Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Structure and Curriculum of Four-Year Multidisciplinary Degree (Honors) Programme with Multiple Entry and Exit option

Undergraduate Programme of Science and Technology

B.Sc. (Honors) in Mathematics

Board of Studies

in

Mathematics

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

w.e.f. June, 2023

(In Accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc Mathematics (Honors) in UG** Programme to be effective from the **Academic Year 2023-24.** It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 09/08/2023

Place: Latur

NEP Cell
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors) in Mathematics** Programme to be effective from the **Academic Year 2023-24.**

Date: 09/06/2023

Place: Latur

Dr. M S Wavare
Chairperson
Board of Studies in Mathematics
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Members of Board of Studies in the Subject Mathematics

Under the Faculty of Science and Technology

Sr. No.	Name	Designation	In position
1	**Dr. Mahesh S Wavare** Professor and Head, Department of Mathematics, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Chairperson	HoD
2	Dr. Bhalchandra D. Karande Head and Associate Professor, Department of Mathematics, Maharashtra Udaygiri Mahavidyalaya, Udaygiri Dist. Latur.	Member	V.C. Nominee
3	Dr. S. D. Kendre, Associate Professor, Department of Mathematics, Savitribai Phule Pune University, Pune.	Member	Academic Council Nominee
4	Dr. M. T. Gophane Associate Professor, Department of Mathematics Shivaji University, Kolhapur.	Member	Academic Council Nominee
5	Dr. N. S. Darkunde School of Mathematical Sciences, S. R. T. M. U Nanded.	Member	Expert from outside for Special Course
6	Mr. S. S. Ranmal Sungrace Computers Pvt Ltd, Pune.	Member	Expert from Industry
7	Prof. S. M. Shinde Department of Mathematics, Government College of Engineering, Amravati, Dist. Amaravati.	Member	P.G. Alumni
8	Dr. N. S. Pimple	Member	Faculty Member
9	Miss. S. D. Shinde	Member	Faculty Member
10	Mr. P. D. Bombalge	Member	Faculty Member
11	Mr. N. D. Kapale	Member	Faculty Member
12	Dr. A. A. Yadav	Member	Member from the same faculty

From the Desk of the Chairperson…

When Shiv Chhatrapati Shikshan Sanstha started the Science Faculty in Rajarshi Shahu Mahavidyalaya, Latur in 1971, the Department of Mathematics was founded. In the beginning, there was just one instructor for the PUC class and the first year of the B.Sc. B.Sc.-II and B.Sc. III year courses began in 1973 and 1974, respectively, in response to the natural expansion. During the 2017–2018 academic year, the department launched its M.Sc. Mathematics programme with a 30-student entry limit.

The undergraduate degree course in mathematics is a six- or eight-semester course spanned across three- or four-academic years, in accordance with the guidelines of the Undergraduate Curriculum Framework 2022 (UGCF 2022). The teaching and learning process is centered on the learner and includes both theoretical and practical elements. While guaranteeing that the student has a solid foundation in the topic and obtains in-depth knowledge, it provides flexibility in program structure. A student may choose courses from the syllabus that includes Discipline Specific Electives (DSEs), Generic Electives (GEs), Skill Enhancement Courses (SECs), Ability Enhancement Courses (AECs), and Value Addition Courses (VACs) in addition to the Discipline Specific Core (DSC) courses. As a result, the interdisciplinary approach and commitment to creative approaches within the curricular framework are highlighted.

The new National Education Policy (NEP), 2020, which includes significant elements, offers a platform to develop, nurture, grow, encourage, and multiply mathematical thinking. To achieve a balance between the requirement for employment in the twenty-first century and entrepreneurship, which is characterized by lateral, critical, and numerical thinking, the essential changes have been put in place. The NEP acknowledged the importance of mathematical thinking and how necessary it is for the country to become a Vishwa guru. The NEP provides children with the nutrition they require by making mathematics enjoyable and engaging from the very beginning. Because it encourages the development of computer skills and intuitive reasoning, the NEP also requires the adoption of a coding curriculum, which should start in middle school.

The courses for the UG Programme are framed using time tested and internationally popular text books so that the courses are at par with the courses offered by any other reputed universities around the world.

Only those concepts that can be introduced at the UG level are selected and instead of cramming the course with too many ideas the stress is given in doing the selected concepts rigorously. The idea is to make learning mathematics meaningful and an enjoyable activity rather than acquiring manipulative skills and reducing the whole thing an exercise in using thumb rules.

As learning Mathematics is doing Mathematics, to this end, some activities are prescribed to increase student's participation in learning. Duration of the degree Programme shall be six- or-eight semesters distributed in a period of three/four academic years.

Dr. Mahesh S Wavare

Chairperson
Board of Studies in Mathematics

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Index

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Mathematics Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT,FP,CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	**2**	**3**		**4**	**5**	**6**	**7**	**8**	**9**	**10**
I 4.5	I	DSC I: 04 Cr. DSC II: 04 Cr.	NA	NA	GE-I: 04 Cr.	VSC-I: 02 Cr. SEC-I: 02 Cr.	AEC-I MIL: 02 Cr. VEC-I: 02 Cr.	CC-I: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-I: 02 Cr. (SES-I)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	44 Cr. UG Certificate
	II	DSCIII: 04 Cr. DSC IV: 04 Cr. (DSC)	NA	NA	GE-II: 04 Cr.	VSC-II: 02 Cr. SEC-II: 02 Cr.	AEC-II MIL: 02 Cr. VEC-II: 02 Cr.	Generic IKS: 02 Cr.	22	
	Cum. Cr.	16	-	-	08	04+04= 08	04+02 +02=08	04	44	
Exit Option: Award of UG Certificate in Major with 44 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor										

Abbreviations:

1. DSC : Discipline Specific Core (Major)
2. DSE : Discipline Specific Elective (Major)
3. DSM : Discipline Specific Minor
4. GE/OE : Generic/Open Elective
5. VSEC : Vocational Skill and Skill Enhancement Course
6. VSC : Vocational Skill Courses
7. SEC : Skill Enhancement Course
8. AEC : Ability Enhancement Course
9. MIL : Modern Indian Languages
10. IKS : Indian Knowledge System
11. FSRCE : Fostering Social Responsibility & Community Engagement
12. VEC : Value Education Courses
13. OJT : On Job Training
14. FP : Field Projects
15. CEP : Community Engagement and Service
16. CC : Co-Curricular Courses
17. RP : Research Project/Dissertation
18. SES : Shahu Extension Services

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

B.Sc. (Honors) Mathematics

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.
I 4.5	I	101MAT1101 (DSC-I)	Topics in Algebra	03	45
		101MAT1103	Lab Course-I	01	30
		101MAT1102 (DSC-II)	Differential Calculus	03	45
		101MAT1104	Lab Course-II	01	30
		GE-I	From Basket	04	60
		101MAT1501 (VSC-I)	Introduction to Mathematics Software	02	30
		(SEC-I)	From Basket	02	30
		(AEC-I)	From Basket	02	30
		(VEC-I)	Constitution of India	02	30
		AIPC/OJT-I	Case Study	02	60
	Total Credits			**22**	
	II	101MAT2101 (DSC-III)	Analytical Geometry	03	45
		101MAT2103	Lab Course-III	01	30
		101MAT2102 (DSC-IV)	Integral Calculus	03	45
		101MAT2104	Lab Course-IV	01	30
		GE-II	From Basket	04	60
		101MAT2501 (VSC-II)	Programming with Mathematics Software	02	30
		(SEC-II)	From Basket	02	30
		(AEC-II)	From Basket	02	30
		(VEC-II)	FSRCE (CBPR)	02	30
		Generic IKS	Introduction to Indian Knowledge System	02	30
	Total Credits			**22**	
Total Credits (Semester I & II)				**44**	

Programme Outcomes (POs) for B.Sc. Programme	
PO 1	
PO 2	
PO 3	
PO 4	
PO 5	
PO 6	
PO 7	
PO 8	
PO 9	
PO 10	

Programme Specific Outcomes (PSOs) for B.Sc. in Mathematics (Honors)	
PSO No.	Upon completion of this Programme the students will be able to
PSO 1	To Develop their mathematical knowledge, oral, written, and practical skills in a way to enhance confidence and provide satisfaction.
PSO 2	To inculcate the confidence by developing a feel for numbers, patterns, and relationships.
PSO 3	To advance an ability to consider, solve problems, present and interpret results.
PSO 4	To improve Communication and reason using mathematical concepts.
PSO 5	To understand mathematical principles and their applications.
PSO 6	To foster the abilities to reason logically, to classify, to generalize and to prove.
PSO 7	To acquire the foundation, appropriate to their further studies of mathematics and of other disciplines.
PSO 8	To qualify IIT-JAM a higher education entrance in the subject of Mathematics.
PSO 9	To do minor research project in the field of Mathematics.
PSO 10	To nurture the basic information of Indian Knowledge System.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-I
Course Title: Topics in Algebra
Course Code: 101MAT1101
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To know Set, Relations, and types of function
LO 2. To get Euclidian algorithm and Properties of congruence's
LO 3. To determine Determinants, Co factor, Minor Adjoint of square Matrix.
LO 4. To find Solutions to linear systems
LO 5. To know Applications of Caley Hamilton theorem.

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Sort out one-one, onto, into, many one types of functions

CO 2. Apply induction principle

CO 3. Apply Division Algorithm

CO 4. Handle Elementary Linear algebra problems

Unit No.	Title of Unit & Contents	Hrs.
I	**Sets Relations and Functions**	**12**
	1. Sets, Relations, Equivalence relations 2. Equivalence classes and partitions of sets 3. Functions, Basic terminology, Types of Functions, Inverse of a Function, Composition of Functions.	
	Unit Outcomes: UO 1. Acquaint with the basic concepts of mathematics such as Set and partitions of set. UO 2. Able to differentiate different types of relations and functions.	
II	**Elementary number theory**	**12**
	1. Mathematical Induction, Well Ordering Principle, Archimedean Property 2. The Binomial theorem, Pascal's triangle. 3. The Division Algorithm, the Greatest Common Divisor 4. The Euclidean Algorithm, Basic Properties of Congruences	
	Unit Outcome: UO 1. Handle various types of problems using Algorithms in Number theory	

Unit No.	Title of Unit & Contents	Hrs.
III	**Rank of Matrix**	**10**
	1. Minor of order k, Rank of Matrix, Elementary Rows, column operations 2. Elementary operations, Inverse of elementary operations. **3.** Equivalent Matrices, Row – Echelon Matrix row rank and column rank of a matrix.	
	Unit Outcomes: UO 1. Handle the problems based on finding rank of matrix. UO 2. Techniques to solve Echelon Matrices.	
IV	**System of Linear Equations**	**11**
	1. Linear equations, equivalent system, 2. System of homogeneous and non-homogeneous equations **3.** Characteristic Roots, Caley Hamilton theorem and applications.	
	Unit Outcomes: UO 1. Differentiate between system of homogeneous and non-homogeneous equations.	

Learning Resources:

1. A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Reprint , Narosa Publication House 2018.
2. Elementary Number Theory, David M. Burton, Sixth Edition, Tata McGraw – Hill Publishing Company Limited(2007).
3. Topics in Algebra , Om. P. Chug, K. Prakash, A.D. Gupta , First Edition , Anmol Pub. Pvt Ltd. New Delhi (2008).
4. A text books of matrices , Shanti Narayan , Reprint , (S. Chand & Company Ltd) Ram Nagar, New Delhi (2010).
5. Theory and Problems of linear Algebra , Seymor Lipschutz, Third Edition , (Tata McGraw Hill) (2004).
6. Matrix & Linear Algebra , K.B. Datta, Prentice Hall India Pvt., Limited, 2004.
7. An Introduction to theory of numbers, I. Niven, H. Zuckerman, V.H.L. Montgomery, Fifth Edition, John Wiley & Sons(1991).

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-I
Course Title: Lab Course –I (Based on DSC-I)
Course Code: 101MAT1103
Credits: 01 **Max. Marks: 50** **Hours: 30**

Leaning Objectives

LO 1. To get Types of functions

LO 2. To Determine Determinants, Co-factor, Minor Adjoint of matrix of square Matrix.

LO 3. To Find Solutions to linear systems and an applications of Caley Hamilton theorem.

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Sort out one-one, onto, into, many one types of functions

CO 2. Apply induction principle and Division Algorithm

CO 3. Handle Elementary Linear algebra problems

Practical No.	Unit
1	Compute various equivalence classes for given relation
2	Find number of relations, functions, and their types.
3	Find inverse and composition of the functions.
4	Apply division algorithm for computing greatest common divisor.
5	Discuss basic properties of congruences.
6	Compute rank, row rank and column rank of matrix
7	Compute row Echelon form and reduced Echelon form of given matrix
8	Solve system of linear equations (Homogeneous and non-homogeneous).
9	Find eigen values and eigen vectors of given matrix.
10	Apply Caley Hamilton theorem

Learning Resources:

1. A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Reprint , Narosa Publication House 2018.
2. Elementary Number Theory, David M. Burton, Sixth Edition, Tata McGraw – Hill Publishing Company Limited(2007).
3. Topics in Algebra , Om. P. Chug, K. Prakash, A.D. Gupta , First Edition , Anmol Pub. Pvt Ltd. New Delhi (2008).

4. A text books of matrices , Shanti Narayan , Reprint , (S. Chand & Company Ltd) Ram Nagar, New Delhi (2010).
5. Theory and Problems of linear Algebra , Seymor Lipschutz, Third Edition , (Tata McGraw Hill) (2004).
6. Matrix & Linear Algebra , K.B. Datta, Prentice Hall India Pvt., Limited, 2004.
7. An Introduction to theory of numbers, I. Niven, H. Zuckerman, V.H.L. Montgomery, Fifth Edition, John Wiley & Sons(1991).

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-II

Course Title: Differential Calculus

Course Code: 101MAT1102

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To trace the curves of Hyperbolic Functions and compute higher order derivatives
LO 2. To solve Problems on Mean Value theorem and its applications.
LO 3. To know Relation between continuity and uniform continuity
LO 4. To understand various indeterminate forms and solve examples on it.

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Know hyperbolic function and compute successive differentiation
CO 2. Expand the function in terms of in Finite series.
CO 3. To compute Extreme Values of Functions.
CO 4. study various indeterminate forms

Unit No.	Title of Unit & Contents	Hrs.
I	**Hyperbolic Function and Successive Differentiation**	**12**
	1. Hyperbolic function, derivatives of Hyperbolic functions, inverse hyperbolic functions 2. Higher order derivatives, calculation of the nth derivative 3. n^{th} derivatives of the products of the powers of sines and cosine 4. Leibnitz theorem, Taylor's theorem, Maclaurin's theorem.	
	Unit Outcomes: UO 1. Techniques to classify derivatives of hyperbolic functions UO 2. Able to solve the problems based on limit and continuity	
II	**Mean Value Theorems**	**10**
	1. Rolle's Theorem, Lagrange's mean value theorem, 2. Meaning of sign of derivative, Graphs of hyperbolic functions. 3. Cauchy's mean value theorem. 4. Generalized mean value theorems, Examples on mean value theorems.	
	Unit Outcomes: UO 1. Discriminate the maximum and minimum value of a function. UO 2. Apply proper MVT's to solve problems.	

Unit No.	Title of Unit & Contents	Hrs.
III	**Maxima and Minima**	**10**
	1. Maximum value of a function; minimum value of a function 2. A necessary condition for extreme values, Sufficient condition for extreme value 3. Use of second order derivatives, Application to problems.	
	Unit Outcomes: UO 1. Discriminate the maximum and minimum value of a function.	
IV	**Indeterminate Forms**	**10**
	1. The indeterminate form $\frac{0}{0}$, The indeterminate from $\frac{\infty}{\infty}$ 2. The indeterminate from $0.\infty$, The indeterminate from $\infty - \infty$ 3. The indeterminate from $0^0, 1^\infty, \infty^0$	
	Unit Outcome: UO 1. Know various types of indeterminate forms.	

Learning Resources:

1. Differential Calculus , Shanti Narayan and Dr. P. K. Mittal , Revised Edition , S. Chand and Co. Ltd.2012 (Reprint 2014)
2. Differential Calculus , Shanti Narayan , Tenth Edition, S. Chand and Co. Ltd.(1962).
3. Text book on Differential Calculus, Gorakh Prasad, Nineteenth Edition , Pothishala Private limited Allahabad(2022).
4. Calculus, Schaum's outline series , Ayres F, Sixth Edition, Mc Graw Hill, (2013).
5. Differential calculus for beginners , Joseph Edwards , Arihant publication India limited(2023).
6. Golden Differential Calculus , N. Bali , Laxmi Publication Pvt Ltd.(2012).
7. Theory and Problems on Advance Calculus, Murray and R Spiegel . Second Edition, Schaum Pub. Co. New York (1963).

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-II
Course Title: Lab Course –II (Based on DSC-II)
Course Code: 101MAT1104
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives:

LO 1.To trace the curves of Hyperbolic Functions and compute higher order derivatives
LO 2.To solve Problems on Mean Value theorem and its applications
LO3. To compute Extreme Values of Functions
LO4. To understand various indeterminate forms and solve examples on it

Course Outcomes:

After completion of the course, students will be able to-
CO1 Solve examples on Tracing of hyperbolic function and compute successive differentiation
CO2: Apply Taylor's theorem and Maclaurin's theorem for expansion of function.
CO3: Calculate Extreme values of given functions
CO4: Study various indeterminate forms

Practical No.	Unit
1	To trace the curves of Hyperbolic Functions
2	To find nth order derivatives of the products of the powers of sines and cosines
3	To apply Taylor's and Maclaurin's theorem for expansion of functions
4	To discuss the applicability of Rolle's Theorem
5	To Discuss the applicability Langrage's Theorem
6	To Discuss the applicability Cauchy's mean value theorem
7	To Discuss the applicability Generalized mean value theorems.
8	To find extreme values of polynomial functions
9	To solve problems based on computation of extreme values of areas and volumes.
10	To apply L' Hospital's Rule to various indeterminate forms.

Learning Resources:

1. Differential Calculus , Shanti Narayan and Dr. P. K. Mittal , Revised Edition , S. Chand and Co. Ltd.2012 (Reprint 2014)

2. Differential Calculus , Shanti Narayan , Tenth Edition, S. Chand and Co. Ltd.(1962).

3. Text book on Differential Calculus, Gorakh Prasad, Nineteenth Edition , Pothishala Private limited Allahabad(2022).

4. Calculus, Schaum's outline series , Ayres F, Sixth Edition, Mc Graw Hill, (2013).

5. Differential calculus for beginners , Joseph Edwards , Arihant publication India limited(2023).

6. Golden Differential Calculus , N. Bali , Laxmi Publication Pvt Ltd.(2012).

7. Theory and Problems on Advance Calculus, Murray and R Spiegel . Second Edition, Schaum Pub. Co. New York (1963).

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-III
Course Title: Analytical Geometry
Course Code: 101MAT2101
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO1: Shift of origin concept, Equation of the locus
LO2: Geometrical Interpretation of first-degree equation in three variables
LO3: Symmetric and unsymmetrical form of a line
LO4: Equations of a Sphere, Cone, Right circular cone, Cylinder and right Circular Cylinder.

Course Outcomes:

After completion of the course, students will be able to-
CO1: Study Geometry of two dimensions
CO2: Analyze geometry of two dimensions
CO3: Find angle between two spheres
CO4: Distinguish equations of different types of conics

Unit No.	Title of Unit & Contents	Hrs.
I	**Analytical Geometry of Two Dimensions**	**11**
	1. Change of axes: translation and rotation. 2. Conic Sections: General equation of second degree in two variables. 3. Reduction to standard form. Centre of conic. 4. Nature of conic.	
	Unit Outcomes: **UO1:** To discuss nature of conic and can able change the axis **UO2:** To discuss Nature of Conic	
II	**The Plane**	**11**
	1. The plane: First degree equation, converse. 2. Transformation to normal form. 3.Plane under given condition. 4. System of planes, length of perpendicular from a point	
	Unit Outcome: Compute length of perpendicular from point and normal form of plane	
III	**The Right Line**	**11**
	1. Right line: equation of line, line through a point and given direction. 2. Line through two points, Angle between line and plane 3.Conditions to lie in plane, coplanar lines. 4. Number of constants in equation of line, shortest distance	
	Unit Outcome: Compute angle between line and plane and shortest distance.	
IV	**Sphere, Cones and Cylinder**	**12**

Unit No.	Title of Unit & Contents	Hrs.
	1.The sphere: Equation of a sphere, general equation. 2.Plane section of sphere, intersection of two sphere. 3.Sphere with given diameter, equations of a circle. 4. Sphere through given circle, intersection of a sphere and a line, equation of tangent plane. 4. Angle between two spheres, conditions of orthogonality 5. Cones and Cylinders: Cone, equation of cone, right circular cone and equation, Cylinder, and its equation.	
	Unit Outcomes: UO1: To Compute plane section and intersection of two sphere UO2: Computation of angle between two spheres, discussion of orthogonality UO3:To study equation of Cone and cylinder.	

Learning Resources:

1) Analytical Geometry of Two and Three Dimensions, Qazi Zameeruddin;(Narosa Publ.)
2) Analytical Solid Geometry, By Shanti Narayan, S. Chand and Co.
3) Text Book on Coordinate Geometry, By Gorakh Prasad, H.C. Gupta. Pothishala Pvt. Ltd.
4) Lectures on Vector Analysis and Geometry, By T.M. Karade and M.S. Bendre.
5) A text book of Analytical Geometry of three dimensions, By P. K Jain and Khalil Ahmed, (Wiley Eastern Ltd, 1999.)
6) Analytical Solid Geometry by Shantinarayan.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-III
Course Title: Lab Course –III (Based on DSC-III)
Course Code: 101MAT2103
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives:

LO1: Shift of origin concept, Equation of the locus
LO2: Geometrical Interpretation of first-degree equation in three variables
LO3: Symmetric and unsymmetrical form of a line
LO4: Equations of a Sphere, Cone, right circular cone, Cylinder and right Circular Cylinder.

Course Outcomes:

After completion of the course, students will be able to-
CO1: Study Geometry of two dimensions
CO2: Analyze geometry of two dimensions
CO3: Find angle between two spheres
CO4: Distinguish equations of different types of conics

Practical No.	List of Practical's based on DSC-III
1	To solve Examples on Shifting of origin
2	To Solve examples on rotation of Axis.
3	To Discus nature of Conics in two variables of degree 2
4	To compute center of Conics
5	To find normal form of Plane
6	To find Length of perpendicular from point to a plane
7	To Compute angle between line and Plane.
8	To Find Equation of line joining two points
9	To study general equation Sphere and its intersections with planes and Sphere.
10	To compute angle between two Sphere

Learning Resources:

1) Analytical Geometry of Two and Three Dimensions, Qazi Zameeruddin;(Narosa Publ.)
2) Analytical Solid Geometry, By Shanti Narayan, S. Chand and Co.
3) Text Book on Coordinate Geometry, By Gorakh Prasad, H.C. Gupta. Pothishala Pvt. Ltd.
4) Lectures on Vector Analysis and Geometry, By T.M. Karade and M.S. Bendre.
5) A text book of Analytical Geometry of three dimensions, By P. K Jain and Khalil Ahmed, (Wiley Eastern Ltd, 1999.)
6) Analytical Solid Geometry by Shantinarayan.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-IV

Course Title: Integral Calculus

Course Code: 101MAT2102

Credits: 03 **Max. Marks: 75** **Lectures: 45Hrs.**

Learning Objectives

LO1: To understand integration as limit of sum
LO2: To Study Beta and Gamma Functions
LO3: To compute multiple integrals
LO4: To study application of Multiple integrals

Course Outcomes :

After completion of the course, students will be able to-
CO1: Discuss integral as limit of sum and apply fundamental theorems of Integral Calculus.
CO2: Study Beta and Gamma Functions.
CO3: Do multiple integrations.
CO4: Study application of Multiple integral.

Unit No.	Title of Unit & Contents	Hrs.
I	**Integral as limit of Sum:**	
	1. Integral as a limit of sum. 2.Properties of Definite integrals. 3. Fundamental theorem of integral calculus. 4. Summation of series by integration. 5. Infinite integrals. 6. Differentiation and integration under the integral sign.	12
	Unit Outcomes: UO1: To understand integral as limit of sum UO2:To study Fundamental Theorem of Integral Calculus UO3: To apply differential rule under integral sign	
II	**Beta and Gamma Functions:**	
	1. Beta function, Properties and various forms. 2. Gamma function, Recurrence formula and other relations. 3.Relation between Beta and Gamma function 4. Evaluation of integrals using Beta and Gamma functions.	11
	Unit Outcomes: UO1: To understand Beta function and study various forms of Beta UO2 To study relation between Beta and Gamma Function	
III	**Multiple Integral:**	

Unit No.	Title of Unit & Contents	Hrs.
	1. Double integrals, Repeated integrals. 2. Evaluation of Double integrals. 3.Double integral in polar coordinates 4.Change of variables, Change of order of integration in Double integrals 5. Triple integrals, Evaluation of Triple integrals, Dirichlet's theorem	11
	Unit Outcomes: UO1:To understand method of multiple integration UO2 : To Change the order of Integration	
IV	**Applications of Multiple Integral:**	
	1. Area bounded by curves (quadrature). 2.Rectification (length of curves) 3. Volumes and Surfaces of Solids of revolution.	11
	Unit Outcomes: UO1 : To compute area under given curves UO2: To Compute length of Curves UO3:To Compute Volumes and Surface of Solids of revolution	

Learning Resources:

1) Shanti Narayan, P.K. Mittal, Integral Calculus, S.Chand 2005

2)Gorakh Prasad, Chandrika Prasad, Text Book on Integral Calculus 2002

3)T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc., 1974

4)H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc. 2007

5)G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010

6)Suggested digital platform: NPTEL/SWAYAM/MOOCs

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: DSC-IV

Course Title: Lab Course -IV (Based on DSC-IV)

Course Code: 101MAT2104

Credits: 01 **Max. Marks: 50** **Lectures: 30Hrs.**

Learning Objectives

LO1: To understand integration as limit of sum
LO2: To Study Beta and Gamma Functions
LO3: To compute multiple integrals
LO4: To study application of Multiple integrals

Course Outcomes :

After completion of the course, students will be able to-
CO1: Discuss integral as limit of sum and apply fundamental theorems of Integral Calculus.
CO2: Study Beta and Gamma Functions.
CO3: Do multiple integrations.
CO4: Study application of Multiple integral.

Practical No.	List of Practical's based on DSC-IV
1	To solve integration as limit of sum.
2	To Apply Fundamental theorem of integral calculus
3	To solve examples on various forms of Beta function
4	To Evaluate integrals using Beta and Gamma Functions
5	To evaluate double integrals when limits given.
6	To evaluate double integral using change of coordinates.
7	To evaluate triple integral
8	To apply Dirichlet's theorem.
9	To compute area bounded by curve and find length of curves.
10	To calculate Volumes and Surfaces areas of solids of revolution

Learning Resources:

1) Shanti Narayan, P.K. Mittal, Integral Calculus, S.Chand 2005

2)Gorakh Prasad, Chandrika Prasad, Text Book on Integral Calculus 2002

3)T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc., 1974

4)H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc. 2007

5)G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010

6)Suggested digital platform: NPTEL/SWAYAM/MOOCs

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: VSC-I

Course Title: Introduction to Mathematics Software

Course Code: 101MAT1501

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To know MATLAB programming language.
LO 2. To assign and manage variables.
LO 3. To create function input validation.
LO 4. To generate linearly spaced vectors.
LO 5. To solve linear system of equations.

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Perform basic MATLAB commands and will apply MATLAB for elementary number theory problem
CO 2. Do Arithmetic Operations of Arrays
CO 3. Solve elementary linear Algebra examples using MATLAB
CO 4. Compute Row Reduced Echelon Form

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction to MATLAB**	**08**
	1. MATLAB Programming language 2. Built-in Functions 3. Graphics, computations, External interface, and Tool boxes 4. MATLAB windows, desktop, command window, workspace, Figure and Editor Windows 5. Input-output 6. File types. 7. Platform dependence. 8. Printing	
	Unit Outcomes: UO 1. Apply MATLAB for elementary number theory problems. UO 2. Able to differentiate function file and structure of function file.	
II	**Programming in MATLAB**	**07**
	1. Scripts and functions 2. Script files, function files 3. Executing of function 4. Writing good functions 5. Sub functions	

	6. Compiled functions	
	Unit Outcome: UO 1. To understand different types of functions.	
III	**Matrix as array**	**07**
	1. Matrices and Vectors 2. Input, indexing, matrix manipulation 3. Creating vectors 4. Matrix and Array operations 5. Arithmetic operations 6. Relational operations **7.** Logical operations	
	Unit Outcome: UO 1. Recognize vectors operations and solve problems based on matrix.	
IV`	**Linear Algebra and MATLAB**	**08**
	1. Elementary math functions, 2. Matrix functions, 3. Character string. 4. Finding the determinant, rank, inverse of matrix. 5. Solving Linear system of equations and computation of row reduced echelon form 6. Finding eigenvalues and eigenvectors.	
	Unit Outcome: UO 1. Perform matrix based operations such as rank, eigen value, eigen function and system of linear equations.	

Learning Resources:

1. Getting Started with MATLAB 7 by Rudra Pratap, Oxford University Press (For MATLAB User)(2005).
2. MATLAB An introduction with applications by Amos Gilat , Fourth Edition , Wiley publication (2012).
3. Understanding Matlab A Textbook For Beginners by , S S Alam , S N Alam, Zeroth Edition , I K International Publishing House (2007).
4. Suggested digital platform: NPTEL/SWAYAM/MOOCs
5. https://nptel.ac.in/courses/103106118
6. https://spoken-tutorial.org/tutorialsearch/?search_foss=Scilab&search_language=Englis

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Mathematics

Course Type: VSC-II

Course Title: Programming with Mathematics Software

Course Code: 101MAT2501

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To know MATLAB programming language.
LO 2. To define user defined functions.
LO 3. To plot 2-D, 3-D plots.
LO 4. To apply software for problem solving in Calculus.

Course Outcomes:

After completion of the course, students will be able to-
CO 1. Understand various logical operators and conditional statements.
CO 2. Define functions.
CO 3. Apply fplot, plot, line, etc., commands for 2-D and 3-D graphs.
CO 4. Solve examples from elementary calculus using software.

Unit No.	Title of Unit & Contents	Hrs.
I	**Programming in MATLAB**	**08**
	1. Relational and Logical Operators, Conditional Statement. 2. The if-end structure, if-else-end Structure, 3. The Switch Case Statement, Loops, For -end loop while-end loop	
	Unit Outcome: UO 1. To apply Relational and Logical Operators, Conditional Statements.	
II	**User Defined Functions and Function Files**	**07**
	1. Creating function file. 2. Structure of function file, Local and Global Variable 3.User defined function.	
	Unit Outcome: UO 1. To create function using local and global variables.	
III	**Two Dimensional and Three Dimensional Plots**	**07**
	1. The plot command, Plot of Given Data, Plot of given Function. 2. The fplot command Plotting multiple plots in same figure window, 3. Labelling of plot and legends. 4. Histograms, Polar Plots, Line Plot, Mesh, and surface plot. 5. Plots with special Graphics, The view Command.	
	Unit Outcome:	

	UO 1. To plot 2-D and 3-D graphs.	
IV`	**Calculus using Software**	**08**
	1. Function declaration, right limit, left limit, limit, 2. Derivative and integration	
	Unit Outcome: UO 1. To solve calculus problems with the help of software.	

Learning Resources:

1. Amos Gilat ,MATLAB An introduction with applications Wiley India Edition 4th 2012(MATLAB User)
2. Getting Started with MATLAB 7 by Rudra Pratap, Oxford University Press (For MATLAB User)(2005).
3. MATLAB An introduction with applications by Amos Gilat , Fourth Edition , Wiley publication (2012).
4. Understanding Matlab A Textbook For Beginners by , S S Alam , S N Alam, Zeroth Edition , I K International Publishing House (2007).
5. Suggested digital platform: NPTEL/SWAYAM/MOOCs https://nptel.ac.in/courses/103106118

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Basket I: Generic/Open Elective (GE/OE)

(GEs offered to the Science & Technology students in Sem.-I and II)

Sr. No.	BoS Proposing GE/OE	Code	Course Title	Credits	Hrs.
1	English	101ENG1401	Business Communication & Grammar	04	60
2	Computer Science	101COS1401	Fundamentals of Computers	04	60
3	Information Technology	101COA1401	Web Designing	04	60
4	Marathi	101MAR1401	स्पर्धा परीक्षा आणि मराठी भाषा	04	60
5	Mathematics	101MAT1401	Fundamentals of Mathematics	04	60
6	Political Science	101POL1401	Human Rights	04	60
7	Biotechnology	101BIO1401	Nutrition, Health and Hygiene	04	60
8	Information Technology	101COM1401	MS-Office	04	60
9	Music	101MUS1401	Indian Vocal Classical & Light Music	04	60
10	NCC Studies	101NCC1401	Introduction to NCC	04	60
11	Sports	101SPO1401	Counseling and Psychotherapy	04	60

Note: Student can choose any one GE from the basket.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem-I and II)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Commerce	101MAE1601	Office Management	02	30
2	Computer Science	101COS1601	Data Analysis and Computer Application	02	30-45
3	English	101ENG1601	Proof Reading and Editing	02	30
4	English	101ENG1602	Communication Skills	02	30
5	Geography	101GEO1601	Tourism & Travel Management	02	30-45
6	Information Technology	101COA1601	PC Assemble and Installation	02	30-45
7	Marathi	101MAR1601	कथा/पटकथालेखन	02	30
8	English	101ENG1603	Leadership and Personality Development	02	30
9	Zoology	101ZOO1601	Bee Keeping	02	30-45

Note: Student can choose any one SEC from the basket.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Basket III: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR1701	भाषिक कौशल्य भाग – १	02	30
2	Hindi	101HIN1701	हिंदी भाषा शिक्षण भाग – १	02	30
3	Sanskrit	101SAN1701	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL1701	उपयोजित व्याकरण	02	30

(AEC offered to the Science & Technology students in Sem.-II)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR2701	भाषिक कौशल्य भाग – 2	02	30
2	Hindi	101HIN2701	हिंदी भाषा शिक्षण भाग – 2	02	30
3	Sanskrit	101SAN2701	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL2701	उपयोजित व्याकरण	02	30

Note: Student can choose any one AEC from the basket

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Extra Credit Activities

Sr. No.	Course Title	Credits	Hours T/P
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken Tutorial Courses	Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/ activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
1	2	3				4		5	6	5 + 6
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
DSC/DSE/ GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	30	45	75
Lab Course/AIPC/ OJT/FP	50	-	-	-	-	05	20	-	25	50
VSC/SEC/ AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.