

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
TELECOMMUNICATIONS**

COURSE CODE: TLMC 211

COURSE TITLE: TELECOMMUNICATIONS FUNDAMENTALS

STREAM: Y2S1

DAY: FRIDAY

TIME: 9.00 – 12.00 P.M.

DATE: 06/08/2010

INSTRUCTIONS:

Answer **ONE** question from **PART ONE** and any **THREE** questions from **PART TWO**

PLEASE TURN OVER

PART ONE

QUESTION ONE (20 MARKS)

- a. A transmission line has the following characteristics.
Resistance per meter = 10^{-5} Ohms/meter
Inductance = 10^{-8} Henrys/meter
Conductance = 10^{-7} Siemens/meter
The transmission line has been constructed according to Heaviside's condition for distortionless transmission. Calculate;
- The characteristic impedance of the line (5 marks)
 - The attenuation constant (4 marks)
- b. A multistage switch is implemented with the following characteristics
It has 30 inputs and 30 outputs
It has three stages
The first stage has 5 crossbar switches
The second stage has 3 crossbar switches
The last stage has 5 crossbar switches
- How many inputs does each of the switches in the first stage have? (2 marks)
 - How many outputs does each of the switches in the first stage have?(2 marks)
 - How many outputs does each of the switches in the second stage have?(2 marks)
 - How many cross points does the multistage switch have? (4 marks)
- c. In multistage switches what does blocking mean? (1 mark)

PART TWO

QUESTION TWO (10 MARKS)

- a. Briefly describe the ways in which the following types of radio waves are propagated. (2 marks)
- Free space waves
 - Ionospheric waves
 - Tropospheric waves
 - Ground waves
- b. With regard to ionospheric waves what is meant by the skip distance? (1 mark)
- c. A dipole antenna is 0.3 meters long. It is excited by an electrical signal with a frequency of 2000 GHz. Draw the polar diagram of the field strength produced by the antenna. (4 marks)

- d. A modulating signal with frequency components between 300 Hz and 3300 Hz is used to amplitude modulate a carrier with a frequency of 100 MHz. Determine the frequency content of the resultant modulated signal. (3 marks)

QUESTION THREE (10 MARKS)

- a. With regard to a satellite what is meant by
- Geosynchronous earth orbit (1 mark)
 - Footprint (1 mark)
- b. Describe two factors that determine the diameter of an ground station dish (2 marks)
- c. What three parameters are required to calculate the azimuth and elevation angles required for pointing a ground station to a geosynchronous satellite? (3 marks)
- d. Incorporating satellites into terrestrial networks is often hindered by three characteristics possessed by satellite communications. Describe these three characteristics. (3 marks)

QUESTION FOUR (10 MARKS)

- a. The operation of lasers is made possible by the phenomenon called stimulated emission. Describe this phenomenon. (3 marks)
- b. What is
- Step index fiber (1 mark)
 - Graded index fiber (1 mark)
- c. Give two advantages of using wave division multiplex (2 marks)
- d. Give three advantages of using fiber optic cable over coaxial cables (3 marks)

QUESTION FIVE (10 MARKS)

- a. An analog signal has frequency components between 1200 Hz and 6700 Hz. It is converted to a digital signal using PCM. It is first sampled at the Nyquist rate. It is then quantized by a quantizer that uses 64 quantization levels and is finally binary encoded by a binary encoder.
- What are the sampling rate and the sampling interval? (2 marks)
 - What is the bit rate of the resultant digital signal? (2 marks)
- b. The following three connections are time division multiplexed.
- Connection 1 bit rate 500 bits per second
 - Connection 2 bit rate 1000 bits per second
 - Connection 3 bit rate 1500 bits per second

The multiplexed signal is then transmitted on a link whereby each time slot in the transmitted frames is 6 bits long. Calculate

- i. The number of time slots in a frame (2 marks)
- ii. Bit rate of the multiplexed signal (2 marks)
- iii. The frame rate (2 marks)