Master of Science in Computer Engineering and High-Performance Computing

Principles of Programming Languages course

1. Introduction to Programming Languages
2. Syntax and Semantics
3. Lexical Analysis and Parsing
4. Data Types
5. Control Structures
6. Memory Management
7. Procedural Programming
8. Object-Oriented Programming (OOP)
9. Functional Programming
10. Concurrency and Parallelism
11. Programming Paradigms and Language Design

Textbook: Sebesta, R. W. (2016). *Concepts of Programming Languages* (11th ed.). Pearson.

Computer Organization and Architecture course:

1. Introduction to Computer Systems
2. Data Representation and Number Systems
3. Computer Arithmetic
4. Basic CPU Organization
5. Instruction Set Architecture (ISA)
6. Memory Hierarchy and Organization
7. Input/Output Organization
8. Control Unit Design
9. Pipelining and Superscalar Architecture
10. Multiprocessor and Multithreading Systems

Textbook: Patterson, D. A., & Hennessy, J. L. (2013). *Computer Organization and Design: The Hardware/Software Interface* (5th ed.). Morgan Kaufmann Publishers.

Data Structures & Algorithms course

1. Introduction to Data Structures and Algorithms
2. Arrays and Strings
3. Linked Lists
4. Stacks and Queues
5. Trees
6. Heaps
7. Hashing
8. Graph Algorithms
9. Sorting Algorithms
10. Dynamic Programming

Textbook: Lafore, R. (2002). *Data Structures and Algorithms in Java* (4th ed.). Sams Publishing.

Introduction to Computer Networks course

1. Network Fundamentals
2. OSI and TCP/IP Models
3. Physical Layer and Transmission Media
4. Data Link Layer
5. Network Layer

6. Transport Layer
7. Application Layer
8. Routing and Switching
9. Network Security
10. Wireless Networks

Textbook: Kurose, J. F., & Ross, K. W. (2016). *Computer Networking: A Top-Down Approach* (7th ed.). Pearson.

Database Systems course

1. Introduction to Databases
2. Database Models
3. SQL and Query Processing
4. Database Design
5. Indexing and Hashing
6. Transaction Management
7. Query Optimization
8. Database Security
9. Distributed Databases
10. Big Data and NoSQL

Textbook: Silberschatz, A., Korth, H. F., & Sudarshan, S. (2019). *Database System Concepts* (7th ed.). McGraw-Hill Education.

Calculus course

1. Limits and Continuity
2. Derivatives and Differentiation
3. Applications of Derivatives
4. Integration and Antiderivatives
5. Applications of Integrals
6. Techniques of Integration
7. Sequences and Series
8. Multivariable Calculus
9. Differential Equations
10. Vector Calculus

Textbook: Stewart, James. *Calculus*. 8th ed., Cengage Learning, 2015.

Linear Algebra course

1. Vectors and Vector Spaces
2. Matrices and Matrix Operations
3. Systems of Linear Equations
4. Linear Transformations
5. Eigenvalues and Eigenvectors
6. Orthogonality and Inner Product Spaces
7. Diagonalization and Spectral Theorem
8. Singular Value Decomposition (SVD)
9. Quadratic Forms
10. Jordan Canonical Form

Textbook: Strang, G. (2016). *Introduction to Linear Algebra* (5th ed.). Wellesley-Cambridge Press.

Probability & Statistics course

1. Introduction to Probability
2. Probability Rules and Theorems
3. Random Variables
4. Probability Distributions (Discrete and Continuous)
5. Expectation and Variance
6. Sampling and Sampling Distributions
7. Statistical Inference
8. Confidence Intervals
9. Hypothesis Testing
10. Regression and Correlation

Textbook: Devore, J. L. (2019). *Probability and Statistics for Engineering and the Sciences* (9th ed.). Cengage Learning.

Embedded Systems course

1. Introduction to Embedded Systems

- Definition, characteristics, and applications
- Basic architecture and components

2. Embedded C Programming

- Introduction to C in embedded systems
- Structure, variables, data types, and control structures
- Functions, pointers, and programming techniques

3. Embedded System Components

- Microcontrollers and Microprocessors
- Sensors, Actuators, and I/O devices

4. Memory Organization

- Types of memory: RAM, ROM, EEPROM, Flash
- Memory mapping and management techniques

5. Interrupts

- Concept and importance of interrupts
- Types and handling of interrupts

6. Timers

- Understanding and programming timers
- Application of timers in embedded systems

7. UART/USART

- Basics of serial communication
- UART/USART implementation and programming

8. I2C and SPI

- Introduction to I2C and SPI protocols
- Communication techniques using I2C and SPI

9. FreeRTOS

- Introduction to RTOS
- Core concepts and programming in FreeRTOS

Textbook**:** "Embedded Systems: Introduction to the MSP432 Microcontroller" by Jonathan Valvano

Microprocessors Course

1. Introduction to Microprocessors – Evolution, basic concepts, and applications.
2. Microprocessor Architecture – Components, registers, ALU, control unit, and data flow.
3. Instruction Set and Assembly Language Programming – Types of instructions, addressing modes, and programming basics.
4. Memory Organization – Types of memory (RAM, ROM), memory interfacing, and mapping.
5. Input/Output (I/O) Interfacing – Parallel and serial communication, interfacing techniques.
6. Interrupts and Handling Mechanisms – Types of interrupts, interrupt handling, and priorities.
7. Timers and Counters – Operation, applications, and programming.
8. Microprocessor Peripherals – Interfacing with peripherals like ADC, DAC, and sensors.
9. Bus Systems and Communication Protocols – Address, data, control buses, and communication standards (I2C, SPI).
10. Microprocessor Applications and Trends – Real-world applications, embedded systems, and future trends.

Textbook: Microprocessor Architecture, Programming, and Applications with the 8085" by Ramesh S. Gaonkar (6th Edition)