Hall Ticket Number:

Code No. : 13312 S

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (EEE: CBCS) III-Semester Supplementary Examinations, June-2019

Electromagnetic Field Theory

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. State Coloumb's Law.
2. Find the total charge inside the volume $\rho_v=\rho_0/r$ C/m^3 enclosed in a sphere of radius r=3 units.
3. A vector field $\mathbf{E}=y\mathbf{a}_y+x\mathbf{a}_x$ .Verify whether E represents an electrostatic field or not.
4. Write the two Maxwell's equations for electrostatic fields.
5. If the vector $\mathbf{B}=x^2\mathbf{a}_x-xy\mathbf{a}_y-Kxz\mathbf{a}_z$ represents a magnetic field. Find the value of the constant K .
6. Magnetic field intensity $\mathbf{H}=3\mathbf{a}_x+7y\mathbf{a}_y+2x\mathbf{a}_z$ A/m. Evaluate conduction current.
7. State Poynting Theorem and write its mathematical form.
8. Find the Conduction and Displacement current densities in a material having conductivity of 10^{-3} S/m and $\varepsilon_r=2.5$ if the electric field in the material is $\mathbf{E}=5x10^{-6}\sin 9x10^9t$ V/m .
9. Explain the significance of insertion loss.
10. Define the term electromagnetic compatibility.

Part-B (5 × 8 = 40 Marks)

11. a) A charge $Q_2=10\mu C$ located at appoint $P_2(0,1,2)$ and another charge $Q_1=50\mu C$ located at a point $P_1(1,0,2)$ in free space. Find the Force on Q_2. [5]

    b) Derive Maxwell's second equation for electrostatic fields. [3]

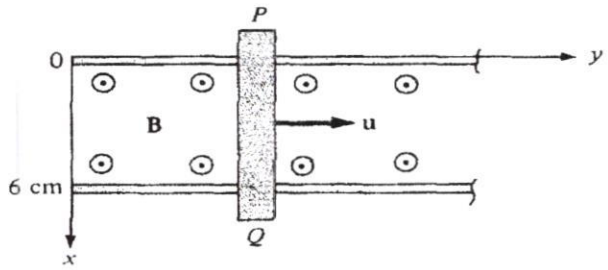
12. a) Find the potential and volume charge density at (1,2,3) in free space for given potential field $V=4yz/x^2+1$. [4]

    b) Obtain the conductor-dielectric boundary conditions for an interface in static electric field. [4]

13. a) Deduce an expression for inductance of a coaxial cable using Ampere's law. [4]

    b) The point charge Q=18 nC has a velocity of 5×10^6 m/s in the direction $\mathbf{a}_v=0.04\mathbf{a}_x-0.05\mathbf{a}_y+0.2\mathbf{a}_z$. Calculate the magnitude of force exerted on the charge be the field (i)$\mathbf{B}=-3\mathbf{a}_x+4\mathbf{a}_y+6\mathbf{a}_z$ mT (ii) $\mathbf{E}=-3\mathbf{a}_x+4\mathbf{a}_y+6\mathbf{a}_z$ kV/m (iii) **B** and **E** acting together. [4]

14. a) A conduction bar can slide freely over two conducting rails as shown in figure. Calculate the induced voltage in the bar if the bar slides at a velocity of $\mathbf{u}=5\mathbf{a}_y$ m/s and $\mathbf{B}=20\mathbf{a}_z$ mT . [3]



    b) Derive the expression for three dimensional wave equation. [5]

15. a) Discuss in detail grounding method to control EMI. [4]

    b) Explain the importance of achieving Electromagnetic compatibility. [4]

16. a) Prove that potential between points A and B is independent of the path taken between the points A and B. [3]

    b) Prove that electric field intensity on either side of the parallel plates is zero. [5]

17. Answer any ***two*** of the following:

    a) Force between two current carrying conductors carrying current in the same direction. [4]

    b) A plane electromagnetic wave travelling in the positive z direction in an unbounded lossless dielectric medium with $\mu_r=1$ and $\varepsilon_r=3$ has peak electric intensity E of 16 V/m. Find i) velocity ii) η iii) **H** iv) Poynting Vector. [4]

    c) List the Sources of Electro Magnetic Interference. [4]

***