

Purbanchal University

BACHELOR OF INFORMATION TECHNOLOGY (BIT)

Year: II

Semester: I

Course Code	Course Title	Credits	Lecture (Hrs.)	Tutorial (Hrs.)	Laboratory (Hrs.)	Total (Hrs.)
BIT201HS	Numerical Methods	3	3	1	2	6
BIT202CO	Microcontroller	3	3	1	2	6
BIT203CO	Data Structure and Algorithm	3	3	1	2	6
BIT204CO	Computer Network and Data Communication	3	3	1	2	6
BIT205CO	System Analysis and Design	3	3	1	-	4
BIT206CO	Project-III	2	-	-	3	3
	Total	17	15	5	11	31

Numerical Methods BIT201HS

Year: II

Semester: II

Teaching schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	2	Theory	Practical	Theory	Practical	100
			20	20	60	-	

Course Objective:

The main objective of this course is to enable students to (a) solve nonlinear equations, (b) use interpolation, (c) fit curves, (d) solve linear equations, and (e) perform integration and differentiation, using numerical methods through computers.

Course Contents:

- 1. Errors in Numerical Computation** **[3 Hrs]**
 - 1.1 Introduction to numerical method
 - 1.2 Introduction to error
 - 1.3 Sources of error
 - 1.4 General errors formula

- 2. Solution of Nonlinear Equations** **[6 Hrs]**
 - 2.1 Introduction
 - 2.2 Bisection method
 - 2.3 Newton Raphson method
 - 2.4 Secant method
 - 2.5 Horner's rule

- 3. Interpolation** **[10 Hrs]**
 - 3.1 Introduction
 - 3.2 Finite differences
 - 3.2.1 Foreward differences
 - 3.2.2 Backward differences
 - 3.2.3 Central differences
 - 3.2.4 Symbolic relations
 - 3.3 Newton's Forward and Backward formulae
 - 3.4 Lagrange interpolation
 - 3.5 Method of Least Square methods (LSM)
 - 3.5.1 LSM for linear equation ($y=a+bx$)
 - 3.5.2 LSM for quadratic equation ($y=a+bx+cx^2$)
 - 3.5.3 LSM for $y=ax^b$
 - 3.5.4 LSM for $y=ae^{bx}$

- 4. System of Linear Equations** **[11 Hrs]**
 - 4.1 Contingency of a linear system of equations
 - 4.2 Solution of linear system - Direct method
 - 4.2.1 Gaussian Elimination method
 - 4.2.2 Gauss Jordan method
 - 4.2.3 Matrix inversion
 - 4.3 Solution of linear system - Indirect method
 - 4.3.1 Gauss Jacobi iteration method
 - 4.3.2 Gauss Seidel iteration method
 - 4.4 Method of Factorization, LU Decomposition method
 - 4.5 Eigen vectors and Eigen values, Power method

- 5. Numerical Differentiation and Integration** **[8 Hrs]**
 - 5.1 Numerical Differentiation for 1st and 2nd order differentiation
 - 5.1.1 Forward formula

5.1.2 Backward formula

5.2 Numerical Integration

5.2.1 Trapezoidal rule

5.2.2 Simpson's 1/3 rule and 3/8 rule

5.2.3 Romberg integration

6. Numerical Solution of Ordinary Differential Equations

[7 Hrs]

6.1 Introduction

6.2 Euler's method and Modified Euler's method

6.3 Rungekutta 2nd order and 4th order methods

6.4 Boundary value problem (Finite Difference method)

Laboratories: There shall be following lab exercises using any high-level Programming language.

1. Bisection method
2. Newton-Raphson method
3. Secant method
4. Horner's rule
5. Langrange interpolation
6. Newton interpolation
7. Least Square method for linear equations
8. Gauss Elimination method
9. Gauss Seidel iteration method
10. Integration (Trapezoidal rule, Simpson's 1/3 rule and 3/8 rule)
11. Euler's method
12. Rungekutta 4th order methods

Reference Books:

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI
2. S. Yakowitz & F. Szidarovszky, "An Introduction to Numerical Computations"
3. Dr. V. N. Vedamurthy, Dr. N. Ch. S. N. Iyengar, "Numerical Methods"
4. S. S. Sastry, "Engineering Mathematics Volume-II", PHI
5. E. Balagurusamy, "Numerical Methods"
6. B.S. Grewal, "Numerical Method "

Microcontroller

BIT202CO

Year: II

Semester: I

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	2	Theory	Practical	Theory	Practical	150
			20	50	80	-	

Course Objective:

The main objective of this course is to provide theoretical and practical knowledge of microcontroller. It focuses on designing, implementing and managing the issues based on 8051.

Course Contents:

Unit1: Introduction to Microcontroller

(10 Hrs)

Microcontroller basic concept, Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization, External Memory (ROM & RAM) interfacing.

Unit 2: Instruction Set

(8 Hrs)

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions, Simple Assembly language program examples (without loops) to use these instructions

Unit 3: Stack, I/O Port Interfacing and Programming

(7 Hrs)

Stack and Subroutine instructions, Assembly language program examples on subroutine and involving loops, Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status

Unit 4: Timers and Serial Port

(10 Hrs)

Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.

Unit 5: Interrupts and Interfacing Applications

(10 Hrs)

Interrupts, Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt,

Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

Laboratory Works:

The practical work consists of all features of Microcontroller

Reference Books:

1. “The 8051 Microcontroller and Embedded Systems – using assembly and C”, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. “The 8051 Microcontroller”, Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.
3. “The 8051 Microcontroller Based Embedded Systems”, Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
4. “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Raj Kamal, Pearson Education, 2005.

Data Structure and Algorithm BIT203CO

Year: II

Semester: I

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	2	Theory	Practical	Theory	Practical	150
			20	50	80	-	

Course Objective:

The main objective of this course is to provide fundamental knowledge of data structure, various algorithms used and their implementations.

Course Contents:

- 1. Introduction** **[2 Hrs]**
 - 1.1 Introduction to Data and Data Types
 - 1.2 Data Structure (DS), Abstract Data Type (ADT) and Applications
 - 1.3 Abstract Data Type vs. Data Structure

- 2. Algorithm Efficiency and Complexity** **[2 Hrs]**
 - 2.1 Time and Space Analysis
 - 2.2 Asymptotic Notations: big O, sigma, theta, omega

- 3. Stack** **[5 Hrs]**
 - 3.1 Definition and Examples of Stack
 - 3.2 Stack as an Abstract Data Type
 - 3.3 Array Representation/ Implementation of Stack
 - 3.4 Primitive Stack Operations and Algorithm Efficiency
 - 3.5 Stack Overflow and Stack Underflow Conditions
 - 3.6 Application of Stack: Prefix, Infix and Postfix Expression:
 - 3.6.1 Definition.
 - 3.6.2 Evaluation of Infix, Prefix and Postfix Expression using Stack.
 - 3.6.3 Converting an Expression from Infix to Postfix and Vice-Versa.

- 4. Queue** **[4 Hrs]**
- 4.1 Definition and Examples of Queue
 - 4.2 Queue as an Abstract Data Type
 - 4.3 Array Representation/ Implementation of Queue
 - 4.4 Primitive Queue Operations and Algorithm Efficiency
 - 4.5 Queue Overflow and Stack Underflow Conditions
 - 4.6 Linear and Circular Queue
 - 4.7 Priority Queue
- 5. List and Linked List** **[6 Hrs]**
- 5.1 Introduction to List as an Abstract Data Type
 - 5.2 Primary List Operations
 - 5.3 Static and Dynamic List Structure
 - 5.4 Linked List as an Abstract Data Type
 - 5.5 Types of Linked List
 - 5.5.1 Linear linked List – Singly and Doubly Linear Linked Lists
 - 5.5.2 Circular linked list – Singly and Doubly Circular Linked Lists
 - 5.6 Advantages of Doubly Linked over Singly Linked List
 - 5.7 Basic Linked List operations: Insertion/Deletion of a Node as: Front Node, Last Node, Before a Given Node, & After a Given Node.
 - 5.8 Dummy Node
 - 5.9 Linked List implementation of Stack and Queue
- 6. Recursion** **[3 Hrs]**
- 6.1 Principle of Recursion
 - 6.2 Recursion Vs. Iteration with Advantages and Disadvantages
 - 6.3 Applications of Recursion: Fibonacci Sequence, TOH and Multiplication of Natural Numbers; with Algorithm Efficiency
- 7. Trees** **[6 Hrs]**
- 7.1 Concepts and Definitions of Tree
 - 7.2 Properties of Tree
 - 7.3 Binary Tree: Definition, Applications, Representation using Linked List
 - 7.4 Binary Search Tree (BST)

- 7.5 Insertion, Deletion in Binary Search Tree
- 7.6 Binary Tree Traversals – Pre-order, In-order and Post-order Traversal.
- 7.7 Height, Depth and Level of a Tree
- 7.8 AVL Tree and Balancing Algorithm
- 7.9 Huffman Algorithm

8. Sorting [6 Hrs]

- 8.1 Definition and types of Sorting: Internal and External sort
- 8.2 Sorting Algorithms: Insertion Sort, Selection sort, Bubble sort
- 8.3 Sorting using Divide & Conquer: Quick Sort, Merge Sort
- 8.4 Radix Sort, Shell sort
- 8.5 Heap Sort as a Priority Queue
- 8.6 Efficiency of Sorting Algorithms

9. Searching and hashing [4 Hrs]

- 9.1 Definition, Concept and Essentials of Searching, Keys
- 9.2 Types of Searching: Sequential Search, Binary Search, Binary Search Tree
- 9.3 General Search Tree
- 9.4 Hashing
 - 9.4.1 Hash Functions and Hash Table
 - 9.4.2 Collision Resolution technique
- 9.5 Efficiency of different Searching Methods

10. Graphs [7 hrs]

- 10.1 Definition and Representation of Graphs
- 10.2 Application of Graphs
- 10.3 Graphs as an Abstract Data Type
- 10.4 Adjacency Matrix Representation, Transitive Closure
- 10.5 Warshall's Algorithm
- 10.6 Types of Graphs
- 10.7 Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS)
- 10.8 Spanning Tree and Spanning Forest
- 10.9 Minimum Spanning Tree & Greedy Approach: Kruskal's Algorithm, Prim's Algorithm, Round Robin Algorithm

10.10 Finding Shortest Path: Dijkstra's Algorithm

Laboratory Works:

There shall be following Lab Exercises:

- Implementation of Stack
- Implementation of Linear and Circular Queues
- Solution of TOH and Fibonacci Sequence
- Implementation of Linked List: Singly and Doubly Linear & Circular Linked List
- Implementation of Tree: Binary Tree Traversals
- Implementation of trees: AVL Trees
- Implementation of Merge Sort
- Implementation of Heap
- Implementation of Search: Sequential, Binary
- Implementation of Hashing
- Implementation of Graph: Graph Traversals

Reference books

1. "Data Structure using C & C++", Aarton M. Tenenbaum, Y. Langsam, M. J. Augenstein, PHI.
2. "Fundamental of Computer Algorithms", H. Sahani
3. "Data Structure of Program Design in C", Robert L. Kruse, B. P. Leung, C. L. TONdo, PHI
4. "The Art of Programming, Sorting & Searching", Donald E. Knuti-I.
5. "Data Structure & Application", Trebly & Sorenson
6. "Introduction to Data Structure & Algorithms with C & C++", G. W. Rowe, PHI
7. "Fundamentals of Algorithms", G. Brassand & P. Bratley, PHI

Computer Network and Data Communication

BIT204CO

Year: II

Semester: I

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	2	Theory	Practical	Theory	Practical	150
			20	50	80	-	

Course Objective:

This course provides students with the fundamental concepts of data communications and networking and their practical applications.

Course Contents:

- 1. Introduction to Networking and Data Communication [3 Hrs]**
 - 1.1 Introduction & Need of Data Communication
 - 1.2 Data & Signal, Properties of a Signal, Analog & Digital Signal
 - 1.3 Introduction of Computer Network, Need and Advantages of Networking
 - 1.4 Types of Network - LAN, PAN, MAN & WAN
 - 1.5 Types of Network Model - Client/Server & Peer to Peer
 - 1.6 Network Topology - Bus, Ring, Star, Mesh, Hybrid

- 2. Layered Network Architecture [4 Hrs]**
 - 2.1 Introduction to Layered Approach
 - 2.2 Benefits of Layered Model
 - 2.3 OSI Reference Model
 - 2.4 TCP/IP Model
 - 2.5 Network Protocol and TCP/IP Protocol Suite

- 3. Data Transmission Fundamentals & The Physical Layer [6 Hrs]**
- 3.1 Signals for Conveying Information
 - 3.2 Analog & Digital Transmission
 - 3.3 Types of Transmission Medium: Guided & Unguided
 - 3.4 Bandwidth, Channel Capacity, Latency, Throughput, Transmission Impairments
 - 3.5 Transmission Modes: Simplex, Half-Duplex and Full-Duplex
 - 3.6 Circuit Switching, Packet Switching
 - 3.7 Serial Data Transmission: Synchronous and Asynchronous Transmission
 - 3.8 Multiplexing and Demultiplexing: FDM, WDM, TDM
 - 3.9 Introduction to Data Encoding and Modulation
 - 3.10 Analog Modulation: Amplitude, Frequency and Phase Modulation
 - 3.11 Digital Modulation: ASK, PSK, FSK
- 4. Data Link Control [6 Hrs]**
- 4.1 Introduction, Functions of Data Link Layer
 - 4.2 Flow Control: Introduction, Benefits
 - 4.3 Flow Control Protocols: Stop-and-Wait, Sliding Window, Piggybacking
 - 4.4 Error Detection and Correction: Parity Bit, Checksum, CRC, Forward and Backward Error Correction, Hamming Code
 - 4.5 Medium Access Sub-layer, MAC Address
 - 4.6 Framing, HDLC, PPP
 - 4.7 Channel Allocation and Multiple Access Protocols
 - 4.8 Collision Domain, Broadcast Domain
 - 4.9 Networks: FDDI, ALOHA, VLAN, IEEE 802.3 Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring, IEEE 802.11 Wireless LAN
- 5. Network Layer [10 Hrs]**
- 5.1 Addressing in Data Communication & Computer Network
 - 5.2 Logical Addressing with IP (IPv4), Classful Addressing

- 5.3 Network Connecting Devices: Hub, Switch (Layer-2 & Layer-3), Bridge, Router, Gateway
- 5.4 Subnetting
- 5.5 Routing: Adaptive and Non-adaptive Routing, Routing Table
- 5.6 Routing Protocols: RIP, OSPF, BGP, Unicast and Multicast Routing
- 5.7 Routing Algorithms: Shortest Path Routing, Distance Vector Routing, Link-State Routing
- 5.8 Protocols operating at Network Layer: ARP, RARP, ICMP
- 5.9 IPv6: Advantages, Packet Formats, Dual Stack, Tunneling

6. Transport Layer **[5 Hrs]**

- 6.1 Functions of Transport Layer
- 6.2 Connection Management: TCP, UDP
- 6.3 Port Addressing: Ports and Sockets
- 6.4 Connection Establishment and Release
- 6.5 Flow Control, Buffering
- 6.6 Congestion Control: Token Bucket, Leaky Bucket
- 6.7 IP Remapping: NAT

7. Application Layer **[5 Hrs]**

- 7.1 Using & Accessing Network: DNS, DHCP, HTTP, HTTPS
- 7.2 Email: SMTP, IMAP, POP3
- 7.3 File Transfer: FTP, FTPS, SFTP
- 7.4 Network Management & Traffic Analyzer: SNMP, Packet Tracer, Wireshark
- 7.5 Proxy, Reverse Proxy, Webmail

8. Network Security **[6 Hrs]**

- 8.1 Information Security Basics: The CIA Model
- 8.2 Security Threats

8.3 Principles of Cryptography, Symmetric & Asymmetric Key Encryption

8.4 AES, RSA Security

8.5 Email/Message Integrity: Digital Signature, PGP

8.6 Secure Transport Connection: SSL, TLS

8.7 Firewall, VPN, Packet Filtering

Laboratory:

There shall be following laboratory exercises that cover the various features and concepts of computer networking. In practical, students should be able to set up small networks. Also, they should be able to configure network hardware and network software.

- Installation of network interface card and various network devices like hub, switch, router
- Cabling: construction of straight-through and cross-over cable
- Installation and configuration of server and workstation in windows/Linux
- Setup client/Server and peer-to-peer networking and verify it
- Workgroup networking, domain networking
- Familiarization with basic network commands: observing IP address and MAC address, setting IP address and default gateway in PC
- File sharing and printer sharing
- Firewall configuration
- Configure HTTP, FTP, DHCP, Telnet server and verify it
- Configuration of DNS and e-mail server
- Basic network commands and network management and troubleshooting
- Static routing and dynamic routing (RIP and OSPF)
- Implement the data link layer framing methods such as character, character

stuffing and bit stuffing

- Implementation of CRC
- Design of local area network (LAN)
- Case study; An existing network system of your college

Reference Books:

1. *"Data & Computer Communications"*, 7/e, William Stallings, Pearson Education
2. *"Computer Networks"*, 4/e, A. S. Tanenbaum, Pearson Education / PHI
3. *"Data Communications and Networking"*, 5/e, Behrouz A. Forouzan, McGraw-Hills
4. *"Data Communications, Computer Networks & Open Systems"*, 4/e, Fred Halsall, Pearson Education
5. *"An Introduction to Computer Networking"*, Kenneth C. Mansfield, Jr. & James L. Antonakos, PHI
6. *"The Essential Guide to Telecommunications"*, 3/e, Annabel Z. Dodd, Pearson Education
7. *"Computer Networks & Internet"*, 2/e, D. E. Comer, Pearson Education

System Analysis & Design

BIT205CO

Year: II

Semester: I

Teaching Schedule			Examination Scheme				
Hours/Week			Internal Assessment		Final		Total
Theory	Tutorial	Practical	Theory	Practical	Theory	Practical	Total
3	1	-	20	-	80	-	

Course Objective:

This course helps to launch the careers of successful systems analysts or of users assuming an active role in building systems that satisfy their organization's information needs. The course also provides a solid foundation of systems.

Course Contents:

- 1. Overview of Systems Analysis and Design (6 Hrs)**
 - 1.1. Introduction to system analysis and design
 - 1.2. Information systems and its types
 - 1.3. Stakeholders of Information systems
 - 1.4. Systems Development Life Cycle and life cycle models (Waterfall, Spiral, Prototype)
 - 1.5. Introduction to analysis and design tools

- 2. Process and Conceptual Modeling (6 Hrs)**
 - 2.1. Introduction to Data Flow Diagram (DFD)
 - 2.2. Concepts used in drawing DFDs
 - 2.3. DFD design (up to level 2)
 - 2.4. Conceptual Modeling
 - 2.5. Entity Relationship Diagrams

- 3. Logic Modeling (3 Hrs)**
 - 3.1. Decision Table
 - 3.2. Decision Tree
 - 3.3. Structured English
 - 3.4. Data Dictionary

4. Systems Analysis (8 Hrs)

- 4.1. System planning and initial investigation
- 4.2. Project scheduling
- 4.3. Requirement analysis
- 4.4. Types of requirements
- 4.5. Requirement gathering methods
- 4.6. Feasibility study and its types
- 4.7. Steps of feasibility study
- 4.8. Cost/Benefit Analysis (Payback method, NPV method)

5. Systems Design (8 Hrs)

- 5.1. Introduction to systems design
- 5.2. The process and stages of systems design
- 5.3. Logical and physical design
- 5.4. Introduction to structured design (Modular system design, Functional strength, Structure chart, Cohesion, Coupling)
- 5.5. Database design and overview of file organization
- 5.6. Introduction to Normalization
- 5.7. Input/Output and Forms design

6. System Implementation (6 Hrs)

- 6.1. Introduction to system implementation
- 6.2. System installation and its types
- 6.3. System quality, Software quality assurance (Formal Technical Review, Walkthrough, Inspections)
- 6.4. System maintenance, types of maintenance, and process of system maintenance
- 6.5. System testing

7. Object-Oriented Analysis and Design (8 Hrs)

- 7.1. Object-Oriented Development Life Cycle
- 7.2. The Unified Modeling Language
- 7.3. Use-Case Modeling
- 7.4. Object Modeling: Class Diagrams
- 7.5. Dynamic Modeling: State Diagrams

7.6. Dynamic Modeling: Sequence Diagrams

Reference Books:

1. "Introduction to System Analysis & Design", Igor Hawryskiewicz, PHI, 4th Edition
2. Jeffery A. Hoffer, Joey F. George, Joseph S. Valacich, "Modern System Analysis & Design", Pearson Education, 2nd Edition
3. Englewood Cliffs, New Jersey, "System Analysis & Design"
4. Jeffrey L. Whitten, Loonnie D. Bentley, "System Analysis & Design Methods", 5th Edition
5. Grady Booch, "Object Oriented Analysis & Design with Applications", Pearson Education

Project-III

BIT 206CO

Year: II

Semester: I

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
-	-	3	Theory	Practical	Theory	Practical	100
			-	60	-	40	

Course Objective:

After finishing this project, students will be able to develop microcontroller based project.

Course Contents:

A Project group will be developing a microcontroller (BIT202CO) based system. Every students of the group should work at least for 45 lab hours under the supervision of the assigned supervisor. Students must develop the assigned software, submit written report, and give oral presentation.

Project Evaluation Criteria for Internal assessment:

The practical marks allotted for the project should be evaluated based on the following criteria:

- Title identification and Proposal Writing— 10 Marks
- Mid-term Presentation — 20 Marks
- Pre-final Submission and final Presentation — 30 Marks

Group Size: 2 to 3 student in a group