**20EC304**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **January, 2024** | **Electronics and Communications Engineering** | | |
| **Third Semester** | **Electromagnetic Field Theory** | | |
| **Time:** Three Hours | | **Maximum:** 70 Marks | |
| ***Answer question 1 compulsory.*** | | | **(14X1 = 14Marks)** |
| ***Answer one question from each unit.*** | | | **(4X14=56 Marks)** |
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|  |  | |  | CO | BL | M |
| 1. | a) | | In what way does the electric field intensity vary with distance for point charge and an electric dipole? | CO 1 | L2 | 1M |
|  | b) | | Write the relationship between E and D in free space. | CO 1 | L2 | 1M |
|  | c) | | Define the capacitance. | CO 2 | L2 | 1M |
|  | d) | | What is the significance of the negative sign in the equation ? | CO 1 | L2 | 1M |
|  | e) | | Write the equation for energy stored in capacitor? | CO 2 | L1 | 1M |
|  | f) | | Define potential difference? | CO 2 | L1 | 1M |
|  | g) | | Write the expression for energy density in electrostatic field. | CO 1 | L1 | 1M |
|  | h) | | What is displacement current? How it is different from conventional current. | CO 3 | L2 | 1M |
|  | i) | | State Gauss law for magnetic field. | CO 3 | L1 | 1M |
|  | j) | | Define magnetic dipole moment. | CO 3 | L2 | 1M |
|  | k) | | What is uniform plane wave? | CO 4 | L1 | 1M |
|  | l) | | What is skin effect? | CO 4 | L2 | 1M |
|  | m) | | Define characteristics impedance of free space | CO 4 | L1 | 1M |
|  | n) | | What is the wave polarization? | CO 4 | L1 | 1M |
| **Unit-I** | | | | | | |
| 2. | a) | Derive the differential form of the Gauss law from the integral form. How this law does appears for non-volume charge distributions in two forms? | | CO 1 | L2 | 7M |
|  | b) | State and explain the Coulombs law for two point charges. | | CO 1 | L3 | 7M |
| **(OR)** | | | | | | |
| 3. | a) | Show that the energy density in the electric field is proportional to the square of the field intensity | | CO 1 | L2 | 7M |
|  | b) | The point charges Q1= 2 nC, Q2= -2 nC, Q3 = 1 nC, and Q4 = -3 nC are positioned one at a time and in that order at (0, 0, 0), (1, 0, 0), (0, 0, 1), and (0, 0, -1), respectively. Calculate the energy in the system after charge is positioned. | | CO 1 | L3 | 7M |
| **Unit-II** | | | | | | |
| 4. | a) | Derive the electric boundary conditions between the two perfect dielectrics. | | CO 2 | L2 | 7M |
|  | b) | Derive the capacitance of parallel plate capacitor. | | CO 2 | L3 | 7M |
| **(OR)** | | | | | | |
| 5. | a) | Derive the expression for equation of continuity of current. | | CO 2 | L2 | 7M |
|  | b) | Two coaxial conducting cylinders of radii 3 cm and 6 cm have a length of 1m. The region between the cylinders is filled with a dielectric εr1= 2 from r = 3 cm to r = 4 cm and εr2 = 3 from r = 4 cm to 6 cm. find the capacitance between the cylinders. | | CO 2 | L3 | 7M |
| **Unit-III** | | | | | | |
| 6. | a) | State and explain the Amperes circuital law for steady currents. Mention its applications and limitations. | | CO 3 | L2 | 7M |
|  | b) | Derive the force between two current elements in steady magnetic field. | | CO 3 | L3 | 7M |
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| **(OR)** | | | | | | |
| 7. | a) | Derive the boundary conditions for static magnetic fields in the general form across a common boundary separated by two different media. The common boundary has a surface current density K. | | CO 3 | L2 | 7M |
|  | b) | In a conducting medium, H = y2z ax + 4(x+1) yz ay – (x+1)z2 az A/m. Find the current density at (1, 0, -2) and calculate the current passing through y =1 plane, 0 ≤ x ≤ 1 and 0 ≤ z ≤ 1. | | CO 3 | L3 | 7M |
| **Unit-IV** | | | | | | |
| 8. | a) | State and explain Maxwells equations in integral form? Obtain the expression for surface impedance in terms of skin depth? | | CO 4 | L4 | 7M |
|  | b) | Show that the vector product E X H = P represents the rate of energy flow per unit area at a point? | | CO 4 | L3 | 7M |
| **(OR)** | | | | | | |
| 9. | a) | Explain the inconsistency of Amperes circuital law. | | CO 4 | L2 | 7M |
|  | b) | A 50 MHz uniform plane wave propagates through a lossy material so that it has a phase shift of 0.5 rad/m and its amplitude is reduced by 20 % every meter travelled. Calculate α and δ. | | CO 4 | L3 | 7M |

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