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Question Paper Code	13988
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B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Computer Science and Engineering (Cyber Security)

20SCPC502 - FUNDAMENTALS OF QUANTIZATION

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. Quantization is a process of converting: (a) Analog signal to digital signal (b) Continuous amplitude to discrete amplitude (c) Continuous time to discrete time (d) None of the above	1	K1	CO1
2. The difference between the input signal and the quantized output is called: (a) Sampling error (b) Quantization error (c) Truncation error (d) Round-off error	1	K1	CO1
3. Which of the following has both discrete time and discrete amplitude? (a) Analog signal (b) Discrete-time signal (c) Digital signal (d) Continuous signal	1	K1	CO2
4. Increasing the number of quantization levels results in: (a) Higher quantization noise (b) Lower signal quality (c) Lower quantization error (d) No change in accuracy	1	K1	CO2
5. Choose a suitable compression method for medical images. (a) Lossy JPEG (b) Vector quantization with codebook pruning (c) Lossless compression (d) Predictive quantization with deadzone	1	K1	CO3
6. Uniform quantization is most suitable when (a) Signal has Gaussian distribution (b) Signal has uniform amplitude distribution (c) Signal is highly peaky (d) Signal is already compressed	1	K1	CO3
7. In symmetric cryptography, encryption and decryption use: (a) Different keys (b) Same key (c) Public key only (d) No key	1	K1	CO4
8. Which of the following ensures secure communication between two parties? (a) Ciphertext transmission (b) Secure communication protocol (SSL/TLS) (c) Plaintext sharing (d) Packet encryption only	1	K1	CO4
9. Quantization in AI accelerators focuses on (a) Floating-point expansion (b) Integer representation of weights and activations (c) Increasing memory usage (d) Data encryption	1	K1	CO5
10. In cloud computing, cryptography mainly provides (a) Faster data transfer (b) Confidentiality and data integrity (c) Data duplication (d) Energy optimization	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Define signal-to-quantization-noise ratio.	2	K1	CO1
12. State the purpose of quantization.	2	K2	CO1
13. Differentiate between continuous-time and discrete-time signal.	2	K2	CO2
14. State the relationship between the number of bits and quantization levels.	2	K2	CO2
15. Compare lossy and lossless compression.	2	K2	CO3
16. List any two principles of digital communication related to quantization.	2	K1	CO3
17. Mention the advantages of asymmetric cryptography.	2	K1	CO4
18. Show how does PKI ensure data authenticity and integrity?	2	K2	CO4

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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| 19. Define vector quantization and give one application. | 2 | K1 | CO5 |
| 20. Specify the significance of adaptive quantization. | 2 | K2 | CO5 |
| 21. Write any two recent developments in quantization techniques. | 2 | K1 | CO6 |
| 22. What is post-training quantization? | 2 | K1 | CO6 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) Compare and contrast different quantization techniques. | 11 | K2 | CO1 |
| OR | | | |
| b) Outline the concept of Quantization Error Analysis. Derive the expression for quantization error and quantization noise power. | 11 | K2 | CO1 |
| 24. a) Explain with neat diagrams the quantization of analog and digital signals. | 11 | K2 | CO2 |
| OR | | | |
| b) i) Summarize the techniques to minimize quantization error. | 5 | K2 | CO2 |
| ii) Discuss the need for signal processing in modern systems. | 6 | K2 | CO2 |
| 25. a) A hospital needs to store large patient data such as text reports, CT/MRI images, and training videos. How does quantization enable lossy compression? Give guidelines for choosing quantization step size for sensitive vs non-sensitive data. | 11 | K3 | CO3 |
| OR | | | |
| b) You are designing an 8-bit A/D converter for an industrial sensor that measures 0–10 V. Describe the block diagram of the A/D process highlighting sampling and quantization. If the customer complains of “fluctuating last digit,” what two engineering remedies will you suggest? | 11 | K3 | CO3 |
| 26. a) A hospital is developing a secure online system to transmit patient data between doctors and diagnostic labs. Explain how cryptography ensures confidentiality and integrity. Conclude with how digital signatures and certificates guarantee authenticity of the sender. | 11 | K4 | CO4 |
| OR | | | |
| b) Analyze and evaluate the role of hash functions in ensuring data security. Justify your choice of the most secure algorithm for digital signatures and authentication. | 11 | K4 | CO4 |
| 27. a) Explain how quantization techniques are applied to reduce computational complexity in AI and ML models. | 11 | K2 | CO5 |
| OR | | | |
| b) Discuss the latest quantization strategies used in deep learning accelerators. | 11 | K2 | CO5 |
| 28. a) Apply the concept of quantization to design a lightweight neural network suitable for mobile or IoT applications. | 11 | K3 | CO6 |
| OR | | | |
| b) Apply vector quantization to an image compression and discuss how it improves efficiency. | 11 | K3 | CO6 |