ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FIRST SEMESTER EXAMINATION, 2017/2018 ACADEMIC SESSION

COURSE TITLE: COMMUNICATION PRINCIPLES

COURSE CODE: EEE 411

EXAMINATION DATE: 29th March 2018

COURSE LECTURER: Dr. O. Akinsanmi

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

(a) Draw the block diagram of a communication system, explaining the function(s) of each block. *(10 marks)*

(b) Explain the reasons why modulation is needed in communication systems. *(5 marks)*

(c) Identify the following electromagnetic spectrum classifications by their full meanings and frequency ranges. (i) MW, (ii) SW, (iii) EHF, (iv) UHF, (v) VHF *(5 marks)*

Question 2

(a) Define the term 'amplitude modulation'. *(3 marks)*

(b) Illustrate the frequency spectrum of the following modulated signals, identifying all the components of the spectrum:

    (i) AMDSB *(2 marks)*

    (ii) AMSSB *(2 marks)*

    (iii) AMDSBSC *(2 marks)*

    (iv) AMVSB *(2 marks)*

(c) A 2000 W carrier is amplitude-modulated to a modulation depth of 80%. Calculate the total power for

    (i) AMDSB *(3 marks)*

    (ii) AMDSBSC *(3 marks)*

    (iii) AMSSB *(3 marks)*

Question 3

(a) Define the following terms (i) Phase modulation, (ii) Frequency modulation. Express each of them mathematically, defining all symbols used. *(8 marks)*

(b) Write down a mathematical expression for a frequency-modulated signal, defining all symbols used. *(3 marks)*

(c) A frequency modulated signal is expressed as $v(t) = 10\sin(10^8 t + 3\sin 10^4 t)$ volts, determine the:

    (i) carrier amplitude *(1 marks)*

    (ii) carrier frequency *(1 marks)*

    (iii) modulating signal frequency *(1 marks)*

    (iv) modulation index *(1 marks)*

    (v) frequency deviation *(1 marks)*

    (vi) power dissipated in a 1 kΩ load *(2 marks)*

    (vii) narrow-band and wide-band bandwidths. *(2 marks)*

Question 4

Write briefly on each of the following transmission media:

    (a) Coaxial cable *(10 marks)*

    (b) Optical fibre cable. *(10 marks)*

Question 5

(a) Explain, with the aid of appropriate illustrations, the principle of sampling as applied in communication systems. *(11 marks)*

(b) State the Nyquist criterion with respect to sampling of signals. *(3 marks)*

(c) A message signal has a lowest frequency component of 500Hz and a highest frequency component of 1500Hz.

    (i) Choose an appropriate sampling frequency; *(2 marks)*

    (ii) Determine the corresponding sampling period; *(2 marks)*

(iii) What is the frame period? *(2 marks)*

Question 6
(a) Explain, with the aid of a well-labelled block diagram, the principle of operation of a multi-channel pulse code modulation system. *(10 marks)*

(b) Fifty (50) sinusoidal message signals, each band-limited to 0-4 kHz, are required to be transmitted using TDM-PCM. The minimum signal-to-quantisation noise ratio is 40 dB. One bit per frame is also to be transmitted for synchronisation. Determine the

(i)   minimum number of bits per sample; *(2 marks)*
(ii) number of quantization levels required; *(2 marks)*
(iii) maximum bit width; *(4 marks)*
(iv) transmission bandwidth. *(2 marks)*

Table Q5: $(SNR)_q$ for some waveforms

Waveform	$(SNR)_q$ in dB
Gaussian	$6n - 7.2$
Sinusoidal	$6n + 1.8$
Triangular	$6n + 4.8$

Question 7
(a) Explain the principle of frequency division multiplexing. *(3 marks)*
(b) Draw a schematic diagram of a frequency division multiplex system. Explain its operation. *(11 marks)*
(c) Design a frequency division multiplex system for a rural telephone exchange to accommodate 300 subscribers. *(6 marks)*