FIJI NATIONAL UNIVERSITY
College of Engineering, Science & Technology

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

EEE504 – ELECTRONIC COMMUNICATIONS SYSTEM.

FINAL EXAMINATION - SEMESTER I - 2014.

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, antenna system and a receiver.

2. Modulation is the process of allowing 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, detector and audio circuits.

4. In a cellular telephone system, the Mobile telephone switching office (MTSO) controls all the cells and provides interface between each cell and the main telephone office.

5. In Amplitude Modulation (AM), the instantaneous value of the Carrier Frequency changes in accordance with the amplitude variations of the modulating signal.

6. The squelch circuit is used to keep the audio turned on until carrier appears at the receiver input.

7. Frequency synthesizers usually provide an output signal that varies in fixed frequency increment over a wide range.

8. In an FM transmitter, a stable crystal oscillator is used to generate the carrier signal and buffer amplifier alongside it to isolate it from the rest of the circuit.

9. After the frequency multiplier stages of FM transmitters, a class C amplifier is used to increase the power level sufficient to operate the final power amplifier.

10. The electrical and magnetic fields of an active antenna are at right angle to one another and propagate through space over a distance.

11. Internal noise, are often too low to interfere with weak signals.

12. The satellite frequency range for Ku-Band is from 10 to 15GHz.

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

No	Question	Answer
1.	What is the Frequency range of the "HF Band" in the frequency spectrum	
2.	List the two main sources of internal noise in the receiver.	
3.	What are the two common ways of transferring information (commun ication) in the ancient days before telephony?	
4.	Explain how a single sideband (SSB) is derived and the reason why it is preferred way of transmission in AM?	
5.	An Am transmitter has a carrier power of 30W. The percentage modulation is 85%. Calculate the power in one sideband?	
6.	Determine the modulating index (m) of an FM signal when the audio signal of 0.3 – 5KHz deviates the carrier by 75kHz?	
7.	Give two reasons why the RF stage of a receiver has less amplifications than the IF stage.	
8.	Express the sampling rate in PCM system (in terms of frequency)	
9.	In AM, what property of the input signal varies the Carrier signal?	
10.	In radio receivers, what is the relationship of the Image Frequency to IF frequencies and the desired signal $f_{s.}$	
11.	Explain the function of AGC circuit in the receiver?	
12.	Calculate the length of an antenna if the carrier is 300MHz?	
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 transmitter module.	A	A half-wave dipole
2	TDMA	B	The desired range of frequencies in the second sideband are kept and used.
3	A method of converting analogue signal to digital format.	C	Detector
4	Sampling rate for input signal of 5- 10KHz	D	Allows several users to share the same channel by dividing the signals into timeslots
5	Quantizing	E	Intermediate frequency
6	The Vestigial Sideband in AM	F	Pulse code modulation (PCM)
7	Frequency synthesizer	G	Modulator
8	Output of a mixer circuit	H	ITU_T standard represented by straight line segment.
9	A most widely used antenna type	I	20KHz
10	A-Law companding	J	Represent the sampled value of the amplitude by a finite set of levels.
		K	Easy and flexible to change frequency

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 and label a block diagram of a Tuned Radio Frequency (TRF) receiver; and

   II. Discuss the reasons TRF receivers are not suitable for commercial use as compared to superheterodyne receiver

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

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2. 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 (4 marks)

   II. Draw the block diagram of a Frequency Synthesizer using Phase Lock Loop, label them and discuss its operation. (4 marks)

3.

   I. In your own words explain the meaning of "Noise" and the reason why noise is important to a telecommunication Engineer. (2 marks)

   II. Discuss the 3 main causes of external noise that a telecom engineer should be mindful of and how he or she can get the signal despite the existence of noise. (6 marks)

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

Question 1. (14 marks)

You are the Senior Engineer Radio Planning for TFL, and you required to constructing an antenna for a dual channel radio link that will provide communication between a resort on Beqa island and the repeater station at Dogowale in Serua.

a) Design a Yagi antenna to operate on 300MHz frequency and to have a reflector and two directors. (8 marks)

b) The antenna in a) above has a gain of 15dB. It is fed by an RG-8/U transmission line 250m long with attenuation of 1.6dB/50m. The transmitter output power is 60W.

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)

Question 2. [14 marks]

A 25.0 MHz RF carrier signal is modulated with a 5 KHz sine wave signal. The modulated carrier voltage is 25 V maximum and 8V minimum across 50 ohms resistive load impedance.

Determine the following:

i) The modulating signal voltage;
ii) The modulation index;
iii) The Carrier power;
iv) The sideband power;
v) Total power;
vi) Sideband frequencies;
vii) Bandwidth

Question 3

a)

i) Draw and label a block diagram of a Single Side Band (SSB) transmitter and briefly explain its operation. (Note that the single side band is generated by using filters).

ii) The SSB transmitter in i) above operates at a frequency of 4.2 MHz and is modulated by voice frequency of 300 to 3400Hz. Calculate the upper and lower sideband ranges?

iii) What should be the approximate centre frequency of the band-pass filter to select the lower sideband (LSB)

[6 marks]

b). An FM broadcast signal has the deviation of 100 KHz and a maximum modulating signal of 20 KHz.

Determine the maximum bandwidth using:

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

THE END **[6 marks]**