



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION 2016/2017

BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS

EEE 4423: TELECOMMUNICATION SYSTEMS

END OF SEMESTER EXAMINATION

SERIES: SEPT. 2017

TIME: 2 HOURS

DATE: Pick Date Select Month Pick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt **Question ONE (Compulsory)** and any other **TWO Questions**

Do not write on the question paper.

QUESTION ONE

- a. Describe with the aid of a block diagram, a time division multiplex system using PCM to transmit four telephone signals along one physical line.

(8 marks)

- b. A telephone line with a bandwidth of 100 kHz is known to have a loss of 20 dB. The input signal power is measured as 0.5 watt, and the output signal noise level is measured as 2.5 μ watt. Using this information,

calculate the output signal-to-noise ratio.

(6 marks)

c. Describe the physical and transmission characteristics of the following guided media

- i. Fiber optic
- ii. Coaxial cable

(6 marks)

d. Describe the following types of satellites and list their areas of applications

- i. GEO satellites
- ii. MEO satellites

(10 marks)

QUESTION TWO

a. Given that the earth's equatorial radius is 6378 km and the height of the geostationary orbit is 36,000 km, determine the inter-satellite distance between the GE American Communications, Inc., satellite and the Hughes Communications Galaxy, Inc., satellite, operating in the Ka band.

(6 marks)

b. Derive the free – space path loss of a radar system

(5 marks)

c. Derive the radar range equation that relates power received to the distance between transmitter and receiver

(7 marks)

d. List **FOUR** applications of radar systems

(2 marks)

QUESTION THREE

- a. Describe **FOUR** design factors relating to the transmission medium and to the signal that determine the data rate and distance

(8 marks)

- b. i. Explain how handover is performed in GSM network
ii. Explain the security functions implemented in the GSM network

(12 marks)

QUESTION FOUR

- a. Define the following terms as used in telecommunication

- i. Information
- ii. Entropy
- iii. Uncertainty

(3 marks)

- b. Derive the Shannon's channel capacity

(8 marks)

- c. Assuming that a PSTN has a bandwidth of 3 kHz and a typical signal-to-noise power ratio of 20 dB, determine the maximum theoretical information (data) rate that can be achieved

(5 marks)

- d. Describe the major categories of communication networks

(4 marks)

QUESTION FIVE

- a. Describe **TWO** primary resources employed in telecommunication systems and the major underlying design objective with regard to these resources
(6 marks)
- b. Consider a memoryless binary source for which symbol 0 occurs with probability p_0 and symbol 1 with probability $p_1 = 1 - p_0$. Derive the entropy of such a source. (4 marks)
- c. Describe the OSI Reference Model
(10 marks)