



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

EEE 400: COMMUNICATIONS SYSTEMS 1

DATE: 13/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

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

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Explain with diagram the following type of communication system. In each case give a suitable example.
 - i) Point-to-Multipoint (3 marks)
 - ii) Half-duplex (3 marks)
 - iii) Full-duplex (3 marks)
- b) Explain a bandpass communication signal (3 marks)
- c) Discuss modulation process (3 marks)
- d) 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 phase deviation produced in the wave. (4 marks)

- f) Explain Vestigial Side Band modulation and its application. (3 marks)
- g) In establishing a communications system, you have options to use fiber, VSAT, terrestrial radio system. Discuss situations when you consider appropriate to use the available options. (4 marks)
- h) With illustration, explain the degree of modulation index required to establish a desirable AM communications?. (4 marks)

QUESTION TWO (20 MARKS)

- a) A bandpass signal is show as $v(t)=\text{Re}\{g(t)e^{jw_c t}\} = R(t)\text{Cos}[w_c t + \theta(t)]$. Show the complex envelope of the signal $v(t)$ (5 marks)
- b) Explain generation of DSB suppressed carrier signal using a balanced modulator. (5 marks)
- c) How will you detect the DSB signal generated above? (4 marks)
- d) Explain generation of FM wave using
- i) Indirect method (3 marks)
 - ii) Direct method (3 marks)

QUESTION THREE (20 MARKS)

- a) Discuss the detection or demodulation methods for FM signal. (5 marks)
- b) An FM broadcasting system has a maximum deviation of 75KHz. If the modulating signal has 7.5 KHz as the highest frequency, calculate the following:
- i) Determine the bandwidth of FM signal. (4 marks)
 - ii) Determine the Explain change in bandwidth if the modulating signal frequency is doubled. (3 marks)
 - iii) Determine the bandwidth when the modulating signals amplitude is doubled. (3 marks)
- c) Discuss the power efficiency of an amplitude modulated system with a modulation index m. (5 marks)

QUESTION FOUR (20 MARKS)

- a) An AM transmitter has a carrier power of 60 W. The percentage of modulation is 70 percent. Calculate the following
 - i) total power (3 marks)
 - ii) power in one sideband. (3 marks)
- b) Discuss the limitations of a communications systems. (4 marks)
- c) Explain generation and demodulation of SSB signal (6 marks)
- d) Using the complex envelope function of AM signal derive the power of the AM signal. (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 900 kHz, compute the maximum and minimum upper and lower sidebands and the total bandwidth occupied by the AM station (7 marks)
- b) Explain with illustration a vector modulator and how it can produce a signal modulated in in-phase and quadrature form.. (7 marks)
- c) Compare FM and AM systems (6 marks)