# Dual Degree Programme in

# Computer Science and Engineering

**Semester I**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Humanities and Social Sciences | 2-0-0 | 2 | HS |
| 2. | Environmental Studies | 2-0-2 | 3 | BS |
| 3. | Engineering Mathematics-I (Calculus and Transform) | 4-0-0 | 4 | BS |
| 4. | Engineering Foundation-I (Computer Programming) | 2-0-4 | 4 | EF |
| 6. | Introduction to Engineering-I (Lecture/Visit/Demo/Doing) | 1-0-2 | 2 | EF |
| 7. | Engineering Drawing & Visualization | 0-0-4 | 2 | DI |
| 8. | Principles of Economics | 2-0-0 | 2 | HS |
| 9. | English in Practice | 2-0-2 | Non-credit | |
| | | **Total (19)** | HS-4, BS-7, EF-6, DI-2 | |

***Non-credit course: need to pass Basic English course**

**Semester II**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Physics-I | 3-0-2 | 4 | BS |
| 2. | Chemistry-I | 3-0-2 | 4 | BS |
| 3. | Engineering Mathematics-II (Probability and Statistics) | 4-0-0 | 4 | BS |
| 4. | Engineering Foundation-II (Data Structure) | 3-0-2 | 4 | EF |
| 5. | Introduction to Engineering-II (Engineering Specific) | 1-0-2 | Non-Credit | EF |
| 6. | Product Realization | 0-0-4 | 2 | DI |
| 7. | IPR and Law | 2-0-0 | 2 | HS |
| | | **Total (20)** | BS-12, EF-4, DI-2, HS-2 | |

**Semester III**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Engineering Foundation-III (Engineering Mechanics) | | 4 | EF |
| 2 | Biology/Chemistry-II/Physics-II | 3-0-2 | 4 | BS |
| 3. | Discrete Mathematical Structures | 3-1-0 | 4 | BC |
| 4. | Digital Logic and Systems Design | 3-0-2 | 4 | BC |
| 5. | Programming Languages | 3-0-2 | 4 | BC |
| | | **Total (20)** | EF-4,BS-4, BC-12 | |

**Semester IV**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Engineering Foundation-1V (Numerical Methods) | | 4 | EF |
| 2. | Engineering Foundation-V (Signals and Systems) | | 4 | EF |
| 3. | Computer Architecture | 3-0-2 | 4 | BC |
| 4. | Design and Analysis of Algorithms | 3-1-0 | 4 | BC |
| 5. | Database Management Systems | 3-0-2 | 4 | BC |
| 6. | Professional Practice & Ethics | 1-0-2 | 2 | HS |
| | | **Total 22** | EF-8, BC-12, HS-2 | |

**Semester V**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Operating Systems | 3-0-2 | 4 | BC |
| 2. | Machine Learning | 3-0-2 | 4 | BC |
| 3. | Bachelor Elective- I | | 4 | BE |
| 4. | Technical Writing | 2-0-0 | 2 | HS |
| 5. | Open-Elective-I | 3-0-0 | 3 | OE |
| 6. | Open-Elective-II | 3-0-0 | 3 | OE |
| | | **Total (20)** | HS-2, BC-8, BE-4,OE-6 | |

**Semester VI**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Theory of Computation | 3-1-0 | 4 | BC |
| 2. | Computer Networks | 3-1-0 | 4 | BC |
| 3. | Bachelor Elective- II | | 4 | BE |
| 4. | Open-Elective-III | | 3 | OE |
| 5. | Open-Elective-IV | | 3 | OE |
| | | **Total (18)** | BC-8, BE-4, OE-6 | |

**Semester VII**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Project (Engineering Specific) | | 6 | BE |
| 2. | Bachelor Elective -III | | 4 | BE |
| 3. | Advanced Algorithms | | 3 | MC |
| 4. | Optimization Techniques | | 3 | MC |
| 5. | Master Specialization-I | | 3 | ME |
| | | **Total (19)** | BE- 10, MC-6, ME-3 | |

**Semester VIII**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Master Specialization –II | | 3 | ME |
| 2. | Master Specialization –III | | 3 | ME |
| 3. | Master Specialization –IV | | 3 | ME |
| 4. | Master Specialization –V | | 3 | ME |
| 5. | Master Specialization –VI | | 3 | ME |
| | | **Total (15)** | ME-15 | |

**Semester IX**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Master Specialization-VII | | 3 | ME |
| 2. | Master Specialization-VIII | | 3 | ME |
| 3. | Dissertation | | 9 | DS |
| | | **Total (15)** | ME-6, DS-9 | |

**Semester X**

| | Course Name | | | |
|---|---|---|---|---|
| 1. | Dissertation | | 15 | DS |
| | | **Total (15)** | DS-15 | |
| | | | | |

**Total Credits: 183 (Minimum)**

**Core Courses for B. Tech Computer Science & Engineering:**

| S. No. | Course Name |
|---|---|
| 1. | Discrete Mathematical Structures |
| 2. | Digital Logic and Systems Design |
| 3. | Programming Languages |
| 4. | Computer Architecture |
| 5. | Design and Analysis of Algorithms |
| 6. | Database Management Systems |
| 7. | Operating Systems |
| 8. | Machine Learning |
| 9. | Theory of Computation |
| 10. | Computer Networks |
| | |

**Elective Courses for B. Tech Computer Science & Engineering:**

| S. No. | Course Name |
|---|---|
| 1. | Minor Project |
| 2. | Independent Study |
| 3. | Compiler Design |

| | |
|---|---|
| 4. | Artificial Intelligence |
| 5. | Cloud Computing |
| 6. | Computer Graphics |
| 7. | Digital Image processing |
| 8. | Modeling & Simulations |
| 9. | Object Oriented Programming |
| 10. | Parallel & Distributed Systems |
| 11. | Software Engineering |

**Elective Courses for M. Tech in Computer Science & Engineering:**

| S,No. | Course Name |
|---|---|
| 1 | Advanced Software Engineering |
| 2. | Big Data Analytics |
| 3. | Computer Vision |
| 4. | Data Communication and Computer Networks |
| 5. | Data Mining and Knowledge Discovery |
| 6. | Large Scale Graph Algorithms and Application |
| 7. | Mobile Ad Hoc Networks |
| 8. | Multicast Communication |
| 9. | Natural Language Processing |
| 10. | Network Security |
| 11. | Object Oriented Software Engineering |
| 12. | Performance Modeling of Computer Communication Networks |
| 13. | Swarm Intelligence |
| 14. | Services Oriented Architecture |
| 15. | Wireless Communication and Mobile Computing |

**Prerequisite for M. Tech in Computer Science & Engineering:**

1. Digital System and Design
2. Computer Architecture
3. Operating System
4. Design and Analysis of Algorithms

## Core Courses for B. Tech Computer Science & Engineering:

### Computer Programming

Stored program concept (with simple computer simulator), machine language and instruction formats, assembly language for the simple computer. Characteristics of Computers, Evolution of Computing, Binary Number Systems, Types of Computer Software, Operating Systems, Programming Languages, Problem Solving Techniques using Computers: Algorithm, Flow Charts, Pseudocode. Introduction to Computer Networks, Internet, World Wide Web, Getting Connected to Internet. Problem Solving, Concept of Algorithms, Introduction to Computer Programming, Editing and Compiling a Program.

**Text/ Reference Books:**

- V. Rajaraman, N. Adabala, Fundamentals of Computers, PHI, 2014
- P. Pannu, Y. A. Tomer, ICT4D Information Communication Technology for Development, I K International Publishing House Pvt. Ltd, 2010.
- S.K.Basandra, Computer Today, Galgotia Publications, 2009.

### Data Structures

Introduction to Data Structures, algorithms, pseudo-code, time and space complexities; arrays and their applications, sparse matrix, stacks and their applications such as recursion, queues including priority queues and their applications, linked lists and their applications, Introduction to trees, forest, static tree structures: binary tree, threaded binary tree, their traversal techniques, Binary Search Trees, including their applications, dynamic tree structures: AVL trees, B-trees, B+ trees, B* tree, including their applications, Introduction to Graphs, DFS, BFS. Sorting and searching algorithms, hashing.

**Text/ Reference Books:**

- H Ellis, S. Sahni, Fundamentals of Data Structures, W H Freeman and Co. 1995.
- J. P. Tremblay, P. G. Sorenson, Introduction to Data Structures: With Applications, McGraw Hill Higher Education, 1983.
- Kruse Robert L., "Data Structures and Program Design", Prentice Hall, 2007
- R. Gilberg, B. A. Forouzan, Data Structures: A Pseudocode Approach with C, Course Technology Inc, 2004.

### Discrete Mathematical Structures

Propositions and Logical Operations: Notation, Connections, Normal forms, Truth Tables, Equivalence and Implications, Theory of interference for statement calculus, Predicate calculus, Rules of Logic, Mathematical Induction and Quantifiers. Sets, Relations and Diagraphs: Review of set concepts, Relations and digraphs, Properties of relations, Equivalence relations, Computer representation of relations and digraphs, Manipulation of relations, Partially Ordered Sets (Posets), Recurrence Relations Groups and Applications: Monoids, Semi groups, Product and quotients of algebraic structures, Isomorphism, homomorphism, automorphism Elementary Graph Theory: Euler, Hamiltonian graph, Tree,

Planner graph, Graph representation Classification of Languages: Overview of Formal Languages-Representation of regular languages and grammars, finite state machines.

**Text/ Reference Books:**

- J. P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Education, 2001.
- C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Education,1986.
- K H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill Education, 1999.
- N. Dev, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, 1979.

**Digital Logic and Systems Design**

Introduction to Number Systems and Codes. Switching properties of Diodes, BJT and FET, Logic gates, DTL, TTL, ECL, I2L, CMOS Gates and their parameters and comparisons, Applications of switching transistors in bistable, monostable, astable and Schmitt trigger circuits.

Boolean algebra, Switching Function, minimization of switching function: Karnaugh map method and Tabulation Method don't care terms and applications w.r.to code converters and Digital Comparators, etc.

Gated Flip Flops, Master Slave Flip Flop, Ripple and Parallel Counter, Up-Down Counter, Shift Registers and Ring Counter, designing the combinational circuits of the counters through Excitation Table.

Introduction to the circuits for Arithmetic Unit: Serial and parallel Binary Adders, 2's compliment and principle of subtraction, Carry-Look Ahead Adder, and BCD adder: Principles of multiplication, division in ALU

Semiconductor memories: ROM, PROM, EPROM, EEPROM, Bipolar RAM, static and dynamic RAM. Encoder and Decoder/Demultiplexer, multiplexer, Designing combinational circuits with multiplexer, ROM and PLA.Introduction to advanced memory concepts.

Analog-to-Digital conversion:, dual slope integration method and voltage to frequency conversion, principal of DVM. , counter type, successive approximation type, Flash ADC ,

D-A converter: weighted resistors type, R-2-R ladder type.

**Text/ Reference Books:**

- H.Taub & D. Schilling, Digital Integrated Electronics, TMH.
- Malvino& Leach, Digital Principles and Application, TMH.
- M. Mano, Digital Electronics And Logic Design, PHI.
- B.S.Sonde Introduction To System Design Using Integrated Circuits, New Age International.
- Z. Kohavi Switching And Finite Automata Theory, TMH.
- R. P. Jain, Modern Digital Electronics, TMH.
- Gothman, Digital Electronics, PHI.

**Programming Languages**

Notions of syntax and semantics of programming languages; introduction to operational/natural semantics of functional and imperative languages. Data abstractions and control constructs; block-structure and scope, principles of abstraction, qualification and correspondence; parameter passing mechanisms; runtime structure and operating environment; practical and implementation issues in run-time systems and environment; abstracts machines; features of functional and imperative languages; the untyped and simply-typed Lambda calculus' type systems for programming languages including simple types and polymorphism; objects, classes and inheritance in object-oriented languages.

**Text/ Reference Books:**

- *Michael Scott, Programming Language Pragmatics, Morgan Kaufmann, 2000.*
- *Wand andHaynes, Essentials of Programming Languages. Friedman, Prentice-Hall International (PHI), 1998.*
- *Tennant, Principles of Programming Languages, PHI, 1981.*

**Computer Architecture**

Data Representation, Data Types, Binary Codes and Error Detection Codes, Register Transfer language, Arithmetic, logic and Shift Microoperations. Computer Registers, Instruction Codes, Timing and Control. Computer Arithmetic- Number Representation, Addition, Subtraction, Multiplication and Division Algorithms. General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer. Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing. Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication. Memory Hierarchy, Main Memory, Auxillary Memory, Associative Memory, Cache Memory, Virtual Memory. Microprogrammed Control- Control Memory, Address Sequencing, Design of Control Unit.

**Text/ Reference Books:**

- M. Mano, Computer System Architecture. Pearson Education, 2012
- D. A. Patterson, J. L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann, 2009
- W. Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education, 2007
- B. Parhami, Computer Architectures: From Microprocessors to Supercomputers, Oxford, 2005.

**Design and Analysis of Algorithms**

Growth of Functions, Summations, Recurrences, Design Techniques: Divide and conquer, Dynamic programming, Greedy algorithms, Backtracking, Branch and Bound, Graph Algorithms: shortest path problems, Network Flow Problems, Minimum spanning trees; P and NP class problems, NP-completeness and reducibility, Polynomials and the Fast Fourier transform (DFT and FFT), Number-theoretic Algorithms, String matching, Algorithms for Parallel computers, Approximation algorithms.

**Text/ Reference Books:**