53 (EC 501) ELMW

2013

(May)

ELECTROMAGNETIC WAVES

Paper : EC 501

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. (a) Derive the wave equation in free space starting from Maxwell's equations.   8

    (b) Find the relation between electric field and magnetic field of a uniform plane wave in free space.   12

2. (a) Explain different types of polarization of an electromagnetic wave.   12

(b) Explain reflection and refraction of plane waves. 8

3. Derive the equations of different components of electric field and magnetic field of an electromagnetic wave travelling in free space between two parallel conducting planes in TE, TM and TEM mode. 20

4. (a) Why TEM mode is impossible in rectangular waveguide ? 5

   (b) How different modes in rectangular wave guide can be excited ? 5

   (c) An airfilled rectangular waveguide of cross section $2 \times 1\,cm$ carries an electromagnetic wave of frequency $9\,GHz$ in TE_{10} mode. Determine —
       (i) Cut off frequency
       (ii) Phase constant
       (iii) Phase velocity
       (iv) Guide wavelength
       (v) Wave impedance. 10

5. (a) Define attenuation factor and Q of a circular waveguide. 6

(b) An airfilled circular waveguide of radius 2cm carries a wave of 9GHz frequency in TE$_{11}$ mode. Find —

  (i) Cut off frequency

  (ii) Phase velocity

  (iii) Phase constant

  (iv) Guide wavelength

  (v) Wave impedance.   10

(c) What are dominant and degenerate modes ?

                                          4

6. (a) Differentiate between cavity resonator and waveguide.   5

  (b) Define the terms Q-factor and coupling coefficient of cavity resonator.   5

  (c) Show how standing wave ratio varies in a cavity resonator with coupling.   10

7. Write short notes on — $10 \times 2 = 20$

  (a) Rectangular cavity resonator

  (b) TE modes in circular waveguide.

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