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53 (EC 501) ELMW

2015

ELECTROMAGNETIC WAVES

Paper : EC 501

Full Marks : 100

Time : Three hours

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

Answer **any five** questions.

1. (a) Derive the Wave equation for a wave in free space starting from Maxwell's equations. 10
- (b) Determine the relation between electric and magnetic field for a uniform plan wave travelling in free space. 10
2. (a) What is polarization ? What are the different types of polarization ? Explain each. 10.
- (b) Explain the reflection of a wave incident normally on a good conductor. 10

Contd.

3. Derive the expressions for different components of electric and magnetic fields for a wave travelling between two parallel conducting plates for TE, TM and TEM modes.

20

4. (a) If a wave with a frequency 9GHz is travelling through an airfilled rectangular waveguide having cross section $2 \times 1\text{cm}^2$ in TE_{10} mode then, determine —

10

(i) Cut off frequency

(ii) Phase Constant

(iii) Phase Velocity

(iv) Wave impedance

- (b) Derive the expressions for different components of electric and magnetic fields for a wave travelling through a rectangular waveguide in TE mode.

10

5. (a) Explain the methods for excitation of different modes in a rectangular waveguide.

8

(b) If a wave with frequency 15GHz is travelling through an airfilled circular waveguide having radius 2cm in TE_{11} mode then determine —

- (i) Cut off frequency
- (ii) Phase constant
- (iii) Guide wave length
- (iv) Phase velocity
- (v) Wave impedance

Determine the cutoff frequency if the waveguide is filled with a dielectric with dielectric constant 2. 12

6. (a) What is a cavity resonator? How it differs from waveguide. 6

(b) What is Q-factor and coupling of a cavity resonator? What are the different types of coupling? Explain each. 14

7. Write short notes on : 7+6+7=20

(a) Circular Cavity resonator

(b) TEM modes in waveguide

(c) Wave propagation in conducting medium.