1. A 100 V/m plane wave of frequency 300 MHz travels in the +z-direction in an infinite, lossless medium having $\varepsilon_r=9$, $\mu_r=1$, and $\sigma=0$. Determine the time domain expression for H field vector knowing that the direction of the vector E is along x-axis.

a. $(5/2\pi)\cos(600\pi.10^6t-6\pi z)\ a_x$ (A/m)
b. $(5/2\pi)\cos(600\pi.10^6t-6\pi z)\ a_y$ (A/m)
c. $(5/\pi)\cos(600\pi.10^6t-6\pi z)\ a_x$ (A/m)
d. $(2\pi/5)\cos(600\pi.10^6t-6\pi z)\ a_y$ (A/m)
e. None of the above

2. A plane wave is traveling in the x-direction in a lossless medium, with a 100 V/m electric field in the z-direction. Given that the wavelength is 25 cm and the velocity of propagation is 2.10^8 m/s, determine the relative permittivity of the medium. Assume $\mu_r=1$.

a. 11/4
b. 7/4
c. 15/4
d. 9/4
e. None of the above

3. In problem 2, express the electric field vector in the time domain

a. $(100)\cos(1.6\pi.10^9t-8\pi x)\ a_z$ (V/m)
b. $(100)\cos(1.6\pi.10^9t-8\pi z)\ a_x$ (V/m)
c. $(100)\cos(1.6\pi.10^3t-8\pi x)\ a_z$ (V/m)
d. $(100)\cos(1.6\pi.10^3t-8\pi z)\ a_x$ (V/m)
e. None of the above

4. Determine the polarization of the following plane wave:

$$E= 1\cos(\omega t+\beta z)\ a_x - 1\sin(\omega t+\beta z)\ a_y$$

a. left-circular
b. right-circular
c. left-elliptical
d. right-elliptical
e. None of the above

5. For a plane wave propagating in the z-direction in air:

$E(z)= (30-j40)e^{-j\pi z}a_x + (20+j10)\, e^{-j\pi z}a_y$

Calculate E(1/3 m, 5ns)

a. $E= 75.4a_x -33.12a_y$
b. $E=-46a_x -12.32a_y$
c. $E=-53a_x -27.45a_y$
d. $E=-23a_x + 6.16a_y$
e. None of the above

6. In a medium characterized by $\sigma =0$, $\mu = \mu_o$, $\varepsilon=4\varepsilon_o$, and

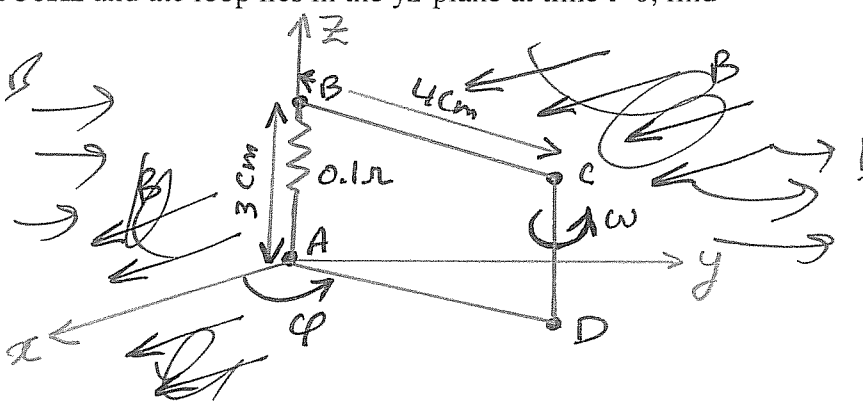
$E= 20 \sin(10^8 t - \beta z)\, a_y$ (V/m)

calculate **H**.

a. $\pm (5/3\pi) \sin [10^8 t \pm (7/3)z]\, a_y$ A/m
b. $\pm (2/3\pi) \sin [10^8 t \pm (2/3)z]\, a_x$ A/m
c. $\pm (1/3\pi) \sin [10^8 t \pm (2/3)z]\, a_x$ A/m
d. $\pm (7/3\pi) \sin [10^8 t \pm (5/3)z]\, a_x$ A/m
e. None of the above

7. The loop shown is inside a uniform field $B=50a_y$ mWb/m^2. If side DC of the loop cuts the flux lines at the frequency of 50Hz and the loop lies in the yz-plane at time t=0, find the induced current at t=3ms.

a. -0.1108 A
b. -0.173 A
c. -0.223 A
d. -0.087 A
e. None of the above



8. A spherical capacitor consists of an inner conducting sphere of radius R_i and an outer conductor with a spherical inner wall of radius R_o. The space in between is filled with a dielectric of permittivity ε. Determine the capacitance.

a. $(2\pi\varepsilon)/(1/R_o - 1/R_i)$
b. $(6\pi\varepsilon)/(1/R_i - 1/R_o)$
c. $(4\pi\varepsilon)/(1/R_i - 1/R_o)$
d. $(3\pi\varepsilon)/(1/R_o - 1/R_i)$
e. None of the above

9. If $E_s=10e^{j4x}\ a_y$, which of these is not a correct representation of E?

a. Im $(E_s\ e^{j\omega t})$
b. 10 cos $(\omega t + j4x)\ a_y$
c. 10 sin $(\omega t + 4x)\ a_y$
d. Re $(E_s e^{j\omega t})$
e. None of the above

10. A section of lossless coaxial cable having $R_c=50\Omega$ and u=200 m/μs is terminated in a short circuit and operated at a frequency of 10MHz. Determine the shortest length of the lines such that, at the input terminals, the line appears to be 100-pF capacitor.

a. 8.23 m
b. 2.44 m
c. 8.65 m
d. 5.97 m
e. None of the above

11. An antenna having an input impedance at 100 MHz of (72+j40) Ω is connected to a 100-MHz generator via a section of 300- Ω air filled line of length 1.75m. Determine the voltage reflection coefficient at the line input terminals.

a. 0.87 <-75.3
b. 0.43 <-175.4
c. 0.73 <-245.8
d. 0.62< -256.09
e. None of the above

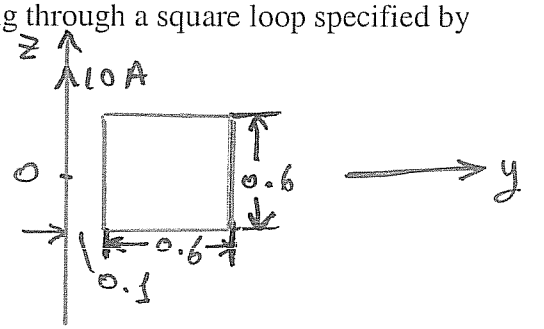
12. In problem 11, calculate the average incident power delivered to the antenna at the sending end of the line by a generator with source voltage of 10V and a source impedance of 50 Ω.

a. 89.22 mW
b. 47.67 mW
c. 76.58 mW
d. 65.28 mW
e. None of the above

13. Determine the work done in carrying a +5(μC) charge from P1(1,2,-4) to P2(-2,8,-4) in the field $E=a_x y + a_y x$ along the staright line joining P1 and P2.

a. 120 μJ
b. 90 μJ
c. 70 μJ
d. 61 μJ
e. None of the above

14. A direct current I=10A flows in an infinitely long wire of radius 2 mm along the z-axis. Determine the total magnetic flux passing through a square loop specified by z=± 0.3 m and y=0.1m and 0.7m in air.



a. 3.12 μWb
b. 5.22 μWb
c. 1.78 μWb
d. 2.34 μWb
e. None of the above

15. Find the magnetic flux density B at the center of a semi-circular loop ($0<\varphi<\pi$) of radius 8cm carrying a dc current of 4A

a. 3π (μT)
b. 5π (μT)
c. 7π (μT)
d. 9π (μT)
e. None of the above

16. The open-circuit and short-circuit impedances measured at the input terminals of a lossless transmission line of length 1.5m, which is less than a quarter wavelength are –j54.6 Ω and ~~~ respectively. Find β of the line.

j103Ω

a. 0. 416
b. 0.241
c. 0.852
d. 0.628
e. None of the above

17. In problem 16, how long should the short-circuited line be in order for it to appear as an open circuit at the input terminals?

a. $l = 4 + (2n-1)$ m, n=1,2,3,...
b. $l = 1.3 + (5n-1)$ m, n=1,3,5,...
c. $l = 2.5 + 5(n-1)$ m, n=1,2,3,...
d. $l = 3 + 7(n-1)$ m, n=1,2,3,...
e. None of the above