

UGANDA INSTITUTE OF



INFORMATION AND

COMMUNICATIONS TECHNOLOGY

END OF SEMESTER EXAMINATIONS

ACADEMIC YEAR 2025/2026

DEPARTMENT: ICT & ENGINEERING

SEMESTER: TWO

PROGRAMME(S): DECE

YEAR OF STUDY: TWO

COURSE: PRINCIPLES OF RADIO COMMUNICATION

COURSE CODE :ECE 221

DATE: FRIDAY, 26/06/2026

TIME: 2:00 PM – 5:00 PM [3 HOURS]

ROOM: TENT A

INSTRUCTIONS:

- (i)** This paper contains two Sections: A (40 marks) & B (60 marks).
- (ii)** **Attempt ALL** questions in **Section A**, and **ONLY THREE** questions in **Section B**.
- (iii)** All questions in Section B carry equal marks.
- (iv)** Credit will be given for use of relevant examples and illustrations.
- (v)** Begin each number in Section B on a new page of the answer sheet.

SECTION A (40 MARKS)

Attempt **ALL** the Questions in this Section,

OBJECTIVES (Select the most correct answer, 2 marks @)

1. An electromagnetic wave **DOESN'T** consist of the following.
a) Electric fields b) Magnetic fields c) Neutral fields d) Transverse wave
2. From the electromagnetic frequency spectrum, Medium Frequency, MF is identified as.
a) 03MHz – 3 MHz b) 3MHz – 30 MHz c) 300MHz – 3MMHz d) 3GMHz
3. Using the speed of light of $3 \times 10^8 \text{ms}^{-1}$, what is the wavelength if the given frequency is 100kHz?
a) 3 Km b) 3M m c) 300 m d) 30 m
4. A device that converts one form of energy to another is termed as.
a) Exchange b) Switch c) transducer d) converter
5. Most frequently used methods of long-distance transmission in Electronics Communication Principle is;
a) Radio Line of Sight
b) Space Wave propagation
c) Ground Wave propagation
d) Sky – wave propagation
6. A range of 1021 to 1089 MHz Calculate the width of this band.
a) 72 MHz b) 48 MHz c) 62 MHz d) 68 MHz
7. Which is **NOT** a characteristic of a Radio wave.
a) Reflection b) Penetration c) Interference d) Diffraction
8. Which of the **DOESN'T** to Digital Modulation in the Radio communication technology?
a) PM b) ASK c) FSK d) PSK
9. In radio communication, **Gain** is a measure of an antenna's ability to direct or focus radio frequency (RF) energy in a specific direction, rather than radiating it equally in all directions, **S.I unit** is;
a) Watts b) Meters c) Hz d) dB
10. Of which is **NOT** an example of antennas.
a) CPU b) Monopole c) Dipole d) Yagi-Uda

SHORT ANSWERS

1. Define frequency deviation in FM and state Carson's Rule of FM bandwidth. **(3 Marks)**
2. Define the following terms as used in communication systems
(i) Polarization
(ii) Electromagnetic wave
(iii) Electromagnetic spectrum **(3 Marks)**
3. Define modulation index of an AM signal. What are the limitations of Amplitude Modulation (AM) **(4 Marks)**
4. Briefly describe the following terms used in propagational communication
i) Optical line of sight
ii) Critical frequency

- iii) Critical Angle
- iv) Skip zone
- v) Skip distance
- vi) Fading
- vii) Wavefront
- viii) MUF **(8 Marks)**

5. Draw an AM modulation envelope **(2 Marks)**

SECTION B (60 MARKS)

Attempt **Any three** Questions in this Section.

Question 1

- a) A single-tone FM is represented by the voltage equation $v(t) = 12 \cos (6 \times 10^8 t + 5 \sin 1250t)$. Determine the following: **(10 Marks)**
- i) Carrier frequency
 - ii) Modulation index
 - iii) Modulating frequency
 - iv) Maximum deviation
 - v) What power this FM wave will dissipate in 10 Ohm resistor
- b) Explain briefly with the aid of a diagram three, 3 commonly types of propagations applied in Radio communication. **(6 Marks)**
- c) Define the following terms.
- i) Radiation pattern
 - ii) Reciprocity
 - iii) Front to Back ratio
 - iv) Directivity **(4 Marks)**

Question 2

- a) Explain horizontal and vertical polarization of a radio wave as used in day-to-day technology **(4 Marks)**
- b) A modulating signal of frequency 5KHz and peak voltage of 6v is used to modulate a carrier signal of frequency 10MHz and peak voltage of 10v. determine; **(6 Marks)**
- i) Modulation index
 - ii) Frequency of lower sideband and Upper sideband
 - iii) Amplitude of Lower sideband and Upper sideband.

- c) What is the relationship between operating frequency and ground wave coverage, citing their applications? **(4 Marks)**
- d) Fully explain space wave propagation and distinguish between direct and reflected wave. **(4 Marks)**
- e) What do you mean by Narrowband (NBFM) and Wideband (WBFM) **(2 Marks)**

Question 3

- a) Derive the total power in an AM wave **(7 Marks)**
- b) Elaborate Radiation resistance, state the most appropriate formula highlighting each parameter used. **(3 Marks)**
- c) Discuss any Five (5) types of antennas commonly used in Radio communication technology **(2 Marks @)**

Question 4

- a) Modulation is a paramount concept applied in this technology, elaborate the differences between Analogue and Digital modulation? **(5 Marks)**
- b) Explain two reasons why we find Modulation most important in Radio communications. **(4 Marks)**
- c) What is the difference between DSB and SSB modulation, why is the SSB most preferred in this technology **(5 Marks)**
- d) Explain the difference between Analog Modulation and Digital Modulation and list their respective modes of modulation per category of Analog Modulation and Digital Modulation. **(6 Marks)**

Question 5

- a) Define propagation of radio waves **(2 Marks)**
- b) What are the factors that affect propagation of radio waves **(4 Marks)**
- c) Describe the layers of the Ionosphere **(6 Marks)**
- d) Differentiate between MUF and LUF **(3 Marks)**
- e) Briefly describe the process of Ionization **(3 Marks)**
- f) Why is radio reception at night better than during the day **(2 Marks)**

END