Course Outline for Semester II (Batch 2024)

S. No.	Category	Course Code	Course Title	Credits	L	T	P	S	Hours per week
1	Major	DS150MJ	Python Programming	4	4	0	2	0	5
2	Minor 2	MTHS150MN	Calculus	4	4	0	0	0	4
4	Multidisciplinary		Student to choose	3	3	0	0	0	3
5	Ability Enhancement		Urdu/Hindi Language	3	3	0	0	0	3
6	Skill Enhancement		Student to choose	2	3	0	0	0	3
7	Value-added		Understanding India	2	2	0	0	0	2
			Environmental Sciences	2	2	0	0	0	2

Course Title: Python Programming	**L**	**T**	**P**	**S**	**Semester: 2nd**
Course Code: DS150MJ	**3**	**x**	**2**	**x**	**Max Marks**: 100
Credits: 4					

Course Objective: Master Python Basics: Learn Python syntax and basic programming constructs. Understand Object-Oriented Programming: Gain insights into Python's object-oriented programming features. Build Practical Applications: Develop real-world Python applications for data analysis, web, and automation. Enhance Problem-Solving Skills: Improve problem-solving and debugging abilities in a programming context.

Course outcomes: After successful completion of this course, students will be able to;

1. Understand programming fundamentals and concepts, write and execute basic Python programs.
2. Utilise control structures (conditional statements and loops).
3. Implement and use functions effectively.
4. Manipulate various data structures (lists, tuples, sets, dictionaries) and apply object-oriented programming concepts.

Unit-I: Introduction to programming concepts - algorithm, flowcharts, pseudocode, Brief history of Python, Installation of Python and setting up the environment (Jupyter Notebook, VS Code), Writing your first Python program, Python syntax - indentation and comments, Input and output in Python (print(), input()), Declaring variables, Common data types - Integers, Floats, Strings, Booleans, Type casting and type conversion.

Unit-II: Operators in Python - Arithmetic operators, Comparison operators, Logical operators (and, or, not), Assignment operators, Conditional statements - if, elif, and else statements, Nested conditionals, Loops - for loops, while loops, Loop control (break, continue, pass), Functions - defining functions (def keyword), Function arguments and return values, Function scope (local vs global variables), Built-in functions - common functions (len(), type(), range()), Modules - importing modules (import statement), Using Python's standard library (math, random).

Unit III: Data structures - Lists - creating and accessing lists, List methods (append(), remove(), sort(), etc.), Tuples - immutable sequences, Tuple operations, Sets - set operations (union, intersection, difference), Dictionaries - key-value pairs, Dictionary methods (get(), update(), pop(), etc.), Introduction to Object-Oriented Programming (OOP) - classes and objects, Creating classes and objects, Attributes and methods, The init method, Basic OOP concepts - encapsulation, inheritance.

Unit IV: Practicals which cover Python syntax, data types, control structures, functions, modules, data structures, and basic OOP concepts.

Text Books/Reference Books:

1. Downey, A. (2012). Think python. " O'Reilly Media, Inc.".
2. Shaw, Z. A. (2024). Learn Python The Hard Way. Addison-Wesley Professional.

3. Sweigart, A. (2016). Invent your own computer games with python.
4. Barry, P. (2016). Head first Python: A brain-friendly guide. " O'Reilly Media, Inc.".
5. Matthes, E. (2023). Python crash course: A hands-on, project-based introduction to programming

Course Title: Calculus	**L**	**T**	**P**	**S**	**Semester: 2nd**
Course Code: MTHS150MJ	**4**	**x**	**x**	**x**	**Max Marks**: 100
Credits: 4					

Course Objective: To explore and comprehend the concepts of limits, continuity, differentiability, and integrability, and to develop the ability to apply these techniques in various fields of science and engineering, as well as to equip students with the foundational knowledge required for pursuing advanced studies in mathematics.

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

1. Apply differential operators to analyze and interpret the dynamics of various real-life situations.
2. Apply differential calculus for optimization and integral calculus for area estimation and complex problem solving.

Unit-I: Limits: Definition and existence of a limit with examples, indeterminate forms, algebra of limits, continuity of function at a point, ε-δ definitions of a limit and continuity, discontinuity and types of discontinuities, Differentiability of a functions, rules of differentiation, Successive differentiation and Leibnitz theorem.

Unit-II: Rolle's theorem and mean value theorems with their geometrical interpretations, Taylor's theorem with Lagrange's and Cauchy's form of remainder, Taylor's series, Maclaurin's series, applications of derivatives(slopes, maxima and minima with applications like maximizing profit & minimizing cost, increasing and decreasing functions, how derivatives affect the shape of a graph).

Unit-III: Differential equation: Definition and formation, order, degree, linear and non-linear differential equations, solution of first order linear differential equations and integrating factors, exact differential equations, necessary and sufficient condition for exactness, applications of differential equations (exponential growth and decay problems, optimization problems).

Unit-IV: Antiderivative: Definition and examples, techniques of integration (substitution and partial fractions), definite integrals with properties and evaluation, definite integral as a limit of sum(concept of area under the curve), differentiation under integral sign, Rectification: rules for curve tracing, formula for rectification and examples, introduction to beta and gamma functions (properties, relation and application).

Text Books/ References

1. James Stewart , Calculus, Early Transcendentals, Seventh Edition Metric Version, Cengage Learning, Inc. 2010.
2. T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc, 1975.
3. G.B.Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
4. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2016.
5. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand, 2005.

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