

**S. P. Mandali's**

**Ramnarain Ruia Autonomous College**  
*Affiliated to Mumbai University*



**Program: TYBSc**

**Program Code: (Computer Programming and  
System Analysis) RUSACMAT**  
(Credit Based Semester and Grading System for Academic Year  
2020-21)

## Program Outcomes

PO	<b>PO Description-A student completing Bachelor's/Master's Degree in Mathematics program will be able to:</b>
PO1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO2	Evaluate scientific ideas critically, analyze problems, explore options for practical demonstrations, illustrate work plans and execute them, organize data and draw inferences.
PO3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
PO5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
PO6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO7	Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
PO8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner

## Program Specific Outcomes

PSO	Description-A student completing Bachelor's Degree in Science/Arts program in the subject of Mathematics will be able to:
PSO1	Demonstrate fundamental systematic knowledge of mathematics and its applications in engineering, science technology and mathematical sciences. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.
PSO2	Demonstrate educational skills in areas of analysis, algebra, differential equations, Graph Theory and combinatorics etc.
PSO3	Apply knowledge, understanding and skills to identify the difficult / unsolved problems in mathematics and to collect the required information in possible range of sources and try to analyse and evaluate these problems using appropriate methodologies.
PSO4	Fulfil one's learning requirements in mathematics, drawing from a range of contemporary research works and their applications in diverse areas of mathematical sciences.
PSO5	Apply one's disciplinary knowledge and skills in mathematics in newer domains and uncharted areas.
PSO6	Identify challenging problems in mathematics and obtain well-defined solutions.
PSO7	Exhibit subject-specific transferable knowledge in mathematics relevant to job trends and employment opportunities.

## Program Outline

Year	Sem	Course Code	Course Title	Credits
TYBSc	V	RUSACMAT501	Computer Programming And System Analysis - I	2
TYBSc	V	RUSACMATP501	Practicals based on (RUSACMAT501)	2
TYBSc	VI	RUSACMAT601	Computer Programming And System Analysis - II	2
TYBSc	VI	RUSACMATP601	Practicals based on (RUSACMAT501)	2

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## Course Outcomes

Course Code: RUSACMAT501

Course Title: Computer Programming And System Analysis-I

Academic Year: 2020-21

CO	CO Description
CO1	to write and run programs using PYTHON.
CO2	to write and run programs using SageMath.

## Detailed Syllabus

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUSACMAT501	I	Introduction to Python	15 lectures
RUSACMAT501	II	Advanced topics in Python	15 lectures
RUSACMAT501	III	Introduction to SageMath	15 lectures
RUSACMAT501	IV	Programming in SageMath	15 lectures

Unit 1: Introduction to Python

1. A brief introduction about Python and installation of anaconda.
2. Numerical computations in Python including squareroot, trigonometrical functions using math and cmath module. Different data types in Python such as list, tuple and dictionary.
3. If statements, For loop and While loops and simple programmes using these.
4. User-defined functions and modules. Various use of lists, tuple and dictionary.
5. Use of Matplotlib to plot graphs in various format.

Unit II: Advanced topics in PYTHON:

1. Classes in Python.
2. Use of Numpy and Scipy for solving problems in linear algebra and calculus, differential equations.
3. Data handling using Pandas.

### Unit III: Introduction to SageMath

1. Sage installation and use in various platforms. Using SageMath as an advanced calculator.
2. Defining functions and exploring concept of calculus.
3. Finding roots of functions and polynomials.
4. Plotting graph of 2D and 3D in SageMath.
5. Defining vectors and matrices and exploring concepts in linear algebra.

### Unit II: Programming in SageMath

1. Basic single and multi-variable calculus with Sage.
2. Developing Python programmes in Sage to solve some problems in numerical analysis and linear algebra.
3. Exploring concepts in graph theory and number theory.

### Distribution of topics for Practicals

<b>Practicals Based on Course : RUSACMAT501. Course Code: RUSACMATP501</b>	
Sr. No.	Practicals
1	Symbolic computations with Sympy package.
2	Plotting of various types of graphs using Matplotlib
3	User defined functions and classes in Python
4	Working with Numpy and Scipy
5	Plotting graphs using Sagemath
6	Linear Algebra using Sagemath
7	Manipulations with polynomials using Sagemath
8	Basic numerical methods using Sagemath

**References:**

1. Hans Petter Langtangen (auth.)-A Primer on Scientific Programming with Python-Springer Berlin Heidelberg (2014)
2. Robert Johansson-Numerical Python. A Practical Techniques Approach for Industry-Apress (2015)
3. George A. Anastassiou, Razvan A. Mezei (auth.)-Numerical Analysis Using Sage-Springer International Publishing (2015)

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## Modalities of Assessment

### Theory Examination Pattern

#### (A) Internal Assessment - 40% 40 Marks

Sr. No.	Evaluation Type	Marks
1	Test	20
2	Assignment/Viva/Test/Presentation	20
<b>Total: 40 Marks</b>		

#### (B) External Examination- 60% 60 Marks

1. Duration: These examinations shall be of **two hours duration**.
2. Theory Question Pattern

Paper Pattern				
Question	Sub-question	Option	Marks	Questions Based on
Question 1	a	Attempt any one of the given two questions.	15	Unit-I
	b	Attempt any two of the given three questions.		
	c	Attempt any two of the given three questions.		
Question 2	a	Attempt any two of the given three questions.	15	Unit-II
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
Question 3	a	Attempt any one of the given two questions.	15	Unit-III
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
Question 3	a	Attempt any one of the given two questions.	15	Unit-IV
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
<b>Total Marks: 60</b>				



## Practical Examination Pattern

### (A) Internal Assessment - 40% 40 Marks

Sr. No.	Evaluation Type	Marks
1	Journal	10
2	Project	30
<b>Total: 40 Marks</b>		

### (B) External Examination- 60% 60 Marks

1. Duration: These examinations shall be of **two hours duration**.
2. Practical Question Pattern

Sr. No.	Evaluation Type	Marks
1	Viva	10
2	Lab work based on first two units	25
3	Lab work based on last two units	25
<b>Total: 60 Marks</b>		

## Overall Examination and Marks Distribution Pattern Semester-V

Course	RUSACMATP501			RUSACMATP501			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory/Practical	40	60	100	40	60	100	200

## Course Outcomes

Course Code: RUSACMAT601

Course Title: Computer Programming And System Analysis-II

Academic Year: 2020-21

CO	CO Description
CO1	to write and run programs using SciLab.
CO2	to typeset different kinds of documents using LATEX

## Detailed Syllabus

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUSACMAT601	I	Introduction to SciLab	15 lectures
RUSACMAT601	II	Programming in SciLab	15 lectures
RUSACMAT601	III	Introduction to L <sup>A</sup> T <sub>E</sub> X	15 lectures
RUSACMAT601	IV	Presentation using slides and articles in L <sup>A</sup> T <sub>E</sub> X	15 lectures

Unit 1: Introduction to SciLab

1. Basic introduction to SciLab, using SciLab as an advanced calculator.
2. Defining vectors and matrices and basic operations.
3. Plotting graphs of 2D and 3D in various forms.
4. Exploring concept of calculus using SciLab.
5. Solving ODE in SciLab.

Unit II: Programming in SciLab

1. If-else conditions, loops, user defined functions etc.

2. Developing programs to find roots of algebraic and transcendental functions and solving systems of linear equations (Gaussian Elimination Method , Gauss-Jacobi Method and Gauss-Siedel Method).
3. Exploring applied linear algebra using SciLab ( eigenvalues, eigenvectors and various properties, applications to solve ODE, matrix factorization and its applications).

### Unit III: Introduction to L<sup>A</sup>T<sub>E</sub>X

1. Introduction, document structure - creating title, sections, table of contents, labelling.
2. Typesetting text - fonts, text colour, lists.
3. Tables, equations.

### Unit II: Presentation using slides and articles in L<sup>A</sup>T<sub>E</sub>X

1. Layout of page, cross references.
2. Footnotes, definitions
3. Page style, presentation slides.

<b>Practicals Based on Course : RUSACMAT501. Course Code: RUSACMATP501</b>	
Sr. No.	Practicals
1	Use of Scilab as a calculator
2	Plotting of various types of graphs using Scilab
3	Applied linear algebra using Scilab
4	Basic numerical methods using Scilab
5	Display titles and sectioning, table of contents, labelling, font colour, page colours etc.
6	Drawing tables and use of Maths environments
7	Defining new commands, use of boxes, using Graphics package
8	Making slides using beamer class

### References:

1. SciLab Textbook Companion For Higher Engineering Mathematics, B. S. Grewal.

2. SciLab Textbook Companion For Linear Algebra and Its Applications, D. C. Lay.
3. SciLab Textbook Companion For Numerical Methods, E. Balguruswamy.
4. Introduction to SciLab, Sandeep Nagar, Apress.
5. A guide to L<sup>A</sup>T<sub>E</sub>X, Kopka and Daly

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Question 2	a	Attempt any two of the given three questions.	15	Unit-II
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
Question 3	a	Attempt any one of the given two questions.	15	Unit-III
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
Question 4	a	Attempt any one of the given two questions.	15	Unit-IV
	b	Attempt any two of the given four questions.		
	c	Attempt any two of the given three questions.		
<b>Total Marks: 60</b>				

## Practical Examination Pattern

### (A) Internal Assessment - 40% 40 Marks

Sr. No.	Evaluation Type	Marks
1	Journal	10
2	Project	30
<b>Total: 40 Marks</b>		

### (B) External Examination- 60% 60 Marks

1. Duration: These examinations shall be of **two hours duration**.
2. Practical Question Pattern

Sr. No.	Evaluation Type	Marks
1	Viva	10
2	Lab work based on first two units	25
3	Lab work based on last two units	25
<b>Total: 60 Marks</b>		

## Overall Examination and Marks Distribution Pattern Semester-VI

Course	RUSACMATP601			RUSACMATP601			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory/Practical	40	60	100	40	60	100	200