



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 548 ANTENNAS AND PROPAGATION

DATE: 2021

TIME: 2 Hours

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) Briefly discuss the following:-
 - i) antenna arrays
 - ii) patch antennas
 - iii) lens antennas. (6 marks)
- b) Distinguish antenna polarization and wave polarization (6 marks)
- c) A helix antenna has a gain of 14 dB. Calculate its effective area. (6 marks)
- d) In a transmitting and receiving antenna system what will determine the polarization efficiency in the system. (6 marks)
- e) Explain the terms parasitic array and parasitic element and where you would find such. (6 marks)

QUESTION TWO (20 MARKS)

- a) Explain the general classification of antennas (5 marks)
- b) There are various types of antennas, discuss three used in laptop applications. (5 marks)
- c) Discuss atmospheric ducting and its effects in radio wave propagation. (5 marks)
- d) Explain characteristics of an isotropic antenna, directional antenna and omnidirectional antenna and what they are used for?. (5 marks)

QUESTION THREE (20 MARKS)

- a) Discuss the Ionosphere and how it impacts on radiofrequency propagation. (5 marks)
- b) Discuss the type of antennas applicable at the various segments of the radiofrequency spectrum. (5 marks)
- c) Discuss atmospheric factors affecting radio wave propagation (5 marks)
- d) Discuss polarization ellipse and the characteristics that define it. (5 marks)

QUESTION FOUR

- a) Explain three models used to analyze diffraction effects where multiple edges exist. (4 marks)
- b) Discuss leaky wave antennas and their application (3 marks)
- c) In a particular radio link operating at 18 GHz, the antenna specified is a parabolic dish of 2m diameter. Calculate antenna gain assuming aperture efficiency of 70%. (5 marks)
- d) Explain with illustrations how the effects of refraction, diffraction, reflection, scattering, absorption and ionosphere affect radio wave propagation. (8 marks)

QUESTION FIVE (20 MARKS)

- a) Explain the reciprocity theorem as applies to antennas. (5 marks)
- b) Briefly discuss antenna characteristics and how they relate to transmitting and receiving functions. (5 marks)
- c) Calculate gain of a small dish 30 deg² antenna. (5 marks)
- d) Explain Broadside and Endfire antenna arrays and their applications (5 marks)