INTI
INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	April 2014
Programme	:	DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING
Course	:	**EEE2107: Introduction to Communication**
Date of Examination	:	23 JULY 2014
Time	:	2.00pm- 4.00pm Reading Time : Nil
Duration	:	2 hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non Programmable Scientific Calculator

Materials provided :

NIL

Examiner(s) : **V.Meenakshi Sundaram.**

Moderator : **Dr.Mandeep Singh**

This paper consists of 6 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEE)

EEE2107: INTRODUCTION TO COMMUNICATION
FINAL EXAMINATION: APRIL 2014 SESSION

Instructions: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1:

a) Explain in detail about time division multiplexing (TDM) with a sketch to show a 6-channel TDM system that includes the transmitter and receiver ends.

(8 marks)

b) The Fourier series for a voltage waveform is:

$$v(t) = \frac{1}{\pi} + \frac{1}{2}\cos\omega_o t - \frac{2}{3}\left[\frac{\sin 2\omega_o t}{3} + \frac{\sin 4\omega_o t}{5} + \frac{\sin 6\omega_o t}{7} + ...\right]$$

i) Draw the spectrum (magnitude and phase). Shows all the steps used to derive the answers.

(8 marks)

ii) Find the value of direct current component.

(2 marks)

iii) Calculate the rms value of the 2^{nd} , 4^{th} and 6^{th} harmonics.

(3 marks)

c) N signal coded into 8 bit Pulse Code Modulation are time division multiplexed into one channel. Determine the minimum transmission bandwidth needed for N = 24 and N = 32 if each signal is a standard voice signal of 4 kHz.

(4 marks)

Question 2:

a) A TDM system uses sample duration of 20μs and a sampling frequency of 11 kHz. What could be the maximum number of messages sent on a single transmission channel?

(5 marks)

b) Why is a telephone channel normally sampled at a rate of 8000 samples per second? What are the disadvantages if the sampling frequency is higher or lower than that?

(6 marks)

c) A digital television system has a source analogue video signal with bandwidth extending from 0 Hz to 2 MHz. This signal is sampled at four times the highest frequency using a 16-bit A/D converter. The resulting data signal is sent over the air using a 16-QAM modulation format. What is the bandwidth occupied by the transmitted digital video signal?

(8 marks)

d) What is the minimum bandwidth required to support a 256 kbps data stream using:

i) BPSK

(2 marks)

ii) QPSK

(2 marks)

iii) 64 QAM.

(2 marks)

Question 3:

a) Give the main relative advantages and disadvantages of Amplitude Shift Keying, Phase Shift Keying and Frequency Shift Keying modulation.

(6 marks)

b) Why is synchronization very important in time division multiplexing?

(2 marks)

c) A 1000 MHz carrier is frequency-modulated by a 10V 10 kHz sinusoidal voltage using a linear modulator. The instantaneous carrier frequency varies between 99.95 and 100.05 MHz.
Calculate the:-

i) Sensitivity of the modulator.

(2 marks)

ii) Modulation index

(2 marks)

iii) Peak phase deviation of the carrier.

(2 marks)

d) Determine the system noise temperature (T_{sys}) of a satellite receiver station in order to maintain a constant figure of merit equal to 40.7dB with a receiver antenna gain of 55dB.

(7 marks)

e) A network has a capacity of 1000 frames per second and the input to the network is 500 frames per second. If it is assumed that 1% of all transmitted frames are lost and must be repeated, find the network utilization.

(4 marks)

Question 4:

(a) Define the following terms

(i) Random signal

(ii) Even signal (2 marks)

(iii) Multiplexing. (2 marks)

(iv) Aperiodic signal. (2 marks)

(v) Periodic Signals. (2 marks)

(2 marks)

(b) An FM signal expressed as $V(t) = 50Cos(2\pi 10^7 t + 0.5Cos2\pi 10^4 t)$ is measured across a 50 antenna. Determine the following

(i) Total antenna power

(ii) Modulation Index (shows the steps to derive it) (2 marks)

(iii) Peak frequency deviation (3 marks)

(iv) Bandwidth based on Carson's rule (1 marks)

(v) Power of the first side band at the antenna (2 marks)

(vi) Sum of all side band power at the antenna. (2 marks)

(5 marks)

Question 5:

a) The non-modulated carrier wave of a FM signal can be represented by $Vc(t) = 10Cos(2\pi 10^6 t)$ This carrier wave is modulated with a signal $Vm(t) = 2Cos(2\pi 10^4 t)$ resulting in a FM signal with modulation index of 2.

(i) What is the Carson's bandwidth requirement for the modulated signal?

(ii) Show the spectrum (magnitude and phase) of the modulated signal. (2 marks)

(iii) Calculate the combined power of the carrier and all the sideband (within the Carson's bandwidth) of the modulated signal. (6 marks)

(4marks)

b) Explain in detail about Double Side Band Amplitude Modulation and prove mathematically that the amplitude modulated signals consists of three different frequency components.

(10 marks)

c) Define ISI?

(3 marks)

Question 6:

a) Explain about Delta modulation also describe the two noises involved in Delta Modulation.

(6 marks)

b) Draw the block diagram of the PCM system and explain how it works?

(7 marks)

c) A receiver has an input power of 42.2 mW while the noise power is 33.3μW.Find the signal to noise ratio for the receiver.

(4 marks)

d) Suppose the signal to noise ratio at the input of an amplifier is 25dB and its NF is 10dB.Find the signal to noise ratio at the amplifier output.

(4 marks)

e) A modem transmits using an eight-level signaling technique. If **each** signaling element has a duration of 0.8333ms, determine

i) the baud rate

(2 marks)

ii) the bit rate

(2 marks)

--THE END--

Bessel Function Table

Bessel Functions $J_n(\beta)$ shown to 4 decimal places.

β	$J_0(\beta)$	$J_1(\beta)$	$J_2(\beta)$	$J_3(\beta)$	$J_4(\beta)$	$J_5(\beta)$	$J_6(\beta)$	$J_7(\beta)$	$J_8(\beta)$	$J_9(\beta)$	$J_{10}(\beta)$	
0.1	0.9975	0.0499	0.0012									
0.2	0.9900	0.0995	0.0050	0.0002								
0.4	0.9604	0.1960	0.0197	0.0013	0.0001							
0.6	0.9120	0.2867	0.0437	0.0044	0.0003							
1.0	0.7652	0.4401	0.1149	0.0196	0.0025	0.0002						
1.5	0.5118	0.5579	0.2321	0.0610	0.0118	0.0018	0.0002					
2.0	0.2239	0.5767	0.3528	0.1289	0.0340	0.0070	0.0012	0.0002				
3.0	-0.2601	0.3391	0.4861	0.3091	0.1320	0.0430	0.0114	0.0025	0.0005	0.0001		
4.0	-0.3971	-0.0660	0.3641	0.4302	0.2811	0.1321	0.0491	0.0152	0.0040	0.0009	0.0002	
5.0	-0.1776	-0.3276	0.0466	0.3648	0.3912	0.2611	0.1310	0.0534	0.0184	0.0055	0.0015	
6.0	0.1506	-0.2767	-0.2429	0.1148	0.3576	0.3621	0.2458	0.1296	0.0565	0.0212	0.0070	
7.0	0.3001	-0.0047	-0.3014	-0.1676	0.1578	0.3479	0.3392	0.2336	0.1280	0.0589	0.0235	
8.0	0.1717	0.2346	-0.1130	-0.2911	-0.1054	0.1858	0.3376	0.3206	0.2235	0.1263	0.0608	
9.0	-0.0903	0.2453	0.1448	-0.1809	-0.2655	-0.0550	0.2043	0.3275	0.3051	0.2149	0.1247	
10.0	-0.2459	0.0435	0.2546	0.0584	-0.2196	-0.2341	-0.0145	0.2167	0.3179	0.2919	0.2075	