



THE PNG UNIVERSITY OF TECHNOLOGY

**DEPARTMENT OF ELECTRICAL & COMMUNICATIONS
ENGINEERING**

SECOND (2nd) SEMESTER (2022)

**EE321 COMMUNICATIONS SYSTEMS
TIME ALLOWED: 3 HOURS**

INFORMATION FOR STUDENTS:

1. You have **TEN (10) MINUTES** to read this paper. Do not write during this allocated time
 2. This paper has **TWO** sections. **Section A is Multiple Choice with 20 Questions** worth **20 Marks**. **Section B has Three (3) Questions** worth **60 Marks**. **Answer all Questions**. Total Marks on offer is **80 Marks**.
 3. All answers must be written in the **Answer Booklet**
 4. **COMPLETE STUDENT DETAILS ARE TO BE FILLED ON THE ANSWER BOOKLET-DO THIS NOW**
 5. Only drawing instruments and calculators are allowed on your desk. Textbooks and notebooks are **NOT** allowed
 6. If you are found **Cheating** in this Exam, penalties specified by the **University** shall be applied.
 7. **TURN OFF** all your mobile phones and place them on the floor under your seat before you start the examination
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SECTION A – MULTIPLE CHOICE

Use the first page on the answer booklet to record your response in two columns. Column A for question number and column A for the correct option. If you wish to change, put a cross over the wrong response and write the new response beside it.

1. What is the name of the frequency range from 0.3 MHz to 3 MHz?
 - a) High frequency
 - b) Medium frequency
 - c) Low frequency
 - d) None of These

2. In which system is data encryption made possible?
 - a) Analog communication
 - b) Digital communication
 - c) Analog & Digital communication
 - d) None of the mentioned

3. Which of the following is a baseband signal?
 - a) Voice Signal on 3G
 - b) 93.6 Signal
 - c) Audio From Speakers in DH
 - d) EM TV

4. What is the process of transmitting a baseband signal over long distances?
 - a) Sampling
 - b) Quantization
 - c) Modulation
 - d) Encoding

5. In the PCM process, sequence of coded pulses indicates what?
 - a) Carrier Signal.
 - b) Message signal.
 - c) Modulating Signal
 - d) Baseband signal

6. What is the purpose of the low pass filter at the transmitter in a PCM system?
- a) Adapt the signal
 - b) Clarify the signal
 - c) Disseminate the signal
 - d) Shape the signal
7. The sampling theorem states that for a broadband signal of $x(t) = 5\cos(200\pi t) + 10\cos(400\pi t) - 15\cos(600\pi t)$ the minimum sampling rate is _____.
- a) 100 Hz
 - b) 200 Hz
 - c) 300 Hz
 - d) 600 Hz
8. Which is NOT a property of line coding?
- a) Capable of error detection and correction
 - b) Favourable power spectral density,
 - c) Low power efficiency
 - d) High bandwidth usage
9. A _____ digital signal includes timing information in the data being transmitted.
- a) self-synchronizing
 - b) self-modulated
 - c) self-transmitted
 - d) self-filtering
10. In decoding a digital signal, the receiver calculates a running average of the received signal power, called the _____.
- a) baseline
 - b) base fault
 - c) line fault
 - d) fault line
11. The _____ rate defines the number of data elements sent in 1s; the _____ rate is the number of signal elements sent in 1s.
- a) data; signal
 - b) signal; data
 - c) baud; bit
 - d) bit, data

12. The signal rate is sometimes called the _____ rate.
- a) baud
 - b) bit
 - c) signal
 - d) elements
13. The data rate is sometimes called the _____ rate.
- a) baud
 - b) bit
 - c) signal
 - d) elements
14. In a _____ scheme, all signal levels are on one side of the time axis, either above or below.
- a) polar
 - b) bipolar
 - c) unipolar
 - d) multipolar
15. In _____ scheme, the voltages are on both sides of the time axis. For example, the voltage level for 0 can be positive and the voltage level for 1 can be negative.
- a) polar
 - b) bipolar
 - c) unipolar
 - d) multipolar
16. In _____ encoding, the duration of the bit is divided into two halves. The voltage remains at one level during the first half and moves to the other level in the second half. The transition at the middle of the bit provides synchronization.
- a) Manchester
 - b) differential Manchester
 - c) both a) and b)
 - d) neither a) nor b)

18. In _____ there is always a transition at the middle of the bit, but the bit values are determined at the beginning of the bit. If the next bit is 0, there is a transition; if the next bit is 1, there is none.
- a) Manchester
 - b) differential Manchester
 - c) Bipolar RZ
 - d) Bipolar NRZ
19. In Manchester and differential Manchester encoding, the transition at the middle of the bit is used _____.
- a) bit transfer
 - b) baud transfer
 - c) synchronization
 - d) bit rate
20. TDM is used to
- a) Increase the information transmission rate
 - b) Use only one carrier frequency to handle different signals
 - c) To use different frequency bands for different signals
 - d) To protect all small signals in PCM from quantizing noise

[1 Mark for each question, 20 Marks in Total]

End of Part A

SECTION B

QUESTION 1

- (a) The voltage induced on a receiving antenna of a communication system is 1 mV. Bandwidth of the system is 100 kHz. The antenna temperature is 290 K. The matched load resistance is 50 ohms. The Boltzmann constant $k = 1.38 \times 10^{-23}$ J/K.

Determine the signal to noise ratio S/N_{IP} at the input of the receiver.

[5 Marks]

- (b) In Figure 1.1 is shown a communication receiver as a cascaded network. Write down the equation for the total noise factor and explain each term of the equation.

[5 Marks]

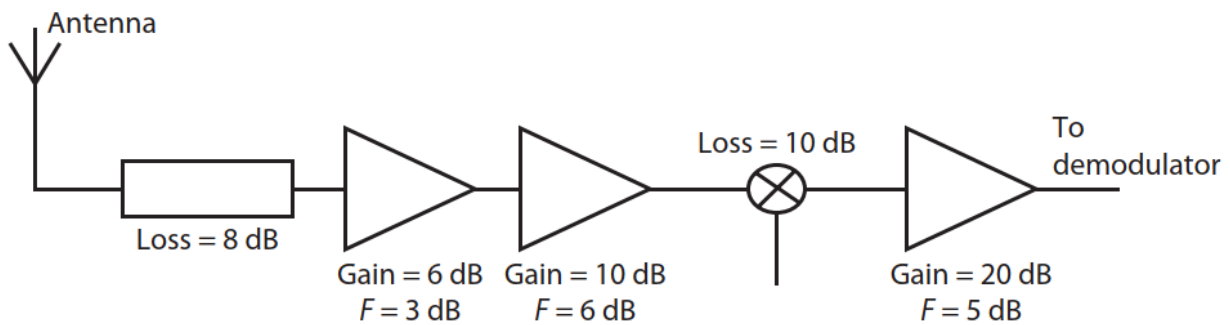


Figure 1.1

- (c) From the data given in 1(a) and 1(b), determine the overall system signal to noise ratio S/N .

[5 Marks]

- (d) If the cable loss increase from 8 dB to 20 dB due to damage, determine the new value for the system S/N .

[5 Marks]

[TOTAL 20 Marks]

QUESTION 2

(a) With an appropriate sketch describe the four different types of losses in a communication system. How is off site interference mitigated by using the following three techniques: spatial methods, spectral methods and time-based methods.

[7 Marks]

(b) With appropriate sketches and technical details, write a brief (maximum 300 words) essay on ONE of the following:

- (i) Optical communication system
- (ii) Wireless, mobile communication systems.

[7 Marks]

(c) With an appropriate flow chart, explain how interference reporting is made and what are the main features that must appear in the report.

[6 marks]

[TOTAL 20 Marks]

QUESTION 3

- (a) In Figure 3.1 is shown a satellite transponder. If one of the two amplifiers malfunctions, what will be the effect observed on the function of the satellite? Outline the functions of each component of the transponder.

[5 Marks]

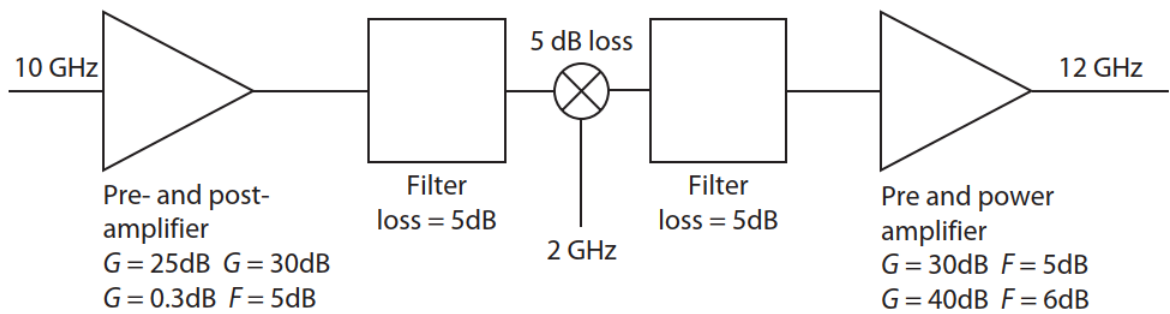


Figure 3.1

- (b) Determine the total noise factor and noise figure of the transponder.

[5 Marks]

- (c) For the 10 GHz, geostationary satellite transponder of Figure 3.1, it is given that the input power from the system modulator is 10 mW, and amplification of 40 dB gives a power of 100 W. The bandwidth is 50 MHz, sufficient to carry many television channels. The 80% efficient dish antenna diameter is 3 m.

Determine the input signal to noise ratio and the output signal to noise ratio. What significance is attached to these results?

[10 Marks]

[TOTAL 20 Marks]