



MACHAKOS UNIVERSITY

University Examinations for 2023/2024 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 400 COMMUNICATION SYSTEMS 1

DATE:

TIME:

INSTRUCTIONS

Answer questions One and any other Two Questions.

Question One is Compulsory and carries 30 Marks. Other questions carry 20marks each.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Discuss four reasons for modulation [4 marks]
- b) Describe advantages of Frequency Modulation over Amplitude Modulation [6 marks]
- c) An AM signal has carrier amplitude $A_c=400V$, the modulation index being 0.8. Calculate both normalized and actual peak envelope power if a 50 ohm resistive load is connected to the output. [5 marks]
- d) Discuss reasons as to why DSB suppressed carrier is not commonly used [4 marks]
- e) Illustrate bandwidth requirements for Amplitude Modulation and Frequency Modulation systems. [5 marks]
- f) Explain Vestigial Side Band modulation and its application. [6 marks]

QUESTION TWO (20 MARKS)

- a). An FM broadcasting system has a maximum deviation of 75KHz. If the modulating signal has 7.5 KHz as the highest frequency, determine the following:
 - i) The bandwidth of the FM signal. [5 marks]
 - ii) The change in bandwidth if the modulating signal frequency is doubled. [5 marks]
 - iii) The bandwidth when the modulating signals amplitude is doubled. [5 marks]
- b). Explain fundamental limitations of communications systems and state how each limitation can be mitigated [6 marks]

QUESTION THREE (20 MARKS)

- a) Discuss process to generate FM signals. [6 marks]

- b) Explain with illustration baseband and bandpass waveforms [4 marks]
- c) Explain with illustration and equations how to generate a bandpass signal represented in in-phase and quadrature form. [4 marks]
- d) Explain generation of a bandpass signal [2 marks]
- e) An FM broadcast system in the band 88MHz to 108MHz, is allocated to each channel a bandwidth of 200KHz. Determine the lowest and the highest transmission frequencies [4 marks]

QUESTION FOUR (20 MARKS)

- a) A modulating signal $\cos(15 \times 10^3 \pi t)$ modulates a carrier of 10MHz and produces a frequency deviation of 75KHz. Calculate the modulation index and the bandwidth produced in the wave [6 marks]
- b) Explain Vestigial Side Band modulation and its application. [4 marks]
- c) Discuss a balanced modulator and a vector modulator [6 marks]
- d) An angle-modulated signal is described by the equation:
 $\phi_{EM(t)} = 6 \cos(\omega_c t + 3 \sin 1600t + 10 \sin 2400\pi t)$. Determine the following:-
 - i) Frequency deviation
 - ii) Modulation Index
 - iii) Bandwidth of the signal $\phi_{EM(t)}$.
 - iv) The type of FM giving reasons

[4 marks]

QUESTION FIVE (20 MARKS)

- a). A standard AM broadcast station is allowed to transmit modulating frequencies up to 5 kHz. If the AM station is transmitting on a frequency of 980 kHz, compute the upper and lower frequencies and the total bandwidth occupied by the AM station. [4 marks]
- b). Discuss quadrature amplitude modulation [4 marks]
- c). An AM transmitter has a carrier power of 20 W. The percentage of modulation is 85 percent. Calculate the following
 - i) power in one sideband. [3 marks]
 - ii) total power [3 marks]
- d) Discuss the detection or demodulation methods for FM signal. [6 marks]