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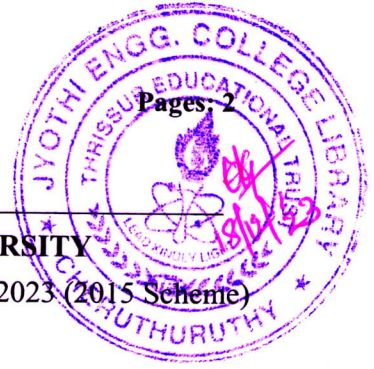
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S, FE) Examination December 2023 (2015 Scheme)



Course Code: EC303

Course Name: APPLIED ELECTROMAGNETIC THEORY

Max. Marks: 100

Duration: 3 Hours

(Smith chart to be supplied)

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) A charge of $-0.3 \mu\text{C}$ is located at A (25,-30,15) in cm and a second charge of $0.5 \mu\text{C}$ is located at B(-10,8,12). Find E at i) origin ii) P(15,20,50) in cm. (8)
- b) Define Ampere's circuit law. Apply Ampere's law to find magnetic field intensity at a point due to infinite line current. (7)
- 2 a) Apply Maxwell's equations to State and illustrate boundary conditions for electrostatic fields. (7)
- b) Given a non magnetic material having $\epsilon_r = 3.2$ and $\sigma = 1.75 * 10^{-4} \text{ S/m}$. Find at 2.5 Mhz for a) loss tangent b) attenuation constant c) phase constant d) intrinsic impedance (8)
- 3 a) Find the nature of the following fields by determining divergence and curl (8)
 - i) $30 a_x + 2xy a_y + 5xz^2 a_z$
 - ii) $150/r^2 a_r + 10 a_\phi$
- b) Starting from Maxwell's equation, derive the wave equation for a conducting medium. (7)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Derive Brewster angle. A plane wave is incident from air onto a dielectric medium with $\epsilon_r = 6 \epsilon_0$ at an angle 40° . What is the refraction angle? (7)
- b) Derive the expression for reflection coefficient for a wave of parallel polarization, travelling from one medium to another at normal incidence. (8)
- 5 a) A transmission line operating at 500 Mhz has $Z_0 = 80\Omega$, $\alpha = 0.04 \text{ Np/m}$, $\beta = 1.5 \text{ rad/m}$. Find all the line parameters. (8)

- b) Derive the equation of input impedance of a transmission line due to line terminated by a load. (7)
- 6 a) Brief on Shorted line, open circuited line and matched load (9)
- b) Brief on the different polarization of electromagnetic waves (6)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) For an infinite transmission line, the characteristic impedance is given by 50 ohm. Find the input impedance. (5)
- b) A $50 + j200 \Omega$ load is connected to a 100Ω lossless transmission line of length 0.2λ . Using Smith chart, find (10)
- Reflection coefficient at load
 - VSWR
 - Input admittance at 0.2λ from the load
 - Reflection coefficient at 0.2λ from the load
- c Explain how transmission line are used as circuit elements (5)
- 8 a) Derive the expression for Electric and magnetic field intensities for TE mode of propagation of rectangular waveguide. (10)
- b) If in a rectangular waveguide for which $a = 2b$, the cut off frequency for TE_{02} is 12 Ghz, Calculate the cut off frequency for TM_{11} mode. (5)
- c) A rectangular air – filled waveguide has a cross section of $4 \text{ cm} \times 10 \text{ cm}$ Find the minimum frequency which can propagation in the waveguide. (5)
- 9 a) Explain stub matching using (i) quarter wave transformer (ii) half wave transformer (10)
- b) How do waveguides act as a high-pass filter? (5)
- c) Note down the advantages and disadvantages of waveguides (5)
