SRM Institute of Science and Technology

Tiruchirappalli Campus, Trichy – 621 105

Faculty of Engineering and Technology

21ECC205T: ELECTROMAGNETIC THEORY AND INTERFERENCE

ASSIGNMENT – 02

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PART A

1.	BiotSavart law in magnetic field is analogous to which law in electric field? A. Gauss law B. Faraday law C. Coulomb's law D. Ampere law
2.	Find the magnetic field of a finite current element with 2A current and height $1/2\pi$ is A. 1 B.2 C. 1/2 D. 1/4
3.	The curl of the magnetic field intensity is A. Conservative B. Rotational C. Divergent D. Conduction current density
4.	In the conversion of line integral of H into surface integral, which theorem is used? A. Green theorem B. Gauss theorem C. Stokes theorem D. It cannot be converted
5.	Find the conduction current density of a material with conductivity 200units and electric field 1.5 units. A. 150 B. 30 C. 400/3 D. 300
6.	Ampere law states that, A. Divergence of H is same as the flux B. Curl of D is same as the current C. Divergence of E is zero D. Curl of H is same as the current density
7.	Given the magnetic field is 2.4 units. Find the flux density in air(in 10-6 order). A. 2 B. 3 C. 4 D. 5
8.	Which of the following cannot be computed using the Biot Savart law? A. Magnetic field intensity B. Magnetic flux density C. Electric field intensity D. Permeability
9.	The energy stored in a capacitor is A. 0.5 C V^2 B. 3C V^2 C. 0.5 C^2 V D. 3 C^2 V

10.	The Magnetic field intensity due to the co-axial cable in the region of $0 \leq \rho \leq a$ is A. Directly proportional to the current I B. Inversely proportional to the current I C. Independent of the current I D. Directly proportional to the square root of the current I
11.	The intrinsic impedance is the ratio of square root of A. Permittivity to permeability B. Permeability to permittivity C. Phase constant to wavelength D. Wavelength to phase constant
12.	The skin depth of a conductor with attenuation constant of 7 neper/m is A. 14 B. 49 C. 7 D. 1/7
13.	The mode which has the highest wavelength is called A. Dominant mode B. Evanescent mode C. Generate mode D. Degenerate mode
14.	The real part of the propagation constant is the A. Attenuation constant B. Phase constant C. Permittivity D. Permeability
15.	For conductors, the loss tangent will be A. Zero B. Unity C. Maximum D. Minimum
16.	Calculate the phase constant of a conductor with attenuation constant given by 0.04 units. A. 0.02 B. 0.08 C. 0.0016 D. 0.04
17.	The intrinsic impedance of free space is A. 489 B. 265 C. 192 D. 377
18.	The cut off wavelength of the TE_{10} mode having a broad wall dimension of 5cm is A. 0.1 B. 1 C. 10 D. 0.01
19.	For a dielectric, the condition to be satisfied is A. $\sigma/\omega\varepsilon > 1$ B. $\sigma/\omega\varepsilon < 1$ C. $\sigma = \omega\varepsilon$ D. $\omega\varepsilon = 1$
20.	In transverse electric waves, which of the following is true? A. E is parallel to H B. E is parallel to wave direction C. E is transverse to wave direction D. H is transverse to wave direction

PART – B

1.	Derive the expression for Magnetic Field $\vec{H}$ intensity due to straight conductor and show that $\vec{H} = \frac{\mu_0 I}{4\pi a}[\sin\phi_2 + \sin\phi_1]\cdot \hat{a}_r$
2.	State and explain Biot-Savart's law
3.	Define Gaus's law and derive its point form.
4.	Find the incremental field strength at P_2 due to current element of $2\pi \hat{a}_z \ \mu \ A/m$ at P_1. The co-ordinates of P_1 and P_2 are $(4,0,0)$ and $(0,3,0)$ respectively.
5.	Write short notes on Displacement current and derive the expression for displacement current density.
6.	Calculate the skin depth and wave velocity at 2 MHz in Aluminium with conductivity 40 MS/m and $\mu_r = 1$.
7.	Write the expression for average power transmission and attenuation of the waveguide.
8.	In a lossless dielectric for which $\eta = 60Z, \ \mu_r = 1$. Find ε_r.
9.	A plane wave propagating through a medium with $\varepsilon_r = 8$, $\mu_r = 2$. Determine i) Wave impedance ii)Wave velocity
10.	Compare Transverse magnetic and transverse electric wave.
11.	Differentiate Transverse Electric (TE) Mode and Transverse Magnetic (TM) Mode.
12.	From Propagation constant explain Cut-off, Evanescent and Propagation mode of TM wave in rectangular wave guide.

PART – C

1.	Derive the magnetic field intensity for infinitely long straight current carrying conductor using Biot-Savart's law.
2.	Derive the magnetic field intensity for infinite sheet of current.
3.	Derive the magnetic field intensity for Co-axial cable in various regions.
4.	Derive the four Maxwell's equations in point and integral form for time varying field.
5.	Derive the Electromagnetic wave equation for lossy dielectric medium.
6.	Derive the Electromagnetic wave equation for a good conductor.
7.	Obtain the E and H field components for a Rectangular Waveguide.
8.	Explain in detail about the TM waves of rectangular waveguides.
9.	A rectangular waveguide with dimensions $a = 2.5cm, b = 1cm$ is to operate below $15.1GHz$. How many TE & TM modes can the waveguide transmit if the guide is filled with a medium characterized by $\sigma = 0, \varepsilon = 4.\varepsilon_0, \mu_r = 1$? Calculate the cutoff frequencies of the modes.
10.	In a rectangular waveguide for which a=1.5cm, b=0.8cm, $\sigma=0$, $\mu=\mu_o$, $\varepsilon = 4\varepsilon_o$ $H_x = 2\sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right) sin(\pi \times 10^{11} t - \beta z) A/m$ The waveguide is operating in TM_{13} mode. Determine (i) The Cut off Frequency (ii) Phase Constant (iii) Propagation Constant. (iv) Intrinsic impedance.

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