



THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF COMPUTER SCIENCE
B. SC. DEGREE PROGRAMME 2023/2024
FINAL EXAMINATION
CSU5307: DATA COMMUNICATION
DURATION: TWO HOURS (2 HOURS)

Date: 24.10.2023

Time: 9.30 am – 11.30 am

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **06** questions in **03** pages.
3. Answer any **05** questions only. All questions carry equal marks.
4. The answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
6. Involvement in any activity considered an exam offence will lead to punishment.
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script.

Q1. Briefly explain the 5 of the following terms.

- a. Physical Layer
- b. HTTPS
- c. GSM
- d. HLR
- e. MSISDN
- f. Modulation
- g. Multiplexing
- h. Duplex

Q2. The input signal of modulation systems is $x(t)$, and the carrier signal is $\text{Cos}(2\pi f_c t)$.
Output signal after modulation is given as,

$$S(t) = A [1 + \mu \cdot (t)]. \text{Cos}(2\pi f_c t)$$

μ is known as the modulation index, and A is the amplitude of the output signal.
The number 1 represents the DC component to prevent loss of information.
Clearly, state the assumptions in answering the following sub-questions.

- i. Identify the modulation system.
- ii. Where is it used in communications?
- iii. Draw the time domain output signal when $x(t)$ is a sinusoidal signal with a frequency of f_c and $f_c = 5 \times f_1$, with similar amplitude.
- iv. Draw the frequency spectrum for the output signal for the double-sideband transmitted carrier (DSBTC).

Q3. Explain the requirement of TDM and FDM systems in data communication.

- i. Draw a diagram and explain the above functions using four channels (A_1, A_2, A_3, A_4) in a transmitter, transmission medium, and de-multiplexing at the receiver.
- ii. Identify the differences between FDD & TDM.
- iii. Briefly explain a practical example of FDD and TDD use.
- iv. Briefly explain a practical example of FDM and TDM used together.

Q4. A Radio DJ's voice signal is sampled at a rate of 44 kHz in radio station A. The sampling is done without compression and 128 levels in quantization.

- i. What is the bit rate of the generated PCM signal?
- ii. Draw a sampling diagram in the time domain.
- iii. What is the minimum bit rate required to transmit the voice through a PCM channel with a similar number of quantization levels and input voice signal bandwidth of 44 kHz?

- iv. If the input (voice) bandwidth is 16 kHz, what is the minimum bit rate required to transmit the voice through a PCM channel with a similar number of quantization levels?
- v. What could be done to reduce the quantization error by half in this case?

Q5. Digital data can be transferred through a transmission medium in the form of analog signals.

- i. Discuss the advantages and disadvantages of analog signals to transmit digital data.
- ii. State two analog encoding schemes and identify them in the form of sinusoidal waveform notation.
- iii. Draw the signal diagram for each of the above if the transmitted digital data stream is **11001010**.

Q6. GSM, which stands for Global System for Mobile Communications, is a widely used standard for digital cellular communication. It was developed to replace the earlier analog cellular networks and has become the foundation for many mobile communication systems worldwide.

- i. Explain three Signaling Channels in GSM.
- ii. Using a diagram, explain the steps in the Outgoing call (to PSTN).
- iii. State three reasons to move to 3G from 2G.

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