



**FIJI NATIONAL UNIVERSITY**

**College of Engineering, Science & Technology**

**CERTIFICATE IV IN ELECTRICAL & ELECTRONIC ENGINEERING**

**EEC460 – ELECTRONIC COMMUNICATIONS SYSTEM 2**

**FINAL EXAMINATION – QUARTER 3 - 2019.**

**DURATION: 2 HRS**

**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. **Answer ALL the questions in every Section.**
  10. Check your work before you leave the room!!
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**SECTION A****MULTIPLE CHOICE****[10 MARKS]**

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

1. The life expectancy of a satellite is:
  - A. 5 years
  - B. 8 years
  - C. 15 years
  - D. 20 years.
  
2. What element of a yagi antenna is connected to the transmission line?
  - A. Director
  - B. Dipole
  - C. Reflector
  - D. Boom
  
3. In PCM, what is the first process that is done to the signal?
  - A. Sampling
  - B. Quantizing
  - C. Filtering
  - D. Coding
  
4. Which statement best describes the term "multiplexing"?
  - A. One output and several outputs
  - B. Several inputs and one output
  - C. Several outputs and inputs
  - D. One output and one input
  
5. The sampling rate for signal 4 KHz – 19 KHz bandwidth is:
  - A. 48 KHz
  - B. 64 KHz
  - C. 38 KHz
  - D. 96 KHz

6. Advantage of optical fiber is:
- A. Light in weight
  - B. Highly skilled staff would be required for maintenance
  - C. Very difficult to tap into the optical fiber to read the data signals
  - D. A and C above
7. In a 8 level PCM code, each decimal number is represented by a series of:
- A. 3 binary digits
  - B. 4 binary digits
  - C. 5 binary digits
  - D. 6 binary digits
8. Which term applies to the highest point of the satellite while orbiting earth?
- A. Apogee
  - B. Perigee
  - C. Ascending node
  - D. Inclination
9. In cellular communication, a coverage area is called a cell and is represented by:
- A. A hexagon
  - B. A triangle
  - C. A square
  - D. A circle
10. Which statement best describes "a cell site" in mobile communication?
- A. The spot where the base station and antennas are located.
  - B. The area a base station covers.
  - C. The area of wide coverage.
  - D. None of the above.

**SECTION B**

## SHORT ANSWERS

**(2 marks each)**

No	Question	Answer
1.	What is the Frequency range of the "EHF Band" in the frequency spectrum	
2.	Explain the function of a "transponder" as referred to satellite communication?	
3.	With aid of diagram, draw a basic construction of a fiber optic cable.	
4.	Explain the difference between digital modulation and analog modulation?	
5.	A sound broadcast channel occupies 200KHz bandwidth. If the center frequency of the channel is 102.6MHz, what is the lower frequency of the channel?	
6.	List two major applications of satellite system?	
7.	What does the term "modulation" mean to you?	
8.	What is the difference between "Bit Rate" and "Baud Rate"	
9.	Calculate the wavelength of an antenna operating at 30MHz signal? (Velocity of light is $3 \times 10^8$ -m/s)	
10.	Why is "Multiplexing" so important in the telecommunication sector?	
11.	What are the two main differences between Frequency division multiplexing and Time division multiplexing?	
12.	State three advantages of fiber optics.	
13.	Explain the term "handoff" in cellular communication?	
14.	How long does it take for a geo-synchronous satellite to orbit the Earth?	
15.	What is the difference between a modulating signal and a Carrier signal?	

**[Total: 30 Marks]**

**SECTION C****[10 MARKS]**

The ITU Radio Frequency Spectrum Band.

Below is the ITU-R Frequency Spectrum that is used by all ITU member countries.  
Fill-in the gaps that are not listed in the chart below. **(1 mark each)**

<b>NAME</b>	<b>FREQUENCY</b>	<b>APPLICATION</b>
Extremely Low Frequencies <b>(ELF)</b>	30-300 Hz	Power Line frequencies
Voice Frequency <b>(VF)</b>		
Very Low Frequency <b>(VLF)</b>	3 – 30 KHz	Navy - Submarine communication
Low Frequencies <b>(LF)</b>	30 – 300 KHz	Navigation, AM longwave broadcasting
Medium Frequencies <b>(MF)</b>		AM (Medium) broadcasting
High Frequencies <b>(HF)</b>		Shortwave Broadcast, Amateur Radio, Over-horizon aviation ...
Very High Frequency <b>(VHF)</b>		
Ultra High Frequencies <b>(UHF)</b>		TV, Microwave oven ,mobile phone, wireless LAN, Bluetooth
	3 – 30 GHz	
Extremely High Frequencies <b>(EHF)</b>		

**SECTION D****Explanation & Calculations****[50 MARKS]****[10 marks]**

- 1) a). Discuss the term "Carrier Signal" in terms of frequency and its function?  
**(2 marks)**
- b). With the aid of diagrams, show how Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) and Phase Shift Keying (PSK) can be processed from an eleven bit signal, for example 00110100010.  
**(8 marks)**

**[10 marks]**

- 2) a) Draw a simple Optical Fiber Communication System and label all components.  
**(4 marks)**
- b) What are the 2 light sources that are used in optical fiber system and where are placed in the system?  
**(2 marks)**
- c) What is an antenna and explain its function?  
**(2 marks)**
- d) FBC has been assigned a VHF frequency of 102.6MHz to broadcast one i-taukei program in the Central Eastern Division. What would be the wavelength of the antenna? Note that the speed of light is 300,000Km/sec.  
**(2 marks)**

**[10 marks]**

- 3) Given the voice frequency of 0.3 – 4 KHz,
- a) Calculate the bit rate for one (1) timeslot assuming 8 bit per character?  
**(4 marks)**
- b) Derive the lowest hierarchy of TDM signal for one E1 Carrier (Note E1 has 32 timeslots)  
**(4 marks)**
- c) In the E1 switch, 2 timeslots are not used for data channels, explain what their functions are?  
**(2 marks)**

**[10 marks]**

4) a) The evolution of cellular service are classified in "generations". Explain the types of services that are utilized in 1G up to 4G (1<sup>st</sup> generation to the 4<sup>th</sup> generation)

**(5 marks)**

b) Frequency spectrum are scarce resources of a Nation and they are finite. In your own words explain how a Service Provider like Vodafone makes it possible for thousands of people to talk to other people simultaneously using the same limited spectrum? **(5 marks)**

**[10 marks]**

5) a) Draw a block diagram of a satellite transponder and discuss the function of each block. Assume the transponder operates on C band. **(4 marks)**

b) Most communication satellite in use today use geo-synchronous orbit. Explain the advantages of using this orbit to other orbits? **(4 marks)**

c) Compare and explain a satellite link to a terrestrial microwave link. **(2 marks)**

-----**The End**-----