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

Question Paper Code : X 60494

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020

Third Semester

Electrical and Electronics Engineering

EE 2202/EE 34/10133 EE 303/080280017 – ELECTROMAGNETIC THEORY

(Regulations 2008/2010)

(Common to PTEE 2202 – Electromagnetic Theory for B.E. (Part-Time) Second Semester – Electrical and Electronics Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. How are the unit vectors defined in cylindrical coordinate systems ?
2. State Stoke's theorem.
3. Determine the electric field intensity at any point between two infinite sheets of charge densities + ρsC/m^2.
4. Distinguish between Dielectric constant and Dielectric strength.
5. Write the expression for the inductance per unit length of a long solenoid of N turns and having a length "l" mtr carrying a current of I amperes.
6. State : Ampere's circuital law.
7. What type of voltage is induced in a loop which is rotating about the y-axis in a magnetic field of flux density $\vec{B} = B_0 \sin \omega t \vec{i}$ Tesla ?
8. Write the relation showing the energy required to establish a magnetic field by a quasi-stationary current system.
9. State the Poynting theorem.
10. Mention any two properties of uniform plane wave.

PART – B **(5×16=80 Marks)**

11. a) i) Describe the classification of vector fields. **(6)**

ii) If $\vec{B} = y\vec{a}_x + (x+z)\vec{a}_y$ and a point Q is located at (–2, 6, 3), express

1) the point Q in cylindrical and spherical coordinates,

2) $\vec{B}$ in spherical coordinates. **(10)**

(OR)

b) Determine the divergence and curl of the following vector fields : **(4+4+8)**

i) $\vec{P} = x^2yz\vec{a}_x + xz\vec{a}_2$

ii) $\vec{Q} = \rho\sin\phi\vec{a}_\rho + \rho^2z\vec{a}_\phi + z\cos\phi\vec{a}_z$

iii) $\vec{T} = \frac{1}{r^2}\cos\theta\vec{a}_r + r\sin\theta\cos\phi\vec{a}_\theta + \cos\theta\vec{a}_\phi$.

12. a) Deduce an expression for the capacitance of a parallel plate capacitor having two dielectric media. **(16)**

(OR)

b) i) State and device electric boundary conditions for a dielectric to dielectric medium and a conductor to dielectric medium. **(10)**

ii) Derive the expression for energy density in electrostatic fields. **(6)**

13. a) i) Derive both Biot-Savart's law and Ampere's law using the concept of magnetic vector potential. **(10)**

ii) Give the analogy between Electric and Magnetic circuits. **(6)**

(OR)

b) i) Explain the classification and magnetization of magnetic materials. **(6+4)**

ii) Find the pull exerted on the plunger of an electromagnet, when the total flux uniformly distributed is 500 micro-weber and the diameter of the plunger is 2.54 cm. **(6)**

14. a) Derive Maxwell's equation from Faraday's law and Ampere's Law in integral form, differential form and vector form. **(16)**

(OR)

b) i) Compare field theory and circuit theory. **(8)**

ii) A conducting loop of radius 10 cm lies in the z = 0 plane. The associated $H = 10\sin(120\ \pi t)\bar{a}_2\ \ MWb/m^2$. Calculate the voltage induced in the loop. **(5)**

iii) State Faraday's law of electromagnetic induction. **(3)**

15. a) i) Deduce the equation of the propagation of the plane electromagnetic waves in free space. **(8)**

ii) An air line has characteristic impedance of 70 Ω and phase constant of 3 radians/m at 100 MHz. Calculate the inductance/meter and the capacitance/meter of the line. **(8)**

(OR)

b) i) Derive the Poynting theorem and give its significance. **(12)**

ii) Describe briefly about Reflection coefficient and Transmission coefficient. **(4)**

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