Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

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) Point charges 5 nC and -2 nC are located at (2,0, 4) and (-3,0, 5), respectively. (7)
(i) Determine the force on a 1nC point charge located at (1, -3, 7).
(ii) Find the electric field **E** at (1, - 3 , 7).

b) State and explain Maxwell's equations in the integral and differential forms. (8)

2 a) Give Poisson's and Laplace equation in electrostatics. Give application (7)

b) A plane wave propagating through a medium with $\varepsilon_r = 8$ $\mu_r = 2$ has E = $0.5e^{-z/3}\sin(10^8 t - \beta z)\, a_x$ V/m. Determine (8)
(i) β
(ii) The loss tangent
(iii) Intrinsic impedance
(iv) Wave velocity
(v) H field

3 a) Derive the expression of capacitance of two wire transmission line. (8)

b) State and prove boundary conditions for E and H in accordance with Maxwell's equations. (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) In free space, H = 0.2 cos (ωt — β x) a_z A/m. Find the total power passing through: (8)
(i) A square plate of side 10 cm on plane x + z = 1
(ii) A circular disc of radius 5 cm on plane x = 1.

b) Derive an expression for characteristic impedance of a transmission line and show that it is resistive at radio frequencies. (7)

5 a) What is polarisation? Explain the different types of Polarisation? (7)

b) A telephone line has R = 30Ω/km, L= 100mH/km , G=0,and C= 20μF/KM. At f=1 KHz, obtain: i) Characteristic impedance ii) propagation constant iii) phase velocity. (8)

6 a) Derive the expression for the ratio of reflected to incident electric field strength for an insulator with oblique incidence. (7.5)

b) Derive the expression of input impedance due to a transmission line terminated by a load .Also find the expression for SWR. (7.5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive the expression for r-circles and x-circles in Smith chart. (10)

b) Determine ,assuming TE_{10} mode of propagation ,the cut-off frequency, cut-off wavelength, guide wavelength ,phase constant, phase velocity, group velocity and wave impedance in the case of a hollow rectangular metallic waveguide of dimensions 6cm and 3 cm ,respectively, when the applied signal frequency is 5GHz (10)

8 a) A 100 + j150 Ω load is connected to a 75 Ω lossless line. Using Smith Chart, find: (10)

(i) Γ
(ii) s
(iii) The load admittance Y_L
(iv) Z_{in} at 0.4λ from the load

b) Obtain the waveguide solution to Maxwell's wave equations (10)

9 a) Explain single stub matching using analytical method. (10)

b) A hollow rectangular waveguide has dimensions of a= 4cm and b= 2cm. Calculate the amount of attenuation if the frequency is 3.5 GHz. Assume dominant mode. (10)

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