Programme	B. Sc. Computer Science				
Course Code	CSC1MN102				
Course Title	Python Programming				
Type of Course	**Minor**				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Have an understanding about algorithms and flowchart				
Course Summary	This course explores the versatility of Python language in programming and teaches the application of various data structures using Python.				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitiv e Level***	**Knowledg e**	**Evaluation Tools used**
CO1	Understand the basic concepts of Python programming	U	C	Instructor- created exams / Quiz
CO2	Apply problem- solving skills using different control structures and loops	Ap	P	Coding Assignments/ Code reading and review
CO3	Design simple Python programs to solve basic computational problems and acquire knowledge of Python's error handling mechanisms to effectively debug	Ap	P	Coding Assignments/ Exams

	programs			
CO4	Analyse the various data structures and operations on it using Python	An	P	Instructor-created exams / Case studies
CO5	Apply modular programming using functions	U	C	Instructor- created exams / Quiz
CO6	Identify the necessary Python packages in the domain and create simple programs with it	U, Ap	C, P	Coding

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	**Introduction to Python**		**12**	20
	1	Features of Python, Different methods to run Python,Python IDE	2	
	2	Comments, Indentation, Identifiers, Keywords, Variables	2	
	3	Standard Data Types	2	
	4	Input Output Functions, Import Functions, range function	1	
	5	Operators and Operands, Precedence of Operators, Associativity	2	
	6	Type Conversion, Multiple Assignment	1	

	7	Expressions and Statements, Evaluation of Expressions	1	
	8	Boolean Expressions	1	
II	**Control Structures**		**12**	20
	9	Decision Making- if statement, if…else statement, if…elif…else statement, Nested if statement	5	
	10	Loops - for loop, for loop with else, while loop, while loop with else, Nested Loops	5	
	11	Using indentation in Python to define code blocks	1	
	12	Control Statements- break, continue, pass	1	
III	**Data Structures in Python**		**12**	20
	13	Working with strings and string manipulation	3	
	14	List - creating list, accessing, updating and deleting elements from a list	2	
	15	Basic list operations	1	
	16	Tuple- creating and accessing tuples in python	2	
	17	Basic tuple operations	1	
	18	Dictionary, built in methods to create, access, and modify key-value pairs	2	
	19	Set and basic operations on a set	1	
	Functions		**9**	15
IV	20	Built-in functions - mathematical functions, date time functions, random numbers	1	
	21	Writing user defined functions - function definition, function call, flow of execution, parameters and arguments, return statement	6	
	22	Recursion. Introduction to basic Python libraries (e.g., math, random)	2	

	Hands-on Data Structures: **Practical Applications, Case Study and Course Project**		**30**	
Design programs from the concepts listed below. Select the topics and programs suited for your domain				
V	1	Programs to: • Run instructions in Interactive interpreter and as Python Script • Perform calculations involving integers and floating point numbers using Python arithmetic operators **Data Structures in Python** • String - Create a string , Indexing / Looping / Slicing • Lists - Create a list , Indexing /Looping / Slicing , Adding items / Modifying items / Removing items • Tuples - Create a tuple , Indexing / Looping / Slicing / Adding items to a tuple • Dictionary - Create a dictionary and access values with key / Adding a key- value pair / Adding to an empty dictionary /Modifying values in a dictionary / Removing key-value pair **Function** • Call functions residing in the math module • Define a function for later use • Pass one or more values into a function • Return one or more results from a function		
		Case study: • Create a Todo List Manager where Users should be able to add, remove, and view tasks • Create Student Grade Tracker: Allow users to add students, add grades for subjects, and calculate average grades.		

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO6	PO 1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	2	3	1	1						
CO 2	-	1	2	3	1	1						
CO 3	-	2	2	3	1	1						
CO 4	1	1	-	-	1	-						
CO 5	1	1	2	2	1	-						
CO 6	-	1	2	2	2	1						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓			✓
CO 6	✓			✓

Reference Books:

1. Jose, Jeeva. Taming Python By Programming. Khanna Book Publishing, 2017. Print.

2. Downey, Allen. Think Python. Green Tea Press, 2nd ed. 2009

Programme	B. Sc. Computer Science				
Course Code	CSC2MN102				
Course Title	Introduction to Data Science				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Python Programming 2. Linear Algebra				
Course Summary	This course provides a comprehensive overview of data science, covering the various types of data and their applications. The students will acquire a deep understanding of exploratory data analysis along with hands-on implementation skills. . The curriculum introduces both supervised and unsupervised and techniques of Machine learning. Additionally, the data pre-processing techniques are introduced Overall, the course provides a comprehensive understanding of the fundamental data science principles, guiding students through the data science process and illustrating practical applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the types of data and the applications of data science	U	C	Instructor-created exams / Quiz
CO2	Analyse the irregularities present in the data and perform data cleaning	An	C	Problem-solving assessments

CO3	Implement various visualisation techniques on different data types	Ap	P	Modelling Assignments
CO4	Create prediction models using supervised techniques	Ap	P	Modelling Assignments/ / Case studies
CO5	Assess the similarity among the data using unsupervised techniques.	Ap	P	Modelling Assignments/ / Case studies
CO5	Gain insights on advanced data pre-processing techniques	U	C	Instructor-created exams / Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (70)
I	**Introduction to Data Science**		**10**	**10**
	1	Introduction to Data: Types of Data – Structured Data, Semi-Structured Data, Unstructured Data and Data Streams, Statistical Data Types - Quantitative Data (Ratio and Interval Scale) and Qualitative Data (Nominal and ordinal)	2	
	2	Basic Methods of Data Analysis- Descriptive Data Analysis, Diagnostic Data Analysis or Exploratory Data Analysis, Inferential Data Analysis and Predictive Analysis.	1	
	3	Inferential Statistics: Statistical Inference, Population and Sample, Statistical Modeling, Probability Distributions – Normal, Uniform	3	
	4	Introduction to Data Science: Big Data and Data Science , Data Science Process	2	
	5	Applications of Data Science , Issues and challenges in Data Science	2	

II	**Exploratory Data Analysis**		**14**	**10**
	6	Exploratory Data Analysis (EDA) : Types of EDA - Univariate non-graphical, Multivariate non- graphical, Univariate graphical, and, Multivariate graphical. Methods of EDA – Descriptive Statistics and Data Visualization	5	
	7	Descriptive Statistics - Measures of Central Tendencies, Dispersion, Skewness and Kurtosis.	5	
	8	Data Visualization - Histograms , Box plots , Quantile-Quantile plots Scatter plots , Heat map, Bubble chart , Bar chart, Distribution plot , Pair plot , Line graph , Pie chart, Area chart	4	
III	**Data Preparation for Analysis**		**6**	**15**
	9	Data Cleaning: Handling Missing and Noisy Data, Removing outliers	2	
	10	Data Integration	1	
	11	Data Transformation: Standardization, Normalization	2	
	12	Data Reduction: Dimensionality Reduction - Principal Component Analysis	1	
1V	**Introduction to Machine Learning**		**15**	**15**
	13	Machine Learning Algorithms : Supervised Learning– Classification, Regression, Unsupervised Learning – Clustering, Dimensionality Reduction , Reinforcement Learning	3	
	14	Test /Train Split, Model Training, Bias and Variance, Overfitting and Underfitting	3	
	15	Evaluation	2	
	16	Linear Regression	1	
	17	k-Nearest Neighbors (k-NN)	1	
	18	k-means Clustering	1	
	19	Naive Bayes	1	
	20	Application of Naive Bayes - Spam Filtering	1	
	21	Singular Value Decomposition	1	
	22	Applications of Supervised, Unsupervised and Reinforcement	1	

		Learning		
V	**Hands-on Data Structures:** **Practical Applications, Case Study and Course Project**		**30**	**20**
	1	Implementation of the concepts or the algorithms learned [Binary Classification, Linear Regression, k-NN, k-means clustering, Spam Filtering]	15	
	2	Case study: Perform exploratory data analysis on a real world dataset using Python. Using appropriate Python packages parse, clean and visualize the data .	5	
	3	Capstone/Course Project: Perform an end-to-end project of the data science process.		

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	-	-	-	1						
CO 2	1	-	2	-	-	-						
CO 3	-	-	2	-	-	-						
CO 4	-	2	3	3	-	1						
CO 5	-	2	3	3	-	1						
CO 6	-	-	-	-	-	2						

Correlation Levels:

Level	**Correlation**
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2	✓	✓		✓
CO 3		✓		✓
CO 4	✓			✓
CO 5	✓		✓	✓
CO 6	✓		✓	✓

References

1. O'Neil, Cathy, and Rachel Schutt. *Doing data science: Straight talk from the frontline*. " O'Reilly Media, Inc.", 2013.
2. Han, Jiawei, et al. Data Mining: Concepts and Techniques. Netherlands, Elsevier Science, 2011.
3. Shah, Chirag. A Hands-On Introduction to Data Science. United Kingdom, Cambridge University Press, 2020.
4. Chopra, Rohan, et al. Data Science with Python: Combine Python with Machine Learning Principles to Discover Hidden Patterns in Raw Data. United Kingdom, Packt Publishing, 2019.

Programme	B. Sc. Computer Science				
Course Code	CSC3MN202				
Course Title	Introduction to AI and Machine Learning				
Type of Course	**Minor**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Sets 2. Fundamentals of Python Programming				
Course Summary	This course provides an introduction to the ideas, techniques, and applications of artificial intelligence (AI) is given in this course. The fundamentals of knowledge representation, machine learning, and problem solving will be taught to the students.				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	Explain the basic concepts of Artificial Intelligence	U	C	Instructor-created exams / Quiz
CO2	Master Problem-Solving Techniques. Apply a problem solving technique to solve standard AI problems	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Master various packages required to develop AI and machine learning applications	Ap	C	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Understand few AI tools and an insight to	U	C	Instructor-

	Machine learning, Deep learning concepts			created exams / Home Assignments
CO5	Implement and analyse Machine learning algorithms to solve practical problems.	Ap	P	Writing assignments/ Exams/ Practical
CO6	Apply Concepts in Real-World Projects	Ap	P	Case Study/ mini Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks(70)
I	**Introduction to Artificial Intelligence & Problem Solving**		**15**	**12**
	1	Introduction to AI – Evolution of AI, AI problems, AI Techniques, AI Applications	4	
	2	Various AI Domains (Introduction only)	2	
	3	Problem Solving Techniques - Search Algorithms, Knowledge representation and reasoning (Concepts only)	3	
	4	Problem Solving Techniques - constraint satisfaction problems, Game playing (Concepts only)	3	
	5	Problem Solving Techniques - Machine learning, Simulated Annealing (Concepts only)	3	
II	**Introduction to Neural Networks**		**8**	**12**
	6	Introduction to Artificial Neural Network	2	
	7	Understanding Brain & Perceptron Model	2	
	8	Single Layer Perceptron Model & Learning in Single layer Perceptron Model	2	
	9	Multi-Layer Perceptron Model & Learning in Multi-layer Perceptron Model	2	

III	**Python Packages for AI**		**15**	**10**
	10	Pandas	3	
	11	MatplotLib	3	
	12	Keras	3	
	13	Scikit-learn:	3	
IV		**Machine Learning Fundamentals**	**7**	**16**
	15	Introduction to Machine learning-	1	
	16	Applications of Machine Learning	1	
	17	Supervised machine learning- Classification, regression (concepts only)	2	
	18	Unsupervised machine learning	1	
	19	clustering, Dimensionality Reduction (concepts only)	1	
	20	Basics of reinforcement learning	1	
	21	Definition and history of deep learning	1	
	22	Key differences between traditional machine learning and deep learning	1	
V	**Hands-on Artificial Intelligence & Machine Learning using Python:** **Practical Applications, Case Study and Course Project**		**30**	**20**
	1	**1. Neural Network** Building a single layer perceptron using Keras **2. Multi-layer Neural Network** Setting up a multi-layer perceptron model **4. Supervised machine learning** Linear regression Decision tree **5. Unsupervised machine learning** K means clustering	20	

		PCA **6. Feature Engineering** Feature selection from a dataset		
	2	Case study – AI tools / Use of AI in any movie	3	
	3	**Implementation of Comparison of any two machine learning algorithms on a dataset**	7	

References

- Elaine Rich, Kevin Knight, Shivsankar B Nair, “Artificial Intelligence”, Third Edition, Tata McGraw Hill Publisher
- Tom M. Mitchell, Machine Learning, McGraw-Hill, 1st Ed.
- Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	1	1	2	1						
CO 2	2	1	2	3	2	2						
CO 3	2	1	2	3	2	3						
CO 4	3	-	1	2	-	-						
CO 5	1	-	2	3	3	3						
CO 6	2	-	3	3	3	3						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
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Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	