BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – B.Sc. (H) in Computer Science/ B.Sc. (H) in Hardware & Networking

Course Name – Electromagnetism and Electronic Communication

Course Code – 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 Question)   10 x 1 = 10

1. *Choose the correct alternative from the following*

(i)   A carrier of 100 W is amplitude modulated to the depth of 40%. The total transmitted power is
   a. 112 W
   b. 125 W
   c. 108 W
   d. 118 W

(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) In a communications system, noise is most likely to affect the signal
   a. at the transmitter
   b. in the channel
   c. in the information source
   d. at the destination

(iv) The unit of magnetic vector potential is
   a. Volt/meter
   b. Weber/meter
   c. Coulomb/meter
   d. Newton/meter

(v)   Poynting vector has the unit
   a. $W\ m^{-2}$
   b. $J\ s^{-1}$
   c. W
   d. $J\ m^{-2}$

(vi) Antenna is a
   a. transducer
   b. amplifier
   c. non-radiating element
   d. none of these

(vii)   A vector with zero divergence is

    a. irrotational vector   b. a null vector

    c. solenoidal vector   d. none of these

(viii) Number of sidebands in FM signal

    a. 2   b. 1

    c. 0   d. none of these

(ix)   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

(x)   Thermal noise is independent of

    a. bandwidth   b. temperature

    c. center frequency   d. Boltzmann constant

Group – B

(Short Answer Type Questions)   3 x 5 = 15

Answer any *three* from the following

2. Using Gauss's theorem in electrostatics, derive Poisson's equation and Laplace's equation.   **5**

3. A transmission line of characteristics impedance 500 Ω is terminated by resistor of 100 Ω. What will be VSWR in the line?   **5**

4. Write down sampling theorem. What is Aliasing effect? State how it can be minimized?   **2+1+2**

5. Elucidate the basic concept of wave guide. Describe the advantages of wave guide over transmission lines. What are the different kinds of wave guide in respect of structure?   **5**

6. Explain directivity and gain of an antenna. What is Hertzian dipole?   **5**

Group – C

(Long Answer Type Questions)   3 x 15 = 45

Answer any *three* from the following

7. (a) State (i) Biot-Savart law (ii) Ampere's circuital law.   **4**

    (b) Obtain the differential form of Faraday's law of electromagnetic induction.   **5**

    (c) In a medium of dielectric constant 5, the maximum displacement current is equal to maximum conduction current at a frequency of 1 MHz. Find the conductivity of the medium. ($\varepsilon_0 = 8.854 \times 10^{-12}$ F/m)   **6**

8. (a) Derive $\nabla.\vec{J}+\dfrac{\partial\rho}{\partial t}=0$, where symbols have their usual meanings   5

  (b) State and explain Poynting theorem in electromagnetic field theory.   5

  (c) Obtain an expression of wave equation inside a conducting medium.   5

9. (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

10. (a) What is amplitude modulation? Show that an amplitude modulated wave can be represented by a carrier and two side frequencies for each modulation frequency.   6

  (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 AM wave with FM wave.   4

11. (a) Summarize the cause and effects of thermal noise in electronic systems, in terms of noise power, voltage and Current.   5

  (b) Illustrate ground wave and space wave in communication.   5

  (c) Explain half power beam width and beam width between first nulls.   3

  (d) Define effective aperture of an antenna.   2