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PAR-003-1152002 Seat No. _____

M. Sc. (Electronics) (Sem. II) (W.E.F. 2016) Examination

August / September - 2020

Advance Electromagnetics : Paper - VI

(New Course)

Faculty Code : 003

Subject Code : 1152002

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Answer the Following : (Any **Seven**) **14**

(1) Prove that $\delta = \frac{1}{\alpha}$

(2) Prove that **E** and **H** fields are perpendicular to each other.

(3) Derive $\nabla^2 E = \mu_0 \in_0 \ddot{E}$.

(4) Draw the diagram of fields of EM wave for the cases of parallel and perpendicular polarization.

(5) Write the expressions for velocity of propagation and attenuation constant.

(6) Prove that $\nabla^2 H = \left(-\omega^2 \mu \in + j\omega\mu\sigma\right) H$.

(7) Define good conductor and good dielectric.

(8) Define polarisation of wave.

(9) Write the expressions for propagation constant and phase shift constant.

(10) Define and draw uniform plane wave.

2 Answer the Following : (Any **Two**) **14**

(1) Prove the relation between E and H in uniform plane wave : $\left|\frac{E}{H}\right| = \frac{E}{H} = 120\pi\Omega$. **7**

(2) Derive the expression for phaseconstant 7

$\beta = \omega\sqrt{\frac{\mu \in}{2}}\left(\sqrt{1+\frac{\sigma^2}{\omega^2 \in^2}}+1\right)$. rad/m using wave

propagation constant $\gamma = \sqrt{-\omega^2 \mu \in + j\omega\mu\sigma} = \alpha + j\beta.$

(3) Derive the expression for intrinsic impedance of the conductor $\eta = \frac{j\omega\mu}{\sigma}$ 7

3 Answer the Following : 14

(1) "A uniform plane wave propagating in x-direction has no x-components of E and H". Prove this statement. 7

(2) Derive the expression for $\alpha = \frac{\sigma}{2}\sqrt{\frac{\mu}{\in}}$ and 7

$\beta = \omega\sqrt{\mu \in}\left(1+\frac{\sigma^2}{8\omega^2 \in^2}\right)$ of wave propagation characteristics in good dielectrics.

OR

3 Answer the Following : 14

(1) Explain the reflection coefficient, transmission coefficient in context of waves on Dielectric - normal incidence. 7

(2) Write a detailed note on the oblique incidence of EM wave onperfect conductor in the case of parallel polarisation. 7

4 Answer the following : 14

(1) Discuss Brewster angle for parallel and perpendicular polarisation. 7

(2) Write a detailed note on surface impedance. 7

5 Answer the following : (Any **Two**) **14**

(1) You are given the following wave equations and field components. **7**

$$\frac{\partial^2 E}{\partial x^2} + \gamma_p^2 E = -\omega^2 \mu_0 \in_0 E \text{ and } \frac{\partial^2 H}{\partial x^2} + \gamma_p^2 H = -\omega^2 \mu_0 \in_0 H$$

$$H_x = \frac{-\gamma_p}{h_p^2}\frac{\partial H_z}{\partial x},\ H_y = \frac{-j\omega\varepsilon_0}{h_p^2}\frac{\partial E_z}{\partial x},\ E_x = \frac{-\gamma_p}{h_p^2}\frac{\partial E_z}{\partial x},$$

$$E_y = \frac{j\omega\varepsilon_0}{h_p^2}\frac{\partial H_z}{\partial x} \text{ where, } h_p^2 = \gamma_p^2 + \omega^2\mu_0\varepsilon_0.$$

Find the field components for TE waves.

(2) Derive the expression for guide wavelength **7**

$$\gamma_p = \frac{\lambda}{\left[1 - \left(\frac{\lambda}{\lambda_c}\right)^2\right]^{1/2}}$$

(3) Write a note on propagation parameters of TE and TM waves and also define and write the expression for cut-off frequency. **7**

(4) Obtain the expression for field components for TM wave when the EM wave passes through two parallel, infinite and perfectly conducting metal plates. **7**