MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	St. Thomas College, Kozhenchery					
Faculty/ Discipline	Mathematics					
Programme	BSc (Hons) Mathematics					
Course Coordinator	Susan George					
Contributors	Dr. Job Mathai, Ligin P Mathew					
Course Name	Advanced Python for Mathematical Computing and Visualization					
Type of Course	SEC					
Specialization title	This Signature Course does not have a specialization.					
Course Code	MG5SECMATA00					
Course Level	300					
Course Summary	This course introduces advanced Python libraries essential for mathematical computing and visualization. It covers data manipulation using Pandas, symbolic mathematics and calculus with SymPy, and rich data visualization techniques with Seaborn. Students gain hands-on experience in data processing, equation solving, and graphical representation of categorical and continuous variables.					
Semester	5	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any	A basic understanding of Python programming, including variables, control structures, data structures, data visualization and NumPy.					

Course Outcomes (CO)

Number of COs		**4**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	To apply the SymPy library for equation solving, calculus operations, and generating 2D and 3D mathematical visualizations.	A, S	PO1, PO2, PO3, PO9, PO10
2	To understand data frame structures, import data, and apply basic functions for efficient management.	A	PO1, PO2, PO3, PO10
3	To extract, group, visualize data, and handle missing values effectively.	A	PO1, PO2, PO3, PO9
4	To create effective visualizations for both categorical and continuous variables using the Seaborn library in Python.	A, S	PO1, PO2, PO3, PO9, PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	-	-	-	-	-	2	1
CO 2	3	3	2	-	-	-	-	-	-	1
CO 3	3	3	2	-	-	-	-	-	1	-
CO 4	3	3	2	-	-	-	-	-	2	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Module 1: The SymPy Library			
	1.1	SymPy, Symbolic Python	4	["1"]
	1.2	Graphics in SymPy	3	["1"]
	1.3	Three-Dimensional Graphs	3	["1"]
	1.4	Calculus with SymPy: Solving equations	3	["1"]
	1.5	Calculus with SymPy: Limits, derivation and integration	4	["1"]
2	Module 2: Pandas Library for Data Processing			
	2.1	Basics of Data Frame	4	["2"]
	2.2	Importing Data	2	["2"]
	2.3	Functions of Data Frame	3	["2"]
	2.4	Data Extraction	3	["3"]
	2.5	Group by Functionality	2	["3"]
	2.6	Creating Charts for Data Frames	2	["3"]
	2.7	Handling Missing Values	2	["3"]
3	Module 3: Seaborn Library for Visualization			
	3.1	Visualization for Categorical Variable	5	["4"]
	3.2	Visualization for Continuous Variable	5	["4"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, seminars, interactive instructions using ICT tools, and hands-on training.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Practical **A. Continuous Comprehensive Assessment (CCA)** **• Practical – 25 Marks** . Written tests . Practical Assignments . Viva . Group Activity etc **B. End Semester Evaluation (ESE)** **• Practical – 50 Marks** Assessment Methods – . Practical Examination: 30 Marks (A total of 6 questions will be asked:(2 questions from each module). Each question will carry 10 marks. Candidates must attempt 1 out of 2 questions from each module. . Viva: 10 Marks . Record: 10 Marks Duration of Examination – 1.30 Hrs

References

- Bharti Motwani, Data Analytics using Python, First edition, Wiley India Pvt. Ltd., 2020. (Module 2 - Chapter 6, Module 3 - Chapter 8)
- Roozbeh Hazrat, A Course in Python, First edition, Springer, 2023. (Module 1 - Chapter 6)

Suggested Readings

- Joel Grus, Data Science from Scratch, First Edition, O'Reilly Media, Inc., 2015.
- Wes McKinney, Python for Data Analysis, O'Reilly Media, Inc., 2022.
- Robert Johansson, Numerical Python: A Practical Techniques Approach for Industry, Apress, 2015.
- Ben Root, Python Plotting with Matplotlib, Ben Root: Packt Publishing Ltd,. 2017.
- Ajith Kumar B.P., Python for Education, Inter University Accelerator Centre - New Delhi, 2010.

Affidavit

- We, St. Thomas College, Kozhenchery and Susan George, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, St. Thomas College, Kozhenchery, agree to appoint a new course coordinator for the proposed Advanced Python for Mathematical Computing and Visualization in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the signature course, for as long as the college offers this programme.
- We, St. Thomas College, Kozhenchery and Susan George, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.