BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - IV E&C :SUMMER- 2022
SUBJECT : EM WAVES & PROPAGATION

Day : Monday
Date : 20-06-2022

S-24603-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use on non – programmable **CALCULATOR** is allowed.
4) Assume suitable data and standard notations **WHEREVER** applicable.
5) Bold letters are **VECTORS**.

Q.1 Apply Gauss's law and the conservative nature of $\boldsymbol{E}$ to derive the necessary boundary conditions for dielectric-dielectric medium under the influence of different $\boldsymbol{E}$ fields. **(10)**

OR

An electric dipole of 100 $\boldsymbol{a_z}$ pC.m is located at the origin. Find electric potential, V and $\boldsymbol{E}$ at points

(a) (0, 0, 10) **(05)**

(b) $(1, \pi/3, \pi/2)$ **(05)**

Q.2 Discuss the forces due to magnetic fields

(a) Due to moving charged particles in a $\boldsymbol{B}$ field **(05)**

(b) On a current element in an external $\boldsymbol{B}$ field. State Fleming's right-hand thumb rule. **(05)**

OR

(a) Determine the magnetic moment $\boldsymbol{m}$ And hence Torque, $\boldsymbol{T}$ considering a uniform magnetic field, $\boldsymbol{B}$. **(05)**

(b) Classify magnetic materials based on magnetic susceptibility (χ_m) and relative permeability (μ_r). **(05)**

Q.3 **(a)** Differentiate between conduction and displacement current **(05)**

(b) State's all four Maxwell's equation in a time-varying field in integral as well as differential form with necessary remarks. **(05)**

OR

Derive induced *emf* due to

(a) A stationary loop in time-varying $\boldsymbol{B}$ field. **(05)**

(b) Moving loop in static $\boldsymbol{B}$ field. **(05)**

P.T.O.

Q.4 **(a)** A lossy dielectric has an intrinsic impedance of $200 \angle 30^0\ \Omega$ at a particular radian frequency w. If, at that frequency, the plane wave propagating through the dielectric has the magnetic field component **(10)**

$\boldsymbol{H} = 10.e^{-\alpha x} \cos\left(wt - \frac{1}{2}x\right) \boldsymbol{a}_y$ A/m.

Determine $\boldsymbol{E}$ and attenuation constant, α.

OR

Using the relations of propagation constant, γ; attenuation constant, α ; phase constant, β; intrinsic impedance, η; and wave velocity, u; in lossy dielectrics find the same parameters in

(a) Plane waves in lossless dielectrics **(03)**

(b) Plane waves in Free space **(03)**

(c) Plane waves in good conductors. Also, find skin depth. **(04)**

Q.5 An antenna with an impedance of 40+j30 Ω is to be matched to a 100 Ω lossless line with a shorted stub. Determine

(a) The required stub admittance **(04)**

(b) The distance between the stub and the antenna **(03)**

(c) The stub length **(03)**

OR

A distortionless line has Z_0=60 Ω, α=20 mNp/m, u=0.6c, where c is the speed of light in a vacuum. Determine R, L, G, C, and λ at 100 MHz. **(10)**

Q.6 Derive and discuss the cut-off, Evanescent and propagation cases in TM mode of a rectangular waveguide using general relations of wave number, k and propagation constant, γ. Mention the dominant mode. **(10)**

OR

Describe briefly the necessary characteristics of an antenna.

(a) Frequency/Wavelength **(02)**

(b) Polarization **(04)**

(c) Antenna losses **(02)**

(d) Gain **(02)**

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The Complete Smith Chart

Black Magic Design