5E1392

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B.Tech. V- Semester (Main) Examination, Nov. - 2019
PCC/PEC Electronics & Comm. Engg.
5EC 4-02 Electromagnetics Waves

Time : 3 Hours Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

*Attempt all ten questions from **Part A**, five questions out of eight from **Part B** and **Four** questions out of seven from **Part C**.*

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

Part - A

(Answer should be given up to **25** words only)

All questions are **compulsory** **(10×2=20)**

1. If the cutoff frequency of an air-filled waveguide is 10 GHz and support TE_{01} mode then what is its size?
2. Write the name of two impedance matching techniques used in Transmission lines.
3. Write the unit of pointing vector.
4. If cutoff frequency of TE_{11} mode is 5 GHz then find the operating frequency of TE_{23} mode.
5. If the length of a transmission line is less than $\lambda/4$ then draw its electrical equiyalent circuit.
6. Write the Maxwell equation in differential form for electric field which determine the pattern of electric flux line.
7. Define the radiation resistance of an antenna.
8. What is the center of constant VSWR circle in Smith?
9. If the group velocity is 0.9×10^3 m/s then find the corresponding phase velocity.
10. Write the general expression of waveguide impedance when TM mode propagating inside waveguide.

PART - B

(Analytical/Problem solving questions)

Attempt any **five** questions **(5×8=40)**

1. The cross section of a rectangular waveguide is 20×40 cm^2 then find the operating frequency of
   a) TE_{02} and
   b) TE_{32} mode.
2. Why TEM mode is not possible inside waveguide explain the reasons supporting with Maxwell's equations.
3. Explain any four antenna parameter and also write their units.
4. Define the characteristic impedance of a Transmission line and find its value at 50MHz. Assume the line primary parameters per unit length are R = 0.2 ohm, L = 0.2 Nanohenery, C = 0.5 nanofarad and G =10 Mho.
5. Draw the 2D and 3D radiation pattern of a dipole and mono pole antenna.
6. Design a single stub of a Transmission line which is terminated with a load of 20+j50 ohm and has characteristic impedance Z_0 = 100 ohm. Assume the signal frequency is 100 MHz.
7. Explain boundary conditions of electric and magnetic field. How these conditions are used?
8. Draw the electric and magnetic field pattern inside a waveguide at
   a) TE_{10} and
   b) TM_{21}.

PART - C

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any **Four** questions **(4×15=60)**

1. Find the expression of input impedance of a Transmission line in terms of its characteristic impedance, load impedance and length of the line. Also find the value of it when the line length is
   a) $l = 2\lambda$ and $Z_L = 0$ ohm and
   b) $l = \lambda/4$ and $Z_L = Z_0$.
2. How EM signal radiated from a conductor? What are the conditions for it? Define the far field and near field around a radiating current element. Also find the interrelation between these two fields.

3. Explain the working of rectangular waveguide. What is the frequency range where these waveguide are most suitable? Find the minimum cutoff frequency of a waveguide, also find it for a waveguide whose cross section is $25 \times 50 cm^2$.

4. Explain the different losses in Transmission line and compare them
   a) in different type of Transmission line and
   b) at different frequency.

   How these losses can be reduced?

5. Define the reflection and transmission coefficient and find their value in following cases :
   a) A Transmission line (with $Z_0 = 100$) terminated with $Z_L = 200 + j\ 10$
   b) A Transmission line (with $Z_0 = 100$) terminated with $Z_L = j\ 100$
   c) A Transmission line (with $Z_0 = 100$) terminated with open circuit

6. Write *all* Maxwell equations in integral form for a dynamic EM field for vacuum *and a* lossy medium. Using these also develop the EM wave equation find prove that in vacuum the Wave are Transverse in nature.

7. Explain
   a) How microstrip lines are better than Waveguide at and above 60 GHz
   b) How Waveguides are better than microstrip lines between 1 to 30 GHz.