NATIONAL EDUCATION POLICY-2020

Skill Enhancement Course

in

Scientific Writing and Computing

Sridev Suman Uttarakhand University

Badshahi Thaul (Tehri Garhwal) Uttarakhand -249199

(State University of Uttarakhand)

2023

Skill Enhancement Course
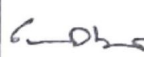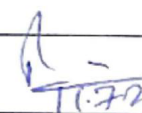
in

"Scientific Writing and Computing"
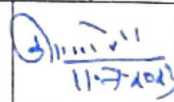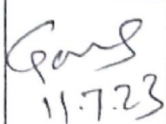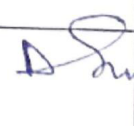
Curriculum Design Committee, Uttarakhand

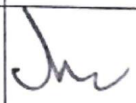| S. No.	Name & Designation	
1.	Prof. N.K. Joshi Vice-Chancellor, Sridev Suman Uttarakhand University, Badshahi Thaul, Tehri Garhwal, Uttarakhand	**Chairman**
2.	Prof. Manmohan Singh Chauhan Vice-Chancellor, Kumaon University, Nainital,Uttarakhand	**Member**
3.	Prof. O.P.S. Negi Vice-Chancellor, Uttarakhand Open University	**Member**
4.	Prof. Jagat Singh Bisht, Vice-Chancellor, Soban Singh Jeena University, Almora	**Member**
5.	Prof Surekha Dangwal Vice-Chancellor, Doon University, Dehradun	**Member**
6.	Prof. M.S.M. Rawat Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	**Member**
7.	Prof. K.D. Purohit Advisor Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	**Member**

Sridev Suman Uttarakhand University
Badshahi Thaul, Tehri Garhwal (Uttarakhand)

Department of Mathematics

Members of Board of Studies

S.No.	Name	Designation	Department	Board of Studies	Signature
1.	Prof. G. K. Dhingra	Dean Faculty of Science Pt. L.M.S. Campus Sridev Suman Uttarakhand University Rishikesh	Faculty of Science	Chairman	
2.	Director	Uttarakhand Science Education and Research Council	USERC	Member	
3.	Prof. K.S. Rawat	Professor and Head Department of Mathematics H.N.B. Garhwal Central University S.R.T. Campus, Tehri Garhwal, Uttarakhand	Mathematics	Member (External Expert)	
4.	Prof. Pushpa Negi	Principal Govt. P.G.College New Tehri	Higher Education	Member	
5.	Prof. Pankaj Pant	Principal, Govt. P.G.College Nagnath Pokhari	Higher Education	Member	
4.	Prof. Kuldeep Singh Negi	Principal, Govt. P.G.College, Khanpur(Haridwar)	Higher Education	Member	
5.	Prof. Anita Tomar	Professor & Head, Department of Mathematics Pt. L.M.S. Campus, Sridev Suman Uttarakhand University Rishikesh	Mathematics	Member	
6.	Prof. Dipa Sharma	Professor Department of Mathematics Pt. L.M.S. Campus, Sridev Suman Uttarakhand University Rishikesh	Mathematics	Member	
7.	Dr. Gaurav Varshney	Associate Professor, Department of Mathematics Pt. L.M.S. Campus, Sridev Suman Uttarakhand University Rishikesh	Mathematics	Member	
8	Dr. Dhirendra Singh	Assistant Professor, Department of Mathematics Pt. L.M.S. Campus, Sridev Suman Uttarakhand University Rishikesh	Mathematics	Member	

Course designed by:

S.No.	Name	Designation	Affiliation
1.	Prof. Anita Tomar	Professor and Head	Department of Mathematics Pt. L. M. S. Campus, Sridev Suman Uttarakhand University Campus, Rishikesh
2.	Dr. Gaurav Varshney	Associate Professor	Department of Mathematics Pt. L. M. S. Campus, Sridev Suman Uttarakhand University Campus, Rishikesh
3.	Dr. Deepak Singh	Assistant Professor	Department of Mathematics B.L.J. Govt. (P.G.) College Purola, Uttarkashi

Course Description

S.No.	Course Code	Course	Semester	Credit
1.	SWC01	Methods of Scientific Writing: LaTeX	First	3
2.	SWC02	Visualizing Data with MATLAB: Techniques and Strategies	Second	3
3.	SWC03	Computer Science: Programming in Python- I	Third	3
4.	SWC04	Computer Science: Programming in Python- II	Fourth	3

Mathematics and computer science are closely related fields. Problems in computer science are often formalized and solved with mathematical methods. Many significant problems currently faced by computer scientists may be solved by researchers skilled in algebra, analysis, combinatorics, logic and /or probability theory. The purpose of this program is to allow students to study a combination of mathematical and potential areas of application in computer science.

Syllabus

SWC01	
Course Title: Methods of Scientific Writing: LaTeX	**Credits:** 3

Objective: The objective of this course is to provide students with the knowledge and skills required to write scientific documents using LaTeX. Students will learn the basics of LaTeX programming and document formatting, including tables, figures, and equations. The course will also cover advanced topics such as bibliography management, creating presentations, and using templates.
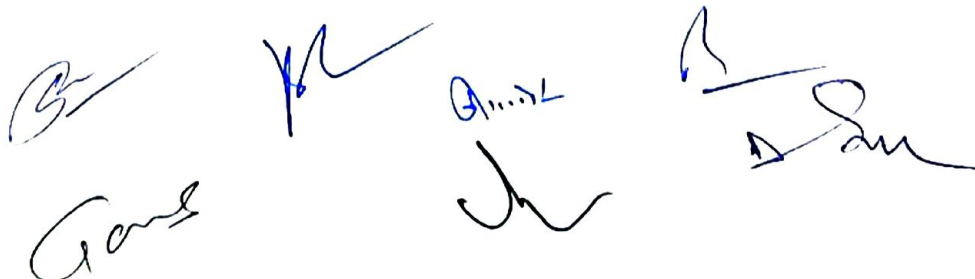
Course Outcome: Upon completion of the course, students will be able to:
- Understand the basic concepts of LaTeX typesetting system and document formatting.
- Use LaTeX to prepare scientific papers, reports, and presentations.
- Apply formatting and typography techniques to enhance the visual appeal of documents.
- Use LaTeX to typeset mathematical equations, figures, and tables.

Unit	Contents	No. of Lectures
1	**Introduction to LaTeX** • Introduction to LaTeX and its advantages • Basic LaTeX commands • Document structure and formatting	10
2	**Tables, Figures, and Equations** • Creating tables using LaTeX • Inserting figures in LaTeX • Creating equations and formulas using LaTeX • Mathematical typesetting in LaTeX	11
3	**Bibliography Management** • Creating bibliographies and references using LaTeX • Managing citations using BibTeX • Formatting bibliographies and references	10
4	**Advanced LaTeX Topics** • Creating presentations using LaTeX • Using templates to create documents efficiently • Customizing document formatting and styles • Debugging LaTeX errors	14
5	**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor	

Reference Books:

1. "Latex For Beginners" by *Murugan Swaminathan* (2022).
2. "LATEX - A Beginner Guide to Professional Documentation" by *S. Swapna Kumar* (2019).
3. "A Beginners Guide to Latex" by *Chetan Shirore* (2015).
4. "LaTeX for Complete Novices" by *Nicola L. C. Talbot* (2012)

SWC02		
Course Title: Visualizing Data with MATLAB: Techniques and Strategies		**Credits:** 3

Objective: The objective of this course is to provide students with an understanding of the techniques and strategies for visualizing data using MATLAB. The course will introduce students to the basic concepts of data visualization and the tools and techniques available in MATLAB. Students will learn how to create effective visualizations and how to use MATLAB to analyze and interpret data.

Course Outcome: Upon completion of the course, students will be able to:
- Understand the basic concepts of data visualization.
- Develop effective visualization strategies and techniques.
- Use MATLAB to create and analyze data visualizations.
- Interpret and communicate complex data using effective visualizations.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Data Visualization** • Overview of data visualization and its importance • Basic concepts of data visualization • Types of data and visualization techniques • Data visualization tools and software	10
2	**Unit 2: Introduction to MATLAB** • Introduction to MATLAB environment and tools • MATLAB programming basics • Data structures in MATLAB • Plotting functions and tools in MATLAB	11
3	**Unit 3: Advanced Data Visualization Techniques** • 2D and 3D plotting techniques in MATLAB • Visualization of large datasets • Customizing plots and graphics • Animation and interactive visualization	12
4	**Unit 4: Applications of Data Visualization** • Visualization of scientific data • Visualization of financial data • Data visualization for machine learning and artificial intelligence • Case studies in data visualization	12
5	**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor	

Reference Books:

1. MATLAB: A Practical Introduction to Programming and Problem Solving (5th edition) by Stormy Attaway
2. Learning MATLAB by Tobin A. Driscoll and Richard J. Braun
3. MATLAB for Engineers (5th edition) by Holly Moore
4. MATLAB Programming for Engineers (6th edition) by Stephen J. Chapman

SWC03	
Course Title: Computer Science: Programming in Python- I	**Credits: 3**

Objective: The objective of this course is to provide students with a strong foundation in computer programming using Python. Students will learn how to write programs to solve mathematical problems, and how to use Python to visualize mathematical concepts. The course will also introduce students to data structures and algorithms commonly used in computer science.

Course Outcome: Upon completion of the course, students will be able to:
- Understand the basic principles of programming in Python.
- Write Python programs to solve mathematical problems.
- Understand and implement common data structures and algorithms.
- Use Python to visualize mathematical concepts.
- Use Python to solve real-world problems.

Unit	Contents	No. of Lectures
1	**Unit 1: Introduction to Python Programming** • Overview of computer programming concepts • Introduction to the Python programming language • Data types, variables, operators, and expressions • Input/output operations in Python • Introduction to Jupyter Notebook	15
2	**Unit 2: Flow Control and Functions in Python** • Conditional statements and loops in Python • Functions and procedures in Python • Recursion • Exception handling in Python	15
3	**Unit 3: Data Structures and Algorithms** • Introduction to data structures • Lists, arrays, and tuples • Stacks, queues, and trees • Sorting and searching algorithms	15
4.	**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor	

Reference Books:
1. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes
2. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" by Al Sweigart
3. "Python Programming: An Introduction to Computer Science" by John Zelle
4. "Introduction to Computing and Programming in Python" by Mark J. Guzdial and Barbara Ericson

<table>
<tr><td colspan="3" align="center">**SWC04**</td></tr>
<tr><td colspan="2">**Course Title:** **Computer Science: Programming in Python- II**</td><td>**Credits: 3**</td></tr>
<tr><td colspan="3">**Objective:** The objective of this course is to provide students with a strong foundation in computer programming using Python. Students will learn how to write programs to solve mathematical problems, and how to use Python to visualize mathematical concepts. The course will also introduce students to data structures and algorithms commonly used in computer science.</td></tr>
<tr><td colspan="3">**Course Outcome:** Upon completion of the course, students will be able to:
• Understand the basic principles of programming in Python.
• Write Python programs to solve mathematical problems.
• Understand and implement common data structures and algorithms.
• Use Python to visualize mathematical concepts.
• Use Python to solve real-world problems.</td></tr>
<tr><td>**Unit**</td><td>**Contents**</td><td>**No. of Lectures**</td></tr>
<tr><td>1</td><td>**Unit 1: Advanced Python Programming**
• Object-oriented programming
• Exception handling
• File I/O</td><td>8</td></tr>
<tr><td>2</td><td>**Unit 2: Numerical Computing with Python**
• Linear algebra and matrix computations
• Introduction to NumPy and SciPy
• Numerical optimization
• Applications to mathematical modeling</td><td>10</td></tr>
<tr><td>3</td><td>**Unit 3: Probability and Statistics with Python**
• Introduction to probability distributions
• Statistical inference and hypothesis testing
• Regression analysis
• Applications to data analysis</td><td>12</td></tr>
<tr><td>4</td><td>**Unit 4: Visualization with Python**
• Introduction to matplotlib
• Scatterplots, line plots, and histograms
• 3D plotting and animation
• Applications to mathematical visualization</td><td>15</td></tr>
<tr><td>5</td><td>**Project Work:** It is mandatory for the students to undertake a project assigned by the course instructor</td><td></td></tr>
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Reference Books:
5. "Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes
6. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" by Al Sweigart
7. "Python Programming: An Introduction to Computer Science" by John Zelle
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