UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
END OF SEMESTER TWO EXAMINATIONS

ACADEMIC YEAR 2024/2025

DEPARTMENT: ICT

SEMESTER: TWO

PROGRAMME(S): DIPLOMA IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

YEAR OF STUDY: TWO

COURSE: PRINCIPLES OF RADIO COMMUNICATION

COURSE CODE : ECE 221

DATE: FRIDAY 27TH JUNE 2025

TIME: 2PM- 5PM

DURATION: 3 HOURS

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.

(vi) DO NOT write on this question paper

SECTION A (40 Marks)
Section A is compulsory

QUESTION ONE

a) Define the following terms [10 Marks]
i) Electromagnetic wave
ii) Bandwidth of a system
iii) Electromagnetic spectrum
iv) Carrier swing in FM
v) Lowest usable frequency

b) Give 4 (four) properties of Electromagnetic waves [4 Marks]
c) Describe the following layers of the Ionosphere. [6 Marks]
i) D Layer
ii) E Layer

d) UICT DECE students are required to establish a high frequency radio link between two points **Awelogwei** and **Iyalakwe** 2500 km apart on the earth's surface. Considering the height to be 200 km and its critical frequency 5 MHz. [20 Marks]

i) Which propagation model should the students deploy and give reasons for your choice.
ii) Give three (3) areas of application of the model chosen above
iii) Calculate the maximum usable frequency and optimal frequency for the chosen model.
iv) Determine the angle of incidence of the ray
v) Discuss some of the challenges the students may face with the given model.

SECTION B (60 Marks)
Attempt any three questions

QUESTION ONE

a) Define propagation of radio waves [2 Marks]
b) Draw a block diagram of a superheterodyne receiver and explain the functions of each block. [8 Marks]
c) Calculate the skip distance for the flat earth with MUF of 10MHz if the wave is reflected from a height of 300km where the value of density is 2.345. [4 Marks]
d) Comment of your answer in (c) above. [3 Marks]
e) Why must surface waves be vertically polarized. [1 Mark]
f) Give areas of application of Ground waves [2 Marks]

QUESTION TWO

a) Define attenuation of radio waves [2 Marks]
b) Differentiate between a single-tone and multi-tone baseband signal? [2 Marks]
c) Define modulation and demodulation [3 Marks]
d) Why is AM signals severely affected by noise? [2 Marks]
e) Calculate the percentage power saving when the carrier and one of the sidebands are suppressed in an AM wave modulated to a depth of [6 Marks]
   i) 100%
   ii) 50%
f) A modulating signal of frequency 5KHz and peak voltage of 6V is used to modulate a carrier of frequency 10MHz and peak voltage of 10V. Determine; [5 Marks]
   i) Moudalation index
   ii) Frequency of LSB and USB
   iii) Amplitude of LSB and USB

QUESTION THREE

a) What is FM [2 Marks]
b) Briefly explain the concept of Frequency Modulation [3 Marks]
c) Using a block diagram, explain how you demodulate SSB-SC signal. [6 Marks]
d) Why is the demodulation of SSB-SC difficult [2 Marks]
e) Define modulation index of an AM system. For modulation indeces $m < 1, m = 1$ and $m > 1$, draw the time domain waveform of each [7 Marks]

QUESTION FOUR

a) Describe the process of Ionization. [4 marks]
b) Define Amplitude modulation and state its general equation [3 Marks]
c) Differentiate between NBFM (Narrow Band FM) and WBFM (Wide Band FM) [5 Marks]
d) Derive the AM equation [8 Marks]

QUESTION FIVE

a) Define antenna polarization [2 Marks]
b) Differentiate between sky wave and surface wave propagation [4 Marks]
c) Define an antenna. [2 Marks]
d) Briefly explain the electric and magnetic fields [3 Marks]
e) Give two disadvantages of FM [2 Marks]
f) Compare the FM and AM systems [5 Marks]
g) Sate Carson's rule for FM bandwidth [2 Marks]

GOOD LUCK