VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING

Continuous Assessment Test – II - Fall Semester, 2023-24

Course Code :BECE205L **Slot:** D2+TD2 **Max. Marks** : 50

Course Title :Engineering Electromagnetics **Duration** : 90 Minutes.

Smith chart will be provided

Answer all questions

1 Region 1, described by $2x + 3y \geq 5$ is free space whereas, region 2 described by $2x + 3y \leq 5$ is a magnetic material with $\mu = 3\mu_0$. Assuming that the boundary between the material and free space is current free, find [10]

(a) Magnetic flux density B_2 if $B_1 = 0.3a_x + 0.4\,a_y + 0.2a_z\ Wb/m^2$.

(b) Current density at the boundary

2 a. A 2 cm by 3 cm rectangular conducting loop rotates at 200π rad/s in a uniform magnetic flux density given by $B = 50a_y$ mT. Determine the voltage induced in the loop. (5 marks) [10]

b. For a certain region of free space, vector magnetic potential is given by $A = xy^2a_x + 2x^2ya_y - xyza_z$ Wb/m. Find: (5 marks)

i. Magnetic flux density B

ii. The flux through the surface $z = 1, 0 \leq x \leq 1, -1 \leq y \leq 4$.

3 In a city, due to high pollution, the atmosphere became lossy for the EM waves of 2G spectrum (operating at 800 MHz). Through experiments it was observed that the impedance of atmosphere is $100\pi\angle 35^o$ and [10]

$$E = 4e^{-0.11y}\sin(\omega t - \beta y)\hat{a}_z$$

Calculate:

a) Phase constant

b) loss tangent

c) Magnitude of E and H fields at a distance of 10 m

4 A transmission line has the following parameters: $L = 0.3\ \mu H/m$, $C = 500\ pF/m$, $R = 2.5\ \Omega/m$, and $G = 0.012\ S/m$. Calculate the propagation constant and characteristic impedance of this line at 500 MHz. If the line is 30 cm long, find line attenuation in dB? [10]

5 A 50 Ω lossless transmission line of length 2.3λ is terminated with a load impedance of $20 + j70$ Ω. Use Smith chart to find (a) VSWR (b) Voltage reflection coefficient (c) impedance at the input of the transmission line (d) Location of first voltage maximum and first minimum voltage. [10]