



CERTIFICATE IV IN ELECTRICAL & ELECTRONIC ENGINEERING

EEE420 – ELECTRONIC COMMUNICATIONS SYSTEM 2

FINAL EXAMINATION – PENSTER 4 - 2017.

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!!**

SECTION A**MULTIPLE CHOICE****[10 MARKS]**

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

1. In satellite communication, the term "polar orbit" means:
 - A. Satellite passing over the East and West
 - B. Satellite passing over the North and East
 - C. Satellite passing North and West
 - D. Satellite passing South-West and North-East

2. What element of a directional yagi antenna is placed at the back?
 - A. Dipole
 - B. Director
 - C. Reflector
 - D. Boom

3. In PCM, name the stage after filtering.
 - A. Filtering
 - B. Sampling
 - C. Holding
 - D. Coding

4. Which statement best describes the term "multiplexing"?
 - A. One input and several outputs
 - B. Several inputs and one output
 - C. Several inputs and outputs
 - D. One input and one output

5. The sampling rate for bandwidth 1 – 12 KHz signal is:
 - A. 12 KHz
 - B. 32 KHz
 - C. 24 KHz
 - D. 10 KHz

6. Disadvantage 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 16 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. A cellular communication "microcell" provides coverage for:
- A. Remote areas.
 - B. Fast moving mobiles like those in vehicles
 - C. Small area (a half mile in diameter) and are used in urban zones.
 - D. Large capacity in an area like a national stadium.
9. In cellular communication, geographical area coverage is called a cell and is represented by:
- A. A circle
 - B. A triangle
 - C. A square
 - D. A hexagon
10. Geo-stationary satellites are situated about:
- A. 360,000 miles above the Equator
 - B. 360,000Km above the Equator
 - C. 36,000Km above the Earth
 - D. 36,000Km above the Equator

SECTION B

SHORT ANSWERS

**[30 marks]
(2 marks EACH)**

No	Question	Answer
1.	What is the Frequency range of the "Audio Frequency"?	
2.	Explain the use of a "Transponder" in a Satellite system?	
3.	List down one advantage and one disadvantage of a Geo-Stationary Satellite.	
4.	Explain the term "Macrocell" as used in Cellular network?	
5.	A sound broadcast signal occupies 200KHz bandwidth. If the Centre of the Carrier frequency is 96 MHz, what is the high frequency limit?	
6.	List two major applications of satellite system?	
7.	Explain the term "frequency reuse" as used in cellular system.	
8.	What is the sampling rate (frequency) of a PCM system with frequency signal band of 5KHz – 32 KHz.	
9.	Calculate the effective length of an antenna for best transmission at 300MHz signal? (Velocity of light is 3×10^8 m/s)	
10.	Explain the term "Multiplexing" as used in Communication systems?	
11.	What are the two main differences between Frequency division multiplexing and Time division multiplexing?	
12.	State three advantages of fibre optics.	
13.	State two characteristics of laser diodes and photo diodes.	
14.	Explain the difference between a digital signal and an analog signal.	
15.	Draw a directional Yagi antenna diagram and name all the elements.	

SECTION C:

[10 MARKS]

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)**

NAME	FREQUENCY	λ Range	APPLICATION
Extremely Low Frequencies (ELF)		$10^7 - 10^6$ m	Power Line frequencies
Voice Frequency (VF)		10 – 10 m	Voice signal
Very Low Frequency (VLF)	3 – 30 KHz	$10^5 - 10^4$ m	Navy - Submarine communication
Low Frequencies (LF)	30 – 300 KHz	$10^4 - 10^3$ m	Navigation, AM long-wave broadcasting
Medium Frequencies (MF)		$10^3 - 10^2$ m	
High Frequencies (HF)	3 – 30 MHz	$10^2 - 10^1$ m	Shortwave Broadcast, Amateur Radio, Over-horizon aviation ...
Very High Frequencies (VHF)	30 – 300MHz	10 – 1 m	
Ultra High Frequencies (UHF)			
Super High Frequencies (SHF)		$10^{-1} - 10^{-2}$ m	
Extremely High Frequencies (EHF)	30 – 300GHz	$10^{-2} - 10^{-3}$ m	Radio astronomy, high speed μ wave radio relay

SECTION D

Explanation & Calculations

[50 MARKS]

- 1) a) In aid of diagrams, illustrate and explain how the 3 types of multiplexing can be used to access the limited spectrum (FDMA, TDMA & CDMA) **[15 marks]**
(6 marks)
- b) Explain the following terms as used in Satellite systems:
• Tracking
• Station Keeping
• Geostationary Orbit
• Transponder **(4 marks)**
- c) Draw a block diagram of a TRANSPONDER in a satellite system and explain its operation. **(3 marks)**
- d) In your own words, compare a satellite link to a terrestrial microwave link. **(2 marks)**
- 2) a) With the aid of diagrams, discuss how the following types of modulation can be derived from an analog signal? **[15 marks]**
i) Pulse amplitude
ii) Pulse width
iii) Pulse Position **(6 marks)**
- b) Explain the 4 processes involved in Pulse Code Modulation (PCM) and the main reason for doing these processes. **(2 marks)**
- c) What is the minimum sampling rate that should be taken in order to recover the original analog signal? Express your answer in mathematical form. **(3 marks)**
- d) Given the signal frequency of 0.3 – 4 KHz,
• Calculate the bit rate for one (1) timeslot assuming 8 bit per sample.
• Derive the lowest hierarchy of TDM signal of one E1 Carrier (Note E1 has 32 timeslots) **(4 marks)**

3). a) What are the 4 key components that make up a Cellular Radio System?
(4 marks)

b) In your own words explain the terms "cell" and "cell site".
(1 marks)

c) What are the criteria that determine the area a cell could cover?
(2 marks)

d) Explain the following terms as used in Cellular Network: macrocell, picocell, hand-off.
(3 marks)

[10 marks]

4) 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) Explain the function of the detector in the receiver and indicate what these components are?
(2 marks)

d) Explain the difference between a single mode and multi-mode fiber
(2 marks)

[10 marks]

-----The End-----

