BRAINWARE UNIVERSITY

Course – BSc(HN)

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) Displacement current can flow through

a. capacitor b. inductor
c. resistor d. insulator

(ii) A vector with zero divergence is called

a. irrotational b. a null vector
c. a scalar d. solenoidal

(iii) Poynting vector has the unit

a. $W\ m^{-2}$ b. $J\ s^{-1}$
c. W d. $J\ m^{-2}$

(iv) If a dielectric is placed in an electric field, the field strength

a. increases b. decreases
c. remains same d. becomes zero

(v) SI unit of magnetic scalar potential is

a. Tesla b. Joule
c. Volt d. Ampere

(vi) The sampling process converts

a. continuous time signal into continuous time signal
b. continuous time signal into discrete time signal
c. discrete time signal into continuous time signal
d. none of these

(vii) What is the highest layer of the atmosphere?

a. ionosphere
b. stratosphere
c. troposphere
d. ozone layer

(viii) Antenna is a

a. transducer
b. amplifier
c. non-radiating element
d. none of these

(ix) Demodulation is required

a. at the receiver of a communication system
b. at the transmitter of a communication system
c. at both the transmitter and receiver of a communication system
d. none of these

(x) If f_c is the frequency of the carrier wave and f_m that of the modulating wave, then

a. $f_c < f_m$
b. $f_c = f_m$
c. $f_c > f_m$
d. none of these

Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. Deduce the differential form of Faraday's law of electromagnetic induction. [5]
3. Deduce the relation $\vec{D}=\varepsilon_0\vec{E}+\vec{P}$ in dielectric medium. Here, the notations bear their usual meanings. [5]
4. Show that an amplitude modulated wave can be represented by a carrier and two side frequencies for each modulating frequency. [5]
5. An air filled rectangular wave guide of inside dimensions 7 cm × 3.5 cm operates in the dominant TE_{10} mode
   (a) Find the cut-off frequency (b) Determine the guided wavelength at 3.5 GHz. [5]
6. In FM signal, a carrier signal is frequency modulated with a sinusoidal signal of 2 KHz resulting in a maximum frequency deviation of 5 KHz. Find the band width and modulation factor. [5]

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) State and explain Poynting theorem. [5]
   (b) State and explain Biot-savart law. [3]
   (c) State Ampere's circuital law. Starting from Ampere's circuital law establish the relation $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$, where symbols have their usual meanings. [2+5]
8. (a) 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]
   (b) State the sampling theorem. Differentiate PCM and DPCM. [5]
   (c) Write short notes on flicker noise and shot noise. [5]
9. (a) Explain VSWR and reflection co-efficient for transmission line. [5]
   (b) Find the input impedance, reflection coefficient and VSWR for (i) lossless transmission line whose load is open, (ii) lossless transmission line whose load is shorted. [10]
10. (a) Obtain an expression of wave equation of a lossy dielectric medium. [5]
    (b) What do you mean by perfect conductor? [2]
    (c) What do you mean by skin effect? If the skin depth is 80 μM at 4 MHz in a certain conducting medium, calculate the skin depth if the frequency is changed to 16 MHz. [3+5]
11. (a) What is secant law in connection with ionospheric reflection of radio waves? Obtain the relation between the maximum radio frequency reflected from an ionospheric layer and the corresponding critical frequency. [10]
    (b) Illustrate half power beam width and beam width between first nulls. [3]
    (c) Define effective aperture of an antenna. [2]