the E-field and H-filed in the interference between dielectric and free space.

Or

(b) (i) Find the capacitance for a coaxial capacitor with inner radius 'a' and outer radius 'b' with length L. (7)

(ii) Derive the equation for the magnetization for the materials and show that $J_b = \nabla \times m$ and $K_b = m \times a_n$. (6)

14. (a) From the basic laws derive the time varying Maxwell's equation and explain the significance of each equation in detail. (13)

Or

(b) (i) State and derive poynting theorem. (8)

(ii) Explain the transformer emf using Faraday's law. (5)

15. (a) Starting from Maxwell's equation derive the equation for E field in the form of wave in free space. (13)

Or

(b) Explain the condition and propagation of uniform plane waves in good conductors and derive the wave constants. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) With relevant examples explain in detail the practicle application of electromagnetic fields. (15)

Or

(b) (i) Find the expression of induction for the co-axial. (8)

(ii) Propose the salient points to be noted when the boundary conditions are applied. (7)

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

09/05/18 (AN)

Question Paper Code : 40957

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Fourth Semester
Electronics and Communication Engineering
EC 6403 – ELECTROMAGNETIC FIELDS
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. State divergence theorem.
2. Write the different coordinate systems.
3. Two capacitances C_1 and C_2 are connected in series. Find the equivalent total capacitance.
4. What is current density ?
5. What is vector magnetic potential ?
6. State Ampere circuital law.
7. Define – dielectric strength.
8. What is ferromagnetic material ?
9. What is electromotive force ?
10. Define Poynting's theorem.

PART – B (5×13=65 Marks)

11. a) i) State and prove Stokes theorem. (6)

ii) Derive Electric field intensity due to line charge. (7)

(OR)

b) i) Derive the equation for potential difference to move a point charge in electric field. (7)

ii) Derive the Electric field due to electric dipole. (6)

12. a) Derive an expression for energy stored in the electrostatic field of a section of a coaxial cable. (13)

(OR)

b) Derive the electric field boundary condition, when a wave travels between two different dielectrics medium. (13)

13. a) State Biot-Savart's law and derive the expressions for magnetic field intensity, of a straight current carrying conductor.

(OR)

b) Derive the magnetic field intensity of a circular current carrying conductor.

14. a) Derive the inductance of toroid and solenoid.

(OR)

b) i) Derive the equation which relates magnetization and permeability. (8)

ii) Explain the different types of magnetic materials. (5)

15. a) Derive the Poynting theorem equation from Maxwell's curl equation.

(OR)

b) Derive the Maxwell's equations in Differential form and integral form.

PART – C (1×15=15 Marks)

16. a) Apply Lorentz force equation, to derive the force on a differential current element.

(OR)

b) Illustrate with an example, to apply Poisson's and Laplace equation.

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

Question Paper Code : 52912

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2019.

Fourth Semester

Electronics and Communication Engineering

EC 6403 – ELECTROMAGNETIC FIELDS

(Regulation 2013)

(Common to PTEC 6403 – Electromagnetic Fields for B.E. Part – time for Third Semester – Electronics and Communication Engineering – Regulation 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. If a vector $\vec{A} = \overrightarrow{a_x} + \overrightarrow{2a_y} + \overrightarrow{3a_z}$, find its magnitude.

2. In Cartesian coordinates, a point is described by $P(1, 2, 4)$ Identify the orthogonal planes whose intersection give this point.

3. State stokes theorem.

4. Give the relationship between potential gradiant and electric field.

5. Define dielectric strength.

6. Why water has much greater dielectric constant than mica?

7. State amperes circuital law.

8. Define magnetic moment.

9. Write down the constitutive relations.

10. State Maxwells Third equation.

PART B — (5 × 13 = 65 marks)

11. (a) Obtain the differential length, volume and surface elements in cylindrical coordinate system.

Or

(b) An infinitely long line charge of uniform density ρ_L C/m is placed along Z – axis. Find the expression for electric field intensity at a point in Y – axis, which is 'a' meters away from 'Z' axis.

12. (a) State Biot Savart Law and its expression.

Or

(b) Elaborate the applications of Poisson's and Laplace's equations in detail.

13. (a) Compute the magnetic field of a long straight wire that has a circular loop with a radius of 0.05m. 2amp is the reading of the current flowing through this closed loop.

Or

(b) Derive Maxwells equation in point form and in integral form.

14. (a) Derive the Poynting vector from Maxwells equations and give its significance.

Or

(b) Derive an expression of inductance of toroid and solenoid.

15. (a) Find the expression for magnetic field intensity due to an infinite long straight conductor carrying a current of I amperes at a point which has the distance of 'a' from the conductor.

Or

(b) Derive the vector wave equation and give its physical interpretation.

PART C — (1 × 15 = 15 marks)

16. (a) Summarize the concept of transformer and motional emf.

Or

(b) Derive an expression of self-inductance and mutual inductance.

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Question Paper Code : 80338

07/11/16 AN

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electronics and Communication Engineering

EC 6403 – ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State coulombs law.
2. What is an electric potential? Write expression for potential due to an electric dipole.
3. Define resistance of a conductor.
4. Give Laplace's and Poisson's equations.
5. State Ampere's circuital law.
6. What is vector magnetic potential?
7. Calculate the mutual inductance of two inductively tightly coupled coils with self-inductance of 25 mH and 100 mH.
8. Give the expression for Lorentz force equation.
9. Define Phase velocity.
10. Find the displacement current density for field $E = 300 \sin 10^9 t \ V/m$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and Prove Stokes theorem. (8)

(ii) Derive the expression for energy and energy density in static electric fields. (8)

Or

(b) (i) A circular disc of radius 'a' meter is charged uniformly with a charge of ρ c/m. Find the electric field intensity at a point h meter from the disc along its axis. (10)

(ii) Explain the concept of superposition principle of electric field intensity. (6)

12. (a) Derive an expression for capacitance of a coaxial cable. (16)

Or

(b) (i) Derive an expression for Polarization 'P'. (4)

(ii) State and explain the electric boundary conditions between two dielectrics materials. (12)

13. (a) From Biot Savart's law obtain expression for magnetic field intensity and vector potential at a point P and distance 'R' from infinitely long straight current carrying conductor. (16)

Or

(b) (i) Consider two identical circular current loops of radius 3 m and opposite current 20 Amps are in parallel planes, separated on their common axis by 10 m. Find the magnetic field intensity at a point midway between the two loops. (8)

(ii) State Biot-Savart's law. Find the magnetic Field intensity at the origin due to current element $Id\vec{l} = 3\pi(\hat{a}_x + 2\hat{a}_y + 3\hat{a}_z)\mu\ A.m$ at (3, 4, 5) in free space. (8)

14. (a) (i) A charged particle with velocity $\vec{u}$ is moving in a medium containing uniform field $\vec{E} = E\hat{a}_x V/m$ and $\vec{B} = B\hat{a}_y\ Wb/m^2$. What should $\vec{u}$ be so that the particle experiences no net force on it? (8)

(ii) State and derive the magnetic boundary conditions between the two magnetic mediums. (8)

Or

(b) Derive the expression for inductance and magnetic flux density inside the solenoid. Calculate the inductance of the solenoid and energy stored when a current of 8 A flowing through the solenoid of 2m long, 10 cm diameter and 4000 turns. (16)

15. (a) (i) State and prove Poynting's theorem and give its physical interpretation. (8)

(ii) Derive Maxwell's equations for time varying fields. (8)

Or

(b) Derive the wave equation starting from Maxwell's equation for free space. (16)

25.11.17 AN

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Question Paper Code : 50439

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Electronics and Communication Engineering

EC 6403 : ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. State Gauss Law.
2. State stokes theorem.
3. What is polarization ?
4. Define skin depth.
5. State amperes circuital law.
6. A long straight wire carries a current I = 10 mA. At what distance is the magnetic field intensity is 15 A/m ?
7. What is the inductance of a toroid for the coil of N turns ?
8. Write the Lorentz force equation for a moving charge.
9. State Faradays law.
10. What is the importance of Poynting vector ?

PART – B (5×13=65 Marks)

11. a) Find the electric field due to infinite long conductor and infinite sheet of charge using Gauss law. (13)

(OR)

b) Derive the energy stored in electrostatic field in terms of field quantities. (13)

12. a) A cylindrical capacitor consists of an inner conductor of radius 'a' and an outer conductor whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity εr and length of the capacitor is L. Find the value of the capacitance. **(13)**

(OR)

b) i) State the relationship between polarization and electric field intensity. **(7)**

ii) Write down the general procedure for solving Poisson's and Laplace's equation. **(6)**

13. a) Derive a general expression for the magnetic flux density B, at any point along the axis of a long solenoid. **(13)**

(OR)

b) Using Biot-Savart's law, determine the magnetic field intensity due to a straight current carrying filamentary conductor of finite length AB. **(13)**

14. a) Derive the boundary conditions for magnetostatic fields at the interface of two different medium with permeability μ_1 and μ_2. **(13)**

(OR)

b) Planes Z = 0 and Z = 4 carry current K = $-10\ a_x$ A/m and K = $10\ a_x$ A/m, respectively. Determine H at (1, 1, 1) and (0, –3, 10). **(13)**

15. a) Derive the Maxwell's equation in point and integral form. **(13)**

(OR)

b) Deduce the Poynting's theorem from Maxwells equation and find the total time average power, crossing a given surface S. **(13)**

PART – C **(1×15=15 Marks)**

16. a) In a medium characterized by $\sigma = 0$, $\mu = \mu_0$, $\varepsilon = 4\varepsilon_0$ and $E = 20 \sin (10^8 t - \beta z)\ a_y$ V/m. Calculate β and H.

(OR)

b) A parallel-plate capacitor with plate area of 5 cm^2 and plate separation of 3 mm has a voltage 50 sin 10^3tV applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$.

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

Question Paper Code : 20413

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth Semester

Electronics and Communication Engineering

EC 6403 — ELECTROMAGNETIC FIELDS

(Regulations 2013)

(Common to PTEC 6403 — Electromagnetic Fields for B.E. (Part-Time) Third Semester – Electronics and Communication Engineering – Regulations 2014)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State divergence theorem.
2. Specify the applications of Gauss law.
3. Define magneto static vector potential.
4. Mention the Laplace equation in electromagnetic field.
5. What is meant by Biot-Savart Law?
6. State stokes theorem.
7. Outline the Amperes law of force between current carrying conductors.
8. Determine the force and torque in terms of mutual inductance.
9. Relate electrostatic and Magneto static models.
10. Outline the fundamental postulate for Electromagnetic Induction.

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate in detail about the coulomb's law in electric fields. (13)

Or

(b) Determine the electric field intensity of an infinitely long, straight line charge of a uniform density ρ in air. (13)

12. (a) Derive the boundary conditions for electrostatic fields. (13)

Or

(b) A parallel plate capacitor consists of two parallel conducting plates of area S separated by a uniform distance d. The space between the plates is filled with a dielectric of a constant permittivity, ϵ. Determine the capacitance. (13)

13. (a) An infinitely long, straight conductor with a circular cross section of radius b carries a steady current I. Determine the magnetic flux density both inside and outside the conductor. (13)

Or

(b) Derive the vector magnetic potential. (13)

14. (a) Find the inductance per unit length of a very long solenoid with air core having 'n' turns per unit length. (13)

Or

(b) Determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in the same direction. The wires are separated by a distance d. (13)

15. (a) Derive the integral form of Maxwell's equations. (13)

Or

(b) A circular loop of N turns of conducting wire lies in the xy-plane with its center at the origin of a magnetic field specified at the origin of a magnetic field specified by $B = a_z B_0 \cos(\pi/2b) \sin \omega t$, where '$b$' is the radius of the loop and ω is the angular frequency. Find the emf induced in the loop. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Express $3 \cos \omega t - 4 \sin \omega t$, as first (i) $A_1 \cos(\omega t + \theta_1)$ and then (ii) $A_2 \sin(\omega t + \theta_2)$. Determine A_1, θ_1, A_2 and θ_2. (15)

Or

(b) A rectangular loop in the xy-plane with sides b_1 and b_2 carrying a current I lies in a uniform magnetic field $B = a_x B_x + a_y B_y + a_z B_z$. Determine the force and torque on the loop. (15)

6/12/19/7N

Reg. No. :

Question Paper Code : 91447

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Electronics and Communication Engineering

EC6403 – ELECTROMAGNETIC FIELDS

(Regulations 2013)

(Common to PTEC6403 – Electromagnetic Fields for B.E. (Part -Time) – Third Semester – Electronics and Communication Engineering (Regulations 2014)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State Stokes theorem.
2. Define potential difference.
3. What is polarization ?
4. What is 'method of images' ? When it is used ?
5. State Biot Savart Law.
6. State Ampere's circuital law.
7. Define torque and its expression.
8. What is a Ferromagnetic material ? Give example.
9. Define Poynting vector, what is its SI unit ?
10. State Faraday's law of electromagnetic induction.

PART – B **(5×13=65 Marks)**

11. a) Derive the electric field due to infinite line charge with charge density ρ_L.

(OR)

b) i) What is energy density ? Explain energy density in electrostatic fields and derive the expression for energy storage. **(8)**

ii) Define Coulombs law. What is its proportionality constant K in free space ? **(5)**

12. a) Explain boundary conditions for electric fields between conductor and free space.

(OR)

b) Derive capacitance of a coaxial cable and for a spherical capacitor.

13. a) Derive magnetic field intensity for a Co-axial Cable.

(OR)

b) i) Determine magnetic field intensity due to infinitely long conductor using Ampere's Law. **(7)**

ii) Given the vector magnetic potential, $\bar{A} = \frac{10}{x^2+y^2+z^2} a_x$, obtain the magnetic flux density. **(6)**

14. a) i) Derive the inductance of a coaxial cable . **(7)**

ii) Derive the inductance of a solenoid. **(6)**

(OR)

b) Explain and derive the magnetic field boundary condition for two different dielectrics.

15. a) Derive displacement current from circuital analysis and from Ampere circuital law.

(OR)

b) Derive and explain Maxwell's equations both in integral and point forms.

PART – C **(1×15=15 Marks)**

16. a) A point charge Q = 18 nc has a velocity of 5×10^6 m/s in the direction $\bar{a}_v = 0.6\, a_x + 0.75\, a_y + 0.3 a_z$.

Calculate the magnitude of the force exerted on the charge by

$\bar{E} = -3\bar{a}_x + 4\bar{a}_y + 6\,\bar{a}_z$ kv / m

$\bar{B} = -3a_x + 4a_y + 6\,\bar{a}_z$ MT

(OR)

b) Given a 60 μC point charge located at the origin. Find the electric flux passing through the closed surface defined by e = 26 cm and z = ±26 cm.