FIJI NATIONAL UNIVERSITY
College of Engineering, Science & Technology

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

EEE504 – ELECTRONIC COMMUNICATIONS SYSTEM.

FINAL EXAMINATION - SEMESTER I - 2013.

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes **EXTRA** as reading time during which you are **NOT** to write.
2. Begin each answer on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each attached sheet.
4. Insert all written foolscap, graph paper, drawing paper, etc. in their correct sequence and secure well.
5. For all sheets of paper on which rough/draft work has been done, cross it through and attach to your answer scripts.
6. Show all workings where necessary
7. Diagrams and graphs can be drawn in pencil.
8. Non- programmable calculators are allowed.
9. Attempt all questions ie; Sections A B, C, D & E
10. Check your work before you leave the room!!

Section A: TRUE or FALSE **(12 marks)**

Attempt all questions in this section and write down your answers, either true or false in your answer sheet provided.

1. All electronic communication systems consist of three basic components; a transmitter, a communication channel (medium) and a receiver.

2. Multiplexing is the process of allowing more than two signals to share the same medium or channel.

3. Receivers are made up of collection of components and circuits such as local oscillators, amplifiers, frequency mixer, modulators and other circuits.

4. In a cellular telephone system, each cell is connected by telephone lines or a microwave radio relay link to a master control center known as the Mobile telephone switching office.

5. In Frequency Modulation (FM), the instantaneous value of the carrier frequency changes in accordance with the amplitude variations of the modulating signal.

6. The amplitude of the Carrier signal remains constant during Amplitude Modulation (AM).

7. Frequency synthesizers are variable frequency generators using a phase lock loop that provide the frequency stability of a crystal oscillator and the convenience of incremental tuning over a broad frequency range.

8. The output of the mixer in the receiver is the IF which has low amplification stages because the frequency is low.

9. The squelch circuits is adjusted to keep the audio amplifier turned on during the time the noise is received

10. Yagi antennas are made up of a driven element and one or more parasitic elements.

11. When a transmitter is connected to an antenna, a voltage creates a magnetic field and the current creates an electrical field.

12. The satellite frequency range for C-Band is from 2 to 6GHZ.

Section B SHORT ANSWERS **(14 marks)**

No	Questions	Answers
1.	What is the Frequency range of the "UHF Band" in the frequency spectrum	
2.	List the two main sources of external noise in the receiver.	
3.	What are the two common ways of transferring information (commun ication) in the ancient days before telephony?	
4.	Calculate the Noise Ratio and Noise Figure of a transistor amplifier which has a S/N power of 30 at its input and 6 at its output.	
5.	A TV signal occupies 7MHZ bandwidth. If the high frequency limit of channel 2 is 70MHZ, what is the upper frequency limit?	
6.	Determine the modulating index (m) of an AM signal when Vmax. is 6.3(p –p) and Vmin. is 2.4(p – p)?	
7.	Give two reasons why the IF stage of a receiver has more amplifications than the RF stage.	
8.	Express the sampling rate in PCM system (in terms of frequency)	
9.	In FM, how does the Carrier signal vary or deviate in frequency?	
10.	In radio receivers, what is the relationship of the Image Frequency to IF frequencies and the desired signal f_s.	
11.	What is the name of the circuit that blocks the audio until a signal is received?	
12.	Calculate the wavelength of a 30MHz signal? (Velocity of light is 3×10^8)	
13.	The coverage of a cell in mobile communication depends on what criteria?	
14.	List two major applications of satellite system?	

Instruction: *Please answer in the "Answer" space provided and submit for marking.*

SECTION C - MATCHING **(10 marks)**

Instruction:
Beside each question number write the corresponding alphabet that represents your answer:

1	A circuit in the receiver module.	A	Handoff
2	A technique used to transmit data from multiple users over the same data channel	B	Consume high power but does not have any information or signal.
3	A method of converting information from an analogue form to a digital form.	C	Easy and flexible to change frequency
4	Sampling rate for audio (speech) signal	D	Time division multiple access (TDMA)
5	Frequency Modulation	E	Intelligence signal
6	The Carrier frequency in AM	F	890 – 960MHz.
7	Frequency synthesizer	G	Detector
8	Output of a demodulator circuit	H	Pulse code modulation (PCM)
9	The process of switching a mobile user from one cell to another cell.	I	8KHz
10	Frequency range commonly used for Mobile Communication.	J	More tolerance to noise
		K	Modulator

SECTION D **Theory & Explanation** **(24 marks)**

1. A Communication receiver consists of various components and circuits and one of its primary roles is to have the sensitivity and selectivity to fully reproduce the modulating signal at its output.

   i) Draw a block diagram of a typical Superheterodyne receiver and label all components; and
   ii) Discuss the intermediate frequency (IF) stage and its requirement.

   Block diagram & labeling – (4 marks)
   Discussion - (4 marks)

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2. a) A Communication Transmitter is an electronic device that accepts the information signal to be transmitted and convert it into an RF signal capable of being transmitted over a long distance.

   i) List down and discuss the four (4) basic function of a transmitter (2 marks)

   ii) Draw the block diagram of a transmitter module, label them and discuss their function. (3 marks)

b) List down six advantages offered by Cellular Mobile system over conventional radio telephony (3 marks)

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3. Figure 1 below shows a Diode detector circuit which is commonly used to recover the original modulating information in Amplitude modulation (AM).

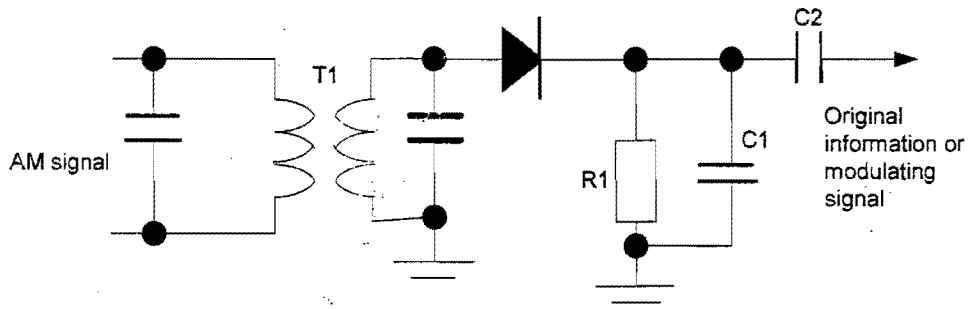

Fig.1 – Diode detector

i) Discuss the operation of the diode detector; (5 marks)

ii) Show and prove that the signal out of the detector is the original modulating information? (3 marks)

Section E **Calculation** **(40 marks)**

Question 1. **(14 marks)**

A receiver with a 75ohms input resistance operates at a temperature of 29°C. The receiver signal is at 86MHz with a bandwidth of 4MHz. The received signal voltage of 8.5μV is applied to an amplifier with a noise figure of 2.8dB.

Find the following:

i) The input noise power; (3marks)
ii) The input signal power; (2 marks)
iii) S/N in dB; (3 marks)
iv) The noise factor & S/N of the amplifier; (4 marks)
v) The noise temperature of the amplifier. (2 marks)

Question 2.

a) A 2.0 MHz RF carrier signal is modulated with a 5 KHz sine wave signal. The modulated carrier voltage is 25 V maximum and 6V minimum across 50 ohms resistive load impedance.

(8 marks)

Determine the following:

i) The RF Carrier voltage without modulation;
ii) The modulation index;
iii) The Carrier power;
iv) The sideband power;
v) Total power;
vi) Sideband frequencies;
vii) Bandwidth

b) An antenna has a gain of 16dB. It is fed by an RG-8/U transmission line 200m long whose attenuation is 3.6dB/50m at 30MHz. The transmitter output is 100W.

Calculate the following:

i) The transmission line loss; and (2 marks)
ii) The effective radiated power (2 marks)
iii) The antenna length for maximum radiation (2 marks)

[6 marks]

Question 3

a)

i) Draw and label a block diagram of a satellite transponder and briefly explain its operation.

ii) Determine the transmit frequency of a C-band transponder if its receiver is on channel 12. The uplink frequency of channel 12 is 6160MHz. Assume Local Oscillator for transponder to be 2GHz.

iii) If one of the transponders is used for binary transmission, determine the maximum theoretical data rate it can handle. (Bandwidth of one transponder channel is 36MHz)

[6 marks]

b). An FM signal was deviated to 30 KHz with a maximum modulating signal of 5 KHz.

Determine the maximum bandwidth using:

i) The Bessel Function table (see attached)
ii) Carson's rule.

[6 marks]

THE END

Bessel Function Table

Modulation Index	Carrier	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	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			
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	0.01		
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	0.20	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	0.25	0.18	0.12

Fig 1