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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EC303

Course Name: APPLIED ELECTROMAGNETIC THEORY (EC)

Max. Marks: 100 Duration: 3 Hours

(Smith Chart to be supplied on request)

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Given $D = 2r\cos\Phi a_\Phi - (\sin\Phi/3r)\, a_z$. Find flux crossing portion of z=0 plane defined by $r \le a$, $0 \le \Phi \le \pi/2$. (7)

b) Let $\mu_{r1}=3$, region is defined by x<0 and region2, x>0 has $\mu_{r2}=5$. If $H_1=4ax+3ay-6az$ A/m, find H_2 and the angle it makes with normal. (8)

2 a) In spherical coordinates, V=-25 on a conductor at r=2cm and V=150 at r=35cm.the space between the conductors is dielectric filled for which $\varepsilon_r=3.12$. Find surface charge densities on the conductors. (7)

b) A travelling wave is described by $y = 10\sin(\beta z-\omega t)$. Sketch the wave at t=0, $t=t_1$ and $t=t_2$ where it advanced by $\lambda/8$ and $\lambda/4$ respectively. Velocity is 3×10^8m/s and $\omega=10^6$rad/s. (8)

3 a) Derive the capacitance and inductance of a two-wire line. (8)

b) Write Maxwell's equation in phasor form. (4)

c) Draw electromagnetic flow diagram showing the relationship between potentials and vector fields of electromagnetic system (time varying case). (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) In free space ($z\le0$) a plane wave with $H=10\cos(10^8t-\beta z)a_x$ mA/m is incident normally on a lossless medium ($\varepsilon=2\varepsilon_0,\mu=8\mu_0$) in the region $z\ge0$. Determine E_r, H_r and E_t, H_t (8)

b) Describe the following terms: (7)

i) Characteristic impedance ii) Lumped and distributed elements

5 a) Derive the expression for refraction and reflection coefficient of plane electromagnetic waves that undergoing oblique incidence with vertical polarization (considering boundary separation). (7)

b) Derive the ABCD parameters of a transmission line. (8)

6 a) An EM wave travels in free space with electric field component $Es=100e^{j(0.866y+0.5z)}a_x$ V/m. Determine ω, λ, magnetic field component and time average power in the wave. (8)

b) A distortion less line has $Z_0=60\Omega$; $\alpha=20$mNp/m; u=0.6c. Find R,L,G,C and λ at 100MHz. (4)

c) Distinguish between lossless line and distortion less line. (3)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Write note on half wave and quarter wave transmission lines. (5)

b) A lossless 60Ω line is terminated by a 60 + j60Ω load. Find **Γ** and **s**, if Z_{in} = 120 -j60Ω. How far is the load from generator (Solve with Smith chart)? (6)

c) What are called degenerate modes? Explain. (5)

d) Draw the field distribution pattern for TE_{20} mode inside a rectangular waveguide. (4)

8 a) Draw the input impedance variation of lossless line when shorted and opened for a 0 to 2π variation in phase. (3)

b) Design a stub to match 40+j30Ω load (antenna) to a lossless line of 100Ω (use Smith chart). (9)

c) List all the modes which are supported in rectangular waveguides and why? (8)

9 a) From Maxwell's equation derive the expression for E fields and H fields inside the waveguide for TE mode. (8)

b) By analytical method, get the value of position where stub has to be placed from load and stub length with single stub impedance matching in transmission lines. (7)

c) Derive the relationship between guide wavelength, free space wavelength and cut off wavelength in rectangular waveguide. (5)

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