



UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

END OF SEMESTER II EXAMINATIONS

DEPARTMENT : ICT

YEAR : ONE

SEMESTER : TWO

PROGRAM : DIPLOMA IN ELECTRONIC COMMUNICATION ENGINEERING

COURSE : PRINCIPLES OF RADIO COMMUNICATION

COURSE CODE : ECE 2201

DATE : FRIDAY, JULY 5, 2024

TIME : 02:00 2PM – 05:00PM

DURATION : 3 Hours

INSTRUCTIONS

- ❖ The paper consists of two Sections A and B
- ❖ Answer **ALL** questions in Section A and **ANY THREE** questions in Section B
- ❖ Credit will be given to relevant examples and illustrations
- ❖ Don Not Write anything on this question paper

SECTION A (40 Marks)

Section A is compulsory

Circle the correct answer

1. The maximum transmission efficiency of a sinusoidal AM signal is
A. 21.68% B. 33.33% C. 58.88% D. 65.55%
2. A certain radio station broadcasts on a frequency of 980kHz . What is the wavelength of electromagnetic radiation broadcasted by the radio station?
A. 3060m B. 3.06m C. 306m D. 30.6m
3. Amplitude modulation is
A. Change in the amplitude of the carrier according to the modulating signal
B. Change in frequency of the carrier according to modulating signal
C. Change in the amplitude of the modulating signal according to the carrier signal
D. Change in amplitude of the carrier according to modulating signal frequency
4. Modulation in which the carrier wave angle varies in accordance with the baseband signal is termed as:
A. Amplitude Modulation B. Angle Modulation
C. Spectral Modulation D. None of the above
5. The modulation frequency of Radio Buligita is 250kHz , which is 10% of the carrier wave. If another AM station approaches UCC for a license, what broadcast frequency will UCC allocate without causing overlap?
A. 1980kHz B. 2250kHz C. 2750kHz D. 2000kHz
6. A carrier signal of 100MHz modulated using a sine wave whose frequency is 75kHz with a deviation frequency of 50kHz . What will be the modulation index?
A. 0.555 B. 0.667 C. 0.778 D. 0.889
7. Narrow Band FM bandwidth is?
A. f_m B. $2f_m [\beta + 1]$ C. $2f_m$ D. $f_m [\beta + 1]$
8. What is the basic difference between Narrow Band FM and AM signal?
A. Bandwidth B. Frequency deviation C. Sidebands
D. Algebraic sign reversal for the lower side frequency
9. Modulation of the source signal with multiple frequency components in it is called.
A. Amplitude Modulation B. Frequency Modulation
C. Phase Modulation D. Multitone Modulation
10. How many sidebands are present in frequency modulation?
A. Finite B. Infinite C. Large D. Both B and C

11. In FM, the total variation of frequency from its lowest to the highest point is termed as.
A. Carrier swing B. Sideband width C. Frequency deviation
D. None of the above

12. For FM signals, the extent of frequency deviation depends on.
A. Modulating frequency B. Carrier frequency C. Amplitude D. Phase

13. For Good audio quality, FM needs
A. High deviation B. Low deviation C. Lesser deviation D. None of the above

14. If the deviation is +20 KHz, what does it indicate?
A. The baseband is 20 KHz above f_0 B. The baseband is 20 KHz below f_0
C. Carrier is 20 KHz above f_0 D. Carrier is 20 KHz below f_0

15. FM broadcast requires _____ max Bandwidth for commercial use.
A. 100 KHz B. 200 KHz C. 300 KHz D. 400 KHz

16. The maximum amount of deviation in frequency modulation allowed for FM commercially is?
A. 50 KHz B. 75 KHz C. 85 KHz D. 100 KHz

17. The ratio of maximum peak frequency deviation and the maximum modulating signal frequency is termed as.
A. Frequency deviation. B. Deviation ratio
C. Signal-to-noise ratio D. Frequency spectrum

18. If the Modulation index 'm' of AM is 0.4 then what is the % of Modulation
A. 50% B. 80% C. 20% D. 40%

19. If the Modulation index is m then what is the ratio of total sideband power to the total power in the Modulated wave?
A. $m^2 / [2 + m^2]$ B. $m^2 / [1 + m^2]$ C. $m^2 / [2 - m^2]$ D. $m^2 / [1 - m^2]$

20. If the unmodulated carrier Amplitude is A_c and the modulation signal is $m[t]$ then the modulated carrier Amplitude is given by?
A. $m^2 A_c^2$ B. $m^2 A_c^2 / 8$ C. $m^2 A_c^2 / 2$ D. $m^2 A_c^2 / 4$

21. A 2.5Mhz carrier is modulated by a music signal that has frequency components ranging from 100Hz to 5Khz. What is the range of frequencies generated for the upper sideband?
A. 2.5 MHz to 2.505 MHz B. 2.495 MHz to 2.505 MHz

C. 2.5001 MHz to 2.499 MHz D. 2.495 MHz to 2.499 MHz

22. Overmodulation:

- A. Results when the modulation index exceeds unity
- B. Is undesirable because it produces sideband splatter
- C. Causes the AM signal to become distorted so that the receiver cannot produce a clean replica of the original intelligence signal
- D. All the above

23. The total output power of an AM transmitter that is being operated at 50% modulation is measured at 1800 watts. What is the carrier power?

- A. 1440 watts B. 1600 watts C. 900 watts D. 2025 watts

26. Which of the following is required for SSB transmission?

- A. Carrier elimination B. Elimination of one sideband
- C. Lower sideband elimination D. A and B

27. If the carrier and one of the sidebands are completely eliminated, the resulting signal is referred to as:

- A. SSB B. SSB-SC C. VSB D. DSB-SC

28. The type of sideband that involves having the upper sideband contain different information than the lower sideband is referred to as.

- A. Independent sideband B. SSB-SC C. ACSSB C. Vestigial sideband

29. The kind of sideband used for television video transmission is called

- A. Independent sideband B. SSB-SC C. ACSSB D. Vestigial sideband

30. The most important advantage of SSB over AM is

- A. That it is a more effective utilization of the available frequency spectrum
- B. That it is less subject to the effects of selective fading
- C. The resulting savings in power
- D. Simplicity in design

31. Which of the following is a directional antenna

- A. Yagi-Uda B. Dipole C. Vertical C. All the above

32. An antenna created by taking a quarter-wavelength section of an open wire line and bending each conductor outward 90 degrees is called

- A. Marconi antenna B. Dipole antenna C. Vertical antenna
- D. All of the above

33. Any non-driven element of an antenna array such as a Yagi is called a

- A. Reflector B. Director C. Lobe D. Parasitic element

34. The polarization of an electromagnetic wave is determined by the direction of

- A. B field B. H field C. E field D. All of the above

35. Another term for groundwave is

A. Space wave B. Skywave C. Surface wave D. Direct wave

36. The characteristic impedance of free space is

A. 50 ohms B. 75 ohms C. 300 ohms D. 377 ohms

37. High-frequency long-distance propagation mostly depends on

A. Ionospheric reflection B. Tropospheric reflection

C. Ground reflection D. Inverted reflection

38. Which of the following is the phenomenon caused by Radio waves traveling in two or more paths during propagation and producing slowly changing phase differences between signals?

A. Absorption B. Fading C. Baffling D. skip

39. Ground wave propagation is used for signals up to frequency.

A. 2MHz B. 2GHz C. 30MHz D. 30GHz

40. The broadcast signals received at low frequencies during the daytime are due to.

A. Ground wave B. Space wave C. Skywave D. Tropospheric waves

SECTION B (60 Marks)

Attempt any three questions

Each question carries 20 marks

Begin each question on a fresh page

QUESTION ONE

- a) Define propagation of radio waves [2 marks]
- b) Draw a block diagram of a typical Radio transmitter and explain the functions of each block. [8 marks]
- c) UICT DECE students experimented on the propagation of Radio waves using the sky wave model and found the critical frequencies at an instant observed for E, F₁, and F₂ layers to be 3, 5, and 9 Mhz respectively. Find the corresponding concentration of electrons in these layers. [4 marks]
- d) If N_{max} for each corresponding layer reduces to 80% of the Values obtained in (C) above, Calculate the critical frequencies for E, F₁, and F₂ layers. [6 marks]

QUESTION TWO

- a) Define Amplitude Modulation and state its equation [2 Marks]
- b) What is a Super Heterodyne Receiver? [2 Marks]
- c) What is single-tone and multi-tone modulating signal? [2 Marks]
- d) Define Demodulation. [2 marks]
- e) Why do you think AM signals are severely affected by noise? [2 Marks]
- f) A transmitter radiates 9 kW without modulation and 10.125 kW after modulation. Determine the depth of modulation. [4 Marks]
- g) Suggest one application for each of AM, SSB, DSB, and VSB modulation techniques and justify your answer [4 marks]
- h) Why do we consider the root mean square value of carrier voltage when calculating the carrier power? [2 Marks]

QUESTION THREE

- a) What do you mean by narrowband and wideband FM [2 Marks]
- b) Define frequency deviation in FM and State Carson's rule of FM bandwidth. [3 Marks]
- c) Using a block diagram, explain how you generate the DSB-SC signal. [6 Marks]
- d) For an AM signal represented by $A_m = 10 [1 + 0.4 \cos 6280t] \cos[6.28 \times 10^6 t]$. What are the values of the modulation index and carrier frequency? [3 Marks]
- e) What are the factors that affect the propagation of radio waves.? [4 marks]
- f) Why is radio reception at night better than during the day? [2 marks]

QUESTION FOUR

a). A 107.6 MHz carrier signal is frequency-modulated by a 7 KHz sine wave. The resultant FM signal has a frequency deviation of 50KHz.

Determine the following.

- i. Carrier swing of FM signal [2 Marks]
- ii. Highest and lowest frequency attained by the modulating signal. [3 Marks]
- iii. The modulation index of FM wave. [2 Marks]
- b). Give reasons why the F2 Layer persists in the night. [3 marks]
- c). Briefly describe the process of Ionization [4 marks]
- e). Define MUF and LUF [3 Marks]
- a) For a carrier signal of 1 MHz and a modulating signal of 2 kHz, what is the frequency range occupied by the AM signal? [3 Marks]

QUESTION FIVE

- a) Describe the four layers of the ionosphere [12 Marks]
- b) Define the term antenna polarization [2 Marks]
- c) Differentiate between sky wave and space wave propagation [4 Marks]
- d) Define an antenna. [2 Marks]