



ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO  
STATE

FACULTY OF ENGINEERING  
DEPARTMENT OF ELECTRICAL AND  
COMPUTER ENGINEERING

FIRST SEMESTER EXAMINATION, 2017/2018 ACADEMIC SESSION

COURSE TITLE: SATELLITE COMMUNICATION

COURSE CODE: ECT 411

EXAMINATION DATE: 19<sup>TH</sup> MARCH 2018

COURSE LECTURER: DR. O. ADETAN

HOD's SIGNATURE

TIME ALLOWED: 3 HOURS

**INSTRUCTIONS:**

1. ANSWER FIVE QUESTIONS ONLY
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE NOT ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

**Question #1 (20 Marks)**

- a. Satellites often start out in an orbit that is elliptical. Discuss the various types of Earth orbits known to you [8 Marks]
- b. In order to maintain the communication link in space, communication satellites require six (6) major on-board subsystems to operate. Mention and discuss them [6 Marks].
- c. Mention three advantages and disadvantages of satellites [6 Marks]

**Question #2 (20 Marks)**

- a. Write short notes on the following terms as used in satellite communication (*Use diagrams where appropriate*) [12 Marks]
  - (i) Orbital velocity
  - (ii) Satellite footprints
  - (iii) Dwell time
  - (iv) Pure and Slotted ALOHA protocols
  - (v) Antenna gain
- b. What are the benefits of the Automatic Vehicle Locator (AVL) [8 Marks]

**Question #3 (20 Marks)**

- a. Satellites transmit information within radio frequency bands. Discuss the various frequency bands mostly used by satellite communication companies. What are the factors to be considered by satellite operators in the selection of any frequency band? [12 Marks]
- b. What do you understand by GPS satellite constellation? [8 Marks]

**Question #4**

- a. Briefly discuss the operations/features of the IRIDIUM and TELEDESIC satellite systems [10 Marks]
- b. What are the key features that affect the Medium Access Control (MAC) in satellite communication? [10 Marks]

**Question #5**

- a. Explain using a suitable diagram the relationships between the Van Allen belts and the different categories of satellites [12 Marks]
- b. A satellite downlink at 15GHz operates with a transmit power of 25W and an antenna gain of 40 dB. Calculate the EIRP in dBW. [8 Marks]

**Question #6**

- a. Using appropriate equations, describe the EIRP of a satellite [8 Marks]
- b. If the satellite at a distance of 39,000 km from the Electrical and Computer Engineering department building radiates a power of 20 W from an antenna with a gain of 22 dB in the direction of a VSAT at the building with an effective aperture of 10 m<sup>2</sup>. Determine the EIRP in dBW [12 Marks]

**Question #7**

- a. What do you understand by link budget? Why is the link budget analysis necessary? [6 Marks]
- b. Mention and explain briefly the factors necessary for the design of any link budget [6 Marks]
- c. What do you understand by the VSAT? Describe the one-way VSAT configuration [8 Marks]