



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIFTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 553: RADIO COMMUNICATION

DATE:

TIME:

INSTRUCTIONS

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

QUESTION ONE

- a) Discuss radiofrequency wave propagation in the various parts of the spectrum (5 marks)
- b) Briefly discuss radio transmission impairments (5 marks)
- c) TV broadcasting has recently become digital in what is known as digital migration. What are the advantages achieved in the digital migration? (5 marks)
- d) Describe briefly the 4 basic building blocks of radio communication. (5 marks)
- e) Explain the absorption effect in radio wave propagation. (5 marks)
- f) Discuss the factors leading to radio signal fading and measures to mitigate such fading. (5 marks)

QUESTION TWO (20 MARKS)

- a) Discuss Outside Broadcasting and how you would arrange such a facility. (5 marks)
- b) In the radiofrequency spectrum, explain where you will find the following services giving supporting reasons
 - (i) FM radio broadcasting
 - (ii) TV broadcasting
 - (iii) Mobile telephone services
 - (iv) Medium wave radio broadcasting
 - (v) High capacity terrestrial radio links (5 marks)
- c) Determine gain of a 70m dish antenna in a radio link designed to use 30.0GHz. Assume aperture efficiency of 0.7 (6 marks)
- d) In designing a radio communications link between two points, discuss why you need to establish a path profile and what you require to do so. (4 marks)

QUESTION THREE (20 MARKS)

- a) Describe in detail with illustrations the over the horizon wave propagation. (6 marks)
- b) Briefly explain the medium properties which affect radio wave propagation. (6 marks)
- c) A radio communications engineer is designing a radio link with a receiver antenna gain of 10dB and transmitter antenna gain of 12dB at a frequency of 10GHz. The receiver sensitivity is -70dBm. The transmitter is transmitting 25 watts across a distance of 60 kilometers. Demonstrate with calculations whether this system will work. (8 marks)

QUESTION FOUR (20 MARKS)

- a) Briefly explain two commonly used diversity techniques in radio communications engineering. (5 marks)
- b) A 40km radio link is to operate at 2GHz. Determine the minimum antenna heights assuming a level and unobstructed path. (5 marks)
- c) A spacecraft, 22bn km away from earth has a 3W power transmitter at 8415MHz and an antenna with 48dB gain. Calculate effective power transmitted to earth. (5 marks)
- d) Signal from the spacecraft in (c) above is received at an earth station by a large 70m dish antenna with an area of 3,800m². Calculate the power received at the earth station. (5 marks)

QUESTION FIVE (20 MARKS)

- a) Explain with illustration the meaning and importance Fresnel zone in radio systems engineering. (7 marks)
- b) Briefly discuss Trunked Radio System showing its advantages. (6 marks)
- c) Discuss method to estimate diffraction loss from 2 edges along the radio path. (7 marks)