



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIFTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 553 RADIO COMMUNICATION ENGINEERING

DATE: 20/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS:

Answer question and any other two questions

QUESTION ONE (30 MARKS)

- a) Describe briefly the 4 basic building blocks of radio communication (6 marks)
- b) Give a brief explanation on how you would prepare a radio link path profile (4 marks)
- c) Briefly explain the important steps in the design of a radio link. (4 marks)
- d) Describe with illustrations the over the horizon wave propagation. (6 marks)
- e) Discuss the occurrence of scattering in radio wave propagation (4 marks)
- f) Discuss radiofrequency spectrum in terms of propagation mode and application for each segment (6 marks)

QUESTION TWO (20 MARKS)

- a) Briefly explain the medium properties which affect radio wave propagation (5 marks)
- b) Voyager1, 25 bn km away from earth has a 3W power transmitter at 8415MHz and an antenna with 48dB gain.
 - i. Calculate effective power transmitted to earth. (5 marks)
 - ii. Signal from Voyager 1 is received by a large 70m dish antenna with an area of $3,800\text{m}^2$. Calculate the power received at the station on earth. (5 marks)
- c) Briefly describe fading and its effects. (5 marks)

QUESTION THREE (20 MARKS)

- a) Describe in detail with illustrations refraction and diffraction as used in radiowave propagation. (5 marks)
- b) Discuss the effects of reflections in radio wave propagation and mitigation measures to counter effects of fading arising from reflected radio waves (5 marks)
- c) Explain with illustration the meaning and importance Fresnel zone in radio systems engineering (6 marks)
- d) Discuss the occurrence of scattering in radio wave propagation (4 marks)

QUESTION FOUR (20 MARKS)

- a)
 - i A radio link from earth to a station some 100Trillion km away is to operate on a wavelength 8×10^{-3} m. Calculate the path loss in dB (4 marks)
 - ii comment on the following:-
 - I. the application of the radio link (3 marks)
 - II. the type and size of antennas to be used in this system (3 marks)
- b) Give a brief description of Trunked Radio System and its advantages (5 marks)
- c) In a radio communications system, discuss the factors you will consider in the link budget. (5 marks)

QUESTION FIVE (20 MARKS)

- a) A 70m antenna operating at 32 Ghz has an aperture efficiency of 0.7. Calculate the gain of this antenna in dB. Where are you likely to use this antenna?. Comment on the frequency used. (4 marks)
- b) You are required to design a high capacity 2 GHz radio system between two stations 40 km apart between which there are buildings and trees and line of sight is just possible. Briefly discuss the following with illustrations and calculations where necessary.
 - i. Acquisition of frequency for the system (2 marks)
 - ii. Selection of antenna type (2 marks)
 - iii. Determination of antenna heights (4 marks)
 - iv. Determination of Transmit power (4 marks)
 - v. Determination of receiver sensitivity. (4 marks)