# SREE VIDYANIKETHAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to JNTUA, Ananthapuramu)

**II B.Tech I Semester (SVEC-16) Regular/Supplementary Examinations November - 2018**

**ELECTROMAGNETIC FIELDS**

**[ Electrical and Electronics Engineering ]**

**Time: 3 hours** **Max. Marks: 70**

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

## UNIT-I

| | | | | |
|---|---|---|---|---|
| 1 | a) | State and explain Coulomb's law. Obtain an expression in vector form. | CO1 | 7 Marks |
| | b) | Point charges of 50nC each are located at A(1, 0, 0), B(−1, 0, 0), C(0,1,0) and D(0,−1, 0) in free space. Find the total force on the charge at A. | CO4 | 7 Marks |
| | | **(OR)** | | |
| 2 | a) | Calculate the potential at a point (0, 0, h) due to a circular disc of radius 'a' having a surface charge density of $\rho_s$ C/m$^2$ with its centre at the origin. Calculate the field at point P (0, 0, z). | CO4 | 7 Marks |
| | b) | A 2 $\mu$C point charge is located at *A(4, 3, 5)* in free space. Find $E_\rho$, $E_\varphi$ and $E_z$ at *P(8, 12, 2)*. | CO4 | 7 Marks |

## UNIT-II

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|---|---|---|---|---|
| 3 | a) | What are electric boundary conditions? Derive them for the case dielectric–dielectric boundary with neat sketch. | CO3 | 8 Marks |
| | b) | Derive the Ohm's law in point form from fundamentals. | CO3 | 6 Marks |
| | | **(OR)** | | |
| 4 | a) | Derive current continuity equation. | CO1 | 7 Marks |
| | b) | For the current density $\mathbf{J}=10z\sin^2\phi\mathbf{a}_\rho$A/m$^2$, find the current through the cylindrical surface $\rho = 2$, $1 \le z \le 5$m. | CO3 | 7 Marks |

## UNIT-III

| | | | | |
|---|---|---|---|---|
| 5 | a) | Derive an expression for magnetic field strength **H** due to a finite filamentary conductor carrying a current I and placed along z-axis at a point P on y-axis. Hence deduce the magnetic field strength for the length of a conductor extending from -infinite to +infinite. | CO4 | 7 Marks |
| | b) | Give Maxwell's equation for static magnetic fields in integral and differential form and explain. | CO2 | 7 Marks |
| | | **(OR)** | | |
| 6 | a) | Derive an expression for magnetic field strength **H** due to infinitely long coaxial transmission line. Find **H** everywhere. | CO4 | 8 Marks |
| | b) | Short notes on scalar and vector magnetic potential. | CO1 | 6 Marks |

## UNIT-IV

| | | | | |
|---|---|---|---|---|
| 7 | a) | Derive the expression for energy stored in static magnetic field. | CO1 | 7 Marks |
| | b) | A point charge of 10C moves with a uniform velocity of $2\mathbf{a}_x-4\mathbf{a}_z$m/s in an EM field having $E = \mathbf{a}_x-3\mathbf{a}_y+8\mathbf{a}_z$V/m and $B=0.3\mathbf{a}_x+0.1\mathbf{a}_y$ Wb/m$^2$. Find the total force on the charge. | CO3 | 7 Marks |
| | | **(OR)** | | |
| 8 | a) | Derive an expression of force between two straight long and parallel current carrying conductors. | CO3 | 8 Marks |
| | b) | Give and explain Lorenz force equation. | CO2 | 6 Marks |

## UNIT-V

| | | | | |
|---|---|---|---|---|
| 9 | a) | A parallel-plate capacitor with plate area of $5cm^2$ and plate separation of 3mm has a voltage $50\sin 10^3 t$ V to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$. | CO3 | 6 Marks |
| | b) | Give Maxwell's equations for time varying fields in both differential and integral form. Explain each. | CO2 | 8 Marks |
| | | **(OR)** | | |
| 10 | a) | Derive Poynting theorem and Poynting vector. | CO5 | 8 Marks |
| | b) | In free space $\mathbf{E(z, t) = 1.0\sin(\omega t - \beta z)\, a_x V/m}$. show that the average power crossing a circular disc of radius 15.5m in a z = constant plane is 1W. | CO2 | 6 Marks |