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Question Paper Code : 51498

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

Third Semester

Electrical and Electronics Engineering

EE 2202/EE 34/EE 1201 A/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. Mention the source of electromagnetic fields.

2. State the physical significance of curl of a vector field.

3. State Coulomb's law.

4. Define potential.

5. Find the inductance per unit length of a long solenoid of N turns and having a length 'L' mtrs. Assume that its carries a current of 'I' amperes.

6. State Ampere's circuital law.

7. Distinguish between transformer emf and motional emf.

8. What is displacement current ?

9. What is Voltage standing Wave Ratio ?

10. Obtain the depth of penetration in copper at 2 MHz, given the conductivity of copper $\sigma = 5.8 \times 10^7$ S/m and its permeability = 1.26 μH/m.

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

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

(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) (i) Write down the uniqueness theorem and explain. **(8)**

(ii) Derive the expression for capacitance of a two-wire line. **(8)**

OR

(b) Write the expression for Laplace and Poisson's equation and derive it for various coordinate systems. **(16)**

13. (a) State and explain Ampere's circuital law and show that the field strength at the end of a long solenoid is one half of that at the centre. **(16)**

OR

(b) (i) State and explain Biot-Savert's law. **(6)**

(ii) Derive an expression for the force between two long straight parallel current carrying conductors. **(10)**

14. (a) Derive the Maxwell's equation of integral form, Point form and Vector form from Faraday's law and Ampere's law. **(16)**

OR

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

(ii) Two parallel circular loops of radii, r_1 and r_2 ($r_1 >> r_2$) are coaxially located and carry currents I_1 and I_2 respectively. The axial distance between the centres of loops is 'z'. Find approximately the force between the loops. **(8)**

15. (a) (i) A transmission line having a characteristic impedance of 75 Ω is terminated in an impedance of 200 + j 200 Ω. If the line is 2.1 λ long and lossless, determine its input impedance. **(6)**

(ii) A co-axial line has an inner conductor of radius 0.1 cm and an inductance of 0.5 μH/m. Find the values of the characteristic impedance, capacitance and the radius of the outer conductor of the line at 100 MHz, if the dielectric constant of the sponge material used as insulation in between the inner and outer conductor is 3. Calculate the velocity of the propagation and wavelength and phase constant in this case. **(10)**

OR

(b) Derive the expression for an intrinsic impedance, propagation constant and velocity of a Plane Electromagnetic wave when propagated in

(i) a perfect medium **(8)**

(ii) Conducting media and Good conductor. **(8)**
