UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	: LEB 20103
COURSE NAME	: ELECTRONIC COMMUNICATION 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF MARINE ELECTRICAL ELECTRONIC
DATE	:
TIME	:
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

NOTE: Instructions below to be edited to suit the needs of the intended course/examination.

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions WITH AT LEAST ONE (1) question from question 4 or question 5.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English / Bahasa Melayu language ONLY.
7. Trigonometry table has been appended for your reference.

THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) Describe a type of a device that can transmit and received the information one at a time. Give example(s) to support your answer.

(3 marks)

(b) Discuss the relationship between frequency and wavelength with suitable diagram.

(3 marks)

(c) Draw and label the block diagram of basic communication system and describe the function of each component.

(6 marks)

(d) List four (4) basic concerns of communication system design.

(4 marks)

(e) The input current flowing through an 8 kΩ power amplifier is 5 mA. The output is 15 mA flowing through a 10 kΩ speaker. Calculate the power gain, in decibels.

(4 marks)

Question 2

(a) Differentiate between Amplitude Modulation (AM) and Frequency Modulation (FM) signals by drawing the modulated waveforms of AM and FM generated from the same information and carrier signal waveforms.

(4 marks)

(b) For an AM wave with a peak unmodulated carrier voltage has 20V with a load resistance of 20Ω. Given modulation index has 20%, determine:-

i. Power contained in the carrier and the upper and lower sidebands

ii. Total sideband power

iii. Total power of the modulated wave

(6 marks)

(c) An oscilloscope is used to monitor an output of a conventional AM modulator. The input signals of the modulator are:

$$V_1 = 20 \cos 1070k \pi t$$

$$V_2 = 5 \cos 20k \pi t$$

Produce the values as follows:

i) upper and lower side frequencies,

ii) modulation coefficient,

iii) upper and lower sideband amplitude voltages,

iv) maximum and minimum amplitudes of AM modulated wave,

v) total transmitted power using conventional AM for 75 Ω load.

(10 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) ONLY from FOUR (4) questions.

Please use the answer booklet provided

Question 3

(a) Frequency modulation has the wave equation which shows the value of the modulation index, m_f can be any value from zero to infinity. Define the terms frequency deviation and carrier swing related to frequency modulation.

(2 marks)

(b) An FM signal is given by:

$$v_{FM}(t) = 100 \cos [200 \pi \times 10^6 t + 1.5 \sin 2 \pi \times 10^3 t] V$$

Determine the:

i. number of significant sideband (n), the frequency deviation (Δf) and the carrier swing frequency (fcs),
ii. maximum and minimum frequencies,
iii. power in the FM signal that appears across a 100 Ω load,
iv. Bandwidth by using Bessel Function Table.
v. Sketch and label the frequency spectrum.

(10 marks)

(c) A carrier signal $v_c(t) = 10 \cos (2 \pi \times 90 \times 10^6)t$ frequency modulated by a modulating signal of 3 kHz with a modulating index of 1.5. The load resistance is 75 Ω. With the aid of a Bessel Function table, determine the:

i. number of sets of significant sidebands,
ii. carrier swing and the maximum frequency of the FM signal,
iii. bandwidth using the Bessel Function table
iv. the frequencies of all the significant sidebands.

(8 marks)

Question 4

(a) When a satellite lands on the orbit, it does not fall off. Discuss the reason behind this incident.

(2 marks)

(b) Satellite transponder acts like a repeater. Give four (2) main functions of a satellite transponder and draw its block diagram.

(4 marks)

(c) All satellites rotate around Earth in an orbit. Briefly describe three (3) orbital paths for communications satellites. Illustrate your answer with appropriate figure.

(6 marks)

(d) A basic telephone set is a simple analogue transceiver designed for converting speech of acoustical signals to electrical signal. With the aid of a block diagram, explain the operation of each component in a basic telephone set.

(8 marks)

Question 5

(a) An antenna radiates a signal at operating frequency of 4.75 GHz. Calculate the wavelength of electromagnetic radiation from the antenna. (Speed of Light, $c = 3 \times 10^8$ m/sec).

(3 marks)

(b) Consider the case of an antenna designed to transmit 5 GHz signals. Determine the approximate distance that can be considered to be in the far field. (Speed of light = 3×10^8 m/sec).

(3 marks)

(c) Antenna radiation pattern is a 3-D plot of its radiation far from the source. With the aid of diagram, explain briefly the following:-

i. elevation pattern and

ii. Azimuth pattern of antenna radiation.

(4 marks)

(d) List three (3) factors that determine the type, size and shape of an antenna. Hence, name and draw four (4) examples of typical antenna types.

(7 marks)

(e) Diffraction is the bending of waves around an object. Explain briefly this concept with appropriate diagram.

(3 marks)

Question 6

(a) A network is a communication system with two or more stations that can communicate with one another. There are four (4) basic types of network. List down all the networks. Hence, describe two (2) features of each network.

(6 marks)

(b) Network topology is a physical schematic for the different configurations or arrangements to show the interconnection of the users. Explain THREE (3) main operation of each topology with suitable diagram.

(6 marks)

(c) There is no single network topology that is ideal for all situations. The best choice depends on several factors. List three (3) factors which we should consider when choosing the best topology.

(3 marks)

(d) Explain briefly four (5) advantages of fiber optic cables over the conventional electric cables.

(5 marks)

End of question paper.

APPENDIX 1

Table 1: Bessel Function Table

Modulation Index	Carrier	Sideband (Pairs)															
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
0.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.25	0.98	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.5	0.94	0.24	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.0	0.77	0.44	0.11	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
1.5	0.51	0.56	0.23	0.06	0.01	-	-	-	-	-	-	-	-	-	-	-	-
2.0	0.22	0.58	0.35	0.13	0.03	-	-	-	-	-	-	-	-	-	-	-	-
2.5	-0.05	0.50	0.45	0.22	0.07	0.02	-	-	-	-	-	-	-	-	-	-	-
3.0	-0.26	0.34	0.49	0.31	0.13	0.04	0.01	-	-	-	-	-	-	-	-	-	-
4.0	-0.40	-0.07	0.36	0.43	0.28	0.13	0.05	0.02	-	-	-	-	-	-	-	-	-
5.0	-0.18	-0.33	0.05	0.36	0.39	0.26	0.13	0.05	0.02	-	-	-	-	-	-	-	-
6.0	0.15	-0.28	-0.24	0.11	0.36	0.36	0.25	0.13	0.06	0.02	-	-	-	-	-	-	-
7.0	0.30	0.00	-0.30	-0.17	0.16	0.35	0.34	0.23	0.13	0.06	0.02	-	-	-	-	-	-
8.0	0.17	0.23	-0.11	-0.29	-0.10	0.19	0.34	0.32	0.22	0.13	0.06	0.03	-	-	-	-	-
9.0	-0.09	0.24	0.14	-0.18	-0.27	-0.06	0.20	0.33	0.30	0.21	0.12	0.06	0.03	0.01	-	-	-
10.0	-0.25	0.04	0.25	0.06	-0.22	-0.23	-0.01	0.22	0.31	0.29	0.20	0.12	0.06	0.03	0.01	-	-
12.0	-0.05	-0.22	-0.08	0.20	0.18	-0.07	-0.24	-0.17	0.05	0.23	0.30	0.27	0.30	0.12	0.07	0.03	0.01
15.0	-0.01	0.21	0.04	0.19	-0.12	0.13	0.21	0.03	-0.17	-0.22	-0.09	0.10	0.24	0.28	0.25	0.18	0.12