(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND COMMUNICATION ENGINEERING

COURSE CODE: ECE 328

COURSE TITLE: ANALOGUE ELECTRONICS

DATE: TUESDAY 19/12/2023 **TIME:** 12: 00 PM – 2:00 PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION ONE

a) Outline both multiplexing principles. (5marks)

b) A 100 KHz carrier wave is amplitude modulated by audio signals between 400 to 1600Hz
Find: (4marks)

i. Frequency span of each side band

ii. The Channel Width

c) Draw a block diagram of a superhetrodune receiver and state the function of each block. (6marks)

d) The bandwidth of a receiver with a 75Ω input resistance is 6 MHz at 29^0C. Calculate the input thermal noise Voltage. (5marks)

e) State two merits of FM and Two Demerits of FM Transmission. (5marks)

f) Deduce that; (5marks)

$$(S_O/N_O)_{SCB\text{-}SC} = (S_O/N_O)_{AM}$$

g) (3marks)

i. Under the same scale draw AM, FM and Pm modulated wave forms.

ii. Under the same scale draw PAM, PWM and PP modulated wave forms.

QUESTION TWO

a) Explain the significance of pre-emphasis and de-emphasis with suitable illustrations (4 marks)

b) In a uniform quantization the error may be expressed as; (8marks)

$$\frac{1}{\Delta V}\int_{\Delta V/2}^{\Delta V/2} e^{-2}\, de = \frac{(\Delta V)^2}{12}$$

c)

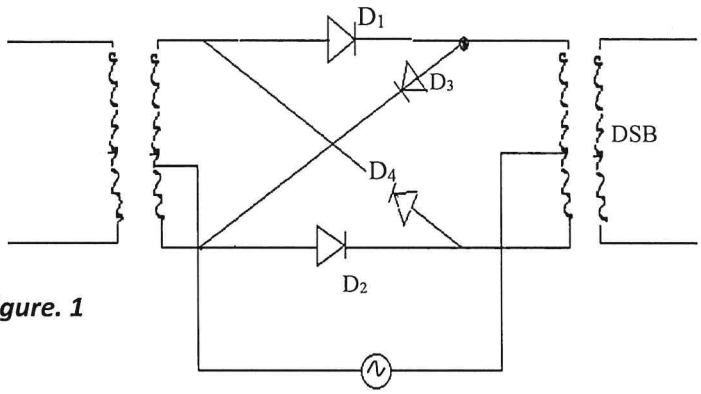

Figure. 1

The circuit of **Figure 1** is a Ring Modulator. Describe its Principle of Operation. (8marks)

QUESTION THREE

a) An RF amplifier has Si/Ni = 8 at input and S_O/N_O = 6 at output Calculate noise figure (F) in db (4marks)

b) It is given that an FM Wave is: (4marks)

$$V_{mod} = 12\text{Cos}\,(6 \times 10^5 t + 5\text{Sin}\,1250t)$$

From this expression determine.

i) Modulating Frequency (4marks)

ii) Carrier Frequency (4marks)

c) Draw an electromagnetic spectrum and indicate the frequencies and the respective wavelengths. (8marks)

QUESTION FOUR

a) An AM broadcast transmitter radiates 10 KW of unmodulated carrier power and 12.5 KW of total power when the carrier is modulated by sinusoidal message signal;

i. Calculate the depth of modulation. (5marks)

ii. If another sinusoidal message signal, modulate the carrier simultaneously to a depth of 60%. Calculate the total power. (5marks)

b) Derive that the modulated PAM signal may be expressed as: (10marks)

$$V_{mod} = \beta A\,(1 + m\text{Sin}\omega_c t)\left[1 + \sum_{-\infty}^{\infty}\left(\frac{\text{Sin}\omega_c \Delta t/2}{n\omega_s} + Cos\omega_s\right)\Delta t/2\right]$$

QUESTION FIVE

a) State and explain the two sampling theorems. (2marks)

b) A transmitter experiences an antenna current change from 4.8A modulated to 5.1A. Calculate the percentage of modulation. (8marks)

c) Describe the demodulation of FM with the help of Ratio Discriminator (Detector) (10marks)