



BRAINWARE UNIVERSITY

Term End Examination 2022

Programme – B.Tech.(ECE)-2019/B.Tech.(ECE)-2020

Course Name – Electromagnetic Waves

Course Code - PCC-EC501

(Semester V)

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Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) The divergence of which quantity will be zero?
 - a) E
 - b) D
 - c) H
 - d) B
- (ii) Which equations are regarded as wave equations in frequency domain for lossless media?
 - a) Maxwell's
 - b) Lorentz
 - c) Helmholtz
 - d) Poisson's
- (iii) The dominant mode in the TM waves is
 - a) TM₀₁
 - b) TM₁₀
 - c) TM₂₀
 - d) TM₁₁
- (iv) Faraday's law states which type of EMF?
 - a) Transformer EMF
 - b) Back EMF
 - c) Generator EMF
 - d) Secondary EMF
- (v) The Poynting vector is the power component that is calculated by the
 - a) Product of E and H
 - b) Ratio of E and H
 - c) Dot product of E and H
 - d) Cross product of E and H
- (vi) The transmission line is said to be lossless when the
 - a) Conductor is perfect and dielectric is lossless
 - b) Conductor is perfect and dielectric is lossy
 - c) Conductor is imperfect and dielectric is lossy
 - d) Conductor is imperfect and dielectric is lossless
- (vii) In transverse magnetic waves, which of the following is true?
 - a) E is parallel to H
 - b) H is parallel to wave direction
 - c) H is transverse to wave direction
 - d) E is transverse to H
- (viii) The resistance of a lossless transmission line is
 - a) 0
 - b) 1
 - c) -1
 - d) Infinity
- (ix) The condition that holds good in a distortionless transmission line is

- a) $R/L = G/C$ b) $RL = GC$
 c) $L/R = C/G$ d) $RG = LC$
- (x) If the phase difference between two rays is $\pi/2$ and the angle of incidence is not equal to $\pi/4$, the emergent light is _____
 a) Linearly Polarized b) Elliptically Polarized
 c) Circularly Polarized d) Non-Polarized
- (xi) When a transmission line has a load impedance same as that of the characteristic impedance, the line is said to be _____
 a) Parallel b) Perpendicular
 c) Polarized d) Matched
- (xii) The modes in a waveguide having a V number of 20 is _____
 a) 400 b) 200
 c) 100 d) 40
- (xiii) The velocity of an electromagnetic wave with frequency 6MHz and a skin depth of 1.6 μm .
 a) 3.75 b) 0.26
 c) 9.6 d) 7.8
- (xiv) The cutoff frequency for the dominant mode in TM mode propagation for a rectangular waveguide of dimension of 30mm*40mm is: _____
 a) 2 GHz b) 1 GHz
 c) 2 MHz d) 4 MHz
- (xv) For dominant mode propagation in TE mode, if the rectangular waveguide has a broader dimension of 31.14 mm , then the cutoff wave number:
 a) 100 b) 500
 c) 50 d) 1000

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Explain the physical significance of divergence of D. (3)
3. Write the field configuration, cut off frequency and velocity of propagation for TM waves in rectangular waveguide. (3)
4. Prepare the wave equation for E and H in a conducting medium (3)
5. Determine the intrinsic impedance or characteristic impedance. (3)
6. A lossless transmission line in air has a characteristic impedance of 300 ohms and is terminated by unknown impedance. When the frequency is 200 MHz, the SWR is 4.48 and first voltage minima are situated at 6 cm from the load. Calculate the complex reflection coefficient and terminating impedance of the line. (3)

OR

Formulate the wave impedance for circular waveguide. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Examine that the intrinsic impedance for free space is $120\sqrt{2}\Omega$. Derive the necessary equation. (5)
8. Categorize the various types of waveform distortions in transmission line and obtain the condition for distortion less lines. (5)
9. Evaluate the relationship between the short circuited impedance, open circuited impedance and characteristic impedance? (5)
10. For a vector field A, examine that $\text{div} \text{curl} A = 0$: that is the divergence of the curl of any vector field is zero. (5)
11. With necessary explanation, establish the Maxwell's equation in differential and integral forms. (5)
12. TM waves cannot exist in single conductor waveguide, illustrate the statement using (5)

Maxwell's equation.

OR

Evaluate the expression for r-circles and x-circles in Smith chart.

(5)

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