



End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: B.Tech (ECE)

Name of the Paper: Electromagnetic Waves

Paper Code: TEC 503

Time: 3 hours

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1.

(2X10=20 Marks)

a. Explain the spherical coordinate system and show the relationship between the Cartesian and cylindrical coordinate systems. CO1

b. Given vectors $\vec{A} = 2\hat{a}_x + 2\hat{a}_y - \hat{a}_z$, $\vec{B} = \hat{a}_x - 3\hat{a}_y + 4\hat{a}_z$ and $\vec{C} = \hat{a}_x - \hat{a}_y + \hat{a}_z$, determine CO1

- (i) $|\vec{A} + \vec{B} + \vec{C}|$
- (ii) $\vec{A} - \vec{B} + \vec{C}$
- (iii) dot product of \vec{B} and \vec{C}
- (iv) $\vec{A} \times \vec{B} \bullet \vec{C}$

c. State and explain: CO1

- (i) Divergence theorem
- (ii) Stokes' theorem. Give the relevance of these theorems to electromagnetic problems

Q2.

(2X10=20 Marks)

- a. What is Magnetic flux density? Discuss the different properties of magnetic flux lines. CO2
- b. Explain Biot-Savart's law. Determine the magnetic field due to a straight current-carrying conductor of finite length using Biot-Savart's law. CO2
- c. What is a Electrostatics boundary condition? Explain boundary conditions in two different Dielectric media in detail. CO3

Q3.

(2X10=20 Marks)

- a. What do you mean by an electromagnetic wave? Discuss the wavelength and time period of a wave moving in the positive x-axis. CO4
- b. What is magnetic boundary condition? Explain boundary conditions in two different magnetic media in detail. CO4
- c. Derive the general expressions for reflection coefficient, transmission coefficient, and standing wave ratio for a plane wave in the case of normal incidence. CO3

Q4.

(2X10=20 Marks)

- a. What is lossless transmission line? Define the following parameters of lossless transmission line. CO4
 - (i) propagation constant
 - (ii) phase velocity
 - (iii) characteristics impedance



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- b. Write the difference between waveguide and the transmission line. Explain TEM, TE, TM mode in rectangular waveguide. CO5
- c. A distortionless line operating at 120 MHz has $\mu = 20 \Omega/m$, $L = 0.3 \mu H/m$ and $C = 63 pF/m$. Determine propagation constant(γ), phase velocity(V) and characteristics impedance (Z_0). CO5

- Q5. (2X10=20 Marks)
- a. Explain the phenomenon of total internal reflection (TIR) of a plane electromagnetic wave at a dielectric interface. Derive the condition for total internal reflection and obtain an expression for the critical angle. CO3
- b. Discuss in detail how the polarization of an electromagnetic wave is affected at the interface of two dielectric media. CO3
- c. Derive the expressions for reflection and transmission coefficients when a plane wave is obliquely incident on a dielectric interface. CO4