

Rajarshi Shahu Mahavidyalaya(Autonomous),Latur

Department of Mathematics

Year: 2020-21



Syllabus for
B.Sc.-I (Mathematics)
CBCS Pattern
w.e.f. 2020-2021

Rajarshi Shahu Mahavidyalaya(Autonomous) , Latur

BoS in Mathematics

1. Introduction:

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 semesters distributed in a period of three academic years.

2. Title of the Course:

B.Sc (Mathematics)

3. Objectives of the Course:

Successful Mathematics students of this institute will gain lifelong skills, including following:

- To develop their mathematical knowledge and oral, written and practical skills in a way which encourages confidence and provides satisfaction and enjoyment.
- The development of their mathematical knowledge.
- Confidence by developing a feel for numbers, patterns and relationships.
- An ability to consider and solve problems and present and interpret results.
- Communication and reason using mathematical concepts.
- To develop an understanding of mathematical principles.
- To develop the abilities to reason logically, to classify, to generalize and to prove.
- To acquire a foundation appropriate to their further study of mathematics and of other disciplines.

4. Advantages of the Course:

Student will be getting highly motivated for higher studies in reputed institutes like IIT's, NIIT's, IISc's, CMI, HRI etc...

5. Duration of the Course:	Three years
6. Eligibility of the Course:	For B.Sc. I :12th Science with Mathematics
7. Strength of the Students:	62
8. Fees for Course:	As per UGC/University/College rules.
9. Period of the Course:	As per UGC/University/College rules
10. Admission / Selection procedure:	As per UGC/University/College rules
11. Teacher's qualifications:	As per UGC/University/College rules
12. Standard of Passing:	As per UGC/University/College rules
13. Nature of question paper with scheme of marking:	As per UGC/University/College rules
15. List of book recommended:	Included in syllabus
16. List of Laboratory Equipments, Instruments, Measurements etc.:	Matlab Software with one computer Lab
17. Rules and regulations and ordinance if any:	As per UGC/University/College rules
18. Medium of the language:	English
19. Structure of the Course:	Attached as Annexure 'A'
20. Allotment of workload (Theory/Practical):	Attached as Annexure 'A'
21. Staffing pattern:	As per UGC/University/College rules.
22. Intake capacity of students:	As per UGC/University/College rules
23. Paper duration:	Each theory paper is of 45Contact hours
24. To be introduced from:	B.Sc. I (CBCS) from June 2020.

Chairman Board of Studies
Mathematics(Mr. M. S. Wavare)

List of BoS Member(2019-2022)

1. Dr. D D Pawar (VC Nominee)
Director,
School of Mathematical Sciences
Swami Ramanand Teerth Marathwada University,
Nanded.
2. Dr. S D Kendre (Subject Expert)
Department of Mathematics,
SPPU,Pune
3. Dr. M T Gophane (Subject Expert)
Department of Mathematics
Shivaji University ,Kolhapur .
4. Dr. A A Yadav
R S M , Latur
5. Prof .S M Shinde (Student Alumni)
Govt.College of Engg., Karad Dist :Satara
6. Mr. S S Ranmal
Sungrace Computers Pvt Ltd, Pune
7. Prof. N . S. Pimple
R S M , Latur
8. Dr. S B Birajdar
R S M , Latur
9. Mr. S D Malegaokar
R S M , Latur
10. Miss A B Kale
R S M , Latur
11. Mr. D M Ghuge
R S M , Latur

Program Outcomes:

On Successful UG Mathematics students of this institute will gain lifelong skills, including following:

- To develop their mathematical knowledge and oral, written and practical skills in a way which encourages confidence and provides satisfaction and enjoyment.
- Confidence by developing a feel for numbers, patterns and relationships.
- An ability to consider and solve problems and present and interpret results.
- Communication and reason using mathematical concepts.
- To understanding of mathematical principles and their applications
- To develop the abilities to reason logically, to classify, to generalize and to prove.
- To acquire a foundation appropriate to their further study of mathematics and of other disciplines.
- They Can qualify IIT-JAM entrance in the subject of Mathematics
- They will get admitted to ranked institute in India
- They can do minor research in the field of Maths
- They can solve problems independently

Annexure 'A'

Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)

Department of Mathematics

B.Sc. I (Mathematics) Semester I

Curriculum Structure with effect from June, 2020

Course Code	Title of the course with paper number	Hours/Week	Marks (50)		Credits
			In Sem	End Sem	
U-MAT-138	Paper-I Algebra	04	20	30	02
U-MAT-139	Paper-I Differential Calculus	04	20	30	02
U-MAT-140	Laboratory Course -I On Basics of Matlab	02	20	30	01
	Total Credits				05

Student Stay Hours: 10/Week

B.Sc. I (Mathematics) Semester II

Course Code	Title of the course with paper number	Hours/Week	Marks (50)		Credits
			In Sem	End Sem	
U-MAT-239	Paper-III Geometry	04	20	30	02
U-MAT-240	Paper-IV Integral Calculus	04	20	30	02
U-MAT-241	Laboratory Course-II Algebra Using Matlab	02	20	30	01
	Total Credits				05

Student Stay Hours: 10/Week

B. Sc. – I [Mathematics] Semester I

Course Code: U-MAT-138

CCM-1

Paper-I

Algebra

Credits:02

Marks : 50

Total Hours : 45

Learning Objectives:

- Euclidian algorithm and Properties of congruence's
- DeMoivre's theorem and its applications.
- Determinants, Cofactor, Minor Adjoint of matrix of square Matrix.
- Solutions to linear systems
- Caley Hamilton theorem.

Course Outcomes:

- ❖ **Students can apply induction principle**
- ❖ **Application of Division Algorithm**
- ❖ **Application of Elementary linear algebra**

Unit I Elementary number theory [13 Lectures]

Mathematical Induction, Well Ordering Principle, Archimedean Property, The Binomial theorem, Pascal's triangle. The Division Algorithm, the Greatest Common Divisor, the Euclidean Algorithm, Basic Properties of Congruences

Text Book: Elementary Number Theory, Sixth Edition David M. Burton,
Tata McGraw – Hill Publishing Company Limited.

Scope Chapter 1 – 1.1, 1.2
Chapter 2 – 2.2, 2.3, 2.4

Unit II Complex Numbers [16 Lectures]

(Prerequisites: Standard form of a complex number, Geometrical representation, Product and quotient of Complex numbers, Geometrical representation of Sum and difference, Results concerning conjugate, Modulus and Amplitude.)

DeMoivre's theorem and Its Applications: Statement, Roots of Complex number, all values of $(\cos \theta + i \sin \theta)^{p/q}$ where p, q being relatively prime numbers, some standard results, Solutions of equations, expansion of $\cos n\theta$, $\sin n\theta$, n being positive integer, Expansion of $\tan n\theta$, finding equation

whose roots are given, expansion of $\cos^n \theta$ in terms of cosine of multiple angles, expansion of $\sin^n \theta$ in terms of cosine or sines of multiple angles of θ according as n is even or odd integer.

Text Book: Topics in Algebra By Om. P. Chug, K. Prakash, A.D.Gupta

Anmol Pub., Pvt Ltd New Delhi.

Scope: Chapters 1 for Prerequisites and Chapter 2: Complete.

Unit III Rank of Matrix & Linear Equations [16 Lectures]

Minor of order K , Rank of Matrix, Elementary Rows, column operations, Elementary operations, Inverse of elementary operations. Equivalent Matrices, Row – Echelon Matrix row rank and column rank of a matrix. Linear equations equivalent system, system of homogeneous equations, Characteristic Roots & Caley Hamilton theorem (only statements)

Text Book: Topics in Algebra By Om. P. Chug, K. Prakash, A.D.Gupta

Anmol Pub., Pvt Ltd New Delhi.

Scope Chapter 11 - 11.1, 11.2, 11.5 to 11.16, 11.32 to 11.39

Chapter 12 - 12.1 to 12.9, 12.18 (Art 12.4 to 12.9 and 12.18 statement only)

Reference Books:

- 1) A text books of matrices, By Shanti Narayan (S.Chand & Company Ltd) Ram Nagar, New Delhi 11055
- 2) Theory and Problems of linear Algebra, third edition by Seymour Lipschutz (Tata McGraw Hill)
- 3) Matrix & Linear Algebra by K.B.Datta, DHI Pub.
- 4) An Introduction to theory of numbers 5th Edition John Wiley & Sons
By I. Niven, H. Zuckerman V.H.L. Mantgomery.
- 5) Introduction to analytical number theory by T.M.Apostol Springer Verlag, New York.

Remark: No questions will be set on Prerequisites in Internal and Semester end Examination

Course Code : U-MAT-139
CCM-1

Paper-II

Differential Calculus

Credits:02

Marks : 50

Total Hours : 45

Learning Objectives:

- Least upper bound axiom of \mathbb{R} and its consequences
- Concepts of limit and Continuity through $\epsilon-\delta$ notations
- Relation between continuity and uniform continuity
- Mean Value theorem and its applications.

Course Outcomes

- Students can find LUB, GLB apply the definition of limit and continuity.
- They can handle the problems on Continuity as well as uniform Continuity
- Application of Mean Value Theorems

Unit I: The Real Numbers:

[12 lectures]

Sets and functions, The Real numbers system: Introduction, \mathbb{R} as complete order field Bounded and unbounded sets Supremum, Infimum, order completeness of \mathbb{R} , Absolute Value of a Real Number, Limit points of a set, open and Closed sets: Closure of a set, Interior and exterior of a set, countable and uncountable sets.

Unit II: Real Functions, Limit and Continuity

[18 lectures]

Algebraic operations on functions, bounded and unbounded functions, limit of a function, algebra of limits, one sided limits, limits at infinity and infinite limits Continuous function discontinuity of a function, algebra of continuous function, Cauchy's criterion for finite limits, properties of functions continuous in closed finite intervals, Uniform continuity.

Unit III: The Derivative and Mean Value Theorems

[20 lectures]

Derivability of a function, Algebra of derivatives, geometrical meaning of derivative, sign of derivative at a point, Darboux's theorem, Rolle's Mean value theorem, Lagrange's mean value theorem. Increasing and decreasing functions, monotonic functions, Cauchy's mean value theorem, generalized mean value theorem, higher order derivatives, Taylor's theorem, power series representation of functions, Maclaurin's infinite series.

Test Book: Elements of Real Analysis, By Shanti Narayan and M.D. Raisinghania.

(Revised edition) S.Chand and company Ltd.

Scope :-Unit I : Chapter 1 -1.1,1.4,1.5,1.6,1.7 Chapter 2-2.1 to 2.8,2.13 Chapter 3-3.1 to 3.3.12

Unit II : Chapter 3 -3.1,to 3.8.7,8.11,8.12,8.15,8.17,8.19

Unit III : Chapter 9 - Complete Chapter 10 – 10.1,10.3,10.4,10.5,10.8 to
10.13

References Books :

1. Introduction to Real Analysis by Robert G. Bartle and Donald R.Sherbert,
Third Edition, John Wiley and Sons, 2002
2. A Course in Calculus and Analysis By Sudhir Ghorpade and Balmohan
Limaye, Springer 2006.
3. Principles of Mathematical Analysis, W. Rudin, Third Edition,
McGraw Hill, 1976
4. Real Analysis by N.P.Bali Golden math series
5. Mathematical Analysis by S.C.Malik & savita Arrora S.Chand and company
ltd. (Second Edition)
6. Methods of Real Analysis by R.R. Goldberg.
- 7) Mathematical analysis and applications by J .V.Deshpande ,Narosa publishing
House.

Course Code: U-MAT-140
Laboratory Course -I

Basics of MATLAB
Marks : 50

Credits:01

Total Hours : 45

Learning Objectives

- Introduction of Matlab
- Plotting of Graphs

Course Outcomes

- Students can learn basic matlab commands.
- Students can plot 2D /3D graphics

Section I. Matlab Introduction:

What is MATLAB ? , Symbolic calculations , MATLAB run on my Computer ,Basics of MATLAB , MATLAB Windows , On-line help , Input-output , File types Platform dependence , General commands Matrices and Vectors : Input , Indexing (or subtracting) ,Matrix manipulation , Creating Vectors , Matrix and Array Operations : Arithmetic operations ,Relational operations ,Logical operations , Elementary math functions , Matrix functions ,Character string Array operations : Vectorization ,Inline functions , Anonymous functions

Section II. Plotting of 2D Graphs

Plotting Simple graphs : Basic 2D Plots , Style options , Labels ,title ,legend , and text objects ,Axis control ,zoom in and zoom out , Modifying plots with the plot editor , overlay plots , Specialized 2 D plots ,Using subplot for Multiple Graphs .

Notes

- Record book consisting set of 16 problems (08 from section 1 and 08 from section 2)
- Practical Examination will be held on at the end of first semester.
- List of Practical's is enclosed separately.

References:

- 1) **Matlab Software**
- 2) **Getting Started With MATLAB 7. - Rudra Pratap, Oxford University Press**

U-MAT-140

List of Practical's

Section I: Matlab Introduction

1. To do simple arithmetic calculations
2. To calculate Exponential and logarithms
3. To calculate values of Trigonometric function
4. Creating and working with arrays of numbers
5. To use the trigonometric functions with array arguments
6. To find sum of Geometric series
7. To compute dot product of vectors
8. To compute cross product of vectors
9. To compute box and vector triple product
10. To Compute angle between two vectors
11. To calculate interest of your money

Section I: Symbolic Mathematics, Calculus, Plotting of Graphs

1. To define the function using variable as symbol
2. To find out left and right limit of a given function
3. To find limit of a function
4. To find derivative of a function
5. To find integration when limits are not given
6. To find integration when limits are given
7. To find values of Beta and Gamma functions
8. To find roots of equation
9. Simple 2-D plots
10. Plotting with function fplot, ezplot
11. Multiple plotting in one window

B. Sc. – I [Mathematics] Semester II

Course Code: U-MAT-239

CCM-2

Paper-III

GEOMETRY

Marks : 50

Credits:02

Total Hours : 45

Learning Objectives:

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

Course Outcomes

- They study Geometry of two dimensions .
- Students can analyze geometry of two dimensions.

Unit I: Analytical Geometry of Two Dimensions

[10 Lectures]

Change of axes: translation and rotation. Conic Sections: General equation of second degree in two variables. Reduction to standard form. Centre of conic. Nature of conic.

Unit II: The Plane and Right Line

[20 Lectures]

The plane: First degree equation, converse, transformation to normal form, plane under given condition, system of planes, length of perpendicular from a point

Right line: equation of line, line through a point and given direction, line through two points, Angle between line and plane, conditions to lie in plane, coplanar lines, number of constants in equation of line, Shortest distance.

Unit III: Sphere, Cones and Cylinder

[15 Lectures]

The sphere: Equation of a sphere, general equation, plane section of sphere, intersection of two sphere, sphere with given diameter, equations of a circle, sphere through given circle, intersection of a sphere and a line, equation of tangent plane, Angle between two spheres, conditions of orthogonality

Cones and Cylinders: Cone, equation of cone, right circular cone and equation, Cylinder and its equation.

Text Book:-

Unit I: Analytical Geometry of Two and Three Dimensions ,Qazi Zameeruddin;
(Narosa Publ.).

Unit II and III

Analytical Solid Geometry, By Shanti Narayan, S.Chand and Co.

Scope: Chapter 2: 2.1, 2.2, 2.3, 2.32, 2.4, 2.41, 2.42, 2.5, 2.7.

Chapter 3: 3.1, 3.11, 3.12, 3.14, 3.2, 3.3 to 3.7.

Chapter 6: 6.11,6.12,6.13,6.31,6.32,6.33,6.4,6.41,6.5,6.6,6.7,6.71.

Chapter7: 7.1, 7.12, 7.61, 7.62, 7.7, 7.71, 7.81, 7.82.

Reference Books:

- 1) Text Book on Coordinate Geometry, By Gorakh Prasad, H.C. Gupta. Pothishala Pvt. Ltd.
- 2) Lectures on Vector Analysis and Geometry, By T.M. Karade and M.S. Bendre.
- 3) A text book of Analytical Geometry of two dimensions, By P.K Jain and Khalil Ahmed, (Wiley Eastern Ltd, 1994)
- 4) A text book of Analytical Geometry of three dimensions, By P.K Jain and Khalil Ahmed, (Wiley Eastern Ltd, 1999.)
- 5) Analytical Solid Geometry by Shantinarayan.

Course Code: U-MAT-240
CCM-2

Paper-IV

Integral Calculus

Credits:02

Marks : 50

Total Hours : 45

Learning Objectives

- To Know about Upper and Lower Darboux's sums
- To know Geometrical Interpretation of Riemann Upper and Lower Integral.
- To know the conditions of Riemann Inerrability.
- Different types of bounded integrable functions.
- Fundamental Theorem of Integral Calculus
- To solve Improper Integral with finite and unbounded range.
- Beta and Gamma functions as a application of Improper Integral.
- **Course Outcomes**

Course Outcomes :

- Students can learn integration through infinite sum.
- They can solve improper integral of any kind using the known methods
- Applications of fundamental theorem of calculus
- Solving beta and gamma functions

Unit I Riemann Integration

[20 Lectures]

Introduction, Partition of a closed interval ,Norm of partition, upper and lower Darboux's sums , oscillatory sum, upper and lower Riemann integrals, Riemann integrals , Darboux's theorem ,Necessary and sufficient condition of Inerrability, some classes of bounded integrable functions. Riemann sum integral as the limit of sum, examples using Riemann sum, Properties of Riemann Integral and First Fundamental Theorem of Integral Calculus.

Unit II Improper integrals

[13 Lectures]

Finite and infinite intervals, bounded functions, proper integral, improper integral, improper integral as the limit of proper integral, test of convergence of $\int_a^{\infty} f(x) dx$ at $x=a$, general test for convergence, Cauchy's test, absolute convergent.

Unit III Beta and Gamma functions

[12Lectures]

Beta functions, convergence of Beta functions, properties of beta function, Gamma function, convergence of gamma functions, recurrence formula for gamma function ,relation between beta and gamma functions(only statements), and duplication formula .

Textbook: Real Analysis by N.P. Bali Golden math series

Scope: Unit I : Chapter 9 – 9.1 to 9.14 ,9.12 (Theorem 3 and 4 only statements)9.16 (only Statements except Theorem 15)

Unit II : Chapter 11 – 11.1 to 11.8

Unit III : Chapter 12 – Complete

Reference Books:

- 1) Introduction to real analysis by Robert G. Bartle, Donald R Sherbert Third edition John wiley & sons publications.
- 2) Advanced Engineering Mathematics by H.K.Das S.Chand and company ltd.
- 3) Elements of real analysis by Shanti Narayan & M.D.Raisinghania ,revised edition S.Chand and company Ltd
- 4) Mathematical Analysis by S.C.Malik & Savita Arrora S.Chand and company ltd.
- 5) Methods of Real Analysis by R.R.Goldberg
- 6) Mathematical analysis and applications by J .V.Deshpande, Narosa publishing House.
- 7) Advanced Calculus by David Widder
- 8) Lectures on Analysis By T.M.Karade, J.N.Salunke, K.S.Adhav, M.S.Bendre (Sonu Nilu Publication)

Course Code: U-MAT-241
CCMP-2

Laboratory Course-II

Credits:01	Algebra using MATLAB Marks : 50	Total Hours : 45
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Learning Objectives:

- Introduction Matlab with input-output file types.
- Matlab in Elementary Number Theory.
- Matrix Algebra Using Matlab.

Course Outcomes

- Students can apply Matlab for elementary number theory problem .
- They are able to write program code in Matlab for matrix algebra

Section – I Elementary Algebra

MATLAB Programming language in functions, Graphics, Computations external interface and tool boxes

Basics of Matlab: MATLAB windows, desktop command window, workspace figure and editor windows input-output file types.

Using Matlab code

- 1) Finding remainder after division.
- 2) Integer division with rounding option.
- 3) Return row vector containing the prime factors of n.
- 4) Factorial function.
- 5) Greatest common divisor and Least common multiple.
- 6) Binomial coefficients or all Combinations and Permutations
- 7) General list of prime numbers.
- 8) Complex numbers its arithmetic operations, Modulus and Argument.

Section – II Matrix Algebra:

Arrays & Matrices, determinant, transpose, rank, reduced row echelon, Trace, linear equation, eigen values, characteristic polynomial.

Reference Books:

- 3) **Matlab Software**
- 4) **Getting Started With MATLAB 7. - Rudra Pratap, Oxford University Press**

List of Practical's

Section – I Elementary Algebra

1. Finding remainder after division.
2. To round off a given number
3. To find factorial of given number
4. To find prime factors of given numbers
5. To find greatest common divisor
6. To find Least common multiple
7. To generate integer m and n such that $\gcd(a,b)=ma+nb$
8. To find binomial coefficients i.e. Pascal triangle
9. To generate the list of prime numbers
10. To study complex numbers and its arithmetic operations.
11. To find modulus and argument of given complex numbers

Section – II Matrix Algebra

1. To input row, column or any order matrix
2. To pick out any entry of given matrix
3. To input zero matrix, matrix with all entries equal of any order
4. To enter identity matrix of any order
5. To check singularity and non singularity of a given square matrix
6. To find row reduced echelon form
7. To find rank of matrix
8. To find trace of matrix
9. To solve given system of linear equations
10. To find Characteristic polynomial of a square matrix
11. To find Eigen values and Eigen vectors of a square matrix.

Notes

- Record book consisting set of 16 problems (08 from section 1 and 08 from section 2)
- Practical Examination will be held on at the end of second semester.