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MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY EDUCATION
IN
ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CODE: TEE 413

COURSE TITLE: COMMUNICATION SYSTEMS 1

DATE: TUESDAY 19/12/2023   **TIME:** 3: 00 PM – 5:00 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.

1. (a) define the following terms as they are used in communication system (3mks)

    I.   Distortion

    II.   Interference

    III.   Noise

b) A monotone signal in a communication system is described by the equation

$$S(t) = B \cos[wt + v(t)]$$

    I.   State the signal amplitude A, Frequency F and phase ϕ (3mks)

    II.   Determine the instantaneous frequency wi if $V(t = \pi t^2$ (2mks)

c. (i) Using a block diagram explain the elements of a basic baseband communication system

(4mks)

(ii) Explain why in most communication systems modulation is required. (2mks).

d) Define the term sampling (1mk)

ii) Explain Nyquist rate of sampling (2mks)

e) An FM signal has a resting frequency of 105 MHz and a higher frequency of 105.03mH3 when modulated by signal frequency 5 KHz (5MKS). Determine:

i) Frequency deviation (1mk)

ii) Carrier swing (1mk)

iii) Modulation index (1mk)

iv) Percentage modulation (1mk)

v) Lowest frequency reached by FM wave (1mk).

f) A binary coded message given 10101110110 (LSB) in the right is transmitted in baseband over a digital channel. Sketch waveforms if the message is transmitted in the channel using

i) Unipolar non return to zero (NRZ) signal mode   (4mks)

ii). Bipolar return to zero (RZ) signalling mode   (4mks)

2(a) using relevant circuits, explain the difference between pre emphasis and de-emphasis.

(6mks)

ii) Highlight any three applications where pre-emphasis and de-emphasis are used (3mks)

b) Define the term coding   (2mks)

ii) State any four properties of line coding   (4mks).

c) In a PCM system, a 5 bit encoder is used. Suppose each level represents IV

i) Find the range of the code   (3mks)

ii) Find the number of quantization error on account of PCM if a voltage of 27.39v is involved

(2mks).

3(a). Define the following terms as they are used in amplitude modulation receiver.
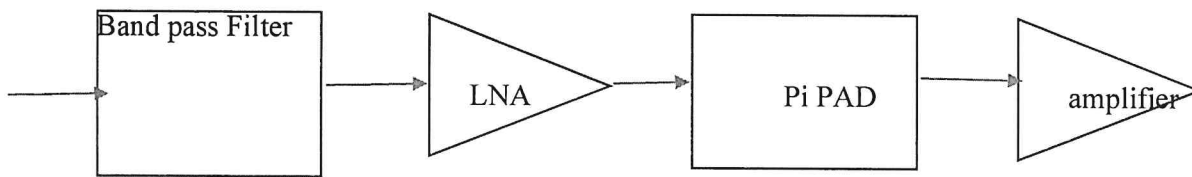
    i)   Fidelity   (2mks)

    ii)   Selectivity   (2mks)

    iii)   Double spotting   (2mks).

b. (i) explain the significance of noise figure in communication circuits   (2mks)

ii) Figure 1 shows multiple devises cascaded in the receiver chain, the gain and noise figure of each devise is given from data sheet. Compute the noise figure of complete receiver chain.

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┌─────────────────┐        ╲        ┌─────────────┐       ╲
│Band pass Filter │         ╲       │             │        ╲
│                 │───▶  LNA  ▶──▶  │   Pi PAD    │──▶ amplifier▶
│                 │         ╱       │             │        ╱
└─────────────────┘        ╱        └─────────────┘       ╱
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Loss =20dB   Gain =20dB, NF=1 Db   Loss =3dB   Gain=12Db, NF=2

c). The total power content of an AM wave is 1500 w for 100% modulation, Determine,

i). power transmitted by the carrier   (2mks)

ii). Power transmitted by each   (2mks)

D). state any advantage of FM over AM.   (2mks)

4. (A) (i). Given the clock phase 1010101010101010101 and the data 101001110. Draw the wave forms for the bipolar none return to zero BNRZ and Bipolar return to zero.BRZ. (5mks).

ii) State any two advantage and disadvantage of bipolar signalling.   (3mks).

b). draw the block diagram of a pube code modulation (PCM) and explain the function of each block   (12mks)

5. (A). Explain the following forms of amplitude modulation.

i) Double side band suppressed carrier (DSB-SC)   (2mks)

ii) Single side band transmitted carrier (SSB-TC)   (2mks)

iii) Single side band suppressed carrier (SSB-SC)   (2mks).

B) (I). Highlight any three disadvantages of SSB-SC   (6mks)

ii).give a reason as to why there is a wide spread use of double side band full carrier (DSBFC) rather than single side band suppressed carrier (SSB-SC) in broadcasting.   (2mks).

c) (I) derive the mathematical expression for FM wave   (3mks)

ii) The turned circuit of the oscillator in an AM transmitted uses a 40mH coil and 1nF capacitor. If the carrier wave produced by the oscillator is modulated by audio frequencies up to 20KH3, calculate the frequency bands and the channel width.   (3mks).