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Examination: B.Tech. End Semester Examination, November-2023

Branch : Electrical Engineering   Semester : IIIrd

Course : Electromagnetic Field Theory   Code : EE-212

Time: 03:00 Hours   **Maximum Marks: 50**

Instruction: Attempt all the questions.

Q. 1. What is the statement of the curl of a vector and explain it with suitable example. Also give the statement of the Stokes's theorem and prove it. **[05]**

Q. 2. Two point charges -4 mC and 5 mC are located at (2, -1, 3) and (0, 4, -2), respectively. Find the potential at (1, 0, 1), assuming zero potential at infinity. **[05]**

Q. 3. If plane $z = 0$ carries uniform current $\boldsymbol{K} = K_y a_y$,

$$\boldsymbol{H} = \begin{cases} \frac{1}{2} K_y a_x, & z > 0 \\ -\frac{1}{2} K_y a_x, & z < 0 \end{cases}$$

Obtain $\boldsymbol{H}$ by using the concept of vector magnetic potential. **[05]**

Q. 4. A parallel-plate capacitor with plate area of $5\ cm^2$ and plate separation of $3\ mm$ has a voltage $50 \sin 10^3 t\ V$ applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$. **[05]**

Q. 5. In free space ($z \le 0$), a plane wave with $\boldsymbol{H_i} = 10\cos(10^8 t - \beta z) a_x\ mA/m$ is incident normally on a lossless medium ($\varepsilon = 2\varepsilon_0, \mu = 8\mu_0$) in region $z \ge 0$. Determine the reflected wave $\boldsymbol{H_r}, \boldsymbol{E_r}$ and the transmitted wave $\boldsymbol{H_t}, \boldsymbol{E_t}$. **[05]**

Q. 6. A uniform plane wave propagating in a medium has $\boldsymbol{E} = 2e^{-\alpha z} \sin(10^8 t - \beta z) a_y\ V/m$. If the medium is characterized by $\varepsilon_r = 1, \mu_r = 20, and\ \sigma = 3\ S/m$, Find $\alpha, \beta, and\ \boldsymbol{H}$. **[05]**

Q. 7. Explain the power and the pointing vector in detail with suitable examples. **[05]**

Q. 8. A distortionless line has $Z_0 = 60\ \Omega, \alpha = 20 \frac{mNp}{m}, u = 0.6c$, where c is the speed of light in a vacuum. Find R, L, G, C, and λ at 100 MHz. **[05]**

Q. 9. What do you mean by Smith Chart and explain it in brief with example. Also, explain the procedure to draw the Smith Chart and application of the Smith Chart. **[05]**

Q. 10. A rectangular waveguide with dimensions $a = 2.5\ cm, b = 1\ cm$, is to operate below 15.1 GHz. How many TE and TM modes can be waveguide transmit if the guide is filled with a medium characterized by $\sigma = 0,\ \mu_r = 1, and\ \varepsilon = 4\varepsilon_0$? Calculate the cutoff frequencies of the modes. **[05]**

****** All the Best ******