



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

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 I

DATE: 9/8/2021

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer question One and any other two Questions. Question One is Compulsory and carries 30Marks.The remaining questions carry 20marks each.

QUESTION ONE (COMPULSORY) (20 MARKS)

- a) Discuss with illustration the components of a basic communications system. (4 marks)
- b) Explain baseband signal and a carrier signal (4 marks)
- c) Illustrate using sketches the processes of AM and FM (6 marks)
- d) Calculate Peak Envelope Power for an AM signal of carrier amplitude $A_c=100V$, message signal $m(t)=0.7\sin(2\pi 4000t)$ connected to a 60 ohm load. (5 marks)
- e) Using a block diagram discuss the components of a bandpass communications system. (6 marks)
- f) Illustrate bandwidth requirements and power efficiencies for Amplitude Modulation systems. (5 marks)

QUESTION TWO (20 MARKS)

- a) i) A bandpass signal $v(t)$ can has three representations. Demonstrate the three representations explaining the terms and the process. (5 marks)
- ii) Discuss three representations of a complex envelope signal $g(t)$ and explain terms used. (5 marks)
- b) With equations, demonstrate modulation and demodulation of AM DSB-SC system bringing out need for coherent detection. (6 marks)
- c) Discuss quadrature amplitude modulation (4 marks)

QUESTION THREE (20 MARKS)

- a) Discuss narrow band FM and wide band FM signals and their applications. (6 marks)
- b) Explain the pros and cons in the development of SSB modulation system (4 marks)
- c) An AM transmitter has a carrier power of 30 W. The percentage of modulation is 85 percent. Calculate the following
 - i) total power (3 marks)
 - ii) power in one sideband. (3 marks)
- d) Discuss the detection or demodulation methods for FM signal. (4 marks)

QUESTION FOUR (20 MARKS)

- a) The FM broadcast is allocated frequency band 88MHz-108MHz. Each FM channel has 200KHz bandwidth.
 - i) Establish how many FM radio broadcast channels we can have (3 marks)
 - ii) Show the lowest and highest channel frequencies. (3 marks)
- b) Compare and contrast AM and FM systems (6 marks)
- c) Discuss the Super heterodyne receiver bringing out main features, advantages and disadvantages of the receiver. (4 marks)
- d) Derive modulation index m of an AM DSB LC signal with maximum signal level $A_{\max}$ and minimum signal level $A_{\min}$ (4 marks)

QUESTION FIVE (20 MARKS)

- a) With illustration, explain the degree of modulation index required to establish a desirable AM communication. (3 marks)
- b) Explain fundamental limitations of communications systems. (3 marks)
- c) A single-tone modulating signal of $\cos 15 \times 10^3 \pi t$ modulates a carrier of 10MHz and produces a frequency deviation of 75KHz. Calculate the
 - i) Modulation index. (3 marks)
 - ii) Modulated signal bandwidth (3 marks)
- d) Explain generation of FM wave using
 - i) Indirect method (4 marks)
 - ii) Direct method (4 marks)