



## BRAINWARE UNIVERSITY

Course – BSc(CS)

Electromagnetism & Electronic Communication (EC401)

(Semester – 4)

**Time allotted: 3 Hours**

**Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group –A

(Multiple Choice Type Questions)

10 x 1 = 10

1. *Choose the correct alternative from the following*
  - (i) Gaussian surface is
    - a. an open surface
    - b. a closed surface
    - c. a semi closed surface
    - d. any surface
  - (ii) Direction of propagation of EM wave is in the direction of
    - a.  $\vec{E} \times \vec{H}$
    - b.  $\vec{E}$
    - c.  $\vec{H}$
    - d. anything
  - (iii) The dominant mode of a rectangular waveguide ( $a=2b$ ) is
    - a.  $TE_{11}$
    - b.  $TE_{10}$
    - c.  $TM_{01}$
    - d. none of these
  - (iv) A lossless transmission line when shorted has input impedance given by
    - a.  $jZ_0 \tan \beta l$
    - b.  $-jZ_0 \tan \beta l$
    - c.  $jZ_0 \cot \beta l$
    - d.  $-jZ_0 \cot \beta l$
  - (v) An open circuited ( $\frac{\lambda}{4}$ ) lossless transmission line has input impedance
    - a. infinity
    - b. zero
    - c.  $Z_0$
    - d. none of these
  - (vi) The frequency range of microwave
    - a. 300 MHz to 300 GHz
    - b. 3 to 30 MHz
    - c. 30 to 300 MHz
    - d. 0.3 to 30 MHz
  - (vii) With increase in modulation index of an FM wave, the number of sidebands having significant amplitude will
    - a. increase
    - b. decrease



**Group – C**

(Long Answer Type Questions)

3 x 15 = 45

Answer any *three* from the following

7. (a) Establish wave equations in lossy dielectric medium. [6]
- (b) What do you mean by a perfect conductor? Explain the concept of skin depth and find out an expression for it. [1+1+3]
- (c) Calculate the skin depth for radio wave of 3 m wavelength (free space) in copper. (Given  $\sigma = 6 \times 10^7$  S/m;  $\mu_0 = 4\pi \times 10^{-7}$  H/m) [4]
8. (a) What is secant law in connection with ionospheric reflection of radio waves? Obtain a relation between the maximum radio frequency reflected from an ionospheric layer and the corresponding critical frequency. [10]
- (b) Write short notes on flicker noise and shot noise. [5]
9. (a) Explain amplitude modulation, derive the expression for modulation index and also obtain the frequency spectrum. [5]
- (b) In case of amplitude modulation, derive the expression for total transmitted power  $P_t$  in terms of  $P_c$  and  $m$ , where  $P_c$  and  $m$  have their usual meanings. [5]
- (c) Compare and contrast AM and FM system. [5]
10. (a) Develop the transmission line equations. [5]
- (b) Find out solutions of the equations. [5]
- (c) Define characteristic impedance of transmission line and obtain expression for it. [5]
11. (a) Establish the relation  $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$ . The notations have their usual meanings. [5]
- (b) State Poynting theorem in electromagnetic field theory. Derive it. [5]
- (c) Define the terms (i) VSWR and (ii) reflection coefficient of transmission line and establish the relation between them. [1+4]