Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

BoS in Mathematics

Curriculum for

Level 4.5 B.Sc.-I (Mathematics)

Certificate Course in Mathematics

As per NEP -2020

Semester Pattern

w.e.f. 2023-2024

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

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 Level 4.5 B.Sc. I :** 12th Science with Mathematics

7. Strength of the Students: As per norms

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 norms

14. List of books recommended: Included in syllabus

15. List of Laboratory Equipment's, Instruments, Measurements etc.: MATLAB /LATEX/R/Python Software with one computer Lab with 20 pcs

16. Rules and regulations and ordinance if any: As per UGC/University/College rules

17. Medium of the language: English

18. Structure of the Course: Attached as Annexure 'A'

19. Allotment of workload (Theory/Practical): Attached as Annexure 'A'

20. Staffing pattern: As per Norms .

21. Intake capacity of students: As per UGC/University/College norms

22. Paper duration: Each theory paper is of 45 clock hours for major Course 60 clock hours for Minor course and GE/OE course and for practical is of 30 clock hours per semester.

23. To be introduced from: **B.Sc. I(Major Mathematics) from June 2023.**

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

List of BoS Member (2021-2024)

1. Dr. Bhalchandra D. Karande (VC Nominee)
   Head and Associate Professor
   Department of Mathematics,
   Maharashtra Udaygiri Mahavidyalaya,Udaygiri Dist. Latur
2. Dr. S. D. Kendre (Subject Expert)
   Associate Professor ,Department of Mathematics,
   Savitribai Phule Pune University, Pune
3. Dr. M. T. Gophane (Subject Expert)
   Department of Mathematics
   Shivaji University, Kolhapur.
4. Dr. Nitin S Darkunde, (co-option)
   School of Mathematical Sciences, S. R. T. M. U Nanded
5. Dr. A A Yadav (Other members of the staff of the same faculty.)
   R S M, Latur
6. Prof. S. M. Shinde (Student Alumni)
   Government College of Engineering, Amravati, Dist. Amaravati
7. Mr. S. S. Ranmal (Industry Expert)
   Sungrace Computers Pvt Ltd, Pune
8. Prof. Nishank S. Pimple
   Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
9. Mr. N. D. Kapale
   Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
10. Miss. Shivkanya D. Shinde
    Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
11. Mr. Shubham B. Khose
    Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

Program Outcomes:

On Successful B.Sc (Mathematics Major) students of this institute will gain lifelong skills, including following:

PO-1. Develop their mathematical knowledge and oral, written, and practical skills in a way which encourages confidence and provides satisfaction and enjoyment.

PO-2. Confidence by developing a feel for numbers, patterns, and relationships.

PO-3. An ability to consider and solve problems and present and interpret results.

PO-4. To Develop Communication and reason using mathematical concepts.

PO-5. To understand mathematical principles and their applications.

PO-6. To develop the abilities to reason logically, to classify, to generalize and to prove.

PO-7. To acquire a foundation appropriate to their further study of mathematics and of other disciplines.

PO-8. To qualify IIT-JAM a higher education entrance in the subject of Mathematics.

PO-9. To do minor research in the field of Mathematics.

PO-10. To acquire knowledge Indian Knowledge System.

Annexure 'A'

Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

Department of Mathematics

Curriculum Structure with effect from June, 2023

SEMESTER WISE TITLES OF THE PAPER IN UG MATHEMATICS COURSE

B.Sc. I (Major Mathematics)

Program	Level	Semester (15 Weeks)	Course Code	Paper No	Title of the course	Prerequisites	Hours/ Week	Marks (50)		Credits
								In Sem	End Sem	
CERTIFICATE COURSE IN MATHEMATICS	4.5	Semester- I	U-MAT-	Paper-I	DSC1 (A): Topics in Algebra	Mathematics in XII	03	30	45	03
			U-MAT-	Laboratory Course -I	DSC1(B): Theory based Practical on DSC1(A)	Mathematics in XII	02	20	30	01
			U-MAT-	Paper-II	DSC2(A): Topics in Calculus	Mathematics in XII	03	30	45	03
			U-MAT-	Laboratory Course -II	DSC1(B): Theory based Practical o DSC2 (A)	Mathematics in XII	02	20	30	01
			Total Credits							**08**
		Semester- II	U-MAT-	Paper-III	DSC3(A): Analytical Geometry	Mathematics in XII	03	30	45	03
			Laboratory Course -II	Laboratory Course -III	DSC3 (B): Theory based Practical on DSC3(A)	Mathematics in XII	02	20	30	01

			U-MAT-	Paper-IV	DSC4(A): Integral Calculus (IKS Two Units)	Mathematics in XII	03	30	45	03
			Laboratory Course -II	Laboratory Course -IV	DSC4(B) Theory based Practical on DSC4(A)	Mathematics in XII	02	20	30	01
									Total Credits	**08**
Exist Option with Certificate with Additional 10 credits Bridge Course Corresponding to Skill-based and Vocational Courses on DSC										
B.Sc. II (Major Mathematics)										
Program	**Level**	**Semester (15 Weeks)**	**Course Code**	**Paper No**	**Title of the course**	**Prerequisites**	**Lectures/ Week**	**Marks (50)**		**Credits**
								In Sem	**End Sem**	
DIPLOMA IN BASIC THEMATICS	5.0	Semester -III		Paper-V	DSC5 (A) : Real Analysis	Certificate Course in Basic Mathematics	03	30	45	03
				Laboratory Course -III	DSC5(B): Theory based Practical on DSC5(A)	Certificate Course in Mathematics	02	20	30	01
				Paper-VI	DSC 6(A) : Group Theory	Certificate Course in Mathematics	03	30	45	03
				Laboratory Course -IV	DSC36(B): Theory based Practical on DSC6(A)	Certificate Course in Mathematics	02	20	30	01
						Total Credits				**06**
		Semester- IV		Paper-VII	DSC7(A): Ordinary Differential Equation	Certificate Course in Mathematics	03	30	45	03

				Paper-VIII	DSC7(B): Theory based Practical on DSC7(A)	Certificate Course in Basic Mathematics	02	20	30	01
				Paper-X	DSC8(A): Ring Theory	Certificate Course in Mathematics	03	30	45	03
					DSC8(B): Theory based Practical on DSC8(A)		02	20	30	01
			Total Credits							**08**
Exist Option with Diploma with Additional 10 credits NSQF course and Internship										

Level 4.5 (B. Sc. – I [Mathematics])

Semester I

DSC 1(A):

U-MAT-

Paper-I Topics in Algebra

Total Hours: 45hrs Maximum Marks: 75 Total Credit :03

Learning Objectives:

- Set, Relations and types of function
- Euclidian algorithm and Properties of congruence's
- Determinants, Cofactor, Minor Adjoint of matrix of square Matrix.
- Solutions to linear systems
- Applications of Caley Hamilton theorem.

Course Outcomes:

After successful completion of this course students can

- Sort out one-one, onto, into, many one types of functions
- Apply induction principle
- Apply Division Algorithm
- Handle Elementary Linear algebra problems

Unit I Sets Relations and Functions [8 Hours]

Sets, Relations, Equivalence relations, Equivalence classes and partitions of set Functions, Basic terminology, Types of Functions, Inverse of a Function, Composition of Functions .

Unit II Elementary number theory [8 Hours]

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.

Unit III Rank of Matrix [7 Hours]

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.

Unit IV System of Linear Equations [7 Hours]

Linear equations, equivalent system, system of homogeneous and non-homogeneous equations, Characteristic Roots , Caley Hamilton theorem and applications .

Recommended Book:

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

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 Seymor Lipschut z (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.Apstol Springer Verlang,New York.

Level 4.5 (B. Sc. – I [Mathematics])

Semester I

DSC 1(B): U-MAT-

Laboratory Course-I

Theory based Practical on DSC1(A))

Total Hours: 30hrs **Maximum Marks :50** **Total Credit :01**

Learning Objectives:

- Types of functions
- Determinants, Cofactor, Minor Adjoint of matrix of square Matrix.
- Solutions to linear systems and an applications of Caley Hamilton theorem.

Course Outcomes:

- After successful completion of this course students can able to
- Sort out one-one, onto, into, many one types of functions
- Apply induction principle and Division Algorithm
- Handle Elementary Linear algebra problems

Note : For Each of the following at least three examples should cover

List of Practical's

1. To compute various equivalence classes for given relation
2. To find number of relations, functions, and their types.
3. To find inverse and composition of the functions.
4. To apply division algorithm for computing greatest common divisor.
5. To discuss basic properties of congruences.
6. To compute rank, row rank and column rank of matrix
7. To compute row Echelon form and reduced Echelon form of given matrix
8. To solve system of linear equations (Homogeneous and non-homogeneous).
9. To find eigen values and eigen vectors of given matrix.
10. To apply Caley Hamilton theorem.

Recommended Book:

4. A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House

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

6. Topics in Algebra By Om. P. Chug, K. Prakash, A.D.Gupta Anmol Pub., Pvt Ltd New Delhi.

Reference Books:

6) A text books of matrices, By Shanti Narayan (S. Chand & Company Ltd) Ram Nagar, New Delhi 11055

7) Theory and Problems of linear Algebra, third edition by Seymor Lipschut z (Tata McGraw Hill)

8) Matrix & Linear Algebra by K.B. Datta, DHI Pub.

9) An Introduction to theory of numbers 5th Edition John Wiley & Sons By I. Niven, H. Zuckerman V.H.L. Mantgomery.

10) Introduction to analytical number theory by T.M.Apstol Springer Verlang,New York.

Level 4.5 (B. Sc. – I [Mathematics])

Semester I

DSC 2(A):

U-MAT-

Paper-II

Topics in Calculus

Total Hours: 45 hrs Maximum Marks :75 Total Credit :03

Learning Objectives:

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

Course Outcomes

After successful completion of this course students can able to

- Find limit points, interior points, exterior points, boundary points of sets
- Find LUB, GLB apply the definition of limit and continuity.
- Handle the problems on Continuity as well as uniform Continuity
- Apply Mean Value Theorems

Unit I: The Real Numbers: [8 Hours]

The Real numbers system: Introduction, R as complete order field Bounded and unbounded sets Supremum, Infimum, Order completeness of 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 [9 Hours]

Algebraic operations on functions, bounded and unbounded functions, limit of a function, algebra of limits, one sided limit, limits at infinity and infinite limit's 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 Derivatives **[7 Hours]**

Derivability of a function, Algebra of derivatives, geometrical meaning of derivative, sign of derivative at a point, Darboux's theorem,

Unit IV: Mean Value Theorems **[6 Hours]**

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.

Recommended Book:

1. Elements of Real Analysis, By Shanti Narayan and M.D. Raisinghania. (Revised edition) S. Chand and company Ltd.

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, Mc Graw 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. Mathematical analysis and applications by J V. Deshpande, Narosa publishing House.

Level 4.5 (B. Sc. – I [Mathematics])

Semester I

DSC 2(B): U-MAT-

Laboratory Course-I

Theory based Practical on DSC2(A))

Total Hours: 30hrs Maximum Marks :50 Total Credit :01

Learning Objectives:

- To Compute limit points, interior point ,supremum and infimum of given set
- Problems on concepts of limit and Continuity through $\in -\delta$ notations
- Problems on Mean Value theorem and its applications

Course Outcomes:

- Find limit points, interior points, exterior points, boundary points of sets
- Find LUB, GLB apply the definition of limit and continuity.
- Handle the problems on Continuity, uniform Continuity and MVT's.

Note : For Each of the following at least three examples should cover

List of Practical's

1. To find supremum and infimum of given set.
2. To find limit points of a set.
3. To discuss nature of set as open or closed.
4. To find interior, exterior, frontier and boundary points of given set.
5. To discuss countability and uncountability of given sets.
6. To compute limit of given functions.
7. To discuss continuity and differentiability of given function.
8. To solve examples on MVT.
9. To apply Generalized MVT.
10. To discuss whether given function is increasing or decreasing.

Recommended Books:

1. A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House

2. Elements of Real Analysis, By Shanti Narayan and M.D. Raisinghania. (Revised edition) S. Chand and company Ltd.

Reference 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, Mc Graw Hill, 1976

4) Mathematical analysis and applications by J V. Deshpande, Narosa publishing House.

5) Real Analysis by N. P. Bali Golden Math's series

6) Mathematical Analysis by S.C. Malik & Savita Arrora S. Chand and company Ltd. (Second Edition)

Level 4.5 (B. Sc. – I [Mathematics])

Semester II

DSC 3(A): U-MAT-

Paper-III

Analytical Geometry

Total Hours: 45hrs Maximum Marks: 75 Total Credit :03

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

After successful completion of this course students can able to

- Study Geometry of two dimensions
- Analyze geometry of two dimensions
- Find angle between two spheres
- Distinguish equations of different types of conics

Unit I: Analytical Geometry of Two Dimensions [8 Hours]

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 [8 Hours]**

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

Unit III: **The Right Line [7 Hours]**

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 IV: Sphere, Cones and Cylinder [7 Hours]

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.

Recommended Books:

1. Analytical Geometry of Two and Three Dimensions, Qazi Zameeruddin;(Narosa Publ.)
2. Analytical Solid Geometry, By Shanti Narayan, S. Chand and Co.

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.

Level 4.5 (B. Sc. – I [Mathematics])

Semester II

DSC 3(B): U-MAT-

Lab Course -III

Theory Based Practical on Analytical Geometry

Total Hours: 30hrs Maximum Marks:50 Total Credit :01

Learning Objectives:

- To study shift of origin concept, Equation of the locus
- To find Symmetric and unsymmetrical form of a line
- To learn equations of a Sphere, Cone, right circular cone, Cylinder and right
- To learn Circular Cylinder.

Course Outcomes

After successful completion of this course students can able to

- Study Geometry of two dimensions
- Analyze geometry of two dimensions
- Find angle between two spheres
- Distinguish equations of different types of conics

Note : For Each of the following at least three examples should cover

List of Practical's

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.

Recommended Books:

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

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

Reference Books:

2) 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)

6) A text book of Analytical Geometry of three dimensions, By P. K Jain and Khalil Ahmed, (Wiley Eastern Ltd, 1999.)

7) Analytical Solid Geometry by Shantinarayan.

Level 4.5 (B. Sc. – I [Mathematics])

Semester II

DSC 4(A): U-MAT-

Paper-IV

Integral Calculus

Total Hours: 30hrs Maximum Marks: 50 Total Credit :02

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
-

Course Outcomes:

After successful completion of this course students can able to

- Students can learn integration through infinite sum.
- Applications of fundamental theorem of calculus

Unit I Riemann Integration [8 Hours]

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 Integrability.

Unit II Classes and Properties of Riemann Integral [7 Hours]

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 III Mathematics in the Vedas and Sulva sutra [8 Hours]

Mathematical references in Vedas, The extant Sulbasutra texts & their commentaries. The meaning of the word Sulbasutra, Qualities of a Sulbasutra. Finding the cardinal directions.

Methods for obtaining perpendicular bisector. Bodhāyana's method of constructing a square. The Bodhāyana Theorem (so-called Pythagoras Theorem)

Unit -IV Mathematics in the Vedas and Sulva sutra(Continued ...) [7 Hours]

Applications of Bodhayana Theorem. Constructing a square that is the difference of two squares. Transforming a rectangle into a square. To construct a square that is n times a given square. Transforming a square into a circle (approximately measure preserving). Rational approximation for $\sqrt{2}$. Construction of Cities. Details of fabrication of bricks, etc.

Recommended Book:

1. Real Analysis by N.P. Bali Golden Math's Series
2. B. Datta and A. N. Singh, History of Hindu Mathematics, 2 Parts, Lahore 1935, 1938;

   Reprint, Asia Publishing House, Bombay 1962; Reprint, Bharatiya Kala Prakashan, Delhi 2004.

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 ArroraS.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)

9)C. N. Srinivas Iyengar, History of Indian Mathematics, The World Press, Calcutta 1967.

10) T. A. Saraswati Amma, Geometry in Ancient and Medieval India, Motilal Banarsidass, Varanasi 1979.

10) S. Balachandra Rao, Indian Mathematics and Astronomy: Some Landmarks, 3rd Ed. Bhavan's Gandhi Centre, Bangalore 2004.

11) G. G. Emch, M. D. Srinivas and R. Sridharan, Eds., Contributions to the History of

Mathematics in India, Hindustan Book Agency, Delhi, 2005.
12) C. S. Seshadri, Ed., Studies in History of Indian Mathematics, Hindustan Book Agency, Delhi 2010.
13)G. G. Joseph, Indian Mathematics Engaging the World from Ancient to Modern Times, World Scientific, London 2016.
14)P. P. Divakaran, The Mathematics of India Concepts Methods Connections, Hindustan Book Agency 2018. Rep Springer New York 2018.
15) Gaṇitayuktibhāṣā (c.1530) of Jyeṣṭhadeva (in Malayalam), Ed. with Tr. by K. V. Sarma withExplanatory Notes by K. Ramasubramanian, M. D. Srinivas and M. S. Sriram, 2 Volumes, Hindustan Book Agency, Delhi 2008.
16) History Of Hindu Mathematics: A Source Book (Part- I-Numeral Notation And Arithmetic) Avadhesh Narayan Singh Bibhutibhusan Datta

Level 4.5 (B. Sc. – I [Mathematics])

Semester II

DSC 4(B): U-MAT-

Theory based Practical on DSC4(A)

Total Hours: 30hrs Maximum Marks: 50 Total Credit :01

Learning Objectives:

- To Know about Upper and Lower Darboux's sums
- To know the conditions of Riemann Inerrability and Different types of bounded integrable functions.
- To solve Improper Integral with finite and unbounded range and Beta and Gamma functions as an application of Improper Integral.

Course Outcomes

After successful completion of this course students can able to

- learn integration through infinite sum.
- apply fundamental theorem of calculus
- study Indian knowledge system
- transform a square into a circle

Note : For Each of the following practical's at least three examples should cover .

List of Practical's

1. To compute U(P,f) and L(P,f) for given function
2. To compute Oscillatory Sum $\omega(P, f)$
3. To check given function is R-integrable .
4. To compute Riemann, sum integral as the limit of sum.
5. To apply first fundamental theorem of Integral Calculus.
6. To Compute Riemannian Sum of given bounded function
7. To Find directions of Cardinal Number .
8. To study Bodhayana Method of constructing Square
9. To find rational approximation of $\sqrt{2}$

10. To transform square into circle

Recommended Book:

3. Real Analysis by N.P. Bali Golden Math's Series

4. B. Datta and A. N. Singh, History of Hindu Mathematics, 2 Parts, Lahore 1935, 1938;

   Reprint, Asia Publishing House, Bombay 1962; Reprint, Bharatiya Kala Prakashan, Delhi 2004.

Reference Books:

4) Introduction to real analysis by Robert G. Bartle, Donald R Sherbert Third edition John wiley & sons' publications.
5) Advanced Engineering Mathematics by H.K. Das S. Chand and company ltd.
6) 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 ArroraS.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)

9)C. N. Srinivas Iyengar, History of Indian Mathematics, The World Press, Calcutta 1967.

10) T. A. Saraswati Amma, Geometry in Ancient and Medieval India, Motilal Banarsidass, Varanasi 1979.

10) S. Balachandra Rao, Indian Mathematics and Astronomy: Some Landmarks, 3rd Ed. Bhavan's Gandhi Centre, Bangalore 2004.

11) G. G. Emch, M. D. Srinivas and R. Sridharan, Eds., Contributions to the History of Mathematics in India, Hindustan Book Agency, Delhi, 2005.

12) C. S. Seshadri, Ed., Studies in History of Indian Mathematics, Hindustan Book Agency, Delhi 2010.

13)G. G. Joseph, Indian Mathematics Engaging the World from Ancient to Modern Times, World Scientific, London 2016.

14)P. P. Divakaran, The Mathematics of India Concepts Methods Connections, Hindustan Book Agency 2018. Rep Springer New York 2018.
15) Gaṇitayuktibhāṣā (c.1530) of Jyeṣṭhadeva (in Malayalam), Ed. with Tr. by K. V. Sarma withExplanatory Notes by K. Ramasubramanian, M. D. Srinivas and M. S. Sriram, 2 Volumes, Hindustan Book Agency, Delhi 2008.
16) History Of Hindu Mathematics: A Source Book (Part- I-Numeral Notation And Arithmetic) Avadhesh Narayan Singh Bibhutibhusan Datta

Level 4.5 B.Sc-I (Sem-I)

Minor Mathematics

Paper -I

Fundamentals of Mathematics

Total Hours: 60hrs Maximum Marks: 100 Total Credit :04

Learning Objectives:

- To study Graph of Equations
- To discuss symmetry of Graph along X axis or Y axis
- To find limit of given function
- To discuss continuity of given function
- To study derivatives of function and their applications

Course Outcomes: After Successful completion of this course students can able to

- Compute distance formula ,midpoint formula ,equation of lines ,parallel lines and perpendicular lines
- Find symmetry of graphs
- Discuss limit and continuity of given function'
- Apply derivative

Unit-I Coordinates Systems and Graphs of Equations [13 Hours]

The coordinate of a point on a line, Absolute value, Coordinate of a point in a plane, Distance formula, Midpoint Formulas, Graphs of equation, Straight line, Slope, Equation of a line, parallel lines, perpendicular lines.

Unit-II Intersection of Graphs, Symmetry and Functions [15 Hours]

Intersection of graphs, Symmetry, Symmetry about a line, Symmetry about a point, Functions and their graphs, Notation of a function, Intervals, Even and Odd functions, Zeros of polynomial.

Unit-III Limit and Continuity [16 Hours]

Limits, Properties of limits, Existence or Non-existence of a limit, One sided limit, Infinite limits, limits at infinity, Continuity, Definition and properties of continuity, One sided continuity, Continuity over a closed interval.

Unit-IV Derivatives and Applications [16 Hours]

The slope of tangent line, Derivative, Differentiability and Continuity, Further rules for derivatives, Maximum and Minimum problems, Relative Extrema, Absolute Extrema, Chain rule, Composite Function, Implicit differentiation.

Reference Books:

1.Elliott Mendelson, Schaum's Outline of Theory and problems of "Beginning Calculus" Second edition, Tata McGraw-Hill publishing company limited.

2.Joseph Edwards, "Differential Calculus for Beginners", Arahant publication.

3) "Thomas' Calculus By George B. Thomas

4) Introduction to Calculus By J. H. Heinbockel

5) Calculus and Analytical Geometry by "George B. Thomas, Jr. And Ross L. Finney" (Pearson)

6) Textbook of Analytical geometry of two dimension By "P.K Jain. Khalil Ahemad. "

Level 4.5 B.Sc-I (Sem-II)

Minor Mathematics

Paper -II

Fundamentals of Statistics

Total Hours: 60hrs Maximum Marks: 100 Total Credit :04

Learning Objectives:

- To understand fundamental concepts in Statistics
- To study Frequency Distributions
- To understands three measures of central tendency
- To study range and variation of data

Course Outcomes: After Successful completion of this course students can able to

- Do tabular and graphical representation of data based on variables.
- Compute Mean, Mode, Median .
- Understand Measures of central tendency, Dispersion, Skewness and Kurtosis.
- Conduct basic statistical analysis of data.

Unit-I: Variables and Graphs [15 Hours]

Statistics, Population and sample; Inductive and Descriptive statistics, Variables; Discrete and continuous, Rounding of Data, Scientific Notation, Significant Figures, Computations, Functions, Rectangular Coordinates, Graphs, Equations, Inequalities, Logarithms, Antilogarithms, Computations using Logarithms.

Unit-II: Frequency Distributions [10 Hours]

Raw Data, Arrays, Frequency Distributions, Class Intervals and Class Limits, Clas Boundaries, Size of a Class Interval, Class Mark, General Rules for Forming Frequency Distributions, Histograms and Frequency Polygons, Relative Frequency Distributions, Cumulative-Frequency Distributions and Ogives, Relative Cumulative-Frequency Distributions and Percentage Ogives, Frequency Curves and Soothed Ogives, Types of Frequency Curves.

Unit-III: Mean, Median, Mode and Others Measures of Central Tendency [20 Hours]

Index, Notation, Summation Notation, Averages, or Measures of Central Tendency, Arithmetic Mean, Weighted Arithmetic Mean, Properties of the Arithmetic Mean, Arithmetic Mean Computed From Grouped Data , Median, Mode, Empirical Relation Between Mean, Median and Mode, Geometric Mean G, Harmonic Mean H, Relation Between Arithmetic, Geometric, Harmonic Means, Root Mean Square, Quartiles, Deciles, Percentiles.

Unit-IV: Standard Deviation, Moments, Skewness and Kurtosis [15 Hours]

Dispersion, or Variation, Range, Mean Deviation, Semi-Interquartile Range, 10-90 Percentile Range, Standard Deviation, Variance, Short Method for Computing the Standard Deviation, Properties of Standard Deviation, Charlier's Check, Sheppard's Correction for Variance, Empirical Relation Between Measures of Dispersion, Absolute and Relative Dispersion ; Coefficients of Variation, Standard Variable; Standard Scores, Moments, Moments for Grouped Data, Relation Between Moments, Computation of Moments for Grouped Data, Charlier's Check and Sheppard's Corrections, Moments in Dimensionless Form, Skewness, kurtosis, population Moments, Skewness and Kurtosis.

Reference Books

1. Murray R. Spiegel, Larry J. Stephens, "Theory and problems of Statistics", Tata McGraw-Hill Publishing Company limited.

2. S.C.Gupta , V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and sons private limited.

Level 4.5 B.Sc-I (Sem-I)

Generic Elective/Open Elective

Paper -I

Quantitative Aptitude and Logical Reasoning

Total Hours: 60hrs Maximum Marks: 100 Total Credit :04

Learning Objectives

The purpose of this course is to meet the needs of the graduating students and familiarize them with the kind of questions that are regularly asked about numeric aptitude and logical reasoning in various exams and campus interviews.

Course Outcome

On successful completion of the course the students will be able to:

- Have a basic understanding of mathematical skills;
- Have a basic understanding of logical thinking
- Complete campus placements aptitude tests encompassing Quantitative Ability and Logical Thinking Ability.
- Develop a suitable level of reasoning proficiency.
- Take part in several tests for competitive employment, such as the CAT, CMAT, GRE, GATE, UPSC, etc.

UNIT – I Quantitative Ability (**Basic Mathematics**) [**15 Hours]**

Number Systems, LCM and HCF, Decimal Fractions, Simplification, Square Roots and Cube Roots, Average, Problems on Ages, Surds & Indices, Percentages, Problems on Numbers

UNIT – II Quantitative Ability (Applied & Engineering Mathematics) [15 Hours]

Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and , Compound Interest, Time, Speed and Distance, Time & Work, Ratio and Proportion, Area, Mixtures and Allegation

UNIT – III Basic Calculus for Life Sciences [15 Hours]

Limit, Continuity, Rate of Change, Derivative and techniques to find derivatives, Integration: definite, indefinite, IBP

UNIT – IV Logical Reasoning (Deductive Reasoning) [15 Hours]

Analogy, Blood Relation, Directional Sense, Number and Letter Series, Coding – Decoding Venn Diagrams, Seating Arrangement, Syllogism

Reference Books:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Schaum's Outline of Precalculus, 1st Edition, McGraw-Hill Education.
5. Analytical and Logical reasoning for CAT and other management entrance test BySijwali B S
6. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4 th edition
7. https://prepinsta.com/
8. https://www.indiabix.com/
9. https://www.javatpoint.com/

Level 4.5 B.Sc-I (Sem-II)

Generic Elective/Open Elective

Paper -II

Vedic Mathematics

Total Hours: 60hrs Maximum Marks: 100 Total Credit :04

Learning Objectives:

- Foster love for maths and remove its fear through Vedic Mathematics
- Enhance computation skills in students through Vedic Mathematics
- Develop logical and analytical thinking
- Promote joyful learning of mathematics
- Discuss the rich heritage of mathematical temper of Ancient India

Course Outcomes: After Successful completion of this course students can able to

- Do basic mathematics faster and with ease.
- Get Familiar with the mathematical underpinnings and techniques.
- Speak on Mathematical advancements of Ancient India.
- Improve his critical thinking

Unit I Vedic Sutras and Compound Multiplication [15 Hours]

Actual Applications of the Vedic Sutras, Arithmetical Computations Multiplication, Practical Application in "Compound Multiplication" Practice and Proportion in Compound Multiplication Division by the Nikhilam method.

Unit II Division and Factorization

[15 Hours]

Division by the Paravartya method, Argumental Division Linking note (Recapitulation and Conclusion),Factorisation (of Simple Quadratics), Factorisation (of Harder Quadratics)

Unit III HCF and Quadratic, Cubic Equations [15 Hours]

Factorisation of Cubic's etc. Highest Common Factor Simple Equations (First Principles) Simple Equations (by Sunyam etc.) Merger Type of Easy Simple Equations Complex Mergers Simultaneous Simple Equations Miscellaneous (Simple) Equations, Quadratic

Equations, Cubic Equations, Bi-quadratic Equations, Multiple Simultaneous Equations, Simultaneous Quadratic Equations

Unit IV Factorisation and Differential Calculus [15 Hours]

Factorisation and Differential Calculus, Partial Fractions, Integration by Partial Fractions, The Vedic Numerical Code, Recurring Decimals, Straight Division, Auxiliary Fractions, Divisibility and Simple Osculators, Divisibility and Complex Multiplex Osculators, Sum and Difference of Squares, Elementary Squaring, Cubing etc. Straight Squaring Vargamüla (Square Root) Cube Roots of Exact Cubes

Reference Books

1. Vedic Mathematics ,Jagadguru Swami Sri Bharati Krsna Tirthaji Maharaja
2. The Essential of Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi 2019.
3. Vedic Mathematics Made Easy, Dahaval Bathia, Jaico Publishing, New Delhi 2011
4. Vedic Mathematics: Sixteen Simple Mathematical formulae from the Vedas, Jagadguru Swami Sri Bharati Krishna Trithaji, Motilal Banarasidas, New Delhi 2015.
5. Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018.