CODE No.: 19BT30202 SVEC-19

# SREE VIDYANIKETHAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to JNTUA, Ananthapuramu)

## II B.Tech I Semester (SVEC-19) Regular Examinations February – 2021

## ELECTROMAGNETIC FIELDS

## [ Electrical and Electronics Engineering ]

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

**Answer One Question from each Unit**
**All questions carry equal marks**

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| | | **UNIT-I** | | | | |
| 1. | a) | State and explain Gauss's law and derive point form of Gauss's law also calculate **E** due to infinite surface charge distribution | 6 Marks | L2 | CO1 | PO2 |
| | b) | A Uniform volume charge density of $80\mu C/m^3$ is present throughout the region 8mm < r < 10mm. Let $\rho_v = 0$ for 0 < r < 8mm.<br>i) Find the total charge inside the spherical surface r = 10 mm.<br>ii) Find $D_r$ at r = 10mm. | 6 Marks | L3 | CO1 | PO2 |
| | | **(OR)** | | | | |
| 2. | a) | Derive an expression for Electric field intensity (**E**) due to infinite line charge distribution. | 6 Marks | L2 | CO1 | PO1 |
| | b) | Find electric field intensity at a point ($\mathbf{r}$, $\theta$, $\phi$), where r>>d, due to two pint charges Q and –Q are located at (0, d/2, 0) and (0, -d/2, 0). | 6 Marks | L3 | CO1 | PO2 |
| | | **UNIT-II** | | | | |
| 3. | a) | Why are there no free charge in the interior or a good conductor under static condition? Explain. | 5 Marks | L2 | CO1 | PO2 |
| | b) | Assume that two homogeneous isotropic dielectric media with dielectric constants $\varepsilon_{r1} = 3$ and $\varepsilon_{r2} = 2$ are separated by the xy-plane. At a common point $\mathbf{E_1}=\mathbf{a_x}-5\mathbf{a_y}-4\mathbf{a_z}$. Find $E_2$, $D_2$, $\alpha_1$ and $\alpha_2$. | 7 Marks | L3 | CO1 | PO2 |
| | | **(OR)** | | | | |
| 4. | a) | Write the capacitance formula for a parallel-plate capacitor of area S whose plates are separated by a medium of dielectric constant $\varepsilon$ and thickness **d**. | 6 Marks | L2 | CO1 | PO1 |
| | b) | What are the boundary conditions for electrostatic fields at an interface between a conductor and a dielectric with permittivity $\varepsilon$. | 6 Marks | L2 | CO1 | PO1 |
| | | **UNIT-III** | | | | |
| 5. | a) | An infinitely long straight, solid, nonmagnetic 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. | 6 Marks | L2 | CO2 | PO2 |
| | b) | Which postulate of magnetostatics denies the existence of isolated magnetic charges? Explain. | 6 Marks | L1 | CO2 | PO2 |
| | | **(OR)** | | | | |
| 6. | a) | Find the magnetic flux density at a point on the axis of a circular loop of radius **b** that carries a direct current **I**. | 6 Marks | L2 | CO2 | PO2 |
| | b) | A thin ring of radius 5cm is placed on plane z = 1cm so that its centre is at (0, 0, 1)cm. If the ring carries 50mA along $\mathbf{a_\phi}$, find **H** at (0, 0, -1)cm. | 6 Marks | L2 | CO2 | PO2 |

## UNIT-IV

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| 7. | a) | A conducting filamentary triangle joins A (3, 1, 1), B (5, 4, 2) and C (1, 2, 4). The segment AB carries a current of 0.2 A in the $\mathbf{a_{AB}}$ direction. In the presence of magnetic field $B = 0.2a_x - 0.1a_y + 0.3a_z T$.<br>i) i) Find the force on segment BC.<br>ii) ii) Find the torque on the loop about an origin at A. | 6 Marks | L2 | CO2 | PO2 |
| | b) | Derive the expression for torque on a current loop placed in a magnetic field. | 6 Marks | L2 | CO2 | PO2 |
| | | **(OR)** | | | | |
| 8. | a) | Write a short note on Scalar magnetic potential and its properties. | 5 Marks | L2 | CO2 | PO2 |
| | b) | A rectangular loop carrying current $I_2$ is placed parallel to an infinitely long filamentary wire carrying current $I_1$ as shown below. Show that the force experienced by the loop is given by $F = -\frac{\mu_0 I_1 I_2 b}{2\pi}\left[\frac{1}{\rho_0} - \frac{1}{\rho_0 + a}\right] a_\rho N$ | 7 Marks | L2 | CO2 | PO4 |

## UNIT-V

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| 9. | a) | State and explain Maxwell's equations in differential and integral form for time varying fields. | 6 Marks | L2 | CO3 | PO2 |
| | b) | State and explain poynting theorem. | 6 Marks | L2 | CO3 | PO2 |
| | | **(OR)** | | | | |
| 10. | a) | In free space $E = 20\cos(\omega t - 50_x)a_y V/m$, find<br>i) $J_d$ ii) H iii) $\omega$ | 6 Marks | L2 | CO3 | PO4 |
| | b) | State and explain faraday's laws of electromagnetic induction. | 6 Marks | L2 | CO3 | PO2 |