2021

(CBCS)
(5th Semester)
ELECTRONICS

FIFTH PAPER
[Transmission Line and Radar System]

Full Marks: 75
Time: 2 hours

INSTRUCTIONS TO CANDIDATES

(Please read the instructions carefully before you start writing your answers)

1. Questions should be attempted as per instructions.
2. Do not copy the Questions. Indicate the Section and Question No. clearly while attempting the answer.
3. For Multiple choice answers, candidate should indicate the Question No., Sub. No., (if any) and the correct answer. For example :

   1. Name the State capital of Mizoram.

   (a) Lunglei

   (b) Aizawl

   (c) Champhai

   Candidate should provide answer as—Q. No. *1* : *(b) Aizawl* [Candidate should avoid writing only *(b)*]
4. Section B - Answer to Short Answer should be limited to **One Page** only.
5. The figures in the margin indicate full marks for the questions.

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SECTION : A – OBJECTIVE

(Marks: 30)

Choose the correct answer from the following: 1x30=30

1. The leakage current in the transmission lines is referred to as the
   a) Resistance
   b) Radiation
   c) Conductance
   d) Polarisation

2. The coaxial line consists of
   a) Conductors
   b) Dielectric
   c) Conductor with dielectric
   d) Two conductors with dielectric

3. The unit of attenuation constant is
   a) Decibel
   b) Bel
   c) Neper
   d) No unit

4 The propagation constant of a wave with attenuation and phase constant given by 2 and 3 respectively is
   a) 2 – 3j
   b) 3 – 2j
   c) 2 + 3j
   d) 3 + 2j

5. The velocity and phase constant relation is given by
   a) $V = \omega/\beta$
   b) $V = \omega\beta$
   c) $V = \beta/\omega$
   d) $V\omega\beta = 1$

6. For a lossless line, which of the following is true?
   a) $\gamma = j\beta$
   b) $\gamma = \alpha$
   c) $\gamma = \alpha + j\beta$
   d) $\gamma = \alpha * j\beta$

7. Expression for a voltage reflection co-efficient (ρ) in terms of load impedance and characteristics impedance is:
   a) $\frac{(Z_R - Z_0)}{(Z_R + Z_0)}$
   b) $\frac{(Z_R + Z_0)}{(Z_R - Z_0)}$
   c) $\frac{(Z_R \times Z_0)}{(Z_R + Z_0)(Z_R - Z_0)}$
   d) $\frac{(Z_R + Z_0)}{(Z_R \times Z_0)(Z_R - Z_0)}$

8. Input impedance of a short-circuited transmission line is:
   a) $-j\, Z_0 \tan\beta l$
   b) $j\, Z_0 \tan\beta l$
   c) $j\, Z_0 \cot\beta l$
   d) $-j\, Z_0 \cot\beta l$

9. If a transmission line of a characteristic impedance 50 Ω is terminated with a load impedance of 100 Ω, then the reflection co efficient is:
   a) 0.33
   b) 0.66
   c) 1.66
   d) 0.22

10. We say a transmission line is matched when:
   a) $Z_R = Z_0$
   b) $Z_R = \sqrt{Z_0}$
   c) $R_L = Z_0/2$
   d) $Z_R = 2Z_0$

11. The maximum power that can be transmitted over a line without danger of insulation breakdown is called _____.
    a) power rating
    b) power loss
    c) power capacity
    d) reflection loss

12. Expression for Voltage Standing Wave Ratio in terms of reflection co-efficient is:
    a) $\frac{1-|\rho|}{1+|\rho|}$
    b) $\frac{1}{|\rho|}$
    c) $\frac{1}{1+|\rho|}$
    d) $\frac{1+|\rho|}{1-|\rho|}$

13. Which of the following is the basic function of the antenna?
    a) Converts photons to electrons.
    b) Converts electrons to photons.
    c) Converts electrons to neutrons.
    d) Both a and b.

14. Which of the following is the correct statement for isotropic radiation?
    a) It is a point source radiator.
    b) It radiates uniformly in all directions.
    c) Maintains uniform intensity.
    d) All the above.

15. Radiation patterns can be represented in terms of _____ types.
    a) Field patterns.
    b) Power patterns.
    c) Both a and b.
    d) Direction pattern.

16. The field strength of Hertzian dipole antenna can be calculated as:
    a) $E = \frac{60\pi L_e I}{\lambda r} sin\theta$
    b) $E = \frac{60 L_e I}{\pi \lambda r} sin\theta$
    c) $E = \frac{60\pi L_e}{I\lambda r} sin\theta$
    d) $E = \frac{60\pi L_e \lambda}{Ir} sin\theta$

17. Directors are used to increase _____ of the Yagi-Uda antenna.
    a) Directivity
    b) Gain
    c) Back lobe
    d) Reflection away from the radiation

18. Hertzian dipole carries which type of current throughout its length while radiating?
    a) Varying
    b) Constant
    c) Depends on type of polarization
    d) Depends on radiation resistance

19. Which of the following part of a pulsed radar system demodulates the signal obtained at the output of the IF amplifier?
    a) Modulator
    b) Detector
    c) Transmitter
    d) Duplexer

20. If the maximum range is to be doubled in a radar system, the peak transmitted power has to be increased by a factor of
    a) 2
    b) 4
    c) 8
    d) 16

21. The average power of a pulsed radar transmitter is given by
    a) the product of peak power of the pulse and the duty cycle.
    b) peak power divided by the number of pulses repeated in one second.
    c) peak power divided by the duty cycle.
    d) sum of the peak power and the duty cycle

22. The radar in which both transmission and reception is done using the same antenna are called:
    a) Monopole radar
    b) Dipole radar
    c) Monostatic radar
    d) Bistatic radar

23. The term radar cross section defines the:
    a) Scattering ability of the target
    b) Power radiating ability of the radar
    c) Amount of energy scattered by unwanted objects
    d) Cross section of radar area through which energy is emitted

24. When a pulsed power P_t is transmitted by an antenna, the power density at the target is given by the expression:
    a) $\frac{P_t}{4\pi R^2}$
    b) $\frac{P_t}{4\pi R^3}$
    c) $\frac{A_p P_t}{4\pi R^2}$
    d) $\frac{A_p P_t}{4\pi R^3}$

25. For an elliptical path, the value of eccentricity (e) is always lie in between 0 and 1 is:
    a) $0 < e < 1$.
    b) $0 > e > 1$.
    c) $0 < e < 2$.
    d) $0 > e > 2$.

26. Which of the following orbit is much close to earth?
    a) LEO
    b) GEO
    c) MEO
    d) Both a and b

27. The name of the world's first true communications satellite launched in 1962 by the American telecommunications giant AT&T was
    a) Telstar
    b) Westar
    c) Molniya
    d) Amos

28. A communication satellite uses _____ to transmit signal.
    a) Antenna
    b) Transponder
    c) Oscillator
    d) Modulator

29. Which of the following are the main components in satellite communication?
    a) Uplink
    b) Downlink
    c) Transponder
    d) All the above

30. GEO is _____ away from the earth.

a) 35,863 km
b) 8,000 - 18,000 km
c) 500 - 1,500 km
d) 1000 km

SECTION : B – SHORT ANSWER

(Marks : 45)

Answer the following questions in not more than 1 (one) page each, choosing 3 (three) questions from each unit.

3x15=45

Unit I

1. Explain the distributed parameters of a transmission line.
2. Explain the different types of Transmission lines.
3. From the equation of propagation constant (γ), obtain phase constant (β) and attenuation constant (α)
4. A cable pair is loaded with 6 mH coils, at intervals of 0.9 km. for operation at frequencies upto 16 kc/s. At this frequency, the primary constants of the cable are:
   R = 72 ohm. L = 1.0 mH, C = 0.065 μF, G = 50 μ mho, all per loop kilometer and the effective resistance of each loading coil is 4.5 ohm. Estimate the approximate attenuation per mile of the loaded cable.

Unit II

5. Derive the equation of input impedance of dissipation less transmission line terminated with any impedance.
6. Obtain the input impedance when the line is terminated by infinite impedance.
7. Derive the expression for Voltage Standing Wave Ratio in terms of reflection co-efficient. What would be the reflection coefficient if the standing wave ratio is 4.
8. Write a short note on power and power capacity on a transmission line

Unit III

9. What are the advantages, disadvantages and applications of folded dipole antenna?
10. Explain a Hertzian dipole.
11. Explain the radiation pattern of Yagi-Uda antenna.
12. What are the properties of Vertical antenna?

Unit IV

13. Explain a Pulse Radar System.
14. What are the factors affecting maximum range of radar?
15. Explain briefly an average power over one pulse repetition interval.
16. Calculate the maximum range of a radar system which operates at 3 cm with a peak pulse power of 500 kW, if its minimum receivable power is 10^{-13} W, the capture area of its antenna is 5 m^2, and the radar cross-sectional area of the target is 20 m^2.

Unit V

17. Explain antenna look angle.
18. Explain Kepler's first law?
19. Describe briefly limits of visibility of satellite.
20. Determine Azimuth angle for the situation given below. Latitude of the earth station (l_E) = -20 deg Longitude of earth station (f_E) = - 30 deg, Longitude of sub satellite point f_s = + 30 deg; height = 35,786 km radiuses of earth = 6378.14 km.

***** End of question *****