



## 1.1.3

### List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

| Colour Codes               |            |  |
|----------------------------|------------|--|
| Name of the Subjects       | Yellow     |  |
| Employability Contents     | Green      |  |
| Entrepreneurship Contents  | Light Blue |  |
| Skill Development Contents | Pink       |  |



**List of Courses Focus on Employability/ Entrepreneurship/ Skill Development**

**Department : Information Technology**

**Programme Name : B.Tech.**

**Academic Year : 2024-25**

**List of Courses Focus on Employability/ Entrepreneurship/Skill Development**

| Sr. No. | Course Code | Name of the Course                    |
|---------|-------------|---------------------------------------|
| 01.     | ITUCTT1     | DATA STRUCTURE & ALGORITHMS           |
| 02.     | ITUCTT2     | OBJECT ORIENTED PROGRAMMING           |
| 03.     | ITUCTT3     | DIGITAL ELECTRONICS                   |
| 04.     | ITUCTK1     | COMPUTER ORGANIZATION & ARCHITECTURE  |
| 05.     | ITUDTT1     | PYTHON FOR DATA SCIENCE               |
| 06.     | ITUDTT2     | OPERATING SYSTEMS                     |
| 07.     | ITUDTK1     | DESIGN & ANALYSIS OF ALGORITHMS       |
| 08.     | ITUDTO1     | COMPUTER NETWORK (Not for IT)         |
| 09.     | ITUETT1     | MACHINE LEARNING                      |
| 10.     | ITUETT1     | DATABASE MANAGEMENT SYSTEMS           |
| 11.     | ITUETT3     | FORMAL LANGUAGE & AUTOMATA THEORY     |
| 12.     | ITUETK1     | DIGITAL IMAGE PROCESSING              |
| 13.     | ITUETK2     | SOFTWARE TESTING & QUALITY MANAGEMENT |
| 14.     | ITUETK3     | SOFT COMPUTING                        |
| 15.     | ITUETK4     | WIRELESS SENSOR NETWORK               |
| 16.     | ITUETK5     | HUMAN COMPUTER INTERFACE              |
| 17.     | ITUETK6     | NETWORK SECURITY                      |
| 18.     | IT207TPC01  | CYBER SECURITY                        |
| 19.     | IT207TPE42  | DATA MINING                           |
| 20.     | IT207TPE51  | INTERNET OF THINGS                    |
| 21.     | IT208TPE02  | OBJECT ORIENTED ANALYSIS & DESIGN     |
| 22.     | IT208TOE34  | REAL TIME SYSTEM                      |



## Scheme and Syllabus

**SCHEME FOR EXAMINATION  
B.TECH (FOUR YEAR) DEGREE COURSE  
SECOND YEAR, INFORMATION TECHNOLOGY  
SEMESTER III  
EFFECTIVE FROM SESSION 2023-24 (NEP)**

| SL. NO.                                                                                   | SUBJECT CODE | SUBJECTS                                 | PERIODS/ WEEK |   |   | EVALUATION SCHEME |     |       | CREDITS |
|-------------------------------------------------------------------------------------------|--------------|------------------------------------------|---------------|---|---|-------------------|-----|-------|---------|
|                                                                                           |              |                                          | L             | T | P | IA                | ESE | TOTAL |         |
| THEORY                                                                                    |              |                                          |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUCTT1      | DATA STRUCTURE & ALGORITHMS              | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 2                                                                                         | ITUCTT2      | OBJECT ORIENTED PROGRAMMING              | 3             | 1 | 0 | 40                | 60  | 100   | 4       |
| 3                                                                                         | ITUCTT3      | DIGITAL ELECTRONICS                      | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 4                                                                                         | ITUCTE1      | MATHEMATICS-III                          | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 5                                                                                         | ITUCTKX      | DEPARTMENT ELECTIVE-I                    | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 6                                                                                         |              | INSTITUTE CORE-I                         | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| PRACTICAL                                                                                 |              |                                          |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUCLT1      | DATA STRUCTURE LAB                       | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| 2                                                                                         | ITUCLT2      | OBJECT ORIENTED PROGRAMMING WITH C++ LAB | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| TOTAL CREDITS                                                                             |              |                                          |               |   |   |                   |     |       | 22      |
| IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL |              |                                          |               |   |   |                   |     |       |         |

**LIST OF DEPARTMENT ELECTIVE-I**

|    |         |                                      |
|----|---------|--------------------------------------|
| 1  | ITUCTK1 | COMPUTER ORGANIZATION & ARCHITECTURE |
| 2  | ITUCTK2 | SOFTWARE ENGINEERING                 |
| 3. | ITUCTK3 | MULTIMEDIA SYSTEM DESIGN             |

**LIST OF INSTITUTE CORE-I**

|   |         |                                                   |
|---|---------|---------------------------------------------------|
| 1 | ITUCTO1 | COMPUTER ORGANIZATION & ARCHITECTURE (Not for IT) |
| 2 | CSUCTO1 | DATA STRUCTURE WITH C++                           |
| 3 | ECUCTO1 | DATA COMMUNICATION                                |
| 4 | CEUCTO1 | GREEN BUILDINGS                                   |
| 5 | CHUCTO1 | ENGINEERING MATERIALS                             |
| 6 | MEUCTO1 | INTRODUCTION TO THERMODYNAMICS                    |
| 7 | IPUCTO1 | LC. ENGINE                                        |



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUCTKI  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

#### **COMPUTER ORGANIZATION & ARCHITECTURE**

##### **Course Objectives:**

1. Conceptualize the basics of organizational and architectural,
2. Learn about various basic arithmetic operation
3. Learn about various control unit design and Input-output subsystems
4. Understand the basics pipeline.
5. Understand the basics Memory organization and their basic working.

##### **UNIT 1**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

##### **UNIT 2**

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

##### **UNIT 3**

Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

##### **UNIT 4**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

##### **UNIT 5**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

##### **Suggested books:**

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

##### **Suggested reference books:**

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.



**Course Outcomes:**

After the course the students are expected to be able to

1. Demonstrate computer organization and architecture concepts of a computer system
2. Describe the Computer arithmetic operation algorithm and hardware
3. Understand the basics of hardwired and micro-programmed control of the CPU, Memory, I/O system
4. Describe fundamentals concepts of pipeline and issues
5. Describe the memory hierarchy and related function.



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUCTT1  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

### DATA STRUCTURE & ALGORITHMS

#### Course Objective

1. To impart the basic concepts of data structures and algorithms and understand concepts about searching and sorting techniques.
2. To understand basic concepts about Linked lists and master the implementation of linked data structures.
3. To understand basic concepts about stacks and queues.
4. To understand basic concepts about Tree.
5. To understand basic concepts about Graph and be familiar with some graph algorithms such as shortest path and minimum spanning tree.

#### UNIT-I

**Introduction:** Basic Terminology, Definition of Data Structure, Types of Data Structure, Operation on Data Structure, **Arrays:** Array Definition, Representation of Arrays: Row Major Order, and Column Major Order.

**Searching and Sorting:** Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Binary Search, Linear Search.

#### UNIT II

**Linked lists:** Definition, Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly Linked List, Circularly Linked List.

#### UNIT III

**Stacks:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.,

**Queue:** Array and linked representation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Deques.

#### UNIT IV

**Trees:** Basic Technology, Binary Tree, Binary tree representation, Algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Full Binary Tree, Array and linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary search trees (BST), Insertion and deletion in BST, AVL trees, Heap and heap sort.

#### UNIT V

**Graph:** Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Weighted Graph, Sequential Representations of Graphs, Adjacency Matrices, Adjacency List, Path Matrices, Linked Representations of Graphs, Graph Traversal - DFS, BFS, Shortest Path algorithm: Warshal Algorithm and Dijkstra Algorithm, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm.

#### References books:

1. Lipschutz, "Data Structures with C" Schaum's Outline Series, TMH.
2. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd.



3. R. Kruse et al, "Data Structures and Program Design in C", Pearson Education Asia.
4. A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd.
5. K Loudon, "Mastering Algorithms with C", Shroff Publisher & Distributors Pvt. Ltd.
6. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.
7. G A V Pai, "Data Structures and Algorithms", TMH.
8. G.S.Baluja, "Data Structures through C", Dhanpat Rai & Co.
9. Yashavant Kanetkar, "Data Structure Through C", BPB Publication.

**Course Outcome**

Upon completion of this course, the students will be able to

1. Student will be able to choose appropriate data structure as applied to specified problem definition.
2. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Students will be able to apply concepts learned in various domains like DBMS, compiler construction etc.
4. Students will be able to use linear and non-linear data structures like stacks, queues, linked list etc.
5. Students will be able to know about different types of graphs and their applications.



| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUCTT3  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### **DIGITAL ELECTRONICS**

#### **Course Objectives:**

1. To understand the basic knowledge of digital logic and components.
2. To simplify the Boolean expressions or Combinational circuits for compact circuits.
3. Design of combinational circuits and sequential circuits.
4. Application of knowledge to understand digital electronics circuits.
5. To impart how to design Digital Circuits.

#### **UNIT 1 - Fundamentals of Digital systems and logic families**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive OR operations, Boolean algebra, examples of IC gates, number systems- binary, signed binary, octal, Hexadecimal number, binary arithmetic, One's and two's complements, arithmetic codes, error detecting, and correcting codes, characteristics of digital ICs, digital logic families, TTL, schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

#### **UNIT 2 - Combinational Digital Circuits**

Standard representation for logic function, K map representation, simplification of logic functions, using K map, minimization of logical functions. Don't care conditions, Multiplexes, De- Multiplexes, / Decoders, Adders, Sub tractors, BCD arithmetic, carry look ahead, serial adders, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker, / generator, code converters, priority encoders, decoders/ drivers, for display devices, Q-M method of function realization.

#### **UNIT 3 - Sequential circuits and systems**

A 1 bit memory, the circuits properties, of Bi-stable latch, the clocked SR flip flop, JK flip flops, T flip flops, D flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counter's design using flip flops, special counter IC's, Asynchronous sequential counters, applications of counters.

#### **UNIT 4 - A/D and D/A converters**

Digital to analog converters: weighted registers/ converters, R-2R Ladder, D/A converters, specifications for D /A converters, examples of D /A converter ICs, sample and hold circuits, Analog to digital converters: quantization and encoding, parallel comparator, A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A / D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

#### **UNIT 5 - Semiconductor memories and Programmable logic devices**

Memory organization and operation, expanding memory size, classification and characteristics of memories, Sequential memories, read-only memory ( ROM ), read and write memory ( RAM ), content addressable memory ( CAM ), charge coupled device memory ( CCD ), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices ( CPLDS ), Field Programmable Gate Array ( FPGA ).

#### **Text / References:**

1. M.M Mano, "Digital logic and Computer design", Pearson Education India.
2. R.P. Jain, " Modern Digital Electronics ", McGraw Hill Education.
3. A kumar, "Fundamentals of Digital Circuits ", Prentice Hall India.
4. S Salivahanan and S Arivazhagan " Digital Circuits and Design" OXFORD University Press.



**Course Outcome (COs):**

At the end of this course, students will demonstrate the ability to

1. Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
2. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
3. Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.
4. Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.
5. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.



| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUCTT2  | 3 | 1 | 0 | 4 HOURS  | 40 | 60  | 4       |

### OBJECT ORIENTED PROGRAMMING

#### Course Objectives:

1. To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, Functions, learn the concept of class and object and develop classes for simple applications with C++.
2. To learn how to implement Constructors, copy constructors and destructor functions.
3. To learn how to overload functions and operators in C++.
4. To learn how to design C++ classes for code reuse and perform inheritance.
5. To learn working with files and handle exceptions in program.

#### UNIT I

**Overview of C++:** Object oriented programming, Concepts, Advantages, Usage. C++ Environment: Program development environment, the language and the C++ language standards. Introduction to various C++ compilers, C++ standard libraries, Prototype of main() function, Data types. C++ as a superset of C, New style comments, main function in C++, meaning of empty argument list, function prototyping, default arguments and argument matching.

**User defined data types:** enumerated types, use of tag names, anonymous unions, scope of tag names  
**Classes & Objects :** Classes, Structure & Classes, Inline Function, Scope Resolution operator, Static Class Members: Static Data Member, Static Member Function, Passing Objects to Function, Returning Objects, Object Assignment. Friend Function, Friend Classes

#### UNIT II

**Array, Pointers References & The Dynamic Allocation Operators:** Array of Objects, Pointers to Object, Type Checking C++ Pointers, The This Pointer, Pointer to Derived Types, Pointer to Class Members, References: Reference Parameter, call by reference and return by reference Passing References to Objects, Returning Reference, Independent Reference, C++'S Dynamic Allocation Operators, Initializing Allocated Memory, Allocating Array, Allocating Objects.

**Constructor & Destructor: Introduction,** Constructor, access specifier for constructors, and instantiation, Parameterized Constructor, Multiple Constructor in A Class, Constructor with Default Argument, Copy Constructor, Destructor.

#### UNIT III

**Overloading as polymorphism:** Function & Operator Overloading : Function Overloading, Overloading Constructor Function Finding the Address of an Overloaded Function, Operator Overloading: Creating A Member Operator Function, Creating Prefix & Postfix Forms of the Increment & Decrement Operation, Overloading The Shorthand Operation (i.e., +=, -= etc), Operator Overloading Restrictions, Operator Overloading Using Friend Function, Overloading Some Special Operators like [ ], ( ), -, Comma Operator, Overloading << etc.

#### UNIT IV

**Inheritance :** Base Class Access Control, Inheritance & Protected Members, Protected Base Class Inheritance, Inheriting Multiple Base Classes, Constructors, Destructors & Inheritance, When Constructor & Destructor Function are Executed, Passing Parameters to Base Class Constructors, Granting Access, Virtual Base Classes .

**Virtual Functions & Polymorphism:** Virtual Function, Pure Virtual Functions, Early Vs. Late Binding.

#### UNIT V

**Working with files:** File & stream, Opening and closing a file, read ( ) and write ( ) functions, detecting end of file.



**Templates and Exception Handling:** Exception handling in C++, try, throw, catch sequence, multiple catch blocks, uncaught exceptions, catch-all exception handler

**Reference Books:**

1. Object Oriented Programming with C++ by M. P. Bhawe, S. A. Patekar, Pearson Education
2. Object Oriented Programming With C++ by E. Balaguruswamy.
3. Object Oriented Programming in turbo C++ by Robert Lafore.
4. Programming with C++ by D. Ravichandan.
5. Programming with C++ (SOS) by Hubbard.

**Course Outcomes:-**

1. Understand the C++ language features. Use the control structure and data types in C++. Write simple programs using classes and objects.
2. Understand the concepts of arrays, pointers, references and use of dynamic allocation operators. Write simple programs to implement Constructor & destructor concepts.
3. Understand the concept of Operator overloading and type conversion.
4. Understand the concepts of inheritance and virtual functions.
5. Understand file handling concepts, generic class and I/O exception handling.



**SCHEME FOR EXAMINATION  
B.TECH (FOUR YEAR) DEGREE COURSE  
SECOND YEAR, INFORMATION TECHNOLOGY  
SEMESTER IV  
EFFECTIVE FROM SESSION 2023-24 (NEP)**

| SL. NO.                                                                                   | SUBJECT CODE | SUBJECTS                    | PERIODS/ WEEK |   |   | EVALUATION SCHEME |     |       | CREDITS |
|-------------------------------------------------------------------------------------------|--------------|-----------------------------|---------------|---|---|-------------------|-----|-------|---------|
|                                                                                           |              |                             | L             | T | P | IA                | ESE | TOTAL |         |
| THEORY                                                                                    |              |                             |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUDTT1      | PYTHON FOR DATA SCIENCE     | 3             | 1 | 0 | 40                | 60  | 100   | 4       |
| 2                                                                                         | ITUDTT2      | OPERATING SYSTEMS           | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 3                                                                                         | ITUDTT3      | DISCRETE MATHEMATICS        | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 4                                                                                         | ITUDTKX      | DEPARTMENT ELECTIVE-II      | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 5                                                                                         |              | INSTITUTE CORE-II           | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| PRACTICAL                                                                                 |              |                             |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUDLT1      | PYTHON FOR DATA SCIENCE LAB | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| 2                                                                                         | ITUDLT2      | OPERATING SYSTEMS LAB       | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| 3                                                                                         | ITUDPV1      | MINI PROJECT                | 0             | 0 | 4 | 50                | 50  | 100   | 2       |
| TOTAL CREDITS                                                                             |              |                             |               |   |   |                   |     |       | 21      |
| IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL |              |                             |               |   |   |                   |     |       |         |

**LIST OF DEPARTMENT ELECTIVE-II**

|   |         |                                         |
|---|---------|-----------------------------------------|
| 1 | ITUDTK1 | DESIGN & ANALYSIS OF ALGORITHMS         |
| 2 | ITUDTK2 | DIGITAL SIGNAL PROCESSING               |
| 3 | ITUDTK3 | COMPUTER APPLICATION IN SOCIAL SCIENCES |

**LIST OF INSTITUTE CORE-II**

|   |         |                                                 |
|---|---------|-------------------------------------------------|
| 1 | ITUDTO1 | COMPUTER NETWORK (Not for IT)                   |
| 2 | ITUDTO2 | FUNDAMENTALS OF PYTHON PROGRAMMING (Not for IT) |
| 3 | CSUDTO1 | INTRODUCTION TO INFORMATION SCIENCE             |
| 4 | ECUDTO1 | ELECTRONICS DEVICES AND CIRCUITS                |
| 5 | CEUDTO1 | REMOTE SENSING & GIS                            |
| 6 | CHUDTO1 | ENERGY AND ENVIRONMENT ENGINEERING              |
| 7 | ESUDTO1 | EFFECTIVE TECHNICAL COMMUNICATION               |
| 8 | MEUDTO1 | INTRODUCTION TO FLUID MECHANICS                 |
| 9 | IPUDTO1 | AUTOMOBILE ENGINEERING                          |



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUDTK1  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

#### DESIGN & ANALYSIS OF ALGORITHMS

##### Course Objectives

1. To develop proficiency in problem solving and programming.
2. To be able to carry out the Analysis of various Algorithms for mainly Time and Space Complexity.
3. To get a good understanding of applications of Data Structures.
4. To develop a base for advanced study in Computer Science.
5. To teach various advanced design and analysis techniques such as greedy algorithms, dynamic programming & Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

##### Unit 1:

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

##### Unit 2:

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branchand-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

##### Unit 3:

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

##### Unit 4:

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

##### Unit 5:

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

##### Suggested books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

##### Suggested reference books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

##### Course Outcomes

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.



2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming.
5. To understand an analyses approximation algorithms, Randomized algorithms, NP and P SPACE.



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUDTO1  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

**COMPUTER NETWORK (Not for IT)**

**Course Objective**

1. Discuss the basic taxonomy and terminology of the computer networking.
2. Discuss the functionality of different layers of OSI Model.
3. Discuss different protocols of TCP/IP protocol suite.
4. Discuss the process of IP addressing and working of routing protocols.
5. Discuss the different challenges of Internetworking, Congestion control and Quality of services.

| Unit No. | Syllabus Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No. of Hours |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1        | <b>Introduction:</b><br><b>Data communications:</b> Components, Data representation, Direction of data flow (simplex, half duplex, full duplex).<br><b>Networks:</b> Distributed processing, Network criteria, Physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, internet today, Protocols and standard.<br><b>Reference models:</b> OSI reference model, TCP/IP reference model, their comparative study.<br><b>Physical Layer:</b> Transmission technology. | 10           |
| 2        | <b>Data Link Layer:</b> Types of errors, Error detection & correction methods, Framing (character and bit stuffing), Flow control, Protocols: Stop & wait ARQ Go – Back – N ARQ, Selective repeat ARQ<br><b>Medium access sub layer:</b> Point to point protocol, Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Token ring, Reservation, Polling, FDMA, TDMA, CDMA.                                                                                                                                     | 10           |
| 3        | <b>Network Layer:</b><br><b>Internetworking devices:</b> Repeaters, Hubs, Bridges, Switches, Router, Gateway.<br><b>Addressing:</b> IP addressing, classful addressing, subnetting.<br><b>Routing:</b> Techniques, Static vs. Dynamic routing, Routing table for classful address, Flooding, Shortest path algorithm, Distance vector routing, Link state routing.<br><b>Protocols:</b> ARP, RARP, IP, ICMP, IPV6.                                                                                                             | 10           |
| 4        | <b>Transport Layer:</b> Process to process delivery, UDP: Services and applications, TCP: Stream Oriented Service, Segment, Timers, Congestion control techniques: Avoidance and Detection.                                                                                                                                                                                                                                                                                                                                    | 8            |
| 5        | <b>Application Layer:</b> DNS, SMTP, FTP, HTTP & WWW.<br><b>Security:</b> Cryptography, User authentication, Security protocols in internet, Firewalls. Recent research topic on networking.                                                                                                                                                                                                                                                                                                                                   | 7            |

**Text Books:**

1. Data Communications and Networking by B.A.Forouzan – TMH Publication.
2. Computer Networks by S. Tanenbaum – Pearson Education / PHI Publication.

**Reference Books:**

1. Internetworking with TCP/IP by Comer - Pearson Education/PHI by Publication.
2. Data and Computer Communications by W.Stallings – PHI Publication.



**Course Outcome**

1. Upon completion of this course, the students will be able to
2. Understand the working of different internetworking devices.
3. Understand the working of Internet.
4. Understand the difference between OSI and TCP/IP.
5. Understand the security mechanism in Networking.
6. Understand core concept of IP addressing and routing.



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUDTT2  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

#### OPERATING SYSTEMS

##### Objectives of the course

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management in contemporary OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
5. To know the components and management aspects of concurrency management.

##### UNIT I - INTRODUCTION TO OPERATING SYSTEM:

Objective and function of operating system. The evaluation of the operating system, system components operating system services, system structure, batch interactive, time sharing and real time operating system, Protection. File system: File concepts, file organization and access mechanism.

##### UNIT II - CONCURRENT PROCESS:

Process concepts, principal of concurrency. The producer consumer problem, the critical section problem, semaphore, classical problem in concurrency, inter process communication, process generation, process scheduling.

##### UNIT III - CPU SCHEDULING:

Scheduling concepts, performance criteria scheduling algorithms. Algorithm evaluation, multiprocessor scheduling. I/O management and Disk scheduling I/O devices and organization of the I/O functions. I/O buffering disk I/O operating system design issues.

##### UNIT IV - DEAD LOCKS:

System models, deadlock characterization, prevention, avoidance and detection recovery from deadlock, combined approach.

##### UNIT V - MEMORY MANAGEMENT:

Base machine, Residence monitor, multiprogramming with fixed partition, multiprogramming with variable partitions, multiple base register, paging, segmentation, paging segmentation, virtual memory concepts, demand paging performance, page replacement algorithms, allocation of frames, thrashing, cache memory organization impact on performance.

##### Reference Books

1. Milenkovic M., "Operating System concepts", MGH
2. Tanenbaum A. S. "Operating System design and implementation", PHI
3. Silberschatz A. and Patterson J.I., "Operating system concepts", Wiley.
4. Stalling William "Operating System", Maxwell McMillan International Edition 1992.
5. Dectel H.N., "An introduction to operating system", Addison Wesley.

##### Course Outcomes

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. Specification of memory organization develops the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.



| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUDTT1  | 3 | 1 | 0 | 4 HOURS  | 40 | 60  | 4       |

### PYTHON FOR DATA SCIENCE

#### Course Objectives:

1. To read and write simple Python programs.
2. To develop Python programs with conditions, loops and functions.
3. To create and work with files in python.
4. To develop OOP programs in python.
5. To create and work on Numpy arrays.
6. To handle data in python using pandas.

#### UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

#### UNIT 2: FILE, EXCEPTION HANDLING AND OOP

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling. OOPs Concepts -Class and Objects, Constructors - Data hiding- Data Abstraction- Inheritance.

#### UNIT 3: INTRODUCTION TO NUMPY

NumPy Basics: Arrays and Vectorized Computation - The NumPy nd array- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes.

Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods - Sorting-Unique and Other Set Logic.

#### UNIT 4: DATA MANIPULATION WITH PANDAS

Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

#### UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas.

Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

#### TEXT BOOKS

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition, 2018.
3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.



4. Miller, Bradley, and David Ranum. Problem Solving with Algorithms and Data Structures Using Python. 2nd ed. Franklin, Beedle & Associates, 2011. ISBN: 9781590282571.

#### REFERENCES BOOKS

1. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

#### E BOOKS

1. <https://www.programmer-books.com/introducing-data-science-pdf/>
2. <https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf>
3. [http://math.ecnu.edu.cn/~lfzhou/seminar/\[Joel\\_Grus\]\\_Data\\_Science\\_from\\_Scratch\\_First\\_Principle.pdf](http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Principle.pdf)

#### MOOC

1. <https://www.edx.org/course/python-basics-for-data-science>
2. <https://www.edx.org/course/analyzing-data-with-python>
3. <https://www.coursera.org/learn/python-plotting?specialization=data-science-python>

#### Course Outcomes:

Upon successful completion of the course, students will be able to

1. Introduce students to Python's history, installation, and basic usage, enabling them to write and execute simple Python programs.
2. Familiarize students with Python syntax, data types, variables, and fundamental operators to build a solid programming foundation.
3. Teach students how to make decisions and control program flow using conditional statements and loops in Python.
4. Equip students with essential skills for file handling, and exception handling, and introduce them to modules and libraries in Python for more advanced programming tasks.
5. Teach students data structures and data manipulation techniques for data analysis
6. Familiarize students for data preparation and visualization tasks



**SCHEME FOR EXAMINATION  
B.TECH (FOUR YEAR) DEGREE COURSE  
THIRD YEAR, INFORMATION TECHNOLOGY  
SEMESTER V  
EFFECTIVE FROM SESSION 2024-25 (NEP)**

| EFFECTIVE FROM SESSION 2024-25 (NEP)                                                      |              |                                   |               |   |   |                   |     |       |         |
|-------------------------------------------------------------------------------------------|--------------|-----------------------------------|---------------|---|---|-------------------|-----|-------|---------|
| SL. NO.                                                                                   | SUBJECT CODE | SUBJECTS                          | PERIODS/ WEEK |   |   | EVALUATION SCHEME |     |       | CREDITS |
|                                                                                           |              |                                   | L             | T | P | IA                | ESE | TOTAL |         |
| THEORY                                                                                    |              |                                   |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUET11      | MACHINE LEARNING                  | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 2                                                                                         | ITUET12      | DATABASE MANAGEMENT SYSTEMS       | 3             | 1 | 0 | 40                | 60  | 100   | 4       |
| 3                                                                                         | ITUET13      | FORMAL LANGUAGE & AUTOMATA THEORY | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 4                                                                                         | ITUETKX      | DEPARTMENT ELECTIVE-III           | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| 5                                                                                         | ITUETKX      | DEPARTMENT ELECTIVE-IV            | 3             | 0 | 0 | 40                | 60  | 100   | 3       |
| PRACTICAL                                                                                 |              |                                   |               |   |   |                   |     |       |         |
| 1                                                                                         | ITUET11      | MACHINE LEARNING LAB              | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| 2                                                                                         | ITUET12      | DATABASE MANAGEMENT SYSTEMS LAB   | 0             | 0 | 3 | 25                | 25  | 50    | 1.5     |
| 3                                                                                         | ITUETPV1     | MINI PROJECT - II                 | 0             | 0 | 4 | 50                | 50  | 100   | 2       |
| TOTAL CREDITS                                                                             |              |                                   |               |   |   |                   |     |       | 21      |
| IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL |              |                                   |               |   |   |                   |     |       |         |

  
  
  
  




LIST OF DEPARTMENT ELECTIVE-III

|    |         |                                       |
|----|---------|---------------------------------------|
| 1  | ITUETK1 | DIGITAL IMAGE PROCESSING              |
| 2  | ITUETK2 | SOFTWARE TESTING & QUALITY MANAGEMENT |
| 3. | ITUETK3 | SOFT COMPUTING                        |

LIST OF DEPARTMENT ELECTIVE-IV

|    |         |                          |
|----|---------|--------------------------|
| 1  | ITUETK4 | WIRELESS SENSOR NETWORK  |
| 2  | ITUETK5 | HUMAN COMPUTER INTERFACE |
| 3. | ITUETK6 | NETWORK SECURITY         |

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| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUET1   | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### **MACHINE LEARNING**

#### **Course Objectives:**

Students must be able to:

1. Understand the concept of learning and candidate elimination algorithms.
2. Understand the concept of perception and explore on Genetic algorithms
3. Explore on computational learning methods
4. Explore on instance based and case based learning.
5. Explore inductive learning and Reinforcement Learning methods

#### **UNIT I**

**Introduction:** Representation and Learning: Feature Vectors, Feature Spaces, Feature Extraction and Feature Selection, Learning Problem Formulation

**Types of Machine Learning Algorithms:** Parametric and Nonparametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.

**Preliminaries:** Over fitting, Training, Testing, and Validation Sets, The Confusion Matrix, Accuracy Metrics: Evaluation Measures: SSE, RMSE, R2, confusion matrix, precision, recall, F-Score, Receiver Operator Characteristic (ROC) Curve, Unbalanced Datasets, some basic statistics: Averages, Variance and Covariance, The Gaussian, the bias-variance tradeoff.

#### **UNIT II**

##### **Supervised Algorithms**

**Regression:** Linear Regression, Logistic Regression, Linear Discriminant Analysis.

**Classification:** Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines, evaluation of classification: cross validation, hold out.

#### **UNIT III**

**Ensemble Algorithms:** Bagging, Random Forest, Boosting

**Unsupervised Learning:**

**Cluster Analysis:** Similarity Measures, categories of clustering algorithms, k-means, Hierarchical, Expectation-Maximization Algorithm, Fuzzy c-means algorithm.

#### **UNIT IV**

**Neural Networks:** Multilayer Perceptron. Back-propagation algorithm. Training strategies, Activation Functions, Gradient Descent For Machine Learning, Radial basis functions, Hopfield network, Recurrent Neural Networks.

**Deep learning:** Introduction to deep learning. Convolutional Neural Networks (CNN), CNN Architecture, pre-trained CNN (LeNet, AlexNet).



### UNITY

**Reinforcement Learning:** overview, example: getting lost, State and Action Spaces, The Reward Function, Discounting, Action Selection, Policy, Markov decision processes, Q-learning, uses of Reinforcement learning

**Applications of Machine Learning in various fields:** Text classification, Image Classification, Speech Recognition.

### TEXT BOOKS:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Second Edition (Chapman & Hall/Cre Machine Learning & Pattern Recognition) (2014)
2. Machine Learning, Tom Mitchell, McGraw-Hill Science/Engineering/Math: (1997).
3. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press (2017)
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer Series in Statistics. (2009).
5. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer. (2006)
6. An Introduction to Pattern Recognition and Machine Learning, M Narasimha Murty, V Susheela Devi, IISc Press.
7. Uma N. Dulhare, Khaleel Ahmad, Khairul Amali Bin Ahmad, Machine Learning and Big Data: Concepts, Algorithms, Tools and Applications, Scrivener Publishing, Wiley, 2020.

### Course Outcomes:

1. Extract features that can be used for a particular machine learning approach in various applications.
2. Compare and contrast pros and cons of various machine learning techniques and to get an insight when to apply particular machine learning approach.
3. Understand different machine learning types along with algorithms.
4. Understand how to apply machine learning in various applications.
5. Apply ensemble techniques for improvement of classifiers.



relational model.

2. Master the basics of SQL for retrieval and management of data.
3. To construct queries in SQL or Relational Algebra.
4. Be acquainted with the basics of transaction processing and concurrency control.
5. Familiarity with database storage structures and access techniques.

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| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETT3  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### Formal Language & Automata Theory

#### Course Objectives:

1. Understand basic properties of formal languages and formal grammars.
2. Design and Understand basic properties of deterministic, nondeterministic finite automata, TM, Mealy, PDA and Moore automata.
3. Understand the relation between types of languages and types of finite automata.
4. Design and Understanding the Context free languages and grammars, and also Normalizing CFG.
5. Know the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem.

**Unit-I** Automata: Basic machine, FSM, Transition graph, Transition matrix, Deterministic and nondeterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, minimization of finite automata, Two-way finite automata, Regular Sets and Regular Grammars: Alphabet, words, Operations, Regular sets, Finite automata and regular expression, MyhillNerode theorem Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.

**Unit-II** Context -Free Grammars: Introduction to CFG, Regular Grammars, Derivation trees and Ambiguity, Simplification of Context free grammars, Normal Forms (Chomsky Normal Form and Greibach Normal forms).

**Unit-III** Pushdown Automata: Definition of PDA, Deterministic Pushdown Automata, PDA corresponding to given CFG, CFG corresponding to a given PDA, Context Free Languages: The pumping lemma for CFL's, Closure properties of CFL's, Decision problems involving CFL's.

**Unit-IV** Turing Machines: Introduction, TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, Church's hypothesis, composite & iterated TM, Turing machine as enumerators, Properties of recursive & recursively enumerable languages, Universal Turing machine

**Unit V** Tractable and Untractable Problems: P, NP, NP complete and NP hard problems, examples of these problems like satisfy ability problems, vertex cover problem, Hamiltonian path problem, traveling sales man problem, Partition problem etc.

#### Suggested books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

#### Suggested reference books:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.



4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

**Course Outcomes :**

1. Comprehend Knowledge to acquire a full understanding of Automata Theory as the basis of all computer science languages - Model building and have a clear understanding of the Automata theory concepts.
2. Cognitive skills - Be able to design FAs, NFAs, Grammars, languages modeling, small compilers basics - Be able to design sample automata - Be able to minimize FA's and Grammars of Context Free Languages.
3. Be able to design sample automata - Be able to minimize FA's and Grammars of Context Free Languages.
4. Professional Skill - Perceive the power and limitation of a computer as a computing machine.
5. Attitude - Develop a perception on the importance of computational theory as model building.

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| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETK1  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### **DIGITAL IMAGE PROCESSING**

#### **Course Objectives:**

1. Cover the basic theory and algorithms that are widely used in digital image processing.
2. Expose students to current technologies and issues that are specific to image processing systems.
3. Develop hands-on experience in using computers to process images.
4. Develop critical thinking about shortcomings of the state of the art in image processing.

#### **Unit I: Introduction**

Image formation model, Spatial & Gray level resolution, Image enhancement in special domain: Piecewise transformation functions, Histogram equalization, Histogram specification, image averaging, spatial filters- smoothing and sharpening. Laplacian filter, Canny edge detector.

#### **Unit II: Image Enhancement in Frequency Domain & Image segmentation:**

2D discrete Fourier transform & its inverse, filtering in frequency domain, Ideal & Gaussian low pass filters, High pass filtering, FFT, Line detection, Edge detection, Edge linking & boundary detection, Thresholding, Region based segmentation.

#### **UNIT III: Morphological Image Processing**

Logic operations involving binary image, Dilation & Erosion, Opening & Closing, Applications to Boundary extraction, region filling, connected component extraction.

#### **UNIT IV: Image compression**

Coding redundancy- Huffman coding, LZW coding, run length coding, Lossy compression- DCT, JPEG, MPEG, video compression.

#### **UNIT V: Image representation & 3D**

Boundary descriptors, Shape numbers, Texture, Projective geometry, Correlation based and feature based stereo correspondence, shape from motion, optical flow.

#### **Text Book**

1. Gonzalez and Woods, Digital Image Processing, Pearson education.
2. Sonka and Brooks, Image Processing, TSP Ltd,

#### **References Book: -**

1. Jain and Rangachar, Machine Vision, MGH.
2. Schalkoff, Digital Image Processing, John Wiley and sons.

#### **Course Outcomes:**

After successful completion of the course, student will be able to

1. Describe, analyze and reason about how digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation.
2. Design and analysis. Analyze and implement image processing algorithms.
3. Apply principles and techniques of digital image processing in applications related to digital imaging system.



| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETK2  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### SOFTWARE TESTING AND QUALITY MANAGEMENT

#### Course Objectives

1. Study fundamental concepts of software testing and its application in various scenarios.
2. Understand white box, block box and other testing's.
3. Understand the importance of software quality and assurance software systems development
4. Understand the quality management, assurance, and quality standard to software.
5. To understand software test automation problems and solutions.

#### UNIT I

Software Quality: Ethical Basis for software Quality. Total quality Management Principles, Software Processes and Methodologies, Quality Standards, Practices & conventions, Top Down and Bottom-Up Approach.

#### UNIT II

Software management Reviews and Audits, Enterprise Resource Planning Software. Measurement Theory , Software Quality Metrics, designing Software Measurement Programs , Organizational Learning.

#### UNIT III

Improving Quality with methodologies: Structured information Engineering , Object-Oriented Software , Reverse Engineering , Measuring Customer Satisfaction Defect Prevention , Reliability Models , Reliability Growth Models.

#### UNIT IV

Software Quality Engineering: Defining Quality Requirements Management, Complexity Metrics and Models, Management issues for software Quality, Project Tracking and Oversight, Use of CASE tool Technology, Role of Groupware, data Quality Control.

#### UNIT V

Project Configuration management: Configuration Management Concepts, Configuration Management Process, Document Control, Configuration Management plan of the WAR Project.

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**List of Books:**

1. Stephan Kan, Metrics and Models in Software quality, Addison Wesley.
2. Mark Paulik, The capability Maturity Model-guidelines for improving the software Process, Addison Wesley.
3. Michael, Deutsch, Willis, Ronald r-Software Quality Engineering- A Total Technical and Management approach, Prentice Hall.
4. Ginac, Frank P, Customer Oriented Software Quality Insurance, Prentice Hall.
5. Wilson, Rodney C, Software RX secrets of Engineering Quality Software, Prentice Hall.
6. Pressman, Software Engineering-A practitioner's approach
7. Pankaj Jalote, CMM Project

**Course Outcomes**

After completion of this course, student will be able to

1. Understand importance of testing techniques in software quality management and assurance.
2. Identify various types of software risks and its impact on different software application.
3. Create test case scenarios for different application software using various testing techniques.
4. Apply different testing methodologies used in industries for software testing.
5. Describe fundamental concepts of software quality assurance.

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| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETK3  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### **SOFT COMPUTING**

#### **Course Objectives:**

1. To introduce the fundamental concepts and techniques of neural networks, including learning rules, activation functions, feedforward and feedback network models, and their applications in various fields.
2. To provide an in-depth understanding of supervised learning, including the perceptron learning algorithm, multilayer neural networks, linear separability, Adaline, Madaline, backpropagation network, and their applications in forecasting, data compression, and image compression.
3. To explore unsupervised learning techniques, including Kohonen SOM, counter propagation, ART, and their applications in pattern and face recognition, intrusion detection, and robotic vision.
4. To provide a comprehensive overview of fuzzy sets and their application in solving engineering problems, including fuzzy rules, fuzzy reasoning, fuzzy relations, and fuzzy inference systems.
5. To introduce genetic algorithms and their basic terminology and operators, including individual, gene, fitness, population, encoding, selection, crossover, mutation, and convergence criteria, and their applications in solving optimization problems like JSPP, TSP, network design routing, and timetabling problem.

#### **Unit I: Introduction to Neural Network:**

Concept, biological neural network, evolution of artificial neural network, McCulloch-Pitts neuron models, Learning (Supervised & Unsupervised) and activation function, Models of ANN Feed forward network and feedback network, Learning Rules- Hebbian, Delta, Perceptron Learning and Windrow-Hoff, winner take all.

#### **Unit II: Supervised Learning:**

Perceptron learning, Single layer/multilayer, linear Separability, Adaline, Madaline, Back propagation network, RBFN. Application of Neural network in forecasting, data compression and image compression.

#### **Unit III: Unsupervised learning:**

Kohonen SOM (Theory, Architecture, Flow Chart, Training Algorithm) Counter Propagation (Theory, Full Counter Propagation NET and Forward only counter propagation net), ART (Theory, ART1, ART2). Application of Neural networks in pattern and face recognition, intrusion detection, robotic vision.

#### **Unit IV: Fuzzy Set:**

Basic Definition and Terminology, Set-theoretic Operations, Member Function, Formulation and Parameterization, Fuzzy rules and fuzzy Reasoning, Extension Principal and Fuzzy Relations, Fuzzy if-then Rules, Fuzzy Inference Systems. Hybrid system including neuro fuzzy hybrid, neuro genetic hybrid and fuzzy genetic hybrid, fuzzy logic controlled GA. Application of Fuzzy logic in solving engineering problems.

#### **Unit V: Genetic Algorithm**

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Introduction to GA, Simple Genetic Algorithm, terminology and operators of GA (individual, gene, fitness, population, data structure, encoding, selection, crossover, mutation, convergence criteria). Reasons for working of GA and Schema theorem, GA optimization problems including JSPP (Job shop scheduling problem), TSP (Travelling salesman problem), Network design routing, timetabling problem.

**Text Book**

1. S.N. Shivnandam, "Principle of soft computing", Wiley.
2. S. Rajshekaran and G.A.V. Pai, "Neural Network, Fuzzy logic And Genetic Algorithm", PHI.

**References Book: -**

1. Jack M. Zurada, "Introduction to Artificial Neural Network System" JAico Publication.
2. Simon Haykins, "Neural Network- A Comprehensive Foudation".
3. Timothy J. Ross, "Fuzzy logic with Engineering Applications", McGraw-Hills.

**Course Outcomes:**

1. Students will be able to understand the fundamental concepts and techniques of neural networks and their applications in various fields.
2. Students will be able to design and implement supervised learning techniques such as the perceptron learning algorithm, multilayer neural networks, and back propagation networks, and apply them in forecasting, data compression, and image compression.
3. Students will be able to implement unsupervised learning techniques such as Kohonen SOM, counter propagation, and ART, and apply them in pattern and face recognition, intrusion detection, and robotic vision.
4. Students will be able to apply fuzzy sets and their related concepts in solving engineering problems, including fuzzy rules, fuzzy reasoning, fuzzy relations, and fuzzy inference systems.
5. Students will be able to design and implement genetic algorithms and apply them in solving optimization problems like JSPP, TSP, network design routing, and timetabling problem.



| SUB CODE | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|----------|---|---|---|---------------|----|-----|---------|
| ITUETK4  | 3 | 0 | 0 | 3 HOURS       | 40 | 60  | 3       |

### **WIRELESS SENSOR NETWORK**

#### **COURSE OBJECTIVES:**

1. To learn about Wireless Networks, architectures and technologies, WSN platforms: Hardware and Software.
2. To understand & implement Energy management and WSN layers (MAC, Link, Routing).
3. To perform Sensor data acquisition, processing and handling.
4. To simulate Signal processing, target localization and tracking, self-organization.
5. Case Study of Applications like (health, environmental monitoring, smart home).

#### **UNIT I – FUNDAMENTALS OF SENSOR NETWORKS**

Introduction to computer and wireless sensor networks, Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem-communication interfaces- prototypes, Application of Wireless sensors

#### **UNIT II- COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS**

Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization- Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization

#### **UNIT III- MAC LAYER**

Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks - Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols- Power Aware Multi-Access with signalling

#### **UNIT IV- ROUTING IN WIRELESS SENSOR NETWORKS**

Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing - SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing- Geographical Based Routing- Transport layer- Transport protocol Design issues- Performance of Transport Control Protocols.

#### **UNIT V - MIDDLEWARE AND SECURITY ISSUES**

WSN middleware principles-Middleware architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security.

*(Handwritten signatures and initials)*



#### REFERENCES

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011
2. Kazem Sohraby, Daniel manoli, "Wireless Sensor networks- Technology, Protocols and Applications", Wiley Inter Science Publications 2010.
3. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge University Press, 2005
4. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati, "Wireless Sensor Networks", Springer Science 2004.

#### COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to-

1. Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks
2. Apply the design principles of WSN architectures and operating systems for simulating environment situations.
3. Apply various concepts for assignment of MAC addresses.
4. Select the appropriate infrastructure, topology, joint routing and information aggregation for wireless sensor networks.
5. Analyse the sensor network platform and tools state-centric programming.

*(Handwritten signatures)*



| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETK5  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### **HUMAN COMPUTER INTERFACE**

#### **COURSE OBJECTIVES:**

1. To learn the foundations of Human Computer Interaction.
2. To become familiar with the design technologies for individuals and persons with disabilities.
3. To be aware of mobile HCI.
4. To learn the guidelines for user interface.
5. To understanding and importance of UI its design and mistakes.

**UNIT1:** Introduction of the human, the computer, the interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories

**UNIT2:** Design Process- Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support

**UNIT3:** Models and Theories0 Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction

**UNIT4:** Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation

**UNIT5:** Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization

#### **Text Books:**

1. "Human Computer Interaction" by Alan Dix, Janet Finlay , ISBN :9788131717035, Pearson Education (2004)
2. "Designing the User Interface - Strategies for Effective Human Computer Interaction", by Ben Shneiderman ISBN : 9788131732557, Pearson Education (2010).

#### **Reference Books:**

1. Usability Engineering: Scenario-Based Development of Human-Computer Interaction, by Rosson, M. and Carroll, J. (2002).
2. The Essentials of Interaction Design, by Cooper, et al. , Wiley Publishing(2007).
3. Usability Engineering, by Nielsen, J. Morgan Kaufmann, San Francisco, 1993. ISBN 0-12-518406-9.
4. The Resonant Interface: HCI Foundations for Interaction Design , by Heim, S. , Addison-Wesley. (2007).

*(Handwritten signatures and initials)*



5. Usability engineering: scenario-based development of human-computer interaction. By Rosson, M.B & Carroll, J.M. , Morgan Kaufman.(2002)

**COURSE OUTCOMES:**

Students will try to learn:

1. Design effective dialog for HCI.
2. Design effective HCI for individuals and persons with disabilities.
3. Assess the importance of user feedback.
4. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
5. Develop meaningful user interface.

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| SUB CODE | L | T | P | DURATION | IA | ESE | CREDITS |
|----------|---|---|---|----------|----|-----|---------|
| ITUETK6  | 3 | 0 | 0 | 3 HOURS  | 40 | 60  | 3       |

### NETWORK SECURITY

#### COURSE OBJECTIVES:

1. To understand the principles and practices of cryptography and network security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand the practical applications that have been implemented and are in use to provide network security.
5. To understand various protocols for network security to protect against the threats in the networks.

**UNIT1:** A Model for Network Security Services, Mechanisms, and Attacks, Viruses & Worms. The OSI Security Architecture, symmetric cipher model, substitution techniques Transposition techniques, Steganography.

**UNIT2:** Block ciphers and the data encryption standard, simplified DES, Block cipher principles, The data Encryption Standard, Differential and Linear Cryptanalysis, Block Cipher Design principles, The AES cipher, Triple DES, blowfish, RC5, Rc4 Stream Cipher.

**UNIT3:** Principles of public-Key Cryptosystems, public-Key cryptosystems, Requirements for public -Key Cryptosystems, The RSA Algorithm, Key management, key Distribution, Hash Functions SHA, MD5, Diffie-Hellman Key Exchange Algorithm.

**UNIT4:** WEB & IP Security: Web Security Threats, SSL Architecture, SSL, Record Protocol, Alert Protocol, Handshake Protocol, Transport Layer Security, Secure Electronic Transaction, IP Security.

**UNIT5:** Intruders: Intrusion Techniques Intrusion Detection, Audit Records Firewall Design principles, Firewall Characteristics, Types of Firewalls

#### Text Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, Prentice Hall, 4th Edition.
2. Cryptography and Network Security, Atul Kahate, McGraw Hill Education (India) Private Limited; Third edition.

#### Reference Books:

1. Applied Cryptography: Protocols & Algorithms, Schneier & Bruce, MGH International.



2. Cryptography and Security – by Dr T R Padmanabhan N Harini . Wiley India Pvt Ltd, 2011

**COURSE OUTCOMES:**

Students will try to learn:

1. Conventional encryption algorithms for confidentiality and their design principles.
2. Public key encryption algorithms and their design principles.
3. Use of message authentication codes, hash functions . digital signature and public key certificates.
4. Network security tools and applications.
5. System-level security issues like threat of and countermeasures for intruders and viruses, and the use of firewalls and trusted systems.



**SCHEME FOR EXAMINATION  
B.TECH (FOUR YEAR) DEGREE COURSE  
THIRD YEAR, INFORMATION TECHNOLOGY  
SEMESTER VII  
EFFECTIVE FROM SESSION 2023-24**

| EFFECTIVE FROM SESSION 2023-24                                                            |              |                    |               |   |    |                   |     |       |         |  |
|-------------------------------------------------------------------------------------------|--------------|--------------------|---------------|---|----|-------------------|-----|-------|---------|--|
| SL. NO.                                                                                   | SUBJECT CODE | SUBJECTS           | PERIODS/ WEEK |   |    | EVALUATION SCHEME |     |       | CREDITS |  |
|                                                                                           |              |                    | L             | T | P  | IA                | ESE | TOTAL |         |  |
| THEORY                                                                                    |              |                    |               |   |    |                   |     |       |         |  |
| 1.                                                                                        | IT207TPC01   | CYBER SECURITY     | 3             | 0 | 0  | 30                | 70  | 100   | 3       |  |
| 2.                                                                                        | IT207TPE4X   | ELECTIVE – IV      | 3             | 0 | 0  | 30                | 70  | 100   | 3       |  |
| 3.                                                                                        | IT207TPE5X   | ELECTIVE – V       | 3             | 0 | 0  | 30                | 70  | 100   | 3       |  |
| 4.                                                                                        | IT207TOE2X   | OPEN ELECTIVE – II | 3             | 0 | 0  | 30                | 70  | 100   | 3       |  |
|                                                                                           |              |                    |               |   |    |                   |     |       |         |  |
| PRACTICAL                                                                                 |              |                    |               |   |    |                   |     |       |         |  |
| 1.                                                                                        | IT207PPC21   | PROJECT-II         | 0             | 0 | 12 | 60                | 40  | 100   | 6       |  |
| TOTAL CREDITS                                                                             |              |                    |               |   |    |                   |     |       | 18      |  |
| IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL |              |                    |               |   |    |                   |     |       |         |  |

**LIST OF ELECTIVE-IV**

|    |            |                                |
|----|------------|--------------------------------|
| 1. | IT207TPE41 | ADVANCE DATABASE DESIGN        |
| 2. | IT207TPE42 | DATA MINING                    |
| 3. | IT207TPE43 | GAME THEORY                    |
| 4. | IT207TPE44 | GLOBAL STRATEGY AND TECHNOLOGY |

**LIST OF ELECTIVE-V**

|    |            |                                  |
|----|------------|----------------------------------|
| 1. | IT207TPE51 | INTERNET OF THINGS               |
| 2. | IT207TPE52 | ADVANCE OPERATING SYSTEM         |
| 3. | IT207TPE53 | COMPUTER VISION                  |
| 4. | IT207TPE54 | OPEN SOURCE SYSTEM & PROGRAMMING |

**LIST OF OPEN ELECTIVE-II**

|    |             |                                          |
|----|-------------|------------------------------------------|
| 1. | IT207TOE01  | MACHINE LEARNING                         |
| 2. | CS207TOE01  | GIS & REMOTE SENSING                     |
| 3. | EC207TOE02  | CMOS DIGITAL VLSI DESIGN                 |
| 4. | CE207TOE02A | GREEN BUILDING AND SUSTAINABLE MATERIALS |
| 5. | ME207TOE02  | PRINCIPAL OF MANAGEMENT                  |
| 6. | CH207TOE02  | WASTE TO ENERGY                          |
| 7. | IP207TOE21  | MANUFACTURING PROCESS-I                  |
| 8. | IP207TOE31  | PRODUCTION PLANNING AND CONTROL          |



| SUB CODE   | L | T | P | DURATION | IA | ESE | CREDITS |
|------------|---|---|---|----------|----|-----|---------|
| IT207TPC01 | 3 | 0 | 0 | 3 HOURS  | 30 | 70  | 3       |

### **CYBER SECURITY**

#### **Course Objectives:**

1. Identify the technical foundations of Cyber security.
2. Apply principles of cryptography for design of block ciphers.
3. Analyze the principles of public – Key Cryptosystems and applications.
4. Explore the importance of Cyber Security and Secure financial transactions.
5. Explore the concepts of Firewall, and intrusion detection.

#### **UNIT I**

A Model for Network Security Services, Mechanisms, and Attacks, Viruses & Worms, The OSI Security Architecture, symmetric cipher model, substitution techniques Transposition techniques, Steganography.

#### **UNIT II**

Block ciphers and the data encryption standard, simplified DES, Block cipher principles, The data Encryption Standard, Differential and Linear Cryptanalysis, Block Cipher Design principles, The AES cipher, Triple DES, blowfish, RC5, RC4 Stream Cipher

#### **UNIT III**

principles of public –Key Cryptosystems, public –Key cryptosystems, Requirements for public –Key Cryptosystems, The RSA Algorithm, Key management, key Distribution, Hash Functions SHA, MD5, Diffie-Hellman Key Exchange Algorithm

#### **UNIT IV**

WEB & IP Security: Web Security Threats, SSL Architecture, SSL Record Protocol, Alert Protocol, Handshake Protocol, Transport Layer Security, Secure Electronic Transaction, IP Security

#### **UNIT V**

Intruders: Intrusion Techniques, Firewall Design principles, Block Chain Technology, BitCoin, Types of Firewalls.

#### **List of Books:**

1. Cryptography and Network Security, Principles and Practice Third edition, William Stallings.
2. Atul Kahate, “Cryptography and Network Security,” TMH
3. Introduction to network security, Krawetz, Cengage

#### **Course Outcomes :**

1. Understand the fundamental network security mechanism and threats.
2. Understand the concept of Block cipher and cryptanalysis.
3. Learn the Concept of Public key cryptography systems.
4. Understand the concept of Web security and secure electronic transaction.
5. Understand the Firewall design principles and Block-chain technology.



| SUB CODE   | L | T | P | DURATION | IA | ESE | CREDITS |
|------------|---|---|---|----------|----|-----|---------|
| IT207TPE42 | 3 | 0 | 0 | 3 HOURS  | 30 | 70  | 3       |

### **DATA MINING**

#### **Course Objectives:**

1. To introduce the concepts and principles of data warehousing, including multidimensional data models, OLAP operations, and data warehousing architecture.
2. To familiarize students with data mining and its related areas, including KDD, DBMS, and DM techniques, and the issues and challenges involved in data mining.
3. To enable students to understand association rules and the various methods to discover them, including the apriori algorithm and hierarchical association rules.
4. To introduce clustering techniques and their applications, including partitioning algorithms, hierarchical clustering, and categorical clustering algorithms.
5. To equip students with the knowledge and skills to design and develop decision trees and understand their construction principles, including the CART, ID3, and C4.5 algorithms.

#### **UNIT I**

Data ware Housing: What is a data warehouse?, definition, Multidimensional data model, OLAP operation, warehouse schema, data ware housing architecture, warehouse serve, metadata, OLAP, engine, Data warehousing backend process, other features.

Data Mining: what is data mining? KDD Vs. data mining, DBMS Vs DM other related areas, DM techniques, other mining problem, issues & challenges in DM, Dm application areas.

#### **UNIT II**

Association rules: Methods to discover association rules, apriori algorithm, partition algorithm, pincer –search algorithm, Dynamic Item set counting algorithm, FP-tree Growth algorithm, Incremental algorithm, Border algorithm, hierarchical association rule, generalized association rules, Association rules with item constraints.

#### **UNIT III**

Clustering Techniques: Introduction, clustering paradigms, partitioning algorithms, k-Medoid Algorithm, CLARA, CLARANS, Hierarchical clustering, DBSCAN, BIRCH, CURE, Categorical clustering algorithms, STIRR, ROCK, CACTUS.

#### **UNIT IV**

Decision trees: Tree construction principal, Best split splitting indices, splitting criteria, Decision tree construction algorithm, CART, ID3, C4.5, CHAID, Decision tree construction with pre-sorting, rainforest, approximate method, CLOUDS, BOAT, pruning technique, integration of pruning & construction, Hierarchical association rule.

#### **UNIT V**

Web Mining: Web mining, web content mining, web structure mining, web usage mining, text mining, unstructured text, Episode rule discovery for texts, Hierarchy of categories, text clustering, Paging algorithm.

#### **List of Books:**

1. Data Mining techniques – Arun K Pujari Universities press
2. Data Mining concepts & techniques – Jiawei han, Micheline Kamber Morgan Kaufmann publisher Elsevier India –2001



3. Data Mining methods for knowledge Discovery –Cios, Pedrycz, swiniarski Kluwer academic publishers London –1998

**Course Outcome:**

1. Students will be able to understand the fundamental concepts and principles of data warehousing and its architecture, including OLAP and metadata.
2. Students will be able to understand data mining and its related areas, including KDD and DBMS, and apply DM techniques to real-world problems.
3. Students will be able to discover association rules and understand the methods used to discover them, including the apriori algorithm and hierarchical association rules.
4. Students will be able to apply clustering techniques to group similar data and understand partitioning algorithms, hierarchical clustering, and categorical clustering algorithms.
5. Students will be able to design and develop decision trees and understand their construction principles, including the CART, ID3, and C4.5 algorithms, and apply them to real-world problems.



| SUB CODE   | L | T | P | DURATION | IA | ESE | CREDITS |
|------------|---|---|---|----------|----|-----|---------|
| IT207TPE51 | 3 | 0 | 0 | 3 HOURS  | 30 | 70  | 3       |

### INTERNET OF THINGS

#### Course Objectives:

1. To understand the fundamental concepts of parallel and distributed databases, including the different architectures, parallelism techniques, and design principles.
2. To comprehend the concepts of object-oriented and object-relational databases, including object identity, structure, persistence, and inheritance, and learn how to use them to design efficient database systems.
3. To learn about intelligent databases and their applications, including active databases, temporal databases, deductive databases, and spatial databases.
4. To explore advanced data models, such as mobile databases, multimedia databases, data warehousing, data mining, and text mining, and learn how to use them to design and manage complex data structures.
5. To understand the emerging technologies in the field of database systems, such as XML databases, web databases, cloud-based databases, and big data storage and analysis.

**UNIT I – OVERVIEW IoT** - An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

**UNIT II – REFERENCE ARCHITECTURE** - IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference ArchitectureIntroduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

**UNIT III – IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS** - PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

**UNIT IV – TRANSPORT & SESSION LAYER PROTOCOLS** - Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

**UNIT V – SERVICE LAYER PROTOCOLS & SECURITY** - Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer



#### REFERENCES

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
5. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2014. 6. [http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot\\_prot/index.htm](http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm)

#### Course Outcomes:

1. Students will be able to compare and contrast different database system architectures, including centralized, client-server, parallel, and distributed architectures.
2. Students will be able to design object-oriented and object-relational databases using different standards, languages, and design principles, such as ODMG, ODL, OQL, and SQL/Oracle.
3. Students will be able to design intelligent databases that incorporate active rules, temporal databases, deductive databases, and spatial databases to support complex applications.
4. Students will be able to design advanced data models, including mobile databases, multimedia databases, data warehousing, data mining, and text mining, to efficiently manage complex data structures.
5. Students will be able to design and manage emerging technologies in the field of database systems, such as XML databases, web databases, cloud-based databases, and big data storage and analysis.



**SCHEME FOR EXAMINATION  
B.TECH (FOUR YEAR) DEGREE COURSE  
THIRD YEAR, INFORMATION TECHNOLOGY  
SEMESTER VIII  
EFFECTIVE FROM SESSION 2023-24**

| SL. NO.                                                                                   | SUBJECT CODE | SUBJECTS            | PERIODS/ WEEK |   |    | EVALUATION SCHEME |     |       | CREDITS |
|-------------------------------------------------------------------------------------------|--------------|---------------------|---------------|---|----|-------------------|-----|-------|---------|
|                                                                                           |              |                     | L             | T | P  | IA                | ESE | TOTAL |         |
| THEORY                                                                                    |              |                     |               |   |    |                   |     |       |         |
| 1                                                                                         | IT208TPC6X   | ELECTIVE – VI       | 3             | 0 | 0  | 30                | 70  | 100   | 3       |
| 2                                                                                         | IT208TOE3X   | OPEN ELECTIVE - III | 3             | 0 | 0  | 30                | 70  | 100   | 3       |
| 3                                                                                         | IT208TOE4X   | OPEN ELECTIVE - IV  | 3             | 0 | 0  | 30                | 70  | 100   | 3       |
|                                                                                           |              |                     |               |   |    |                   |     |       |         |
| PRACTICAL                                                                                 |              |                     |               |   |    |                   |     |       |         |
| 1                                                                                         | IT208PPC31   | PROJECT-III         | 0             | 0 | 18 | 60                | 40  | 100   | 9       |
| TOTAL CREDITS                                                                             |              |                     |               |   |    |                   |     |       | 18      |
| IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL |              |                     |               |   |    |                   |     |       |         |

**LIST OF ELECTIVE – VI**

|    |            |                                       |
|----|------------|---------------------------------------|
| 1. | IT208TPE61 | MACHINE LEARNING                      |
| 2. | IT208TPE62 | OBJECT ORIENTED ANALYSIS & DESIGN     |
| 3. | IT208TPE63 | SOFTWARE TESTING & QUALITY MANAGEMENT |
| 4. | IT208TPE64 | HUMAN COMPUTER INTERFACE              |

**LIST OF OPEN ELECTIVE –III**

|    |            |                                       |
|----|------------|---------------------------------------|
| 1. | IT208TOE31 | WIRELESS SENSOR NETWORK               |
| 2. | IT208TOE32 | DIGITAL SIGNAL PROCESSING             |
| 3. | IT208TOE33 | INFORMATION TECHNOLOGY FOR AUTOMATION |
| 4. | IT208TOE34 | REAL TIME SYSTEM                      |

**LIST OF OPEN ELECTIVE-IV**

|    |            |                                            |
|----|------------|--------------------------------------------|
| 1. | IT208TOE01 | SOFT COMPUTING                             |
| 2. | CS208TOE01 | ARTIFICIAL INTELLIGENCE                    |
| 3. | EC208TOE03 | INTRODUCTION TO IoT                        |
| 4. | CE208TOE03 | INFRASTRUCTURE PLANNING AND MANAGEMENT     |
| 5. | ME208TOE03 | SUPPLY CHAIN MANAGEMENT                    |
| 6. | CH208TOE03 | PLANT ENGINEERING ECONOMICS AND MANAGEMENT |
| 7. | IP208TOE41 | ADVANCED MANUFACTURING PROCESS             |
| 8. | IP208TOE51 | COMPUTER AIDED PROCESS PLANNING (CAPP)     |



| SUB CODE   | L | T | P | DURATION | IA | ESE | CREDITS |
|------------|---|---|---|----------|----|-----|---------|
| IT208TPE62 | 3 | 0 | 0 | 3 HOURS  | 30 | 70  | 3       |

### OBJECT ORIENTED ANALYSIS & DESIGN

#### Course Objectives

- To have clear idea about traditional and modern SW development Methodologies.
- Discuss the overview of Object oriented methodologies
- To introduce the concept of Object-oriented system development lifecycle
- To identify objects, relationships, services and attributes.
- To develop robust object-based models for Systems

#### UNIT I - OBJECT MODELING:

Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, candidates keys, constraints.

#### UNIT II - DYNAMIC MODELING:

Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concept, a sample dynamic model.

#### UNIT III - FUNCTIONAL MODELING:

Data flow diagram, specifying operations, constraints, a sample functional model. OMT (Object modeling techniques) methodologies, SA/SD, JSD

#### UNIT IV – INTRODUCTION TO UML

Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

#### UNIT V – ARCHITECTURAL MODELING

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

#### Text Books

1. James Rumbaugh et al “ object Oriented Modeling and design” PHI
2. Herbert Schildt “ The complete Reference : Java” TMH
3. E. Balagurusamy “ Programming in Java”, TMH



**Reference Books :**

1. Booch Grady, " Object Oriented Analysis & design with application 3/e", Person
2. Bjarne Stroustrup " C++ Programming Language" Addison Wesley
3. E Balagurusami " Object Oriented Programming with C++, TMH

**Course Outcomes**

On completion of this course the students will be able to

- Explain and apply basic OOPS concepts.
- Explain and implement the SW development Methodologies.
- Ability to analyze and model software specifications.
- Ability to abstract object-based views for software systems.
- Ability to deliver robust software components.

**Course Outcomes and their mapping with Programme Outcomes:**

| CO  | PO  |     |     |     |     |     |     |     |     |      |      |      | PSO  |      |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2   | 3   | 2   | 3   | 2   |     |     |     |     |      |      |      | 3    | 3    | 2    |
| CO2 | 2   | 3   | 3   | 3   | 2   |     |     |     |     |      |      |      | 3    | 3    | 2    |
| CO3 | 3   | 3   | 3   | 3   | 2   |     |     |     |     |      |      |      | 3    | 3    | 2    |
| CO4 | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      |      | 3    | 3    | 2    |
| CO5 | 3   | 2   | 3   | 3   | 2   |     |     |     |     |      |      |      | 3    | 3    | 2    |

Weightage: 1-Slightly, 2-Moderately, 3-Strongly



| SUB CODE   | L | T | P | DURATION/WEEK | IA | ESE | CREDITS |
|------------|---|---|---|---------------|----|-----|---------|
| IT208TOE34 | 3 | 0 | 0 | 3 hours       | 30 | 70  | 3       |

### REAL TIME SYSTEMS

#### COURSE OBJECTIVES:

- To apply the terminology, and list applications, of real time systems.
- Be able to explain the purpose and structure of a real time operating system.
- To illustration of key OS analysis and optimization
- To understand purpose, structure and functions of operating systems
- General understanding of structure of modern computers.

#### Unit-I

Basic Real- Time Concepts, Computer Hardware, Language Issues: Basic component Architecture, terminology, Real Time Design Issues, CPU, Memories, Input- Output, Other Devices Language Features, Survey of Commonly Used Programming Languages, Code Generation

#### Unit-II

Software life cycle, Real Time Specification and Design Techniques, Real Time Kernels: Phases of software life cycle, Non-temporal Transition in the software life cycle, Spiral model, Natural languages, Mathematical Specification, Flow Charts, Structure Charts, Pseudocode and programmable Design Languages, Finite state Automata, Data Flow Diagrams, Petrinets, Statecharts, Polled Loop Systems, phase/State Driven Code, Coroutines, Interrupt Driven System, Foreground/Background Systems Full Featured Real Time OS

#### Unit-III

Intertask Communication and Synchronization, Real Time memory Management, System Performance Analysis and Optimization: Buffering Data, Mail boxes Critical Region, Semaphores, Event Flags and Signals, Deadlock, Process Stack Management, Dynamic Allocation, Static Schemes, Response Time Calculation, Interrupt Latency, Time Loading and its Measurement, Scheduling NP Complete, Relocating Response Times And time Loading, Analysis of Memory Requirements, Reducing Memory Loading, I/O Performance.

#### Unit-IV

Queuing Models, Reliability, Testing, And Fault Tolerance, Multiprocessing Systems: Basic Buffer size Calculation, Classical Queuing Theory, Little's Law, Faults, Failures ,bugs AND effects. Reliability, Testing, Fault Tolerance, Classification of Architectures, Distributed Systems, Non Von Neumann Architectures.

#### Unit-V

Hardware/ Software Integration, Real Time Applications: Goals of Real Time System Integration, Tools, Methodology, The Software Heisenberg Uncertainty Principle, Real Time Systems As Complex System, First Real Time Application Real Time Databases, Real time Image Processing Real Time UNIX, building Real Time Applications with Real Time Programming Languages.

#### Text Books :

1. Real Time System, Jane W.S.Liu
2. Real Time Systems Design and Analysis by Phillip A. Laplante, PHI



**Reference Books:**

- 1 Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications by Giorgio C. Buttazzo
- 2 Real Time Design Patterns: Robust Scalable Architecture for Real Time System by BrucePowel Douglass.
3. Real Time System: Scheduling, Analysis and Verification by Albert M.K. Change.

**COURSE OUTCOMES:**

Students will try to learn:

- Describe the general architecture of computers and operating system.
- Understand and analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files.
- Describe the foundation for programming languages developed for real time programming.
- Use real time system programming languages and real time operating systems for real time applications.
- Analyze real time systems with regard to keeping time and resource restrictions.

**Course Outcomes and their mapping with Programme Outcomes:**

| CO  | PO  |     |     |     |     |     |     |     |     |      |      |      | PSO  |      |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1   | 2   | 2   | 2   | 1   | 2   |     |     |     |      |      |      | 1    | 2    | 2    |
| CO2 | 3   | 3   | 3   | 3   | 2   | 2   |     |     |     |      |      |      | 3    | 3    | 3    |
| CO3 | 2   | 2   | 2   | 2   | 2   | 3   |     |     |     |      |      |      | 2    | 2    | 2    |
| CO4 | 3   | 2   | 2   | 3   | 2   | 2   |     |     |     |      |      |      | 3    | 2    | 2    |
| CO5 | 3   | 3   | 3   | 3   | 2   | 3   |     |     |     |      |      |      | 3    | 3    | 3    |

Weightage: 1-Sightly, 2-Moderately, 3-Strongly