College of Arts, Science & Commerce

SIES

R I S E   W I T H   E D U C A T I O N

Sion (West), Mumbai – 400022.

(Autonomous)

Faculty: Science

Program: B.Sc.

Subject: Data Science

Academic Year: 2022 – 2023

F.Y.B.Sc.

Credit Based Semester and Grading Syllabi approved by Board of Studies in Data Science to be brought into effect from June 2022.

PREAMBLE

Data has become the most important factor in this era of digital transformation. The technological advancements are seen in all walks of life and therefore we are flooded with enormous data. Every business relies on data to deliver better products as well as services. All data are stored in cloud, and so accessed and processed easily. Data analytics has helped in better decision making with sufficient data insights.

Predictive Analysis has played a crucial role in making businesses smarter with improvised strategies. Machine Learning and Artificial Intelligence are used together to optimize business operations and data management. Augmented analytics uses machine learning and natural language processing to automate the process of data analysis. Global data is predicted to grow due to data generated by the Internet of Things(IoT) and cloud computing advancements. These developments have given rise to a new area of study, called Data Science.

Data Science as an area has evolved out of the applications of various tools and techniques in the field of Computer Science, Mathematics and Statistics. There is an increasing demand to capture, analyse the enormous data present in a number of application domains. The data in these applications then needs to be converted into actionable strategies for effective decision making. So, the study of data science has become essential to cater to the growing need of data scientists and data analysts.

This course focuses on educating the students about the essentials of computer science, applied mathematics and applied statistics with respect to the data science applications.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

NO.	Details
PO1.	**Solving Complex Problems**:- Apply the knowledge gained in breaking down complex problems into simple components; and to design processes required for problem solving.
PO2.	**Critical Thinking:-** Ability to apply the acquired knowledge to identify assumptions and evaluate their accuracy and validity.
PO3.	**Reasoning ability and Rational thinking:-** Ability to analyse, interpret data and draw logical conclusions; to evaluate ideas rationally.
PO4.	**Research Aptitude:-** Ability to ask relevant questions to identify and define the problem, applying research tools for analysis and interpretation of data. Understand and comply with research ethics.
PO5.	**Effective Communication skill:-** Demonstrate the ability to listen and to clearly express ideas verbally. Equip to write reports, make presentations effectively.
PO6.	**Information and Digital Literacy:-** Equip to use appropriate tools and techniques inclusive of internet and electronic media for acquiring, assessing and analysing data from diverse resources.
PO7.	**Social Interactive Skills and team work:-** Exhibit networking and social interactive skills; function effectively as an individual and as a member in diverse groups; demonstrate leadership quality useful for employability
PO8.	**Self-directed and Lifelong Learning:** Ability to explore and gain knowledge in independent and self-reliant ways. Demonstrate ability to adapt and upgrade with the global , social and technological changes.
PSO1.	**Sound Knowledge:** Demonstrate the knowledge of core data science concepts and apply them to develop a user- friendly, scalable and robust applications
PSO2.	**Critical and Rational Thinking:** Exhibit higher order skills to adapt to the everchanging technological environment
PSO3.	**Logic Building and Programming Skills:** The ability to apply logic to problem solving and acquire proficiency in various programming languages.
PSO4.	**Data Analysis :** Apply quantitative modeling and data analysis techniques to solve real world business problems, Learn tools and techniques for transformation of data and statistical data analysis
PSO5.	**Pursue Higher Education:** Make students competent to take up advanced degree courses like MSc(Data Science),MCA, MSc(CS), MSc(IT) and MBA etc.

FYBSc(DS) - Semester I

Course Code	Course Type	Course Title	Periods per week (1 Period = 50 min)	Credits
SIUSDS11	Core Subject	Digital Principles and Computer Organisation	5	2
SIUSDS12	Core Subject	Python Programming – I	5	2
SIUSDS13	Core Subject	Discrete Mathematics and Graph Theory	5	2
SIUSDS14	Core Subject	Computer Oriented Statistical Techniques – I	5	2
SIUSDS15	Ability Enhancement Skill Course	Soft Skills Development	5	2
SIUSDSP11	Core Subject Practical	Digital Principles and Computer Organisation Practical	3	2
SIUSDSP12	Core Subject Practical	Python Programming – I Practical	3	2
SIUSDSP13	Core Subject Practical	Discrete Mathematics and Graph Theory Practical	3	2
SIUSDSP14	Core Subject Practical	Computer Oriented Statistical Techniques – I Practical	3	2
SIUSDSP15	Ability Enhancement Skill Course Practical	Soft Skills Development Practical	3	2
		TOTAL CREDITS		**20**

Digital Principles and Computer Organisation (SIUSDS11)

Course Objective:
Students can understand the digital logic design and structure of various functional modules of the computer and how they interact to provide the processing needs of the user.

Course Outcomes:
Upon completion of this course, student will be able to:

CO1: Compare the representation of numbers employed in arithmetic operations and on the binary coding of symbols used in data processing.

CO2: Acquire necessary background for understanding the digital circuits and logical operation of the most common standard digital components.

CO3: Compose microoperations in symbolic form using register transfer language and describe the internal operation of the computer and to specify the requirements for its design.

CO4: Illustrate an execution unit with common buses and an arithmetic logic unit which forms the general register organization of typical CPU (Central Processing Unit).

CO5: Explain the concept of pipelining and the way it can speed up the processing with examples.

Unit	Contents	No. of Lectures
I	**Number Systems:** Decimal, Binary, Octal and Hexadecimal number system and conversion, Binary weighted codes, signed number binary order 1's and 2's complement codes, binary arithmetic. **Boolean Algebra and Logic Gates:** Basic definition, Axiomatic Definition, Basic theorem and Properties of Boolean algebra, Minterms and Maxterms, Logic Operations, Digital logic gates, IC digital logic families.	12
II	**Simplification of Boolean functions**: Different types of map method, product of sum simplification, NAND or NOR implementation, don't care condition, Tabulation method, Adder, subtractor, Code Conversion, Universal Gate. **Sequential Logic:** Flip-flops, Triggering of Flip-flops, Analysis of clocked sequential circuits, State reduction and Assignment, Flip-flop excitation, Design of counters, Design with state equations.	12

III	**Overview Of Register Transfer and Microoperations**: Register Transfer Language, Register transfer. Bus and Memory transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit. **Basic Computer Organization and Design**: Instruction codes, Computer registers, Computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Design of Basic computer, Design of Accumulator Unit.	**12**
IV	**Central Processing Unit**: Introduction, General Register Organization, Stack Organization, Instruction format. Addressing Modes, Data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC) **Microprogrammed Control**: Control Memory, Address sequencing, Microprogram format, Symbolic microinstructions, The Fetch Routine, Symbolic Microprogram, Binary Microprogram.	**12**
V	**Pipeline Processing**: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline and Example: Four-Segment Instruction Pipeline, Data Dependency, Handling of branch instructions, RISC Pipeline, Example: Three Segment Instruction Pipeline, Delayed Load, Delayed Branch.	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Computer System Architecture	M.Morris Mano	Pearson	Third	1992
2	Computer Organization	William Stallings	Pearson	Eighth	2006
3	Introduction to Logic Design.	Allan B Marcontz	McGraw-Hill	Third	-

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class test	Presentation

Digital Principles and Computer Organisation Practical (SIUSDSP11)

List of Practical(Online Simulators like MMLogic, Logisim, CircuitVerse, CircuitLab can be used)

1.	To study and perform logic gates.
2.	To study and perform De' Morgan's Theorem.
3.	To study and perform NAND and NOR as a universal gate.
4	To design and implement circuit that converts binary code to gray code.
5	To study and perform Half Adder and full Adder.
6	To study and perform Half subtractor and full subtractor
7	To study and perform R-S and D flip flop.
8	To study and perform J-K and T flip flop.
9	To study and perform Master slave JK flip flop.
10	To realize Boolean functions using multiplexer.

Python Programming - I (SIUSDS12)

Course Objective:

Students can develop mini projects in Python for any real time situation they are exposed to.

Course Outcomes:

Upon completion of this course, student will be able to:

CO1: Compare the different data types and operators in Python and use the IF statement in writing programs.

CO2: Design programs using loops and arrays, predict the use of string concepts to solve simple and complex problems.

CO3: Compose python statements using list, dictionary and tuples.

CO4: Discuss functional programming.

CO5: Classify the different modules in Python and categorize the various exceptions

Unit	Contents	No. of Lectures
I	**Getting started with Python Language**: Getting Started, Creating variables and assigning values, Block Indentation, Data types, Collection Types, IDLE - Python GUI, User Input, Built in Modules and Functions, Creating a module **Python Data Types**: String Data Type, Set Data Types, Numbers data type, List Data Type, Dictionary Data Type, Tuple Data Type **Set:** Operations on sets, Get the unique elements of a list, Set of Sets, Set Operations using Methods and Built-ins **Simple Mathematical Operators:** Division, Addition, Exponentiation, Trigonometric Functions, Inplace Operations, Subtraction, Multiplication, Logarithms, Modulus. **Bitwise Operator:** Bitwise NOT, Bitwise XOR (Exclusive OR), Bitwise AND, Bitwise OR, Bitwise Left Shift, Bitwise Right Shift, Inplace Operations **Boolean Operators:** `and` and `or` are not guaranteed to return a Boolean, A simple example, Short-circuit evaluation, and, or, not **Operator Precedence** **Variable Scope and Binding:** Nonlocal Variables, Global Variables, Local Variables, The del command, Functions skip class scope when looking up names, Local V_s Global Scope **Basic Input and Output**: Using the print function, Using input(), Function to prompt user for a number, Printing a string without a newline at the end **Conditional Statement:** Conditional Expression (or "The Ternary Operator"), if, elif, and else, Truth Values, Boolean Logic Expressions, Using the cmp	**12**

		function to get the comparison result of two objects, Else statement, Testing if an object is None and assigning it, If statement, Chain Comparisons, Comparison by `is` vs `==`, Greater than or less than, Not equal to, Equal To, Comparing Objects	
II		**Loops**: For loops, Iterating over lists, Loops with an "else" clause, The Pass Statement, Iterating over dictionaries, The "half loop" do-while, Looping and Unpacking, Iterating different portion of a list with different step size, While Loop, Break and Continue in Loops **Functions:** Defining and calling simple functions, Defining a function with an arbitrary number of arguments, Lambda (Inline/Anonymous) Functions, Defining a function with optional arguments, Defining a function with optional mutable arguments, Argument passing and mutability, Returning values from functions, Closure, Forcing the use of named parameters, Nested functions, Recursion limit, Recursive Lambda using assigned variable, Recursive functions, Defining a function with arguments, Iterable and dictionary unpacking, Defining a function with multiple arguments **Defining functions with list arguments**: Function and Call **Functional Programming in Python**: Lambda Function, Map Function, Reduce Function, Filter Function	12
III		**Arrays**: Access individual elements through indexes, Basic Introduction to Arrays, Append any value to the array using append() method, Insert value in an array using insert() method, Extend python array using extend() method, Add items from list into array using fromlist() method, Remove any array element using remove() method, Remove last array element using pop() method, Fetch any element through its index using index() method, Reverse a python array using reverse() method, Get array buffer information through buffer_info() method, Check for number of occurrences of an element using count() method, Convert array to string using tostring() method, Convert array to a python list with same elements using tolist() method, Append a string to char array using fromstring() method **Multidimensional arrays**: Lists in lists, Lists in lists in lists in. **String Formatting**: Basics of String Formatting, Alignment and padding, Format literals (f-string), Float formatting, Named placeholders, String formatting with datetime, Formatting Numerical Values, Nested formatting, Format using Getitem and Getattr, Padding and truncating strings, combined, Custom formatting for a class **String Methods**: Changing the capitalization of a string, str.translate: Translating characters in a string, str.format and f-strings: Format values into a string, String module's useful constants, Stripping unwanted leading/trailing characters from a string, Reversing a string, Split a string based on a delimiter into a list of strings, Replace all occurrences of one substring with another substring, Testing what a string is composed of, String Contains, Join a list of	12

		strings into one string, Counting number of times a substring appears in a string, Case insensitive string comparisons, Justify strings	
IV		**Dictionary**: Introduction to Dictionary, Avoiding KeyError Exceptions, Iterating Over a Dictionary, Dictionary with default values, Merging dictionaries, Accessing keys and values, Accessing values of a dictionary, Creating a dictionary, Creating an ordered dictionary, Unpacking dictionaries using the ** operator, The trailing comma, The dict() constructor, Dictionaries Example . **List**: List methods and supported operators, Accessing list values, Checking if list is empty, Iterating over a list, Checking whether an item is in a list, Any and All, Reversing list elements, Concatenate and Merge lists, Length of a list, Remove duplicate values in list, Comparison of lists, Accessing values in nested list, Initializing a List to a Fixed Number of Elements **List comprehensions**: Conditional List Comprehensions, Avoid repetitive and expensive operations using conditional clause, Dictionary Comprehension, List Comprehensions with Nested Loops, Generator Expressions, Set Comprehensions, Refactoring filter and map to list comprehensions, Comprehensions involving tuples, Counting Occurrences Using Comprehension, Changing Types in a List, Nested List Comprehensions, Iterate two or more list simultaneously within list comprehension **List slicing (selecting parts of lists)**: Using the third "step" argument, Selecting a sublist from a list, Reversing a list with slicing, Shifting a list using slicing **Tuple**: Tuples are immutable, Packing and Unpacking Tuples, Built-in Tuple Functions, Tuple Are Element-wise Hashable and Equatable, Indexing Tuples, Reversing Elements	**12**
V		**Importing modules:** Importing a module, The __all__ special variable, Import modules from an arbitrary filesystem location, Importing all names from a module, Programmatic importing, Importing specific names from a module, Importing submodules, Re-importing a module, __import__() function . **Difference between Module and Package**: Modules, Packages **Math Module**: Rounding: round, floor, ceil, trunc, Trigonometry, Pow for faster exponentiation, Infinity and NaN ("not a number"), Logarithms, Constants, Imaginary Numbers, Copying signs, Complex numbers and the cmath module **The OS Module:** makedirs - recursive directory creation, Create a directory, Get current directory, Determine the name of the operating system, Remove a directory . **Random module:** Creating a random user password, Create cryptographically secure random numbers, Random and sequences: shuffle, choice and sample, Creating random integers and floats: randint, randrange, random, and uniform, Reproducible random numbers: Seed and State **Installing a special purpose Module**	**12**

| | **Exceptions:** Catching Exceptions, Do not catch everything!, Re-raising exceptions, Catching multiple exceptions, Exception Hierarchy, Else, Raising Exceptions, Creating custom exception types, Practical examples of exception handling, Exceptions are Objects too, Running clean-up code with finally, Chain exceptions with raise from, Raise Custom Errors / Exceptions, Custom Exception, Catch custom Exception. | |

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	A Practical Introduction to Python Programming	Brian Heinold	*		2021
2	Python Basics: A Practical Introduction to Python 3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler	Not Known	4th	Copyright © Real Python (realpython.com), 2012–2020
3	Learning Python	Mark Lutz	O'Reilly Media, Inc.	5th	2013
4	Python Tutorial Release 3.7.0	Guido van Rossum	Python Software Foundation	3rd	2018
5	Think Python	Allen B. Downey	O'Reilly Media, Inc.	2nd	2015

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Internal Evaluation: 40 Marks

20 Marks	**20 Marks**
Class Test	Mini Project using Python

FYBSc(DS) - Semester I

Python Programming – I Practical (SIUSDSP12)

List of Practical: (To be implemented using IDLE Python 3.8/Spyder(Anaconda3))

1.	**Code the following programs using if-elif-else:**
a.	Accept a number and check whether the number is positive or negative or a zero.
b.	Accept 3 numbers and find the largest of the 3 numbers.
c.	Swap 2 numbers using multiple assignment statement.
d.	A company insures its drivers in the following cases: − If the driver is married. − If the driver is unmarried, male & above 30 years of age. − If the driver is unmarried, female & above 25 years of age. In all other cases the driver is not insured. If the marital status, sex and age of the driver are the inputs, write a program to determine whether the driver is to be insured or not.
e.	i. Assign a name in the code and allow the use to guess the name and check if both are same. ii. Generate a random number in the code. Allow user to guess the number and check if both are the same.
2.	**Code the following programs using Loops and Functions:**
a.	i. Accept a number and find the factorial of the number ii. Accept a number and find the factorial of the number. Use Recursive Function. iii. Print Fibonacci series up to 10 terms. Use multiple assignment too. iv. Print Fibonacci series up to 10 terms. Use Recursive function. v. iv. Accept a number and find the sum of the digits of that number.
b.	Accept a number and check whether the number is: i. An Armstrong number or not ii. Strong number or not iii. Perfect number or not iv. Palindrome

c.	Accept a number and print the number in words. Example 326 should be printed as Three Two Six

d.	Write a menu driven program to:
	
	   i. Accept a number and check if the number is odd or even
	   ii. Accept a number and check whether the number is Prime or not

3.	**Code the following programs using Functions, Loops, Arrays, Strings:**
a.	Initialize an array with 5 integers and demonstrate the use of append((), insert(), extend(), fromlist(), remove(), pop(), index(), reverse(), buffer_info(), count(), tostring(), tolist() and fromstring()

b.	Perform the following on Strings:
	
	   ii. Split a string based on '\n'
	   iii. Check for the presence of a substring in a string
	   iv. Replace a string with any other
	   v. Find the index of the first occurrence of a substring

c.	Perform the following on Strings:
	
	   i. Reverse a string by words
	   ii. Generate password
	   iii. Count the occurrences of a substring in a given string
	   iv. Exchange the last and the first letter in a string
	   v. Swapcase
	   vi. Wrap text

4.	**Code the following programs using Functions, Loops, List:**
a.	Accept a string. Print smallcase letters first and then uppercase letters of the input string – Output to be stored in a list.

b.	Work on the following aspects using lists as input:
	
	   i. Find largest number in the list
	   ii. Remove duplicates in a list
	   iii. Copy a list
	   iv. To print any value from a given list

c.	Use lists as the data structure to do as directed:

	i. Count the number of occurrences of each element in a list ii. To concatenate any two lists iii. To check for a common element in two given lists
5.	**Code the following programs using Functions, Loops, Dictionary:**
a.	Print the key value in a given Dictionary to demonstrate the use of Dictionary comprehension
b.	Find the occurrences of each word in a string and print it as a key value pair using Dictionary.
c.	Use a Dictionary data structure and Sort a dictionary by key and by value.
6.	**Code the following programs using Functions, Loops, Tuples:**
a.	Do the following taking a tuple(s) as an input: i. Unpack a tuple ii. Convert a tuple to a string iii. Minimum element in a tuple iv. Remove an element form a tuple
b	Using tuple as an input print tuples applying various Slicing on these tuples.
c	i. Initialize 2 or 3 tuples and concatenate the same. ii. Initialize tuples and Concatenate a particular position element in the tuple to form a list
7.	**Code the following programs using Functions, Loops, Modules:**
a.	Programs using Operator Module.
b	Programs using Random Module.
c	Programs using OS and Math Module.
8.	**Code the following programs using Functions, Loops, Custom Modules:**
a.	Create a module to find the largest and smallest number in a list. Use this module in a python code.

b	Create a module to count the number of digits, smallcase letters, uppercase letters and special characters in a string data. Use this module in a python code.
c	Create a module to count the occurrences of all letters in a string and output the same as a dictionary. Use this module in a python code.
9.	**Code the following programs using Functions, Loops, Exception handlers:**
a.	Display the type of exception occurred in any snippet of the python code.
b	Demonstrate the use of raise statement with respect to exception.
c	Write a python code to throw Assertion Error.

Discrete Mathematics and Graph Theory (SIUSDS13)

Course Objective:
To familiarize the prospective learners with mathematical structures that are fundamentally discrete by introducing concepts of sets and functions, forming and solving recurrence relations and different counting principles.

Course Outcomes:
Upon completion of this course, student will be able to:
CO1: Examine discrete objects, starting with relations and partially ordered sets.
CO2: Identify properties of Combinatorics structures and properties, know the basic techniques in Combinatorics and counting.
CO3: Inspect recurrence relations, generating function and operations on them.
CO4: Construct graphs and trees which are widely used in software.
CO5: Apply graph theory concepts to understand real life concepts and solve problems

Unit	Contents	No. of Lectures
I	**Introduction:** Variables, The Language of Sets, The Language of Relations and Function Set Theory: Definitions and the Element Method of Proof, Properties of Sets, Algebraic Proofs, Boolean Algebras. The Logic of Compound Statements: Logical Form and Logical Equivalence, Conditional Statements, Valid and Invalid Arguments. **Relations:** Relations on Sets, Reflexivity, Symmetry, and Transitivity, Equivalence Relations, Partial Order Relations	**12**
II	**Quantified Statements**: Predicates and Quantified Statements, Statements with Multiple Quantifiers, Arguments with Quantified Statements **Elementary Number Theory and Methods of Proof:** Introduction to Direct Proofs, Rational Numbers, Divisibility, Division into Cases and the Quotient-Remainder Theorem, Floor and Ceiling, Indirect Argument: Contradiction and Contraposition, Two Classical Theorems, Applications in algorithms.	**12**
III	**Sequences, Mathematical Induction, and Recursion**: Sequences, Mathematical Induction, Strong Mathematical Induction and the Well Ordering Principle for the Integers, Correctness of algorithms, defining sequences recursively, solving recurrence relations by iteration, Second order linear homogenous recurrence relations with constant coefficients. general recursive definitions and structural induction. **Functions:** Functions Defined on General Sets, One-to-One and Onto, Inverse Functions, Composition of Functions, Cardinality with Applications to Computability	**12**

IV	**Graphs and Trees**: Definitions and Basic Properties, Trails, Paths, and Circuits, Matrix Representations of Graphs, Isomorphism's of Graphs, Trees, Rooted Trees, Isomorphism's of Graphs, Spanning trees and shortest paths Multigraphs: Loops and Multiple Edges, Eulerian and Hamiltonian Graphs, Graph Coloring, Planar Counting **Network Flows**: Basic Notation and Terminology, Flows and Cuts, Augmenting Paths, The Ford-Fulkerson Labeling Algorithm	**12**
V	**Counting and Probability**: Introduction, Possibility Trees and the Multiplication Rule, Possibility Trees and the Multiplication Rule, Counting **Elements of Disjoint Sets:** The Addition Rule, The Pigeonhole Principle, **Counting Subsets of a Set:** Combinations, r Combinations with Repetition Allowed, Probability Axioms and Expected Value, Conditional Probability, Bayes' Formula, and Independent Events.	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	Tata McGraw Hill	Seventh	2007
2	Discrete Mathematics, Schaum's Outlines Series	Seymour Lipschutz, Marc Lipson	Tata McGraw Hill		2007
3	Discrete mathematical structures	B Kolman RC Busby, S Ross	PHI		
4	Discrete Mathematics with Applications	Sussana S. Epp	Cengage Learning	Fourth	2010
5	Discrete structures	Liu	Tata McGraw Hill		
6	Graph Theory: Modeling, Applications and Algorithms	Agnarsson	Pearson Education India		2008

Internal Evaluation: 40 Marks

20 Marks	**20 Marks**
Class Test	Assignments (Problem Solving)

Discrete Mathematics and Graph Theory Practical (SIUSDSP13)

List of Practical: (To be implemented using Scilab)

1.	**Set Theory** a. Inclusion Exclusion principle. b. Power Sets c. Mathematical induction.
2.	**Functions and Algorithms** a. Recursively defined functions b. Cardinality c. Polynomial evaluation d. Greatest Common Divisor
3.	**Counting** a. Sum rule and Product rule principle b. Factorial c. Binomial coefficients d. Permutations and Permutations with repetitions e. Combinations and Combinations with repetitions f. Ordered partitions and Unordered partitions
4.	**Probability Theory** a. Sample space and events b. Finite probability spaces c. Addition Principle d. Conditional Probability e. Multiplication theorem for conditional probability f. Independent events and Repeated trials with two outcomes
5.	**Graph Theory - I** a. Paths and connectivity b. Minimum spanning tree c. Isomorphism and Planar Graphs d. Solving problems on Eulerian and Hamiltonian graphs.
6.	**Graph Theory - II** a. Kruskal's Algorithm b. Prim's Algorithm c. Dijkstra's Algorithm
7.	**Properties of integers** a. Primes b. Division algorithm and Euclidean algorithm

	c. Fundamental theorem of arithmetic d. Congruence relation and Linear congruence equation
8.	**Algebraic Systems and Boolean algebra** a. Properties of operations b. Roots of polynomials c. Basic definitions in Boolean Algebra d. Boolean algebra as lattices
9.	**Recurrence relations** a. Linear homogeneous recurrence relations with constant coefficients b. Solving linear homogeneous recurrence relations with constant coefficients c. Solving general homogeneous linear recurrence relations
10.	**Ford Fulkerson Algorithm**

Computer Oriented Statistical Techniques - I (SIUSDS14)

Course Objective:
Students can apply the various statistical functions on any given data to analyse and take necessary decisions.

Course Outcomes:
Upon completion of this course, student will be able to:

CO1: Assess the mean, median, mode of a data set which describes the whole set of data with a single value.

CO2: Predict whether data is uniformly distributed, based on the value taken by Skewness and Kurtosis.

CO3: Construct a Hypothesis, a testable statement of what the researcher(s) predict will be the outcome of the study.

CO4: Compare and predict whether two variables are related or independent from one another using Chi Squared test.

CO5: Assess the relationship between the dependent variable and the independent variables using Regression and quantifying the association between a dependent and independent variable or among two independent variables using Correlation

Unit	Contents	No. of Lectures
I	**Statistical Methods:** Definition and scope of Statistics, concepts of statistical population and sample Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.	**12**
II	**The Mean, Median, Mode, and Other Measures of Central Tendency:** Index, or Subscript, Notation, Summation Notation, Averages, The Arithmetic Mean , The Weighted Arithmetic Mean ,Properties of the Arithmetic Mean ,The Arithmetic Mean Computed from Grouped Data ,The Median ,The Mode, The Empirical Relation Between the Mean, Median, and Mode, The Geometric Mean G, The Harmonic Mean H ,The Relation Between the Arithmetic, Geometric, and Harmonic Means, The Root Mean Square, Quartiles, Deciles, and Percentiles, Software and Measures of Central Tendency. The Standard Deviation and Other Measures of Dispersion: Dispersion, or Variation, The Range, The Mean Deviation, The SemiInterquartile Range, The 10–90 Percentile Range, The Standard Deviation, The Variance, Short Methods for	**12**

	Computing the Standard Deviation, Properties of the Standard Deviation, Charlie's Check, Sheppard's Correction for Variance, Empirical Relations Between Measures of Dispersion, Absolute and Relative Dispersion; Coefficient of Variation, Standardized Variable; Standard Scores, Software and Measures of Dispersion.	
III	**Moments, Skewness, and Kurtosis :** Moments , Moments for Grouped Data ,Relations Between Moments , Computation of Moments for Grouped Data, Charlie's Check and Sheppard's Corrections, Moments in Dimensionless Form, Skewness, Kurtosis, Population Moments, Skewness, and Kurtosis, Software Computation of Skewness and Kurtosis. **Elementary Probability Theory**: Definitions of Probability, Conditional Probability; Independent and Dependent Events, Mutually Exclusive Events, Probability Distributions, Mathematical Expectation, Relation Between Population, Sample Mean, and Variance, Combinatorial Analysis, Combinations, Stirling's Approximation to n!, Relation of Probability to Point Set Theory, Euler or Venn Diagrams and Probability.	**12**
IV	**Elementary Sampling Theory :** Sampling Theory, Random Samples and Random Numbers, Sampling With and Without Replacement, Sampling Distributions, Sampling Distribution of Means, Sampling Distribution of Proportions, Sampling Distributions of Differences and Sums, Standard Errors, Software Demonstration of Elementary Sampling Theory. **Curve Fitting and the Method of Least Squares:** Relationship Between Variables, Curve Fitting, Equations of Approximating Curves, Freehand Method of Curve Fitting, The Straight Line, The Method of Least Squares, The Least-Squares Line, Nonlinear Relationships, The Least Squares Parabola, Regression, Applications to Time Series, Problems Involving More Than Two Variables.	**12**
V	**Correlation Theory:** Correlation and Regression, Linear Correlation, Measures of Correlation, The Least-Squares Regression Lines, Standard Error of Estimate, Explained and Unexplained Variation, Coefficient of Correlation, Remarks Concerning the Correlation Coefficient, Product-Moment Formula for the Linear Correlation Coefficient, Short Computational Formulas, Regression Lines and the Linear Correlation Coefficient, Correlation of Time Series, Correlation of Attributes, Sampling Theory of Correlation, Sampling Theory of Regression	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Schaum's Outline of Statistics	Murray R. Spiegel, Larry J. Stephens.	Mcgraw – Hill International	6th	2018
2.	Fundamental of Mathematical Statistics	S.C. Gupta and V.K. Kapoor		12th	2020
3.	Mathematical statistics	J.N. Kapur and H.C. Saxena	S. Chand	20th	2016
4	Introduction to the Theory of Statistics	Mood, A.M. Graybill, F.A. and Boes, D.C	Tata McGraw-Hill Pub. Co. Ltd.	3rd	2017
5	Mathematical Statistics with Applications	Miller, Irwin and Miller, Marylees	Pearson Education, Asia	8th	2014

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Take a sample data from Kaggle.com, Perform any 10 statistical techniques and Analyse the data

Computer Oriented Statistical Techniques - I Practical (SIUSDSP14)

List of Practical: (Use Excel , Use data from Kaggle.com or any data repository from any website)

1.	Graphical representation of data.
2.	Execute the statistical functions: mean, median, mode
3.	Execute the statistical functions: quartiles, range, inter quartile range histogram
4	Calculate the standard deviation, variance, co-variance, correlation
5	Problems based on moments, skewness and kurtosis.
6	Problems based on Probability.
7	Correlation coefficient for a bivariate frequency distribution.
8	Fitting of polynomials, exponential curves.
9	Planes of regression and variances of residuals for given simple correlations.
10	Planes of regression and variances of residuals for raw data.

Soft Skills Development (SIUSDS15)

Course Objective:

To develop an all - round personality through the understanding of various soft skills like presentation skills, communication skills, leadership skills, time management skills.

Course Outcomes:

Upon completion of this course, student will be able to:

CO1: Describe the various hard skills, soft skills and components of emotional intelligence

CO2: Develop professional etiquettes and mannerisms, listening skills

CO3: Write impressive resume, plan the preparation for job interviews and presentations.

CO4: Explain the techniques of group and panel discussions, personality and develop emotional intelligence

CO5: Describe the strategies for Capacity Building, Leadership, Team Building and managing stress and time.

Unit	Contents	No. of Lectures
I	**Introduction to Soft Skills and Hard Skills:** Skills to master, Academia – Industry Connect, Softening of Hard Skills, Interdisciplinary Relevance, Global Perspectives. **Personality Development**: Knowing Yourself, Positive Thinking, Johari's Window, Communication Skills, Non-verbal Communication, Physical Fitness **Emotional Intelligence:** Meaning and Definition, Need for Emotional Intelligence, Intelligence Quotient versus Emotional Intelligence Quotient, Components of Emotional Intelligence, Competencies of Emotional Intelligence, Skills to Develop Emotional Intelligence	12
II	**Etiquette and Mannerism:** Introduction, Professional Etiquette, Technology Etiquette **Communication Today:** Significance of Communication, GSC's 3M Model of Communication, Vitality of the Communication Process, Virtues of Listening, Fundamentals of Good Listening, Nature of Non-Verbal Communication, Need for Intercultural Communication, Communicating Digital World	12
III	**Employment Communication:** Introduction, Resume, Curriculum Vitae, Scannable Resume, Developing an Impressive Resume, Formats of Resume, Job Application or Cover Letter **Professional Presentation:** Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation **Job Interviews:** Introduction, Importance of Resume, Definition of Interview,	12

	Background Information, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips, Changes in the Interview Process, FAQ During Interviews		
IV	**Group Discussion:** Introduction, Ambience/Seating Arrangement for Group Discussion, Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Traits, Types of Group Discussions, topic based and Case based Group Discussion, Individual Traits **Professional Skills - Creativity at Workplace:** Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method **Ethical Values:** Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics	12
V	**Capacity Building:** Learn, Unlearn and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building Leadership and Team Building: Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams, Decision Making and Negotiation: Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts **Stress and Time Management:** Stress, Sources of Stress, Ways to Cope with Stress	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Soft Skills: An Integrated Approach to Maximise Personality	Gajendra Singh Chauhan, Sangeeta Sharma	Wiley	First	2016
2	Personality Development and Soft Skills	Barun.K.Mitra	Oxford Press	Second	2018
3	Soft Skills - Enhancing Employability	M. S. Rao	Wiley	First	2020
4	Cornerstone: Developing Soft Skills	Sherfield	Pearson	Fourth	2011
5	Effective Business Communication	Herta A Murphy, Herbert Hildebrant, Jane P Thomas	Tata McGraw Hill	Seventh	2017

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Book review (A book on any appropriate subject)

Soft Skills Development Practical (SIUSDSP15)

List of Practical:

1.	**Communication Origami**
	Give one sheet of letter size/A4 paper to each
	Tell the group that you will start giving them all instructions on how to fold the paper to create an origami shape.
	Tell the group that while you give them the instructions, they must keep their eyes closed and cannot ask any questions
	Start giving the group several instructions to fold and rip their paper several times then ask them to unfold their paper and compare how it looks like.
2.	**Guessing Game**
	Split your class into two equal groups/teams
	One person from each team think of a business object (any common business object that can be found in any office like a stapler, printer, ..etc.)
	When each person returns to his team, it's the team's task to ask him/her closed ended questions only to try and find out what the object is. If needed, explain that closed ended questions are those that can be answered by yes or no
	Once any team finds the object, this means that they won this round. And they can go for another round.
3.	**Guessing the emotion**
	Participants are split into teams and act out an emotion, such as disgust, affection, fear, anxiety, embarrassment, anger, determination, etc. and the total group will try to guess what the emotion is.
	Divide the group into two teams.Place on a table (or put in a box) a packet of cards, each of which has a particular emotion typed on it.Have a participant from Group A take the top card from the table and act out (pantomime) the emotion for his/her group. This is to be done in a fixed time limit (such as a minute or two).
	If the emotion is guessed correctly by Group A, they receive ten points.
	Now have a participant from Group B act out an emotion; award points as appropriate. Rotate the acting opportunities between the two groups.
	After 20–30 minutes, call time and announce the winning team based on its point total.
4.	**Body Language**
	Body language speaks louder than any words you can ever utter.
	Explain to the group that you are going to give them a series of instructions, which you would like them to copy as fast as they can
	State the following actions as YOU do them:
	• Put your hand to your nose
	• Clap your hands
	• Stand up
	• Touch your shoulder
	• Sit down

	• Stamp your foot • Cross your arms • Put your hand to your mouth – BUT WHILE SAYING THIS PUT YOUR HAND TO YOUR NOSE Observe the number of group members who copy what you did rather than what you said.
5.	**Brainstorming session**
	The participants will be divided into groups of 3-4 . A day before the practical session, the participants will be instructed to bring stationary: colored card board papers, book mark colored slips , fevistick, colored sketch pens . A topic will be given to the students. They will be given a topic and they will be told to write down whatever words that come to their mind , on the bookmarks slips and stick on the card board. Group members should not discuss about any word or its relevance to the topic. Whatever comes to their mind, they should just note down and stick. Also members should not restrict other members on any concept/word. This activity is to be completed in limited time frame (eg. 10 mins)
6.	**On the spot Elocution / Debate**
	The class will be divided into two groups and a topic will be given on the spot for debating.
7.	**Group Discussion**
	The class will be divided into two groups and a topic will be given on the spot for debating. The participants are expected to abide by the rules and protocol of the group discussion.
8.	**Leadership Characteristics**
	The teacher puts students into pairs or groups of three. Then, each group member shares a story about someone whom they consider to be an influential leader. After each story has been shared, students discuss the characteristics that they think made the person in the story an effective leader.Once each student has shared a story, students compile a list of all the characteristics of an influential leader they identified.
9.	**Use of word processing software like Microsoft Office /Libre Office for communication**
	A letter / report is to be made. The different features of the software to be explored
10.	**Presentation software like Microsoft Power Point for Communication.**
	PPT presentations to be done. The features of powerpoint like layout, design, Smartart, animations to be explored.

FYBSc(DS) - Semester II

Course Code	Course Type	Course Title	Periods per week (1 Period = 50 min)	Credits
SIUSDS21	Core Subject	Database Management Systems - I	5	2
SIUSDS22	Core Subject	Python Programming - II	5	2
SIUSDS23	Core Subject	Numerical Methods and Calculus	5	2
SIUSDS24	Core Subject	Computer Oriented Statistical Techniques - II	5	2
SIUSDS25	Skill Enhancement Course	Computer Networks	5	2
SIUSDSP21	Core Subject Practical	Database Management Systems – I Practical	3	2
SIUSDSP22	Core Subject Practical	Python Programming – II Practical	3	2
SIUSDSP23	Core Subject Practical	Numerical Methods and Calculus Practical	3	2
SIUSDSP24	Core Subject Practical	Computer Oriented Statistical Techniques – II Practical	3	2
SIUSDSP25	Skill Enhancement Course Practical	Computer Networks Practical	3	2
		TOTAL CREDITS		**20**

In this semester, the students will be granted 1 credit on completion of a value added credit based course on "Redefining Life Skills -Part 1"

Database Management Systems - I (SIUSDS21)

Course Objective:
To acquaint learners about the importance of various data models in designing a database along with usage of SQL queries.

Course Outcomes:
Upon completion of this course, student will be able to:

CO1: Outline the database architecture, basic building blocks of a data model and entity relationship model.

CO2: Describe the relational database model , Role of SQL and write SELECT queries in SQL to filter and sort data.

CO3: Write SQL queries for data from multiple tables, aggregate data and different kinds of subqueries.

CO4: Write SQL queries using DDL,DML statements and data integrity constraints.

CO5: Write SQL queries to create views and handle access rights.

Unit	Contents	No. of Lectures
I	**Introduction to Databases:** What is database system, purpose of database system, view of data, relational databases, database architecture **Data Models :**The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction. **Database design and ER Model:** Overview, ER Model, Constraints, ER Diagrams, ERD Issues, weak entity sets, Relational Schemas	12
II	**Relational database model:** Logical view of data, keys, integrity rules, Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF). **SQL Basics:** Introduction, Role of SQL, Statements, Names, Datatypes, Constants, Expressions, NULL values, Codds 12 rules **Simple Queries:** SELECT statement, Duplicate Rows, Row Selection, Search Conditions in WHERE clause, Sorting Query results through ORDER BY, Rules for Single Table Query Processing	12
III	**Multitable Queries:** Simple joins, non-equi joins, Multitable query performance, Structure of a join, Outer Joins **Summary Queries:** Column functions, GROUP BY clause, Group search conditions through HAVING clause, Advancements in Group By(Roll Up, Cube, Grouping Set), Hierarchical Retrieval	12

	Subqueries: Introduction, Subqueries in WHERE clause, Outer References, Subquery search conditions, Subqueries and joins, Nested Subqueries, Correlated Subqueries, Subqueries in the HAVING clause	
IV	**Database Updates:** Adding data to the database through INSERT statement, Deleting data from the database using DELETE statement, Modifying the data in the database using UPDATE statement **Data Integrity:** Definition, Required Data, Simple validity check, Entity Integrity, Referential Integrity. **Creating a Database:** Data Definition Language, DDL Statements – Create, Alter, Drop, Constraint Definitions, Aliases, Synonyms, Indexes	**12**
V	**Views:** Definition, How DBMS handles views, Advantages and Disadvantages of views, Creating different kinds of views, Updating a view **SQL Security:** User-IDs, Security Objects, Privileges, Views and SQL Security, Granting and Revoking Privileges, Role-Based Security **Applications of SQL in data analytics :** SQL for data preparation, Aggregate functions for data analysis.	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Database System and Concepts	A Silberschatz, H Korth, S Sudarshan	McGraw-Hill	Sixth Edition	2011
2.	Database Systems	Rob Coronel	Cengage Learning	Ninth Edition	2011
3.	Fundamentals of Database Systems	Ramez Elmasri & Navathe	Pearson Education	Seventh Edition	2016
4.	Introduction to Oracle 9i : SQL – Volume I and II	Nancy Greenberg, Priya Nathan	Oracle	--	2001
5.	SQL – The Complete Reference	James Groff, Paul Weinberg, Andrew Oppel	McGraw-Hill	Third Edition	2010
6.	SQL for data analytics	Upom Malik, Matt Goldwasser, Benjamin Johnston	Packt	First Edition	2019

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Design the ER model and the data dictionary for a real world scenario

Database Management Systems - I Practical (SIUSDSP21)

List of Practical: (To be implemented using Oracle/Oracle live SQL/MySQL/SQL Server)

1.	**Writing Basic SQL Queries – Select ,Where and Group By**
a.	SELECT Statements
b.	Restricting and Sorting Data
2.	**Multitable Queries – Joins**
a.	Equi joins & Non equi joins
b.	Outer joins
c.	Self joins
3.	**Aggregating Data – Group By**
a.	Using Group Functions
b.	Advanced Group By (Roll Up, Cube, Grouping Sets)
4.	**Queries within queries – Subqueries**
a.	SubQueries with Comparison Test, Set Membership Test
b.	Subqueries with Quantified Test, Existence Test
c.	Correlated Subqueries, Nested Subqueries, Parallel Subqueries
5.	**Manipulating Data – DML statements**
a.	Using INSERT statement
b.	Using DELETE statement
c.	Using UPDATE statement
6.	**Creating and Managing Tables – DDL statements**
a.	Create,Alter,Drop statements
b.	Including Constraints
7.	**Creating and Managing other database objects**
a.	Creating Views
b.	Other Database Objects
c.	Controlling User Access
8	**Using SET Operators and hierarchical retrieval**
a.	Set Operators like UNION,INTERSECT,MINUS
b.	Hierarchical queries

Python Programming - II (SIUSDS22)

Course Objective:

Students can develop projects with Python GUI as front end and MySQL as backend for any real time situation using Object oriented approach.

Course Outcomes:

Upon completion of this course, student will be able to:

CO1: Design programs using Object oriented approach and multiprogramming concepts .

CO2: Compare various file handling methods and perform validations and pattern matching using regular expressions

CO3: Compose python GUI programs.

CO4: Discuss and implement database connectivity to move data to and from python programs using MySQL and perform network connectivity.

CO5: Discuss and implement the different modules like NumPy and Pandas and work with Jupyter Notebook.

Unit	Contents	No. of Lectures
I	**Object Oriented Methodology:** Introduction, Advantages and Disadvantages of Procedure Oriented Languages, what is Object Oriented? Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding **Multithreaded Programming:** Thread Module, creating a thread, synchronizing threads, multithreaded priority queue	**12**
II	**Python File Input-Output:** Opening and closing files, various types of file modes, reading and writing to files, manipulating directories. **Iterables, iterators** and their problem solving applications. **Regular Expressions:** Concept of regular expression, various types of regular expressions, using match function.	**12**
III	**GUI Programming in Python (using Tkinter/wxPython/Qt) :** What is GUI, Advantages of GUI, Introduction to GUI library. **Widgets:** Button, Canvas, Checkbutton, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radiobutton, Scale, Scrollbar, text, Toplevel, Spinbox, PanedWindow, LabelFrame, tkMessagebox. Handling Standard attributes and Properties of Widgets. Layout Management: Designing GUI applications with proper Layout Management features. Look and Feel Customization: Enhancing Look and Feel of GUI using different appearances of widgets.	**12**

IV	**Database connectivity in Python:** Installing mysql connector, accessing connector module module, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, Unit executing transactions, understanding exceptions in database connectivity. GUI and Database Connection. **Network connectivity:** Socket module, creating server-client programs, sending email, reading from URL	12
V	**Working with Jupyter Notebook:** Installation of Anaconda, Contents of Anaconda, Creating notebooks in Jupyter, The Notebook Interface**,** Working with simple programs. **Introduction to NumPy:** Creating NumPy arrays , Indexing and slicing in NumPy, Downloading and parsing data, Creating multidimensional arrays , NumPy Data types ,Array tributes , Indexing and Slicing ,Creating array views copies, Manipulating array shapes I/O, Comparison operators and value testing, Vector and matrix mathematics, Polynomial mathematics, Random Numbers. **Introduction to Pandas:** Introduction to data structures in Pandas, Common functionalities in Pandas, IO tools, Indexing and selecting data, Merge, Join , Concatenate, Compare, Reshaping and Pivot tables, Working with text data, Working with missing data, Duplicate Labels, Categorical data, Chart Visualization, Table Visualization.	12

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Practical Programming: An Introduction to Computer Science Using Python 3	Paul Gries , Jennifer Campbell, Jason Montojo	Pragmatic Bookshelf	2nd	2014
2	Python 3 Object Oriented Programming	Dusty Phillips	Packt Publishing		2010
3	Python Tutorial Release 3.7.0	Guido van Rossum	Python Software Foundation	3rd	2018
4	Think Python	Allen B. Downey	O'Reilly Media, Inc.	2nd	2015
5	MySQL for Python: Database Access Made Easy,	A. Lukaszewski	Packt Publisher		2010

Additional References:

1. https://www.dataquest.io/blog/jupyter-notebook-tutorial/
2. https://pandas.pydata.org/pandas-docs/stable/user_guide/10min.html

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Mini Project with GUI Python and Mysql Backend

Python Programming -II Practical (SIUSDSP22)

List of Practical: (To be implemented using

1.	**OOP**: a) Write a python program to implement a class employee with data as empid, empname, basicpay, leavebal, and methods excluding initializer function are payslip(), DA=90% of bp, HRA=40% of bp, TA=20% of bp, leaveapplication(), display() b) Write a python program to implement a super class publication (title, price) with a subclass book (author, no_of_pages) and a subclass Magazine (issueno).
2.	**Multithreading:** a) Program to display Summation of numbers using thread b) Program to display the prime numbers using thread c) Program to display the Fibonacci series using thread
3.	**File Handling** : a) Write a python program to input a file nums.txt with some numbers and create a file results,txt which contains the sum,mean and square-sum of numbers in the input file b) Write a python program to input a file emp.txt with data empname,empid and basicpay of n employees. Create a file Payslip.txt which contains empid,basic pay,da,hra ,ta and netsalary. (da=85% of basicpay,hra=50% of basicpay ,ta=12% of basicpay , netsalary=basicpay+da+hra+ta c) Write a program to read numbers from a file file1 and perform the factorial of each number and store into file2.
4.	**Iterators and Iterables :** 1. Write a program to implement traversing through a list using while loop 2. Create a user defined iterable class PowTwo which on iteration gives powers of two like 1,2,4,8,16….(By using __iter__() and __next__() functions with in the class definition)
5	**Regular Expressions :** 1. Write a python program accept from user following information and validate as per the constraints using regular expressions 2. UserName-Starts with an alphabet and can contain a minimum 8 characters and maximum 15 characters of alphanumeric characters. 3. Mobile number- Contains 10 digits 4. Email id- starts with lower case alphabet followed by any number of lower case alphanumeric charcters or "." charcater followed by @ symbol followed by alphanumeric characters and then end with ".com".

	5. Write a Python function text_match() that matches a string that has an ' a' followed by zero or more occurences of 'b''s anywhere in the input string.(use search) 6. Write a Python function text_match() that matches a string that has an 'a' followed by zero or more occurrences of anything, ending in 'b'. 7. Write a python program to accept an address and replace occurrences of Road by Rd., District by Dst. And Street by St.
6.	**GUI Programs:** 1. Write a GUI python program to accept two numbers and find sum, difference, product and quotient using different buttons. 2. Write a GUI python program to create a login form that accepts username and password and checks if it is correct as per predefined values, if so, a successful login message is displayed else invalid login message is displayed. 3. #Program to use check buttons for representing RGB to set the background colour of a Label (Graphics colours with RGB are represented as a string colour="#(FF|00)(FF|00)(FF|00)" where the first FF or 00 is for Red, second FF or 00 is for green and third FF or 00 is for Blue) 4. Write a Python GUI program to create an Order form for ABC Pizza Corner. The program should use labelled frame for collecting Customer details and Pizza Details. On click of submit button, Customer details and pizza details should be displayed on message box along with Total cost incurred.(Cost for Large Pizza-Rs.250,Regular-200,Medium-150,Small-100,Veg Pizza-100,Non-Veg-150,Each extra topping Rs.50)
7.	**Database Applications :** Write a database program to perform the following • Show all databases in the DBMS. • Create a Database named "Company". • Create a table Employee in Company Database(empid int,empname varchar(50), designation varchar(50),basic int) • Insert 10 records into employee table • Display all records of employee table • Display the employees details with designation as entered by the user at runtime • Display the employee details with basic<20000 • Update the basic of Manager by 10%
8.	**Socket Programming :** Echo Client and Echo Server
9.	**S**end email using Python SMTP

Numerical Methods and Calculus (SIUSDS23)

Course Objective:
To learn important concepts of Calculus in a scientific way by solving problems and get compete clarity and understanding of the topics covered.

Course Outcomes:
Upon completion of this course, student will be able to:

CO1: Apply various interpolation to find an unknown value from the set of given values related to a situation and find the solution of simultaneous algebraic equations using iterative methods.

CO2: Inspect the problems related to interpolation, integration and find solution of simultaneous equations using Gauss Elimination, Gauss Jordan, etc.

CO3: Construct a problem through Mathematical modeling and simulation.

CO4: Assess the problem related to integration, derivatives and simulation.

CO5: Apply the concepts of partial derivatives to solve real world problems.

Unit	Contents	No. of Lectures
I	**Mathematical Modeling and Engineering Problem Solving**: A Simple Mathematical Model, Conservation Laws and Engineering Problems Approximations and Round-Off Errors: Significant Figures, Accuracy and Precision, Error Definitions, Round-Off Errors Truncation Errors and the Taylor Series: The Taylor Series, Error Propagation, Total Numerical Errors, Formulation Errors and Data Uncertainty. **Solutions of Algebraic and Transcendental Equations:** The Bisection Method, The Newton-Raphson Method, The Regula-falsi method, The Secant Method.	**12**
II	**Interpolation**: Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation. **Solution of simultaneous algebraic equations (linear) using iterative methods:** Gauss-Jordan Method, Gauss-Seidel Method. Numerical differentiation **Integration**: Numerical differentiation, Numerical integration using Trapezoidal Rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules and Weddles rule.	**12**

III	**Derivatives and its applications**: Review of Functions, limit of a function, continuity of a function, derivative function. Derivative In Graphing And Applications: Analysis of Functions: Increase, Decrease, Concavity, Relative Extrema; Graphing Polynomials, Rational Functions, Cusps and Vertical Tangents. Absolute Maxima and Minima, Applied Maximum and Minimum Problems.	**12**
IV	**Integration and its applications:** An Overview of the Area Problem, Indefinite Integral, Definition of Area as a Limit; Sigma Notation, Definite Integral, Evaluating Definite Integrals by Substitution, Area Between Two Curves. Modeling with Differential Equations, Separation of Variables, **Numerical solution of 1st and 2nd order differential equations**: Taylor series, Euler's Method, Modified Euler's Method, Picard's Method, Runge-Kutta Method for 1st and 2nd Order Differential Equations.	**12**
V	**Partial derivatives and its applications**: Functions of Two or More Variables Limits and Continuity Partial Derivatives, Differentiability, Differentials, and Local Linearity, Chain Rule, Directional Derivatives and Gradients, Tangent Planes and Normal, Vectors, Maxima and Minima of Functions of Two Variables	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Calculus: Early transcendental	Howard Anton, Irl Bivens, Stephen Davis			2012
2	Calculus: Early Transcendentals	James Stewart, Brooks Cole		Eighth	2015
3	Calculus and analytic geometry	George B Thomas, Ross L Finney, Addison Wesley		Ninth	1995
4	Calculus	Ron Larson, Bruce H. Edwards	Cengage Learning	Tenth	2013

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Assignments (Problem Solving)

Numerical Methods and Calculus Practical (SIUSDSP23)

List of Practical : (To be implemented using Python)	

1	**Interpolation**
	    a. Newton's forward interpolation.
	    b. Newton's backward interpolation.
	    c. Lagrange's interpolation.

2	**Solution of algebraic and transcendental equations:**
	    a. bisection method.
	    b. false position method.
	    c. Secant method.
	    d. Newton Raphson method.

3	**Solving linear system of equations by iterative methods**
	    a. Gauss Jordan method.
	    b. Gauss Seidel method.

4	**Numerical Integration**
	    a. Trapezoidal rule.
	    b. Simpson's /3rd rule.
	    c. Simpson's $3/8^{th}$ rule.

5	**Solution of differential equations**
	    a. Euler's method and modified Euler's method.
	    b. Runge kutta 2nd order and 4th order methods.

6	Continuity of functions; Derivative of functions
7	Increasing, decreasing, concave up and concave down functions
8	Calculation of Partial derivatives of functions
9	Local linear approximation and directional derivatives
10	Maxima and minima of functions of two variables

Computer Oriented Statistical Techniques - II (SIUSDS24)

Course Objective:

To familiarize students with basics of Statistics, essential for prospective researchers and professionals.

Course Outcomes:

Upon completion of this course, student will be able to:

CO1: Examine statistical concepts like standard distributions and association of attributes

CO2: Illustrate the concepts of sampling and chi-square test

CO3: Examine Hypothesis Testing, Formulate one and two way ANOVA

CO4: Use non- parametric tests in statistics

CO5: Solve problems using Correlation and Regression

Unit	Contents	No. of Lectures
I	**Standard distributions**: random variable; discrete, continuous, expectation and variance of a random variable, pmf, pdf, cdf, reliability, Introduction and properties without proof for following distributions; binomial, poison, normal. **Association of Attributes**: Introduction: Difference between correlation and association, notations and terminology, order of classes and class frequencies, Number of frequencies, consistency of data, association and disassociation, Methods of association, association of three attributes, Duncan's test Chi-square test of association.	12
II	**Small Sampling Theory**: Small Samples, Student's t Distribution, Confidence Intervals, Tests of Hypotheses and Significance, The Chi Square Distribution, Confidence Intervals for Sigma, Degrees of Freedom, The F Distribution. **The Chi-Square Test:** Observed and Theoretical Frequencies, Definition of chi-square, Significance Tests, The Chi-Square Test for Goodness of Fit, Contingency Tables, Yates' Correction for Continuity, Simple Formulas for Computing chi-square, Coefficient of Contingency, Correlation of Attributes, Additive Property of chi square.	12
III	**Hypothesis testing**: one sided, two sided hypothesis, critical region, p-value, tests based on t, Normal and F, confidence intervals. Analysis of variance : one-way, two-way analysis of variance, applications of F-test, Assumption in analysis of variance, Techniques of analysis of variance.	12

IV	**Non-parametric tests**: need of non-parametric tests, sign test, The Paired Sample Sign Test, Wilicoxon's signed rank test, run test, The Mann- Whitney U Test, Kruskal-Walis tests or H Test, Spearman's Rank Correlation, Spearman's Limitations of Non-Parametric Test.	12
V	**Partial and Multiple Correlation**: Introduction, Partial Correlation, Partial Correlation Coefficient, Zero order, first order and second order coefficients, Coefficient of Multiple Correlation, **Multiple Regression Analysis**: Multiple regression and correlation analysis, Normal equation for least square regression plane, Assumptions of linear regression analysis, other equation of Multiple Linear Regression, Generalization for more than three variables.	12

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	An Outline of Statistical Theory	Goon A.M., Gupta M.K & Dasgupta B			2013
2	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons		2007
3	Introduction to Mathematical Statistics	Hoel P. G.	John Wiley & Sons Inc	Fourth	1966
4	Probability and Statistical Inference	Hogg R. V.& Tannis E. A.	Collier McMillan Publishers	Third	1988
5	Mathematical Statistics	Kapur J. N.& Saxena H.C.	Chand & Company Ltd	Fifteenth	

Internal Evaluation: 40 Marks

20 Marks	20 Marks
Class Test	Assignments (Problem Solving)

Computer Oriented Statistical Techniques - II Practical (SIUSDSP24)

List of Practical: (To be implemented using Excel/Python/R)

1.	Statistical Methods and Testing of Hypothesis - Problems based on binomial distribution
2.	Problems based on normal distribution
3.	Property plotting of binomial distribution
4.	Property plotting of normal distribution
5.	Plotting pdf, cdf, pmf, for discrete and continuous distribution
6.	t test, normal test, F test, Chi Square test
7.	Association of attributes
8.	Analysis of Variance
9.	Non parametric tests- I
10.	Non- Parametric tests – II

Computer Networks (SIUSDS25)

Course Objective:
To orient the students about the OSI networking model with detailed study of its layers along with the protocols.

Course Outcomes:
Upon completion of this course, student will be able to:
CO1: Describe the OSI model and components of physical layer like analog, digital signals and its conversions.
CO2: Explain bandwidth utilization, transmission media, switching and certain concepts of data link layer like link layer addressing, error detection, error correction and checksum
CO3: Examine data link layer protocols, ethernet protocols and Wireless LANs.
CO4: Describe the network layer services, network layer protocols, routing algorithms, IPv4 and IPv6 addressing techniques.
CO5: Explain transport layer protocols and client/server protocols.

Unit	Contents	No. of Lectures
I	**Introduction:** Data communications, networks, network types, Internet history, standards and administration. **Network Models:** Protocol layering, TCP/IP protocol suite, The OSI model. **Introduction to Physical layer:** Data and signals, periodic analog signals, digital signals, transmission impairment, data rate limits, performance. **Digital and Analog transmission:** Digital-to-digital conversion, analog-to-digital conversion, transmission modes, digital-to-analog conversion, analog-to-analog conversion.	**12**
II	**Bandwidth Utilization: Multiplexing and Spectrum Spreading:** Multiplexing, Spread Spectrum **Transmission media:** Guided Media**,** Unguided Media **Switching:** Introduction, circuit switched networks, packet switching, structure of a switch. **Introduction to the Data Link Layer:** Link layer addressing, Data Link Layer Design Issues, Error detection and correction, block coding, cyclic codes, checksum, forward error correction, error correcting codes, error detecting codes.	**12**

III	**Data Link Control:** DLC services, data link layer protocols, HDLC, Point-to-point protocol. **Media Access Control**: Random access, controlled access, channelization, Wired LANs – Ethernet Protocol, standard ethernet, fast ethernet, gigabit ethernet, 10 gigabit ethernet, **Wireless LANs:** Introduction, IEEE 802.11 project, Bluetooth, WiMAX, Cellular telephony, Satellite networks. **Connecting devices and Virtual LANs.**	**12**
IV	**Introduction to the Network Layer**: Network layer services, packet switching, network layer performance, IPv4 addressing, forwarding of IP packets, Internet Protocol, ICMPv4, Mobile IP **Unicast Routing:** Introduction, routing algorithms, unicast routing protocols. **Next generation IP:** IPv6 addressing, IPv6 protocol, ICMPv6 protocol, transition from IPv4 to IPv6.	**12**
V	**Introduction to the Transport Layer**: Introduction, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol, Bidirectional protocols), Transport layer services, User datagram protocol, Transmission control protocol **Standard Client/Server Protocols:** World wide-web and HTTP, FTP, Electronic mail, Telnet, Secured Shell, Domain name system.	**12**

Books and References

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Data Communication and Networking	Behrouz A. Forouzan	Tata McGraw Hill	Fifth Edition	2013
2.	TCP/IP Protocol Suite	Behrouz A. Forouzan	Tata McGraw Hill	Fourth Edition	2010
3.	Computer Networks	Andrew Tanenbaum	Pearson	Fifth	2013

Internal Evaluation: 40 Marks

20 Marks	**20 Marks**
Class Test	Test various protocols on a given topology

Computer Networks Practical (SIUSDSP25)

List of Practical: (To be implemented using any network simulators)

1.	**IPv4 Addressing and Subnetting**
	a) Given an IP address and network mask, determine other information about the IP address such as:
	    • Network address
	    • Network broadcast address
	    • Total number of host bits
	    • Number of hosts
	b) Given an IP address and network mask, determine other information about the IP address such as:
	    • The subnet address of this subnet
	    • The broadcast address of this subnet
	    • The range of host addresses for this subnet
	    • The maximum number of subnets for this subnet mask
	    • The number of hosts for each subnet
	    • The number of subnet bits
	    • The number of this subnet

2.	Use of ping and tracert / traceroute, ipconfig / ifconfig, route and arp utilities.
3.	Configure IP static routing.
4.	Configure IP routing using RIP.
5.	Configuring Simple OSPF.
6.	Configuring DHCP server and client.
7.	Create virtual PC based network using virtualization software and virtual NIC.
8.	Configuring DNS Server and client.
9.	Configuring OSPF with multiple areas.
10.	Use of Wireshark to scan and check the packet information of following protocols • HTTP , ICMP , TCP , SMTP , POP3