5E1392

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B. Tech. V - Sem. (Main / Back) Exam., Feb.-March - 2021

PCC/PEC Electronics & Communication Engineering

5EC 4–02 Electromagnetics Waves

Time: 2 Hours [To be converted as per scheme]

Max. Marks: 82

Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Distinguish between a travelling wave and a standing wave.

Q.2 What do you mean by a stub matching?

Q.3 Define input impedance of a transmission line having both incident and reflected waves.

Q.4 Define scalar and vector fields with examples.

Q.5 Write the differential surface vector in rectangular, cylindrical and spherical coordinates in terms of the components.

Q.6 Write the unit of Poynting vector.

Q.7 Why the displacement current is zero in a perfect conductor and the conduction current is zero in a perfect dielectric?

Q.8 Why is the electric field described by $E_{xm}\cos(\omega t - \beta z)$ called a uniform plane wave?

Q.9 The TEM mode not supported by waveguide. Why?

Q.10 Draw the field lines of TE_{11} and TM_{01} modes.

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 A two-conductor transmission line is excited by a 50 MHz source. The inductance and capacitance per meter length of the line are 300nH and 120pF. Calculate the characteristic impedance (z_o) of the transmission line. Also calculate phase constant, phase velocity and wavelength of the voltage wave.

Q.2 Write the four Maxwell's equations in differential and integral forms.

Q.3 An electromagnetic wave is propagating along +y direction. The electric field associated with it has only – z components. Find the components of the associated magnetic field.

Q.4 Describe the all-electric field components of rectangular waveguide.

Q.5 Define Transverse Electric waves, Transverse magnetic waves and Transverse Electromagnetic waves.

Q.6 Distinguish between near and far fields of a Hertzian dipole. State their properties.

Q.7 State the radiation properties of an isotropic radiator.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30**

Attempt any two questions

Q.1 The parallel branches of a two – wire transmission line are terminated in 100Ω ar 200Ω. The characteristic impedance of the line is 50 Ω and each section has a length $\lambda/4$. Find the voltage reflection co-efficient at the input.

Q.2 A uniform plane wave propagates along +z direction in free space. The electric field intensity in the wave has components both in x and y directions. The amplitude of the field in x-direction is 250 V/m and along y direction the amplitude is 300 V/m. The frequency of the wave is 50 MHz. Obtain the phasor expressions of electric and magnetic field intensities.

Q.3 The height and width of a hollow rectangular waveguide with perfect conducting walls are a = 5 cm and b = 3 cm. respectively. Find the operating frequency if its value is midway between the cut – off frequencies of TM_{11} and TM_{21} modes.

Q.4 Derive the Friis transmission formula in terms of the directivities of the receiving and transmitting antennas.

Q.5 What is the order of Laplace's and Poisson's equations? Write the Laplace's equation for the electro static potential V that is a function of only y and z and that is a function of only r in cylindrical coordinates.
