INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session : **August 2015**

Programme : Diploma in Electrical and Electronic Engineering (DEEI)

Course : **EEE2111: Telecommunication Systems**

Date of Examination : 8th December 2015 (Tuesday)

Time : 11:00am – 1:00pm

Duration : 2 Hours Reading Time : Nil

Special Instructions :

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

IMPORTANT NOTE : THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL

Materials Permitted :

Nil

Materials Provided :

Nil

Examiner(s) : **Mr. Meenakshi Sundaram Vellaichamy**

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 (DEEI)

EEE2111: TELECOMMUNICATION SYSTEMS
FINAL EXAMINATION: AUGUST 2015 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) i) What do you understand by the term, fading? ii) Why does it occur?
(6 marks)

b) A Frequency Modulated signal expressed as $V(t) = 50Cos(2\pi 10^7 t + 0.5Cos2\pi 10^4 t)$ is measured across a 50 Ω antenna. Calculate the following:

(i) Total antenna power in Watts
(2 marks)

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

(iii) Peak frequency deviation
(1 marks)

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

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

(vi) Sum of all side band power at the antenna in Watts.
(3 marks)

c) A Time Division Multiplexing (TDM) system uses sample duration of 20 μs and a sampling frequency of 11 kHz. Calculate the maximum number of messages sent on a single transmission channel?
(6 marks)

Question 2:

a) Define single tone and multi tone modulation and what are the differences between these tones?
(6 marks)

b) Define the following terms

i) isotropic source
(2 marks)

ii) isotropic medium
(2 marks)

c) Name the following type of wave.

This wave suitable for low and medium frequencies and it progress long the surface of the earth. Normally use for ship communication.

(2 marks)

d) List one main advantages of Delta Modulation over Pulse Code Modulation. Name and describe the two type of quantization error effecting Delta Modulation. How to remove these two types of quantization error?

(9 marks)

e) If at 20 km in free space from an isotropic source the power density is 200 mW/m^2, calculate the power density if it is at 100 km away from the isotropic source?

(4 marks)

Question 3:

a) A digital television system has a source analogue video signal with a 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. Calculate the bandwidth occupied by the transmitted digital video signal?

(8 marks)

b) An amplitude modulated signal, $V(t) = 10\left(1 + 0.5\cos 4\pi 10^3 t\right)\cos 2\pi 10^5 t$
Calculate the:-

(i) Different frequency components in the signal.

(3 marks)

(ii) Modulation Index

(2 marks)

(iii) Bandwidth, Hz

(1 mark)

(iv) Total power when measured at a 50 Ω resistor, W

(2 marks)

c) An antenna has a loss resistance of 8ohms, a power gain of 20 and directivity of 28.Calculate its efficiency and radiation resistance.

(6 marks)

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

(3 marks)

Question 4:

(a) An analogue signal, band limited to a standard voice frequency (telephone) channel, is sampled at the usual rate and coded into 8 bit samples.

i) How many sample height levels are there?

(1 mark)

ii) What is the quantization interval, for a 10 V range?

(1 mark)

iii) How can negative signals be taken into account?

(1 mark)

iv) What bandwidth is required for coded samples?

(2 marks)

v) It is generally thought better to send a PCM signal rather than just a sampled (PAM) one. Give reasons.

(3 marks)

vi) If 4 bits are used to represent each sample (instead of 8 bits/sample), what will be the disadvantages?

(2 marks)

vii) If 12 bits are used to represent each sample (instead of 8 bits/sample), what will be the disadvantages?

(2 marks)

(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) Describe the ground wave propagation method in brief and explain its application.

(3 marks)

Question 5:

a) Define the following terms by giving examples for each one

(i) Free Space.

(2 marks)

(ii) Attenuation.

(2 marks)

(iii) Deterministic Signals.

(2 marks)

(iv) Aperiodic signal.

(2 marks)

(v) Periodic Signals.

(2 marks)

b) A modem is using phase shift keying (PSK) technique in signal transmission.
   i) Identify the PSK type and calculate the bandwidth if the modem is transmitting with 9600 bps and 2400 baud.
   ii) Suggest a way to reduce the baud rate to 1200 baud and calculate the new bandwidth.

(8 marks)

c) If an audio signal with a 12 kHz bandwidth using Double Side Band Amplitude Modulation is transmitted within a 1.2 MHz bandwidth, how many channels can be accommodated in the transmission, allowing for a 25% guard band?

(7 marks)

Question 6:

a) Define polarization of electromagnetic wave and how to receive the maximum tramitted signal

(5 marks)

b) Draw and explain the architecture of a super heterodyne receiver and explain how this can overcome the limitations of Tuned Radio Frequency receivers.

(12 marks)

c) Explain why the maximum radiation for a $\lambda/2$ dipole in the direction at right angles to the antenna?

(3 marks)

d) Discuss about any three environmental factors that can affect the transmission and reception of wave in electronic communication.

(5 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	

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