Syllabus for 4 Year B. Tech Course in Computer Science and Engineering (Artificial Intelligence)

Third Semester

Career Advancement & Skill Development-III: Communication Skill (TIU-UEN-S297)
Contact Hours/Week: 2–0–0 (L–T–P)
Credit: Sessional–2

Course Content
Detailed Syllabus: French:- Introducing on eself,the adjectives of nationalities, salutations, the verb s'appeler, être and avoir, the numbers from 0 to 1000,the articles définis and indéfinis, the days of the week and the months of the year, adjectives interrogatif, er ending verbs in present tense, the prepositions of place and the prepositions and name of the countries, the basic negation ne...pas, the verbs aimed, adorer, detested and parler and the present tense of the verb aller and the different ways of saying the hour. The family tree. The activities in the class includes: Informing about ones identity and giving and demanding personal informations written and verbal, asking someone the price of something in a market or a shop, indicating one's taste and speaking about passion and dreams, speaking about one's city and speaking about one's activities and family.

Mathematics-III (Discrete Mathematics) (TIU-UMA-T215)
Contact Hours/Week: 3–0–0 (L–T–P)
Credit: Theory–3

Course Outcome

CO1	To develop a foundation of set theory and concept of mathematical induction
CO2	To explore a variety of various mathematical structures by focusing on mathematical objects, operations, and resulting properties
CO3	To develop formal logical reasoning techniques and notation, demonstrate the application of logic to analyzing and writing proofs
CO4	To develop techniques for counting, permutations and combinations
CO5	To explore the concept of recurrence relations and generating functions and applications in algorithms

Course Content
Module-1
Propositional logic: logical operators, propositional equivalences, normal forms, validity and satisfiability of arguments. Proof techniques: forward proof, proof by contradiction, contrapositive proofs, proof of necessity and sufficiency.
Module-2

Sets, relations and functions: Operations on sets, relations and functions, binary relations, partial ordering relations, equivalence relations, principles of mathematical induction. Size of a set: Finite and infinite sets, countable and uncountable sets.

Module-3

Introduction to counting: Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations.

Module-4

Recurrence: Introduction to recurrence relation and generating function, Tower of Hanoi, Fibonacci Series. Derangement – Hatcheck Problem.

Module-5

Algebraic structures and morphisms: Algebraic structures with one binary operation - semigroups, monoids and groups, congruence relation and quotient structures. Free and cyclic monoids and groups, permutation groups, substructures, normal subgroups. Algebraic structures with two binary operations - rings, integral domains and fields.

Recommended Books:

Main Reading

1. Discrete Mathematics and Its Applications, K.H. Rosen.
2. Discrete Mathematics: An Open Introduction, O. Levin.

Environmental Science (TIU-UMB-T201)

Contact Hours/Week: 2–0–0 (L–T–P)

Credit: Theory–2

Course Content

Module-1: Introduction

Environment and environmental pollution from chemical process industries, characterization of emission and effluents, environmental Laws and rules, standards for ambient air, noise emission and effluents.

Module-2: Pollution Prevention

Process modification, alternative raw material, recovery of by co-product from industrial emission effluents, recycle and reuse of waste, energy recovery and waste utilization.
Material and energy balance for pollution minimization. Water use minimization, Fugitive emission/effluents and leakages and their control-housekeeping and maintenance.

Module-3: Air Pollution Control

Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by absorption and adsorption, Design of cyclones, ESP, fabric filters and absorbers.

Module-4: Water Pollution Control

Physical treatment, pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation.

Module-5: Biological Treatment
Anaerobic and aerobic treatment biochemical kinetics, trickling filter, activated sludge and lagoons, aeration systems, sludge separation and drying.

Module-6: Solids Disposal
Solids waste disposal - composting, landfill, briquetting / gasification and incineration.

Recommended Books:
Main Reading

1. A. K. De, "Environmental Chemistry", New Age
2. G. M. Masters, "Introduction to Environmental Engineering and Science", Pearson
3. G. S. Sodhi, "Fundamental Concepts of Environmental Chemistry", Narosa
4. E. Odum, M. Barrick& G. W. Barrett, "Fundamentals of Ecology", Brooks & Cole

Digital Electronics (TIU-UEC-T211)
Contact Hours/Week: 3–0–0 (L–T–P)
Credit: Theory–3

Course Outcome

CO1	Design and analyze combinational logic circuits.
CO2	Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder.
CO3	Design & analyze synchronous sequential logic circuits.

Course Content

Module-1: Number System and Codes
Decimal, binary, octal and hexadecimal number systems and their arithmetic operations, conversion of one number system to another, Signed and floating-point representations of binary numbers, 1's complement and 2's complement representations, Binary codes, natural BCD codes, Excess-3, Gray codes, Alphanumeric Code, code conversion- from one code to another.

Module-2: Logic Gates, Boolean Algebra & Basic logic families
NOT, AND, OR, NAND, NOR, XOR and XNOR –operations, truth tables and Venn diagram representations, universal gates, postulates and laws of Boolean algebra, De Morgan's theorem, minterms and maxterms, SOP and POS forms, switching algebra, minimizing functions using K- maps, Minimization using QM method, Different logic families: TTL, ECL, CMOS.

Module-3: Combinational and arithmetic logic circuits

Adders/subtractors circuit using logic gates, parallel adder, magnitude comparator, multiplexer, demultiplexers, encoders, decoders, priority encoders, parity generator and checkers, BCD adder and subtractor.

Module-4: Sequential Logic Circuits

Flip flops and latches, S-R, J-K, D and T type flip-flops and their conversions, master-slave configuration, edge triggered and level triggered clock, registers, shift registers, synchronous and asynchronous counters, ring and Johnson (twisted ring) counters, Modulus Counter.

Module-5: Memory and Programmable Logic Devices

ROM, PROM, RAM-SRAM, DRAM, EPROM, EEPROM, Flash ROM, Programmable and gated array devices for designing combinational circuits PAL, PLA, PLD, CPLD, FPGA with examples.

Recommended Books:

Main Reading

1. D. P. Leach and A. Malvino, "Digital Principles and Applications", McGraw Hill
2. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill
3. D. L. Schilling and H. Taub, "Digital Integrated Electronics", McGraw Hill
4. V. K. Puri, "Digital Electronics", Tata McGraw Hill

Supplementary Reading

1. S. Salivahanan and S. Arivazhagan, "Digital Circuits & Design", Vikas
2. T. L. Floyd, "Digital Fundamentals", Pearson
3. M. Morris Mano & M. D. Ciletti, "Digital Design", Prentice Hall
4. V. Kumar, "Digital Technology", New Age
5. D. Ray Chowdhury, "Digital Circuits", Platinum Publishers.
6. J. M. Yarbrough, "Digital Logic Applications & Design", Vikas
7. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
8. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall
9. R. Anand, "Digital System Design using VHDL", Khanna Publishing House

Data Structures and Algorithms (TIU-UCS-T201)

Contact Hours/Week: 3–0–0 (L–T–P)

Credit: Theory–3

Prerequisite Course:

Introduction to Computing (TIU-UCS-T105); Problem Solving Techniques (TIU-UCS-T106)

Course Outcome

CO1	To understand the concepts and applications of different types of data structures
CO2	To develop programs to implement linear and nonlinear data structures
CO3	To be able to learn various algorithms and their implementations
CO4	To analyze algorithms to do efficiency tradeoffs

CO5	To be able to apply the concepts of data structures and algorithms to find efficient solutions for real world problems
CO6	To be able to understand the concepts of complex data structures and algorithms

Course Content

Module 1:
Basic Concepts of Data Representation: Abstract Data Types, Fundamental and Derived Data Types, Representation, Primitive Data Structures.
Introduction to Algorithm Design and Data Structures: Algorithm Definition, Comparison of Algorithms, Top-Down and Bottom-Up Approaches to Algorithm Design, Analysis of Algorithm, Complexity Measures in Terms of Time and Space, Structured Approach to Programming.

Module 2:
Arrays: Representation of Arrays, Single and Multidimensional Arrays, Address Calculation Using Column and Row Major Ordering, Various Operations on Arrays, Application of Arrays Matrix Multiplication, Sparse Polynomial Representation and Addition.

Module 3:
Stacks and Queues: Representation of Stacks and Queues using Arrays and Linked List, Circular Queues, Priority Queue and D-Queue. Applications of Stacks, Conversion from Infix to Postfix and Prefix Expressions, Evaluation of Postfix Expression Using Stacks.
Linked Lists: Single Linked List, Operations on List, Linked Stacks and Queues, Polynomial Representation and Manipulation Using Linked Lists, Circular Linked Lists, Doubly Linked Lists.

Module 4:
Trees: Binary Tree, Traversal Methods: Preorder, In-Order, Post-Order Traversal (Recursive and Non-Recursive), Algorithms for Above Mentioned Traversal Methods. Representation of Trees and Its Applications. Binary Tree. Binary Search Tree, Height Balanced (AVL) Tree, B-Trees, B+ Tree, Min Heap, Max Heap Graphs: Graph Representation, Adjacency Matrix, Adjacency Lists, Traversal Schemes, Depth First Search, Breadth First Search.

Module 5:
Searching, Sorting and Complexity: Searching: Sequential and Binary Searches, Indexed Search, Hashing Schemes. Sorting: Insertion, Selection, Bubble, Quick, Merge.

Recommended Books:
Main Reading

1. 1. Seymour Lipschutz, Data Structures, Revised First Edition, McGraw-Hill Education.
2. Aaron M. Tenenbaum, Data Structures Using C, Prentice Hall.

Supplementary Reading

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Eastern Economy Edition, PHI Learning Pvt. Ltd., 2010.
2. Donald Knuth, Art of Computer Programming, The: Volume 1: Fundamental Algorithms, Addison-Wesley, 1997.

Computer Organization (TIU-UCS-T207)

Contact Hours/Week: 3–0–0 (L–T–P)
Credit: Theory–3

Course Outcome

CO1	Describe Stored Program Digital Computer System.
CO2	Identify & apply appropriate procedures and algorithms of Computer Arithmetic
CO3	Explain different aspects of Central Processing Unit (CPU).
CO4	Understand the fundamentals of Memory Unit and illustrate memory operations.
CO5	Explain models of I/O operations & the I/O subsystems.
CO6	Identify the micro-instructions and basics of Computer Architecture.

Course Content

Module 1:
Basic Functional Blocks of a Computer: Von Neumann machines, Harvard Architecture, SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures, concept of operating systems and processes, processor register sets, processor instruction sets, processor architecture, memory hierarchy, Parallel Processor and Pipeline Architecture.

Module 2:
Data Representation: Signed number representation, fixed and floating-point representations, Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication -Booth multiplier, Division - non-restoring and restoring techniques.

Module 3:
CPU and Control Unit Design: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU - registers, instruction execution cycle, Basic Instruction format, Immediate, Direct address, Indirect address, Effective addresses. Instruction Formats: Memory/ Register/Input-Output reference, Types of Instruction: Data Transfer/ Data Manipulation/ Program Control, Zero/One/Two/Three address instructions, RISC instructions, RTL interpretation of instructions, addressing modes, instruction set. Case study - instruction sets of some common CPUs.

Module 4:

Memory organization: Concept of hierarchical memory organization, Memory interleaving, Semiconductor memory technologies, primary memory and concept of cache memory.

Module 5:
Peripheral Devices and Their Characteristics: Input-output subsystems, I/O transfers – program controlled, interrupt driven and DMA.

Module 6:
Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. (Parallel Processor)

Recommended Books:

Main Reading

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier.
2. Carl Hamachar, ZvoncoVranesic and Safwat Zaky, Computer Organization, McGraw Hill.

Supplementary Reading

1. John P. Hayes, Computer Architecture and Organization, McGraw Hill.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education.
3. Vincent P. Heuring and Harry F. Jordan, Computer Systems Design and Architecture, Pearson Education.