Program: B. Tech and MBA Tech (Computer Engineering)/ B Tech Computer Science				**Semester :** III /III	
Course/Module : Probability and Statistics				**Module Code:** 702BS0C034	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Nil

Course Objectives

This course aims to instill in students a sound knowledge of probability theory and statistical techniques. It equips the students with intermediate to advanced level concepts and tools in probability and statistics that help them tackle relevant problems within engineering domain.

Course Outcomes

After completion of the course, students would be able to

1. solve problems involving random variables, probability distributions and testing of hypothesis, correlation and regression,
2. identify suitable probability distribution and testing techniques to solve related problems,
3. apply knowledge of random variables, probability distributions, measures of central tendency, correlation and regression to solve real life problems,
4. analyse data samples using statistical methods.

Detailed Syllabus

Unit	Description	Duration
1	**Basic Probability** Probability spaces, conditional probability, independence; Bayes theorem.	3
2	**Random variables and Probability Distributions** Discrete random variables, probability mass function, cumulative distribution function, Independent random variables, Continuous random variables, distribution functions and densities, expectation, variance, raw and central moments of random variables, Binomial distribution, Poisson approximation to the binomial distribution, Normal distribution.	6
3	**Bivariate Distributions** Definition of Bivariate Distribution and their properties, Conditional densities.	2
4	**Basic Statistics** Measures of Central tendency; Moments, Moment generating function, skewness, kurtosis. Mean and variance of Binomial distribution & Poisson distribution, Moments, skewness & kurtosis for Normal distribution.	2

5	**Testing of hypothesis:** Point estimation, Interval estimate and Confidence interval, Criteria for good estimates, Null and Alternate hypothesis, Test Statistic, Type I and Type II errors, One-tailed and two-tailed test, Critical region, Large sample statistical test for mean, Large sample statistical test for proportion, t-test for small samples, Test for variance- F test, Chi-square test for Goodness of fit and independence of attributes, Analysis of variance.	12
6	**Linear Statistical Models**: Scatter diagram, Linear regression and correlation, Least squares method, Rank correlation, Multiple regression.	5
	Total	**30**

Text Books:

1. Veerarajan T, "Probability, Statistics and Random Processes", McGraw hill Education, 4th Edition, 2017.
2. S. Ross , "A First Course in Probability", Pearson Education India, 9th Edition, 2013.

Reference Books:

1. W. Feller, "An Introduction to Probability Theory and its Applications",Vol.1, John Wiley & Sons, 3rd Edition, 2017.
2. Devore, "Probability and Statistics for Engineering and Sciences", Cengage Learning, 2nd Indian Edition, 2009.
3. Irwin Miller, John E. Freund and R.A. Johnson, "Probability & Statistics for Enginees", Pearson Education India, 8th Edition, 2015.
4. S.C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, 2014.
5. Murray R. Spiegel, John J. Schiller, R. Alu Srinivasn, "Probability and Statistics, McGraw Hill Education, 4th edition, 2013.

Laboratory Work:

8 to 10 experiments based on the syllabus.

Signature
(Head of the Department)

Program: B Tech/MBA Tech Artificial Intelligence B Tech/MBA Tech Information Technology B Tech/MBA Tech Computer Engineering B Tech/MBA Tech EXTC Engineering B Tech Artificial Intelligence and Data Science B Tech Artificial Intelligence and Machine Learning B Tech CSE- Cyber Security	**Semester:** III /III /III /V / III /III/III
Course- Discrete Mathematics	**Course Code-** 702BS0C047

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
2	0	1	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Linear Algebra and Ordinary Differential Equations

Objectives-

The principal objective of the course is to train the students in the construction and understanding of mathematical proofs and common mathematical arguments. It will instil sound knowledge of different topics of discrete mathematics which students will readily apply in the subsequent courses of their programme.

Course Outcomes-

After completion of the course, students would be able to:

1. Define and relate basic notions of discrete mathematics,
2. Demonstrate the ability to understand mathematical logic, concepts in abstract algebra and mathematical proof techniques,
3. Solve problems based on combinatorics, graph theory and abstract algebra,
4. Demonstrate understanding of the applications of algebra, combinatorics and graph theory.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1.	**Set Theory, Relations and Functions** ***Revision of prerequisite concepts - 'Sets, Venn diagrams, Operations on sets, Laws of set theory'.*** Power set, The principle of Inclusion-Exclusion, Partitions of sets. Relations, Properties and types of binary relations, Equivalence relation.	06

	Functions, injective, surjective and bijective functions, Composition, inverse of a function.	
2.	**Logic** ***Revision of prerequisite concepts – 'Propositions, Truth table, Laws of logic, Equivalence'.*** Satisfiability, tautology, validity, disjunctive and conjunctive normal forms, Predicates and Quantifiers, Proof Techniques, Mathematical Induction.	06
3.	**Combinatorics** Pigeonhole principle, Homogeneous and non-homogeneous linear recurrence relations with constant coefficients, Generating functions.	04
4.	**Graphs and Trees** Graphs and their properties, Degree, Connectivity, Path, Cycle, Eulerian graph, Hamiltonian graph, Planar graphs, Graph Coloring. Trees, Rooted trees, Spanning tree and minimum spanning tree, Kruskal's and Prim's algorithms for minimal spanning trees.	08
5.	**Abstract algebra** Definition and examples of groups, subgroups, cyclic groups, group homomorphism, group isomorphisms. Definitions and Examples of Rings and Fields.	06
	Total	**30**

Text Books:

1. Kenneth H. Rosen , "Discrete Mathematics and its Applications", Tata McGraw Hill, 8th edition 2018.
2. Kolman, Busby and Ross, "Discrete Mathematical Structures", Prentice Hall India, 6th edition 2015.

Reference Books:

1. C. L. Liu, "Elements of Discrete Mathematics" McGraw Hill, New Delhi, 4th edition 2017.
2. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", McGraw Hill education, Schaum's Outline Series, Revised 3rd edition 2017.
3. I. N. Herstein , "Topics in Algebra", John Wiley and Sons, 2nd edition 1975.
4. Narsingh Deo, Graph theory with Applications to Engineering and computer science, Prentice Hall India, 1st edition 2016.

Tutorial Work:
8 to 10 Tutorial exercises based on the syllabus

Signature
(Head of the Department)

Program: B. Tech and MBA Tech (Computer Engineering) / B Tech Computer Science				**Semester :** III/ III	
Course: Environmental Science				**Code:** 702CI0C014	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- ---)**
1	0	1	2	Marks Scaled to 50	--

Pre-requisite: Fundamental Knowledge of physics, chemistry and mathematics

Course Objective

This course aims to understand the multidisciplinary nature of environmental sciences, greenhouse effect and climate change. It also aims to discuss the basics of natural resources, biodiversity, environmental pollution.

Course Outcomes

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

1. Explain the concept of natural resources, ecosystem and biodiversity
2. Relate the various aspects of environmental pollutions with its cause and effect
3. Explain the greenhouse effect and climate change

Detailed Syllabus

Unit	Description	Duration
1	**Multidisciplinary nature of environmental science** Definition, scope and importance of environmental sciences.	**01**
2	**Natural Resources** Natural resources: Forest resources, Water resources, Mineral resources, Food resources. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.	**02**
3	**Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features of the following ecosystem:- a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems.	**02**
4	**Biodiversity** Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.	**02**
5	**Environmental Pollution** Definition, Cause and effects for Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards and Solid waste pollution.	**04**

6	**The Science of Climate Change** Greenhouse effect, Global warming, Global environmental changes, Acid rain Ozone layer depletion, Carbon footprint	**04**
	Total	**15**

Text Books

1. Erach Bharucha, *Textbook of Environmental Studies*, 2nd Edition, University Press, 2019.

Reference Books

1. MP Poonia & SC Sharma, *Environmental Studies*, 1st Edition, Khanna Publishing House, 2017.
2. Rajagopalan, *Environmental Studies*, 3rd Edition, Oxford University Press, 2015.

Tutorial Work

8 to 10 Tutorial exercises based on the syllabus.

Signature
(Head of the Department)

Program: B Tech EXTC B Tech/MBA Tech Information Technology B Tech/MBA Tech Computer B Tech CSE -Cyber Security	**Semester:** III III III III
Course : Digital Logic Design	**Code :** 702EX0C014

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Basic Electronics

Course Objective

This course introduces the fundamental concepts and techniques underlying the construction of digital systems. It further provides insight into designing digital logic circuits using basic building blocks and necessary techniques required in computer hardware design.

Course Outcomes

After completion of the course, students will be able to -

1. Explain the concept of digital system and logic simplification
2. Develop combinational circuits for various applications
3. Design sequential circuits for various application
4. Implement basic digital logic circuits using EDA tools with the help of HDL

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction to Digital Systems** Number Systems - Binary, Octal, Hexadecimal, BCD, Conversion from one system to another, Binary subtraction using 1's and 2's complement method. Weighted codes - BCD and Binary, Non-weighted codes - Grey and Excess 3, conversion from one code to another.	**04**
2.	**Logic Gates and Boolean Algebra** Logic gates, Concept of universal logic and implementation of digital logic using universal gates, Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables.	**06**
3.	**Combinational logic circuit and its implementation** Combinational circuits - Adders, Subtractors (half and full), Multiplexers, DE-multiplexers, Decoders, Encoders, Design of digital logic using multiplexers.	**07**
4.	**Sequential Logic Circuits** Flip flops - SR, T, D, JK, master slave JK, converting one flip-flop to another, Registers - Serial input, serial output; serial input-parallel output; Parallel In-Parallel Out, Serial In -Serial Out, Bi-Directional Shift Registers,	**09**

	Counters -Synchronous Counters, Asynchronous (Ripple) Counters and asynchronous counter designing.	
5.	**Introduction to VHDL** VLSI Design flow - Design entry, Schematic, Different modelling styles in VHDL - Dataflow, Behavioural and Structural Modelling, Data types and objects, Synthesis and Simulation of any basic digital logic circuits.	**04**
	Total	**30**

Text Books

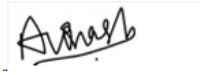
1. Morris Mano, *Digital Design - With an Introduction to the Verilog HDL, VHDL, and System Verilog*, 6th ed., Pearson Education, 2018.
2. R.P Jain, *Modern Digital Electronics*, 4th ed., Tata McGraw-Hill, 2013.

Reference Books

1. Kumar A. Anand, *Fundamental of digital circuits*, 4th ed., 2016.
2. D.P. Kothari and J.S. Dhillon, *Digital Circuits and Design*, Pearson Education, 2015.
3. Roth and John, *Principles of Digital Systems Design*, 6th ed., Ceneage Learning, 2011.

Laboratory Work

8 to 10 practical exercises (and a practicum) based on the syllabus.



Signature
(Head of the Department)

Program: B Tech/MBA Tech Artificial Intelligence B Tech/MBA Tech Computer Engineering B Tech/MBA Tech Information Technology B Tech Artificial Intelligence and Machine Learning B Tech Artificial Intelligence and Data Science B Tech CSE (Cyber Security) B Tech Computer Science	**Semester:** III/V III III III III III III
Course: Database Management Systems	**Code:** 702AI0C001

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Nil

Course Objective

The objective of the course is to provide a comprehensive introduction to the fundamental concepts for design and development of database systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a database management system.

Course Outcomes

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

1. Describe core concepts of database and model a database management system through ER modelling
2. Apply knowledge of relational algebra and structured query language to retrieve and manage data from relational database
3. Demonstrate the use of normalization for database design
4. Use modern database techniques such as NoSQL

Detailed Syllabus

Unit	Description	Duration
1	**Introduction** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Data Models, Database Users and Administrator	03
2	**Database Design and the E-R Model** Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity Relationship Diagrams, Reduction to Relational Schemas, Schema Diagrams , Entity-Relationship Design Issues, Extended ER features	05
3	**Introduction to the Relational Model** Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Basic operators of Relational Algebra, Modification of Databases using Relational Algebra, Database Constraints	03

4	**Structured Query Language** Overview of the SQL Query Language, SQL Data Definition, SQL Constraints, Basic Structure of SQL Queries, Additional Basic Operations, DML operations, Set operations, Aggregate Functions, Nested Sub-queries, Joins, views	**06**
5	**Relational Database Design** Features of Good Relational Designs, Problems with bad design, Decomposition using concept of functional dependencies, Armstrong's axioms, Closure of functional dependency, Closure of attribute, Introduction to process of Normalization and de-normalization, Normal Forms- 1NF, 2NF, 3NF, BCNF, De-normalization	**05**
6	**Transactions** What is Transactions? Properties of transaction, Transaction states, Issues with concurrent executions, Schedules, Serializability- Conflict and View	**04**
7	**Introduction to NoSQL** Overview of NoSQL, characteristics of NoSQL, Storage types of NoSQL, Implementing NoSQL in MongoDB - Managing Databases and Collections from the MongoDB shell, Finding Documents in MongoDB collection from the MongoDB shell.	**04**
	Total	**30**

Text Books:

1. Hennery Korth and Abraham Silberschatz, *Database System Concepts*, 7th Edition, McGraw Hill, 2019
2. Gaurav Vaish, *Getting Started with NoSQL*, 1st edition, Packt Publication, March 2013
3. Brad Daylel, *NoSQL with MongoDB in 24 Hours*, 1st edition, Sams Teach Yourself, January 2015

Reference Books:

1. Elmarsi and Navathe, *Fundamentals of Database Design*, 7th Edition, Addison Wesley, 2019
2. Bob Bryla, Kevin Loney *Oracle Database 12C The Complete Reference*, 1st edition, Tata McGraw Hill, 2017

Laboratory/ Tutorial Work

8 to 10 experiments/programming exercises (and a practicum where applicable) based on the syllabus

Signature
(Head of the Department)

Program: B Tech Artificial Intelligence/ B Tech/MBA Tech. Computer Engineering/ B Tech/MBA Tech. Electronics & Telecommunication Engineering B Tech Computer Science	**Semester:** V III V III
Course: Computer Networks	**Code**: 702AI0C007

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

Prerequisite: NA

Course Objective

This course provides the fundamental knowledge of computer networks through the understanding of each layer of computer network architecture, computer hardware and transmission systems to network applications. It also focuses on congestion control techniques, protocols and application layer functions.

Course Outcomes

After completion of the course, students will be able to -

1. Explain the concepts of computer networks, topologies and data communication.
2. Analyze the various error detection and correction and medium access techniques.
3. Apply network layer addressing and routing techniques to different network topologies.
4. Analyze the different protocols of the layered architecture of computer networks.

Detailed Syllabus

Unit	**Description**	**Duration**
1	**Introduction** Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures.	**02**
2	**Data communication and transmission media** Representation of data and its flow, Network Topologies, Protocols and Standards, OSI and TCP/IP model, Transmission Media.	**02**
3	**Multiplexing techniques for Bandwidth utilization** Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	**02**
4	**Data Link Layer and Medium Access Sub Layer** Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait ARQ, Go-back–N ARQ, Selective Repeat ARQ, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA	**07**

5	**Network Layer** Switching, Logical addressing – IPV4 addressing, subnet mask, classless inter-domain routing (CIDR), IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols—shortest path algorithm, flooding, distance vector routing algorithm, Bellman-ford algorithm, Dijkstra's algorithm, link state routing, RIP, Open shortest path first protocol (OSPF).	**09**
6	**Transport Layer** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.	**05**
7	**Application Layer** DNS, WWW, HTTP, FTP, SMTP, SNMP.	**03**
	Total	**30**

Text Books

1. A. S. Tanenbaum, *Computer Networks*, 5th edition, Pearson Prentice Hall, 2013
2. W. Stallings, *Data and Computer Communications*, 8th edition, Pearson Prentice Hall, 2017

Reference Books

1. Behrouz A. Forouzan and Sophia Chung Fegan, *TCP/IP Protocol Suite*, 4th edition, McGraw-Hill Higher Education, 2009 (Classic)
2. Alberto Leon-Garcia and Indra Widjaja, *Communication Networks: Fundamental Concepts and Key Architectures*, 2nd edition, McGraw-Hill, 2004 (Classic)
3. Larry L. Peterson, Bruce S. Davie, *Computer Networks - A Systems Approach*, 5th edition, Elsevier, 2021.
4. Mark Dye, Rick McDonald, and Anton Rufi, *Network Fundamentals*, 1st edition, CCNA Exploration Companion Guide, 2012.

Laboratory/ Tutorial Work

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

Signature
(Head of the Department)

Program: B. Tech (Computer Engineering) / B Tech Computer Science				**Semester:** III /III	
Course: Data Extraction and Processing				Module Code: 702CO0C031	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks 50)**	**Term End Examinations (TEE)**
1	2	0	2	Marks Scaled to 50	__

Prerequisite: NIL

Course Objective:

- Students will be familiar with basic steps of processing given raw data and will be able to use them in data cleaning, integration and transformation.
- They will be able to utilize graphical and numerical summaries of data in understanding and analysing the data more effectively.

Course Outcomes:

After completion of the course, students would be able to:

1. Explain steps in data science lifecycle.
2. Describe ETL process and its significance.
3. Obtain, clean and transform data.
4. Analyse and interpret data using ethical approach.

Detailed Syllabus

Unit	Description	Duration
1	Introduction to Data Science Data science life cycle, Discovery, Data Preparation, Model Planning, Model Planning, Model Building, Operationalize, Communicate Result.	**2**
2	Getting to know your data Data types like structured and unstructured data, Data objects and attribute types, basic statistical analysis of data, Data visualization, Introduction to Data Warehousing, Advantages, characteristics, Architecture, Front room & back room; Metadata, its classification: - operational, extraction and Transformational, end user; its role in ETL environment, security mechanism in DW environment, ETL (extract, transform, load).	**4**

3	Overview of data processing steps which increases the value of data, Basics of data analytical tool, Basics Statistical Analysis Tool like SPSS, Open source data cleaning tool like open refine etc.	**3**
4	Getting data into environment, Data quality, Data cleansing, deduplicating, and reformatting the data, Data wrangling and Analysis, slices or subsets of data, Online analytical processing.	**3**
5	Creating and working with vectors, matrices, lists, arrays, data frames, missing values, special values, Imputation for fields where data is missing, join data, functioning with dates, characters, functions, Distributing data, Scripting for data cleaning,	**3**
	Total	**15**

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques" 3rd Edition, Morgan kaufmann 2011.
2. Paulraj Ponniah, "Data Warehousing Fundamentals" 2nd Edition, Wiely Interscience Publications, 2010.

References:

1. Joel Grus, "Data Science from Scratch" 1st Edition, O'reilly Media Publication, 2015.

Internet references: NIL

Laboratory Work:

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

Seema Shah

Signature
(Head of the Department)

Program: B Tech/MBA Tech. Artificial Intelligence / B Tech Artificial Intelligence and Machine Learning/ B Tech Artificial Intelligence and Data Science/ B Tech/MBA Tech. Computer Engineering B Tech Mechatronics Engineering B Tech/MBA Tech. Information Technology B Tech Cyber Security B Tech Electronics & Telecommunication Engineering B Tech Computer Science	**Semester:** III III III III IV III III III III
Course: Python Programming	**Code:** 702AI0C004

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks - 100)**
0	2	0	1	Marks Scaled to 50	Practical examination Marks Scaled to 50

Pre-requisite: Nil

Course Objective

The course is designed to provide basic knowledge of Python programming and how to design and program Python applications.

Course Outcomes

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

1. Recognize various data structures and apply them in solving computational problems.
2. Understand and apply different file handling operations
3. Apply core python and object-oriented python concepts to build real world applications.
4. Implement database connectivity in python

Detailed Syllabus

Unit	Description	Duration
1	**Introduction to Python** Installation, Features, Python Interpreter and its working, Syntax and Semantics, comments, imports, indentation, variables, data types, math arithmetic, operators (comparison, logical, bitwise), expressions, print, formatting print, generating random numbers	3
2	**Python Data Structures & Flow Control** Strings, Lists, Dictionaries, Tuples, Sets; Slicing; properties, operations and methods of these data structures Conditional blocks using if, else and elif, Simple For loop, For loop using Ranges, While loops, Loop manipulation using Pass, Continue, Break List and dictionary comprehension, NumPy to create one-dimensional and two-dimensional arrays, Pandas using dataframes.	9

3	**Python Functions** Defining and calling functions, return, scope, function arguments (args and kwargs), recursive functions; Built-in functions: Lambda, Map, Filter, Reduce, Zip, Enumerate	6
4	**File and Exceptional Handling** File I/O read/write operations, open, close, with, seek, tell; manipulating files and directories Exception, Types of errors, handling an exception, try, expect, else, try-finally clause, Argument of an Exception, Raising an Exception	4
5	**Classes and Objects** Class definition, object creation, class variables and methods, accessing class attributes, meaning of self, __init__, inheritance, overriding super class	5
6	**Regular Expression and database connectivity using Python** Regular Expressions, Match function, Search function, Matching vs Searching, Wildcard, Database connectivity using SQLite3	3
	Total	**30**

Text Books:

1. Dr. R. Nageswara Rao, *Core Python Programming*, 2nd Edition, Dreamtech Pres, Wiley Publication, 2018.
2. Paul Barry, *Head first Python: A Brain Friendly guide*, 2nd Edition, O'Reilly publication, 2016.
3. Martin C. Brown, *Python: The Complete Reference*, 4th Edition, McGrawHill Education, 2018.

Reference Books:

1. Bill Lubanovic, *Introducing Python Modern computing in simple packages*, 3rd Edition, O'Reilly publication, 2019.
2. Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly publication, 2017.
3. Jeeva Jose, P. Sojan Lal, *Introduction to Computing and Problem Solving with Python*, 1st Edition, Khanna Publication, 2019.

Laboratory/ Tutorial Work

8 to 10 experiments / Programming exercises (and a practicum where applicable) based on the syllabus

Signature
(Head of the Department)