Detailed Curriculum for Undergraduate Degree
B.Tech in Computer Science and Engineering
(w.e.f. AY: 2025-26)

Part VI: Detailed Curriculum of 3rd semester

Course Name:	**Mathematics -III**		
Course Code:	BS-M301	**Category:**	Basic Science Course
Semester:	Third	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To understand probability distributions of random variables
2	To apply statistical techniques for data analysis and inference
3	To use Fourier analysis for signal and system representation

Course Contents:

Module No.	Description of Topic	Conduct Hrs.
1	**Probability Distribution:** (i) Introduction to probability theory (ii) Discrete and continuous random variables: Probability mass function (p.m.f.) and probability density function (p.d.f.) of single random variable; Cumulative distribution function (c.d.f.); (iii) Expectation, variance of random variables and their properties **Some special types of distributions** (i) **Discrete probability distribution:** Binomial and Poisson distributions; Mean and variance (ii) **Continuous probability distribution:** Uniform, Exponential and Normal distributions; Mean and variance	8
2	**Bivariate Probability Distribution, Correlation & Regression:** **Discrete bivariate distribution** (i) Joint probability distribution of two discrete random variables, marginal distribution; (ii) Expectation, variance, covariance; Independent random variables;	8

	Continuous bivariate distribution (i) Joint probability distribution of two continuous random variables, marginal distribution; (ii) Expectation, variance, covariance; Independent random variables; **Correlation & Regression:** Karl Pearson's Correlation Coefficient, Rank Correlation, Regression lines	
3	**Statistics:** **Sampling distribution** (i) Population and sampling distribution; statistic, standard error and confidence interval; (ii) Point and interval estimation; unbiased and consistent estimator; maximum likelihood estimate; (iii) Chebyshev's inequality; **Test of hypothesis** (i) Simple and composite hypothesis. Critical region. Level of significance; (ii) Type I and Type II errors; (iii) One sample and two sample tests for means and proportions, t-test, χ^2-test for goodness of fit.	12
4	**Fourier Series and Fourier Transform:** **Fourier Series** (i) Periodic function and periodic extension of a function; Odd and even functions; (ii) Special wave forms: square wave, half wave rectifier, full wave rectifier, saw-toothed wave, triangular wave (graphical illustration only); (iii) Euler's formulae for Fourier series; Fourier series of functions of period 2π; Fourier series of functions of period 2L; Dirichlet's conditions (iv) Half range Sine and Cosine series (v) Parseval's identity (statement only) **Fourier Transform** (i) Definition of Fourier transform; Properties of Fourier transform: Linearity, Shifting, change of scale property; Fourier transform of some elementary functions; Fourier transform of derivatives; (ii) Fourier sine and cosine transform (iii) Inverse Fourier transform and convolution theorem.	8
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply the concepts of probability distributions to model random phenomena and compute probabilities, moments, and expectations for discrete and continuous random variables.
2	Analyze bivariate distributions to determine marginal and conditional distributions, correlation, and apply regression analysis for modeling relationships between two variables.
3	Apply principles of inferential statistics to estimate population parameters, test statistical hypotheses, and interpret results using appropriate confidence levels and significance tests.
4	Analyze and solve problems using Fourier series and Fourier transforms and apply these techniques to represent periodic functions and analyze signals in engineering and scientific applications.

Learning Resources:	
1	"Advanced Engineering Mathematics" by Erwin Kreyszig, John Wiley & Sons.
2	"Advanced Engineering Mathematics" by Michael Greenberg, Pearson.
3	"Higher Engineering Mathematics" by B.S. Grewal, Khanna Publishers.
4	"Mathematical Methods of Science and Engineering" by Kanti B. Dutta, Cenage Learning.
5	"Advanced Engineering Mathematics" by Reena Garg, Chandrika Prasad, Khanna Publishers.
6	"Statistical Methods (Combined Volume)" by N.G. Das, Tata-McGraw Hill.
7	"A First Course in Probability" by S. Ross, Pearson Education India.
8	"An Introduction to Probability Theory and its Applications, Vol. 1" by W. Feller, Wiley.

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**NPTEL Course Name**	**Instructor**	**Host Institute**
1	Applied Multivariate Statistical Modeling	Prof. Jhareswar Maiti	IIT Kharagpur
	Course Link: https://nptel.ac.in/courses/111105091		
2	Probability –I with Examples Using R	Prof. Siva Athreya	ISI Bangalore
	Course Link: https://onlinecourses.nptel.ac.in/noc22_ma27/preview		

Course Name:	**Vedic Mathematics (Indian Knowledge System-II)**		
Course Code:	BS-M303	**Category:**	Basic Science Course
Semester:	Third	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	Basic mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To introduce students to the legacy of Indian mathematicians and the evolution of mathematical thought in India.
2	To enhance efficiency in arithmetic operations using Vedic techniques.
3	To develop problem-solving abilities in algebra, linear equations, and matrix operations.
4	To build geometric intuition based on Śulba Sūtra traditions.
5	To encourage appreciation of Indian Knowledge Systems and their relevance to modern engineering education.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Indian Mathematical Heritage and IKS Perspective:** Overview of the development of mathematics in India from ancient to medieval periods. Contributions of eminent mathematicians such as Aryabhata, Brahmagupta, Mahaviracharya, Bhaskara, Kuttaka and others. Algorithmic nature of Indian mathematics and its relevance to modern science and engineering.	3
2	**Fundamentals of Vedic Mathematics:** Introduction to sutras and sub-sutras, Vedic sutras for addition- Purna puranabhyam, Sankalan Vyavkalanabhyam and Ekadhikena Purvena, Vedic sutras for subtraction- Nikhilam Navatascaramam Dastataḥ and Vinculum.	3
3	**Vedic Techniques for Fast Arithmetic Operations:** Vedic sutras of multiplication and division, their meanings and applications, Urdhva–Tiryag bhyam sutra for multiplication and division. Fast computation of squares and square roots (Dwanda-Yoga or Duplex Method, Vilokanam), and cubes (Yāvadunam).	5
4	**Algebraic Techniques and Linear Equations:** Factorization of cubic	5

	polynomial using Gunita Samuccaya Samuccaya Gunita, Solution of quadratic equations using Vilokanam, Shunyam Sama Samuchchaye and Anurupye Sunyamanyat.	
5	**Vedic Approaches to Matrix Algebra and Computation:** Historical development of matrices and determinants. Calculation of determinants up to 4X4 using Urdhva Tiryag Sutra, Inverse of matrices using Vedic approaches.	3
6	**Vedic Geometry and Śulba Sūtra Concepts:** Geometrical ideas from Śulba Sūtras, Baudhāyana's formulation of the Pythagorean theorem and its applications, Geometric constructions including transformation of rectangles into squares, approximate squaring of the circle, and rational approximation for $\sqrt{2}$.	5
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Explain the contributions of ancient Indian mathematicians to the development of global mathematics.
2	Apply Vedic arithmetic techniques for numerical computation.
3	Solve algebraic expressions and linear equations efficiently.
4	Apply Vedic mathematical techniques to solve problems involving basic matrix and determinant.
5	Interpret fundamental geometrical ideas derived from Vedic and Śulba Sūtra texts.

Learning Resources:	
1	Bharati Krishna Tirthaji, Vedic Mathematics, Motilal Banarsidass, New Delhi.
2	Rajesh Kumar Thakur, Essentials of Vedic Mathematics, Rupa Publications.
3	Vandana Singhal, Vedic Mathematics for All Ages, Motilal Banarsidass.
4	Udayan S. Patankar & Sunil M. Patankar, Elements of Vedic Mathematics, TTU Press.
5	Dahaval Bathia, Vedic Mathematics Made Easy, Jaico Publishing House.
6	Ronak Bajaj, Vedic Mathematics: The Problem Solver, Black Rose Publications.
7	S. K. Kapoor, Vedic Geometry Course, Lotus Press.
8	S. N. Sen & A. K. Bag (Eds.), The Śulba Sūtras, Indian National Science Academy.
9	T. A. Sarasvati Amma, Geometry in Ancient and Medieval India, Motilal Banarsidass.

Corresponding NPTEL/SWAYAM Courses:			
Sl.	**Course Name**	**Instructor Name**	**Host**

No.			Institute
1	Mathematics in India - From Vedic Period to Modern Times	Prof.K.Ramasubramanian, Prof. M.D.Srinivas, Prof. M.S.Sriram	IIT Bombay
	Course Link: https://nptel.ac.in/courses/111101080		

Course Name:	**Digital Electronics**		
Course Code:	ES-EC302	**Category:**	Engineering Science Course
Semester:	Third	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Basic Electronics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To acquire the basic knowledge of digital logic gates and apply it to understand digital circuits.
2	To prepare students to perform the analysis and design of various combinational and sequential digital circuits.
3	To acquire knowledge of different logic family, A/D Converter, D/A Converter.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction to Number System and code:** Number System and Number Base Conversion, BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.	4
2	**Boolean algebra and Logic Gates:** Boolean operations and functions, algebraic manipulation, minterms and maxterms, sum-of-products and product-of-sum representations, Digital Logic gates	4
3	**Simplification of Boolean functions:** K-map method, don't care conditions, prime implicants, Quine-McCluskey method.	5
4	**Combinational logic circuits:** Adders and subtractors, comparator, multiplexer, demultiplexer,	6

	decoder, encoder, parity generator etc. Design of different combinational circuits.	
5	**Sequential Circuits:** Basic Flip-flop & Latch, Clocking and timing issues, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counter, design methodology of Synchronous and asynchronous counter, Introduction to FSM (Mealy and Moore Machine)	12
6	**Logic families:** TTL, ECL, MOS and CMOS - basic concepts	2
7	**A/D and D/A conversion techniques:** Basic concepts D/A: R-2-R only A/D: Successive Approximation, Monostable and Astable Circuit using 555 Timer.	3
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Solve problems involving number systems, basic gate operations and laws of Boolean algebra.
2	Design and implement of combinational logic circuits.
3	Design and implement of sequential logic circuits.
4	Explain A/D and D/A conversion and the basic concepts of Logic families.

Learning Resources:	
1	Morris Mano- Digital Logic and Computer Design- PHI
2	S. Salivahanan, S. Arivazhagan – Digital Circuits and Design
3	Leach & Malvino—Digital Principles & Application, 5/e, McGraw H
4	Floyed & Jain- Digital Fundamentals-Pearson.
5	A. Anand Kumar- Fundamentals of Digital Circuits-PHI
6	D. Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publisher
7	Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**
1	Digital Circuits	Prof. Santanu Chattopadhyay	IIT Kharagpur
	Course Link: https://nptel.ac.in/courses/108105113		
2	Digital Electronic Circuits	Prof. Gautam Saha	IIT Kharagpur

	Course Link: https://nptel.ac.in/courses/108105132

Course Name:	**Data Structures and Algorithms**		
Course Code:	PC-CS301	**Category:**	Professional Core
Semester:	Third	**Credit:**	4
L-T-P:	3-1-0	**Pre-Requisites:**	ES-CS101, BS-M101, BS-M201
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To enable students to explain the fundamental concepts of linear data structures and their associated operations.
2	To acquaint the students with an understanding of nonlinear data structures and their application areas.
3	To develop the ability to analyze the complexity of various sorting and searching algorithms.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Introduction: Basic Terminologies:** Elementary Data Organizations, Array, Data Structure Operations: insertion, deletion, traversal etc. Analysis of Algorithm: Asymptotic Notations, Time-Space trade off. Recursion: Definition and types with examples of each types, Tower of Hanoi problem and its complexity analysis.	4
2	**Linear Data Structure:** Stacks and Queues: Stack as an ADT and its operations, Applications of Stacks: Expression Conversion and Evaluation – corresponding algorithms. **Types of Queues:** Linear Queue, Circular Queue, Operations on each type and their algorithms. Priority Queue and DEQUE	6
3	**Searching and Sorting (Searching, Sorting, and Hashing):** Searching: Linear Search and Binary Search algorithms and their complexity analysis, Interpolation Search algorithm. Sorting: Objective and properties of different sorting algorithms: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort;	8

	Performance analysis and comparison among all the methods; Hashing: Definition, Hash functions, Collision resolution techniques.	
4	**Linear Data Structure: Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Application of Linked list: representation of Polynomial and addition of two polynomials. Doubly linked list and Circular Linked List: Basic Concept and Operations.	6
5	**Non-Linear Data Structures:** Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, its properties, Complete and Strictly Binary Tree, Threaded Binary Tree, Binary Search Tree: insertion, deletion & traversal algorithms, AVL tree, Applications of Binary Trees. B Tree, B+ Tree: definitions and construction algorithms. Graph: Basic terminologies and Representations, Graph traversal algorithms (BFS and DFS), Minimal Spanning Tree algorithms (Prim's and Kruskal's).	12
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Explain the fundamental concepts of data structures and interpret the time and space complexity of algorithms using asymptotic notations.
2	Analyze the complexity of various searching, sorting, and hashing algorithms.
3	Demonstrate the concepts of linear and nonlinear data structures and operations on them.
4	Apply appropriate linear and non-linear data structures to solve computational problems.

Learning Resources:	
1	"Data Structures with C" by Seymour Lipschutz, McGrawHill
2	"Data Structures Using C" by Reema Thareja, Oxford
3	"Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni
4	"Data Structures using C" by A N Tenenbaum, Y Langsam, M J Augenstein, Pearson

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**

1	Data Structure and Algorithms Using Java	Prof. Debasis Samanta	IIT Kharagpur
	Course Link: https://onlinecourses.nptel.ac.in/noc23_cs85/preview		

Course Name:	**Universal Human Values-II (Jeevan Kaushal-IV)**		
Course Code:	HM-HU301	**Category:**	Humanities and Social Sciences including Management Courses
Semester:	Third	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	None
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Contents:		
Module No.	**Description of Topic**	**Conduct Hrs.**
1	**Introduction to Value Education:** Basic Human Aspirations, Right Understanding, Value education, Self-exploration, Exploring Natural Acceptance, Continuous Happiness and Prosperity, Present Scenario: Problems due to lack of Values, Practice Sessions: Sharing about Oneself, Exploring Human Consciousness, Natural Acceptance	**5**
2	**Harmony in the Human Being:** Human beings as the Co-existence of the Self and the Body, Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony, Harmony of the Self with the Body. Practice Sessions: Exploring the Difference between Needs of Self and Body, Sources of Imagination in the Self, Harmony of Self with the Body	**5**

3	**Harmony in the Family and Society:** Family as the Basic Unit of Human Interaction, Harmony in the Family, Trust as the Foundational Value in Relationships, Respect as Right Evaluation Affection, Care, Guidance, Gratitude, Reverence, Justice in Human-to-Human Relationship, Understanding Harmony in the Society and Universal Human Order. Practice Sessions: Exploring the Feeling of Trust, Feeling of Respect, Exploring Systems for Fulfilment of Human Goals	**5**
4	**Harmony in Nature/Existence:** Understanding Harmony in Nature, Interconnectedness, self-regulation and Mutual Fulfilment, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Practice Sessions: Exploring the Four Orders of Nature, Co-existence in Existence.	**4**
5	**Implications of the Holistic Understanding – Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession. Practice Sessions: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Steps for Transition towards Universal Human Order	**5**
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Become more self-aware and responsible towards self, family, society, and nature
2	Resolve life and professional problems through sustainable and ethical solutions. While keeping human relationships and human nature in mind.
3	Practice values-based decision making with improved critical ability and commitment.

Learning Resources:	
1	**A Foundation Course in Human Values and Professional Ethics** – R. R. Gaur, R. Asthana, G. P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi.
2	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
3	**Human Values & Professional Ethics –** R. Subramanian
4	Small is Beautiful - E. F Schumacher.
5	Economy of Permanence - J C Kumarappa.

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**

Course Name:	**Digital Electronics Laboratory**		
Course Code:	ES-EC392	**Category:**	Engineering Science Course
Semester:	Third	**Credit:**	2
L-T-P:	0-0-4	**Pre-Requisites:**	
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To acquire the basic knowledge of digital logic gates and its application to understand digital circuits.
2	To prepare students to design various combinational and sequential circuits.
3	To know the working principle of A/D and D/A Converter.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Realization of Basic gates (AND, OR, NOT) from Universal Gates (NAND & NOR).	**4**
2	Implementation of the given Boolean function using logic gates in both sop and pos forms.	**4**
3	Design and Verify adder, subtractor Circuit	**8**
4	Implementation and Verification of Decoder, Encoder, Multiplexer, Demultiplexer Circuit	**8**
5	Verification of state tables of RS, JK, T and D flip-flops	**4**
6	Design of Shift Register	**4**
7	Design of Asynchronous Up-Down Counter	**4**
8	Design of Synchronous Up-Down Counter	**4**
9	Design of Ring/Johnson Counter	**4**
10	Study of D/A Converter and A/D Converter Circuit	**4**
Total		**48**

Course Outcomes:
After completion of the course, students will be able to:

1	Use basic gate operations and laws of Boolean algebra.
2	Implement combinational logic circuits.
3	Implement sequential logic circuits.
4	Demonstrate A/D converter and D/A converter circuits.

Learning Resources:	
1	Morris Mano- Digital Logic and Computer Design- PHI
2	S. Salivahanan, S. Arivazhagan – Digital Circuits and Design
3	Leach & Malvino—Digital Principles & Application, 5/e, McGraw H
4	Floyed & Jain- Digital Fundamentals-Pearson.
5	A. Anand Kumar- Fundamentals of Digital Circuits-PHI
6	D. Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publisher
7	Tocci, Widmer, Moss- Digital Systems, 9/e- Pearson

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**

Course Name:	**Data Structures Laboratory**		
Course Code:	PC-CS391	**Category:**	Professional Core
Semester:	Third	**Credit:**	2
L-T-P:	0-0-4	**Pre-Requisites:**	ES-CS101, ES-CS191
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To develop the ability to design and implement menu-driven programs to analyze and compare the performance of various sorting and searching techniques.
2	To familiarize students with the programming knowledge required to implement linear data structures and perform their fundamental operations.

3	To enable students to apply dynamic memory allocation concepts for implementing linear and non-linear data structures effectively.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Linear Data Structure: Basic data structure operations using Array	4
2	Linear Data Structure: a) Implementation of Stack operations using array; b) Implementation of Linear Queue operations using array; c) Implementation of Circular Queue operations using array	12
3	Application of Stack: a) Program to convert an infix expression to Postfix Expression; b) Program for Evaluating a Postfix Expression. (optional)	4
4	Searching and Sorting: a) Implementation of various Searching algorithms (Menu driven) b) Implementation of various Sorting algorithms (Menu driven)	12
5	Programs using Dynamic Memory Allocation: Implementation of Single Linked List and associated operations (menu driven) Application of Single Linked List: a) Implementation of Stack and Queue using Single Linked List. b) Program to add two Polynomials using Single Linked List (SLL).	12
6	Implementation of Non-Linear Data Structure a) Binary Search Tree: Construction and Traversal b) AVL tree: Construction and Traversal (optional)	4
Total		**48**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Implement linear data structures and perform fundamental operations using programming constructs.
2	Analyze and compare the performance of various searching and sorting algorithms through menu-driven program implementations.
3	Apply stack-based linear data structures to develop programs for expression conversion and evaluation.
4	Apply dynamic memory allocation concept to implement linear and nonlinear data structures and perform associated operations

Learning Resources:

1	"Data Structures with C" by Seymour Lipschutz, McGrawHill
2	"Data Structures Using C" by Reema Thareja, Oxford
3	"Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni
4	"Data Structures using C" by A N Tenenbaum, Y Langsam, M J Augenstein, Pearson

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**
1			
	Course Link:		

Course Name:	**Python for Problem Solving Laboratory**		
Course Code:	PC-CS392	**Category:**	Professional Core
Semester:	Third	**Credit:**	2
L-T-P:	0-0-4	**Pre-Requisites:**	Basic knowledge of programming
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To acquire a strong foundation in algorithmic thinking and problem-solving strategies using flowcharts and pseudocode.
2	To master the syntax and semantics of the Python programming language, including control structures and built-in data types.
3	To design and implement modular software solutions using functions, modules, and Object-Oriented Programming (OOP) principles.
4	To understand and implement advanced programming concepts such as exception handling, file manipulation, and concurrent programming.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction Python Basics:** History, features; variables, expressions, statements, precedence of operators, type conversion; operators; formatted input and output	4

2	**Conditional and Iterative statement in Python:** Boolean values, execution flow, simple if, if-else, elif, nested conditional statement; Loops: while loop, for loop, range () function, break, continue, pass.	8
3	**Datatypes and data structures in Python:** Integer, Float, Complex-number; Strings: String slicing, immutability, string methods, string formatting; Lists: List operations, slices, methods, list comprehension, mutability, cloning lists; Tuples: Tuple assignment, packing/ unpacking, immutability; Dictionaries & Sets: Creating dictionaries, keys/values, get(), dictionary methods, set operations (union, intersection).	8
4	**Modular Programming and Recursion:** Functions: Defining functions, parameters vs. arguments, return values, keyword arguments, default parameters, recursive functions; Scope: Local and global scope, the global keyword; Modules: Importing standard libraries (math, random, datetime), creating custom modules; Concept of decorator	8
5	**Object-Oriented Programming (OOPs):** Classes and Objects, attributes and methods, the self-parameter; Constructors: The __init__ method, instance variables vs. class variables; Encapsulation: Public, protected, and private members; Inheritance: Single, multiple, and multilevel inheritance, super() function, method overriding; Polymorphism: Operator overloading, magic methods (e.g., __str__, __add__).	8
6	**File Handling and Exception Handling:** Files: Opening files, file modes (r, w, a, b), reading/writing text and binary files, stricture (using with statement); Exception Handling: Concept of Runtime error try, except, else, finally blocks; Custom Exceptions: Raising exceptions (raise), defining user-defined exception classes	8
7	**Concurrent Programming and Advanced Topics:** Concurrency vs. Parallelism: Concepts, processes vs. threads, the Global Interpreter Lock (GIL); Threading: The threading module, creating threads, start() and join(), thread synchronization (Locks); Multiprocessing: The multiprocessing module, Process class, simple inter-process communication (Queues); Brief Overview of Standard Libraries: Introduction to os and sys modules for system interaction.	4
Total		**48**

Course Outcomes:
After completion of the course, students will be able to:

1	Design algorithmic solutions to simple computational problems and translate them into Python programs.
2	Utilize Python's built-in data structures (lists, tuples, dictionaries, sets) effectively to manage and manipulate data.
3	Decompose complex problems into manageable functions and modules to promote code reusability.
4	Apply Object-Oriented Programming concepts (classes, objects, inheritance, polymorphism) to model real-world entities.
5	Implement robust programs by handling runtime errors and performing file I/O operations.
6	Develop efficient programs that utilize concurrent execution (multithreading/multiprocessing) to solve time-intensive tasks.

Learning Resources:	
1	Python Programming: A Modular Approach, Sheetal Taneja and Naveen Kumar, Pearson India
2	Python Programming using Problem Solving Approach, Reema Thareja, Oxford University Press
3	Introduction to Computing and Problem Solving with Python, Jeeva Jose, Khanna Book Publishing
4	Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
5	Introduction to Computing and Problem-Solving Using Python, E. Balagurusamy, McGraw Hill Education India
6	Programming and Problem Solving with Python, Ashok Namdev Kamthane and Amit Ashok Kamthane, McGraw Hill Education India
7	Python Programming, Ch. Satyanarayana, M. Radhika Mani, and B. N. Jagadeesh, Universities Press

Corresponding NPTEL/SWAYAM Courses:			
Sl. No.	**Course Name**	**Instructor Name**	**Host Institute**
	Course Link:		

Detailed Curriculum for Minor Degree under Department of Computer Science and Engineering (w.e.f. AY: 2025-26)

Part VII: Detailed Syllabus of 3rd semester for Minor Degree

No Minor paper in 3rd Semester