



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 545: SATELLITE COMMUNICATION

DATE: 17/8/2021

TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

Answer Question One [Compulsory] And Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Explain three reasons why cooperatives firms switch to satellite communication. (3 marks)
- b) Demonstrate the importance of ITU in reference to spectrum mapping and regulation. (2 marks)
- c) On what factors does the limit of visibility depend? Considering an earth station at the equator, with the antenna pointing either west or east along the horizontal, evaluate the limiting angle. (4 marks)
- d) Enlist three characteristics of LEO in satellite communication. (3 marks)
- e) A satellite downlink at 10GHz operates with a transmit power of 5W and an antenna gain of 48.2dB. Estimate the EIRP in dBW. (4 marks)
- f) State how intermodulation noise originates in a satellite link and describe how it is reduced? (4 marks)
- g) Distinguish between pre-assigned and demand-assigned TDMA satellite access; hence enlist the merits and demerits of TDMA over FDMA. (4 marks)
- h) Explain the following satellite applications: (i) Direct Broadcast Satellites (DBS) (ii) Digital Audio Broadcast (DAB) (iii) GRAMSAT (iv) Dom sat (v) dilution of precision (vi) PDOP (6 marks)

QUESTION TWO (20 MARKS)

- a) Deduce an expression that defines the three Kepler's laws for satellite communications. (6 marks)
- b) Discuss the effects of orbital perturbation due to a non-spherical earth. (4 marks)
- c) Explain the advantages and disadvantages of the following orbits: i) GEO ii) MEO (6 marks)
- d) During satellite launching, there are certain factors that have to be considered in selecting the track of trajectory. Explain four of them. (4 marks)

QUESTION THREE (20 MARKS)

- a) With an aid of diagram, explain the functional elements of a basic digital earth station and its main elements of a satellite tracking system. (12 marks)
- b) In Satellite communication, there has been mass shift towards digital transmission despite having large analog bases. Explain the main factors contributing to that. (4 marks)
- c) Demonstrate how Propagation Characteristics and Frequency considerations as well as system reliability are key elements in systems design. (4 marks)

QUESTION FOUR (20 MARKS)

- a) How does the system noise temperature affect the performance? Derive the expression for overall system noise temperature at the receiving earth station. (8 marks)
- b) There are several multiple access techniques defined for satellite communication. Conventional FDMA/TDMA. How are they different from CDMA? Explain their principle and applications. (12 marks)

QUESTION FIVE (20 MARKS)

- a) Define the term DTH, hence describe its design issues that have to be considered during launching DTH systems. (8 marks)
- b) Write brief notes on mounting system and security aspect of laser satellite communications. (4 marks)
- c) State the advantages of using Laser satellite hence enlist the various factors that affect its link analysis. (8 marks)