Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર T. Y. B. Sc. Mathematics Sem. -5 & 6 ના અભ્યાસક્રમ અંગે ગણિતશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૨૧/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ થી કરેલ ભલામણને વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૧૪૯ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/સિલેબસ/૧૨૨૫૮/૨૦૨૫
તા.૨૬–૦૫–૨૦૨૫

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS
BACHELOR OF SCIENCE- NEP-2020-Mathematics
SEMESTER V AND VI
EFFECTIVE FROM –JUNE-2025-26

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12^{th} Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	• PO-01: Scientific Knowledge & Conceptual Understanding: Develop a strong foundation in scientific principles, theories and concepts across disciplines, fostering interdisciplinary learning, advance knowledge and problem-solving abilities. • PO-02: Analytical & Critical Thinking: Apply critical thinking and analytical reasoning to evaluate scientific data, hypotheses and real-world problems, leading to evidence-based conclusions. • PO-03: Research & Inquiry-based Learning: Develop investigative skills through experimentation, data analysis and scientific inquiry to contribute to research and innovation. • PO-04: Laboratory & Technical Skills: Gain hands-on experience with laboratory techniques, instrumentation and computational tools relevant to scientific research and industry applications. • PO-05: Digital & Computational Literacy: Utilize digital tools, computational techniques and emerging technologies such as AI, bioinformatics and statistical modelling to enhance scientific learning and problem-solving. • PO-06: Environmental & Societal Responsibility: Understand the role of science in addressing environmental, health and societal challenges, promoting sustainability and ethical responsibility. • PO-07: Effective Communication & Collaboration: Develop proficiency in scientific communication, both written and oral, for effective dissemination of knowledge while collaborating in multidisciplinary teams. • PO-08: Innovation & Entrepreneurship: Foster an entrepreneurial mind-set by applying scientific knowledge for innovation, technology development, and industry-oriented applications. Develop sustainable solutions to address real-world challenges in research and environmental management. • PO-09: Lifelong Learning & Professional Growth: Cultivate curiosity and adaptability for continuous learning, equipping students for higher education, research, and professional careers. • PO-10: Ethical Leadership & Value-based Education: Develop leadership qualities, ethical values, and a sense of responsibility in applying science for societal progress, aligning with Indian knowledge systems and global perspectives.
Program Specific Outcomes	• PSO1 : Develop and strengthen the fundamental core concepts that are

	required to solve complex problems • PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership • PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem • PSO4 : Develop students for self-learning and practicing challenging problem solution • PSO5 : Train students to apply mathematical skills for new investigation. • PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. • PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. • PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.

Mapping between POs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
PO1									
PO2									
PO3									
PO4									
PO5									
PO6									
PO7									
PO8									
PO9									
PO10									

Medium of Instruction	English
Program Structure	Semester 5 **(Major)**

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MH-MJ-501	Group Theory -1	2	0	2	1Hrs	25	25	50
MHP-MJ-501	Practical based on MH-MJ-501	0	4	2	6Hrs	25	25	50
MH-MJ-502	Ancient Indian Mathematics and Linear Algebra	2	0	2	1Hrs	25	25	50
MHP-MJ-502	Practical based on MH-MJ-502	0	4	2	6Hrs	25	25	50
MH-MJ-503	Real Analysis -1	2	0	2	1Hrs	25	25	50
MHP-MJ-503	Practical based on	0	4	2	6Hrs	25	25	50

	MH-MJ-503							
	Total	6	12	24				

Program Structure	Semester 6 **(Major)**

Course Code	**Title**	**Teaching per week**		**Course Credits**	**University Examination**		**Internal Marks**	**Total Marks**
		Theory	**Practical**		**Duration**	**Marks**		
MH-MJ-601	Group Theory -2	2	**0**	2	1Hrs	25	25	50
MHP-MJ-601	Practical based on MH-MJ-601	0	**4**	2	6Hrs	25	25	50
MH-MJ-602	Ancient Mathematics and Applied Linear Algebra	2	**0**	2	1Hrs	25	25	50
MHP-MJ-602	Practical based on MH-MJ-602	0	**4**	2	6Hrs	25	25	50
MH-MJ-603	Real Analysis -2	2	**0**	2	1Hrs	25	25	50
MHP-MJ-603	Practical based on MH-MJ-603	0	**4**	2	6Hrs	25	25	50
	Total	6	12	12				

Program Structure	Semester 5 **(Minor)**

Course Code	**Title**	**Teaching per week**		**Course Credits**	**University Examination**		**Internal Marks**	**Total Marks**
		Theory	**Practical**		**Duration**	**Marks**		
MH-ME-501	Numerical Methods -I	2	0	2	1Hrs	25	25	50
MHP-ME-501	Practical based on MH-ME-501	0	4	2	6Hrs	25	25	50
MH-ME-502	Matrix	2	0	2	1Hrs	25	25	50

	Algebra							
MHP-ME-502	Practical based on MH-ME-502	0	4	2	6Hrs	25	25	50
	Total	4	8	8				

Program Structure	Semester 6 **(Minor)**

Course Code	**Title**	**Teaching per week**		**Course Credits**	**University Examination**		**Internal Marks**	**Total Marks**
		Theory	**Practical**		**Duration**	**Marks**		
MH-ME-601	Numerical Methods -II	2	**0**	2	1Hrs	25	25	50
MHP-ME-601	Practical based on MH-ME-601	0	**4**	2	6Hrs	25	25	50
MH-ME-602	Statistical Methods	2	**0**	2	1 Hrs	25	25	50
MHP-ME-602	Practical based on MH-ME-602	0	**4**	2	6 Hrs	25	25	50
	Total	4	8	8				

Program Structure	Semester 5 **(SEC)**

Course Code	**Title**	**Teaching per week**		**Course Credits**	**University Examination**		**Internal Marks**	**Total Marks**
		Theory	**Practical**		**Duration**	**Marks**		
MH-SEC- 5001	Computer Oriented Numerical Methods-I	2	0	2	1Hrs	25	25	50
MH-SEC- 5002	Operations Research-I	2	0	2	1Hrs	25	25	50
	Total	4	0	4				

[Subject Code-2503000505013001]

B.Sc.Mathematics 5th Semester (Major)

Course: MH-MJ-501: Group Theory – I

Course Code	MH-MJ-501
Course Title	Group Theory – I
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theconcepts ofGroup Theory.
Course Objective	To make students acquainted with concepts of Group Theory
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of group theory. CO2 :Analyze Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 :Find Normal subgroup & Quotient groups, . CO4 : Recognize Congruence Relation in Group Lagrange's theorem and its applications CO5 :Determine Cosets and Order of an element CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host ofother disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■			■	■
CO3	■	■	■	■	■			
CO4	■	■	■	■				■
CO5	■	■	■	■	■			■
CO6						■	■	■

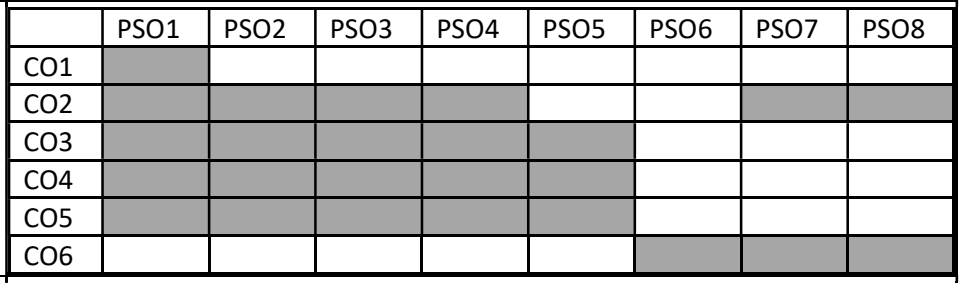
Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Definition of a Group, Examples of Group, elementary properties of a Group, Finite Groups. Subgroups, Cyclic Groups, Order of an element. **Unit II:** Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle, Normal subgroups & Quotient groups.
Reference Books	1. I. N. Herstein: Topics in Algebra, 2/e, Wiley Eastern Ltd. New Delhi, 2008. 2. I. H. Sheth : Abstract Algebra, 3/e, Nirav Prakashan, Ahmedabad, 2011. 3. N. S. Gopal Krishnan: University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition,1997.

	5. Shantinarayan:Modern Algebra, S. Chand &CoSerge Lang : Algebra, Addition Wesley,1993.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505013002]

B.Sc.Mathematics 5th Semester (Major)

Course: MHP-MJ-501: Practical based on MH-MJ-501

Course Code	MHP-MJ-501
Course Title	Practical based on MH-MJ-501
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Group Theory.
Course Objective	To make students acquainted with concepts of Group Theory
Course Outcomes	CO1 : Explain the insight of the Formation of group theory. CO2 :Analyze Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 :Find Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Congruence Relation in Group Lagrange's theorem and its applications CO5 :Determine Cosets and Order of an element CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Group and Elementary properties of the Group Practical-2 Special types of group Practical-3 Subgroup Practical-4 Cosets Practical-5 Lagrange's theorem Practical-6 Euler's theorem & Fermat's theorem

	Practical-7 Counting principle Practical-8 Normal subgroups & Quotient groups
Reference Books	1. I. N. Herstein: Topics in Algebra, 2/e, Wiley Eastern Ltd. New Delhi, 2008. 2. I. H. Sheth : Abstract Algebra, 3/e, Nirav Prakashan, Ahmedabad, 2011. 3. N. S. Gopal Krishnan: University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition,1997. 5. Shantinarayan:Modern Algebra, S. Chand &Co Serge Lang : Algebra, Addition Wesley,1993.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505023001]

B.Sc.Mathematics 5th Semester (Major)

Course: MH-MJ-502: Ancient Indian Mathematics and Linear Algebra

Course Code	MH-MJ-502
Course Title	Ancient Indian Mathematics and Linear Algebra
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Ancient Indian Mathematics and Linear Algebra .
Course Objective	To make students acquainted with concepts of Ancient Indian Mathematics and Linear Algebra
Course Outcomes	This course will enable the students to: CO1 : Explain the Ancient Indians. CO2 : Assimilate the Unique aspects of Indian MathematicsArithmetic:. CO3 :Verify Vector space, Subspace. CO4 : Elaborate Necessary and sufficient condition for a subspace. CO5 :Explain Properties of Vector Spaces and Subspaces. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■					■
CO4	■		■	■	■			■
CO5	■	■		■		■		■
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Ancient Indians- tryst with Mathematics, Unique aspects of Indian Mathematics Arithmetic: Square of a number, square root, square root of imperfect Square, Cubes. **Unit II:** Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Properties of Vector Spaces and Subspaces, Illustrations, Linear Combination, Span of a set
Reference Books	1. P. Mahadevan, Vinayak Rajat Bhatt, Nagendra Pavana R. N.: Introduction to Indian knowledge system Concepts and application, Eastern Economy edition, PHI Publication. 2. B. Datta, A. N. Singh: History of Hindu Mathematics - I & II, Asia Publishing House, 1962. 3. V. Krishnamurthy, V. P. Mainra& J. L. Arora: An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., NewDelhi. 4. I. H. Sheth : Linear Algebra, Nirav Prakashan. 5. S. Kumaresan : Linear Algebra, Prentice Hall of India,2000. 6. Serge Lang: Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 7. Balakrishnan: Linear Algebra, Tata-McGraw Hill Ed
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505023002]

B.Sc. Mathematics 5th Semester (Major)

Course: MHP-MJ-502: Practical based on MH-MJ-502

Course Code	MHP-MJ-502
Course Title	Practical based on MH-MJ-502
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Ancient Indian Mathematics and Linear Algebra.
Course Objective	To make students acquainted with concepts of Ancient Indian Mathematics and Linear Algebra.
Course Outcomes	This course will enable the students to: CO1 : Explain the Ancient Indians. CO2 : Assimilate the Unique aspects of Indian MathematicsArithmetic:.

	CO3 :Patterned Vector space, Subspace. CO4 : Elaborate Necessary and sufficient condition for a subspace. CO5 :Explain Properties of Vector Spaces and Subspaces. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Square of a number Practical-2 Square root Practical-3 Square root of imperfect Square Practical-4 Cubes Practical-5 Examples of Vector space & subspace Practical-6 Necessary and sufficient condition for a subspace Practical-7 Span of a set Practical-8 Union & Intersection, Sum & Direct sum of subspaces
Reference Books	1. P. Mahadevan, Vinayak Rajat Bhatt, Nagendra Pavana R. N.: Introduction to Indian knowledge system Concepts and application, Eastern Economy edition, PHI Publication. 2. B. Datta, A. N. Singh: History of Hindu Mathematics - I & II, Asia Publishing House, 1962. 3. V. Krishnamurthy, V. P. Mainra& J. L. Arora: An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., NewDelhi. 4. I. H. Sheth : Linear Algebra, Nirav Prakashan. 5. S. Kumaresan : Linear Algebra, Prentice Hall of India,2000. 6. Serge Lang: Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 7. Balakrishnan: Linear Algebra, Tata-McGraw Hill Ed
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505033001]

B.Sc. Mathematics 5th Semester (Major)

Course: MH-MJ-503: Real Analysis – I

Course Code	MH-MJ-503
Course Title	Real Analysis – I
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)

Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theconcepts ofReal Analysis.
Course Objective	To make students acquainted with concepts of Real Analysis
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the Sets and elements, Operations on sets,. CO2 : Assimilate the Functions, Real-valued functions. CO3 :Check convergent and divergent of sequence and series. CO4 : Elaborate Countable & Uncountable sets, Greatest lower bound and least upper bound. CO5 :Find Greatest lower bound and least upper bound. CO6 : Apply real analysis in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■					
CO4	■	■		■		■		■
CO5	■	■	■	■	■			
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Sets and elements, Operations on sets, Functions, Real-valued functions, Countable & Uncountable sets, Greatest lower bound and least upper bound. **Unit II:** Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub.Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik: Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505033002]

B.Sc. Mathematics 5th Semester (Major)

Course: MHP-MJ-503: Practical based on MH-MJ-503

Course Code	MHP-MJ-503
Course Title	Practical based on MH-MJ-503
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Real Analysis .
Course Objective	To make students acquainted with concepts of Real Analysis
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the Sets and elements, Operations on sets,. CO2 : Assimilate the Functions, Real-valued functions. CO3 :Check convergent and divergent of sequence and series. CO4 : Elaborate Countable & Uncountable sets, Greatest lower bound and least upper bound. CO5 :Find Greatest lower bound and least upper bound. CO6 : Apply real analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Sets and elements, Operations on sets Practical-2 Functions, Real-valued functions Practical-3 Countable & Uncountable sets Practical-4 Greatest lower bound and least upper bound Practical-5 Sequences & Sub-sequences of real numbers Practical-6 Limit of a sequence Practical-7 Convergent sequences Practical-8 Divergent sequences
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub.Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik: Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505063001]

B.Sc. Mathematics 5th Semester (SEC)

Course: MH-SEC- 5001: Computer Oriented Numerical Methods-I

Course Code	MH-SEC- 5001
Course Title	Computer Oriented Numerical Methods-I
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods
Course Outcomes	The course will enable the students to: CO1: Explain the insight of the Computer Oriented Numerical Methods. CO2 :Draw Flow charts for FORTRAN language CO3 : Compute the operations in expressions CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function. CO5 : Familiarize with operations in expressions CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Flow charts and symbols, more flow chart examples. FORTRAN Language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions). **Unit II:** Hierarchy of operations in expressions, Examples of Arithmetic expression. arithmetic statement.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■		■			■
CO3	■	■	■	■	■			
CO4	■	■	■	■				■
CO5	■	■	■	■	■			■
CO6						■	■	■

Reference Books	1. V. Rajaraman: Computer Programming in FORTRAN-77, PHI. 2. V. Rajaraman: Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta: Programming with FORTRAN-77, Wiley Eastern Ltd. 4. R. S. Salaria: Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar: FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy: FORTRAN based Algorithms, East-West Press, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505063002]

B.Sc. Mathematics 5th Semester (SEC)

Course: MH-SEC- 5002: Operations Research-I

Course Code	MH-SEC- 5002
Course Title	Operations Research-I
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Computer Oriented Numerical Methods .
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of Operations Research CO2 :Examine Basic, Non-basic, Degenerate, Non-degenerate and Basic feasible solutions of LPP. CO3: Find Graphical solution of Linear Programming Problem. CO4: Elaborate Slack and Surplus variable. CO5: Draw the graph of Linear Programming Problem. CO6 : Apply Operations Research in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■			■	■
CO3	■	■	■	■	■			
CO4	■	■		■		■		■
CO5	■	■	■		■			■
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:**

	Graphical solution of Linear Programming Problem (LPP). Definition of the Dual Problem, General rules for converting any Primal Problem into its dual, The symmetric Dual Problems. **Unit II:** Basic concept of Basic, Non-basic, Degenerate, Non-degenerate and Basic feasible solutions of LPP, Slack & Surplus variables,
Reference Books	1. J. K. Sharma: Operations Research: Theory & Applications, McMillan India Ltd.,1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan: Operations Research, S. Chand & Sons, New Delhi,1998. 3. G. Hadley: Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath&Co. 5. P. M. Karak: Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta. 6. K. V. Mittal & L. Mohan: Optimization methods in O.R. and System Analysis, New Age InternationalPublications. 7. Goel & Mittal : O.R., PragatiPrakashan,Meerut.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc.70% External based on semester end University examination

[Subject Code-2603000506013001]

B.Sc. Mathematics 6th Semester (Major)

Course: MH-MJ-601: Group Theory – II

Course Code	MH-MJ-601
Course Title	Group Theory – II
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Group Theory .
Course Objective	To make students acquainted with concepts of Group Theory
Course Outcomes	The course will enable the students to: CO1: Explain the insight of the Homomorphism and Isomorphism. CO2 :Analyze Isomorphic groups CO3 : Learn about Fundamental theorem ofhomomorphism, Automorphism CO4 :Explain Cayley's theoremand its applications CO5:Determine Permutation Groups, Orbit& Cycles, even permutation, odd permutation, Alternating Group. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem ofhomomorphism, Automorphism, Cayley's theorem. **Unit II:** Permutation Groups, Orbit& Cycles, even permutation, odd permutation, Alternating Group.
Reference Books	1. I. N. Herstein: Topics in Algebra, 2/e, Wiley Eastern Ltd. New Delhi, 2008. 2. I. H. Sheth : Abstract Algebra, 3/e, Nirav Prakashan, Ahmedabad, 2011. 3. N. S. Gopal Krishnan: University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, 5. Cambridge University Press, Indian Edition,1997. 6. Shantinarayan :Modern Algebra, S. Chand &Co. 7. Serge Lang : Algebra, Addition Wesley,1993.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2603000506013002]

B.Sc. Mathematics 6th Semester (Major)

Course: MHP-MJ-601: Practical based on MH-MJ-601

Course Code	MHP-MJ-601
Course Title	Practical based on MH-MJ-601
Credit	2

Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Group Theory .
Course Objective	To make students acquainted with concepts of Group Theory
Course Outcomes	The course will enable the students to: CO1: Explain the insight of the Homomorphism and Isomorphism. CO2 :Analyze Isomorphic groups CO3 :Verifyhomomorphism, Automorphism CO4 :Explain Cayley's theorem and its applications CO5 : Determine Permutation Groups, Orbit& Cycles, even permutation, odd permutation, Alternating Group. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Homomorphism Practical-2 Isomorphism Practical-3 Automorphism Practical-4 Cayley's theorem Practical-5 Permutation Groups Practical-6 Properties of Permutation Groups Practical-7 Special types of Permutation Practical-8 Alternating Group
Reference Books	1. I. N. Herstein: Topics in Algebra, 2/e, Wiley Eastern Ltd. New Delhi, 2008. 2. I. H. Sheth : Abstract Algebra, 3/e, Nirav Prakashan, Ahmedabad, 2011. 3. N. S. Gopal Krishnan: University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, 5. Cambridge University Press, Indian Edition,1997. 6. Shantinarayan :Modern Algebra, S. Chand &Co. 7. Serge Lang : Algebra, Addition Wesley,1993. 8. Surjeet &KaziZameeruddin : Modern Algebra, Vikas Publishing House
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc.70% External based on semester end University examination

[Subject Code-2603000506023001]

B.Sc. Mathematics 6th Semester (Major)

Course: MH-MJ-602: Ancient Mathematics and Applied Linear Algebra

Course Code	MH-MJ-602
Course Title	Ancient Mathematics and Applied Linear Algebra
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Ancient Mathematics and Applied Linear Algebra .
Course Objective	To make students acquainted with concepts of Ancient Mathematics and Applied Linear Algebra
Course Outcomes	This course will enable the students to: CO1: Explain the Numeral Terminology. CO2 : Assimilate the Development of Numerical Symbolism, Series and Progression, Sum of the series of square and cubes, Repetition summation of series. CO3: Find Union and intersection of subspaces. CO4: Elaborate Sum and Direct sum of subspaces. CO5: Examined linearly dependent and independent vectors. CO6 : Apply Linear Algebra in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Numeral Terminology, The Development of Numerical Symbolism, Series and Progression, Sum of the series of square and cubes, Repetition summation of series. Geometry: Properties of right-angled triangle in Sulba Sutras. **Unit II:** Union and intersection of subspaces, Sum and Direct sum of subspaces, linearly dependent and independent vectors, Verification of Linear dependence or independence.

Reference Books	1. P. Mahadevan, Vinayak Rajat Bhatt, Nagendra Pavana R. N.: Introduction to Indian knowledge system Concepts and application, Eastern Economy edition, PHI Publication. 2. B. Datta, A. N. Singh: History of Hindu Mathematics - I & II, Asia Publishing House, 1962. 3. V. Krishnamurthy, V. P. Mainra& J. L. Arora: An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 4. I. H. Sheth: Linear Algebra, Nirav Prakashan. 5. S. Kumaresan: Linear Algebra, Prentice Hall of India, 2000. 6. Serge Lang: Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 7. Balakrishnan: Linear Algebra, Tata-McGraw Hill Ed
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc.70% External based on semester end University examination

[Subject Code-2603000506023002]

B.Sc. Mathematics 6th Semester (Major)

Course: MHP-MJ-602: Practical based on MH-MJ-602

Course Code	MHP-MJ-602
Course Title	Practical based on MH-MJ-602
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Ancient Mathematics and Applied Linear Algebra.
Course Objective	To make students acquainted with concepts of Ancient Mathematics and Applied Linear Algebra
Course Outcomes	This course will enable the students to: CO1: Explain the Numeral Terminology. CO2 : Assimilate the Development of Numerical Symbolism, Series and Progression, Sum of the series of square and cubes, Repetition summation of series. CO3: Find Union and intersection of subspaces. CO4: Elaborate Sum and Direct sum of subspaces. CO5: Examined linearly dependent and independent vectors. CO6 : Apply Linear Algebra in social sciences, physical sciences, life sciences and a host of other discipline

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Numerical Symbolism Practical-2 Series and Progression Practical -3 Sum of the series of square and cubes Practical -4 Right-angled triangle using Sulba Sutras Practical -5 Union and intersection of subspaces Practical -6 Sum and Direct sum of subspaces Practical -7 Linearly independent vectors Practical -8 Linearly dependent vectors
Reference Books	1. P. Mahadevan, Vinayak Rajat Bhatt, Nagendra Pavana R. N.: Introduction to Indian knowledge system Concepts and application, Eastern Economy edition, PHI Publication. 2. B. Datta, A. N. Singh: History of Hindu Mathematics - I & II, Asia Publishing House, 1962. 3. V. Krishnamurthy, V. P. Mainra& J. L. Arora: An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 4. I. H. Sheth: Linear Algebra, Nirav Prakashan. 5. S. Kumaresan: Linear Algebra, Prentice Hall of India, 2000. 6. Serge Lang: Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 7. Balakrishnan: Linear Algebra, Tata-McGraw Hill Ed
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc., 70% External based on semester end University examination

[Subject Code-2603000506033001]

B.Sc. Mathematics 6th Semester (Major)

Course: MH-MJ-603: Real Analysis - II

Course Code	MH-MJ-603
Course Title	Real Analysis – II
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts ofReal Analysis .
Course Objective	To make students acquainted with concepts of Real Analysis
Course Outcomes	This course will enable the students to: CO1: Explain the insight of Bounded sequences, Monotone sequences.

	CO2: Assimilate the Operations on convergent and divergent sequences. CO3 :Tests for absolute convergence, Series whose terms form a non-increasing sequence. Convergence and divergence of series of real numbers, Series with non-negative terms CO4: Elaborate Concepts of limit superior and inferior, Cauchy sequence. CO5: ExplainAlternating series, Conditional and absolute convergence. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	**Unit I:** Bounded sequences, Monotone sequences, Operations on convergent sequences. Operations on divergent sequences, Concepts of limit superior and inferior, Cauchy sequence. **Unit II:** Tests for absolute convergence, Series whose terms form a non-increasing sequence.Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence.
Reference Books	1. R. R. Goldberg: Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik: RealAnalysis, Wiley-Eastern Pub. Co., NewDelhi. 4. Walter Rudin: Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc.70% External based on semester end University examination

[Subject Code-2603000506033002]

B.Sc. Mathematics 6th Semester (Major)

Course: MHP-MJ-603: Practical based on MH-MJ-603

Course Code	MHP-MJ-603
Course Title	Practical based on MH-MJ-603
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Real Analysis .

Course Objective	To make students acquainted with concepts of Real Analysis
Course Outcomes	This course will enable the students to: CO1: Explain the insight of Bounded sequences, Monotone sequences. CO2: Assimilate the Operations on convergent and divergent sequences. CO3 : Tests for absolute convergence, Series whose terms form a non-increasing sequence. Convergence and divergence of series of real numbers, Series with non-negative terms CO4: Elaborate Concepts of limit superior and inferior, Cauchy sequence. CO5: Explain Alternating series, Conditional and absolute convergence. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■			■	■
CO4	■	■	■	■		■		■
CO5	■							
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Bounded sequences& Monotone sequences. Practical-2 Operations on convergent sequences&Operations on divergent sequences Practical -3 Concepts of limit superior and inferior Practical -4 Cauchy sequence Practical -5 Convergence and divergence of series of real numbers Practical -6 Series with non-negative terms Practical -7 Alternating series Practical -8 Conditional and absolute convergence
Reference Books	1. R. R. Goldberg: Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik: RealAnalysis, Wiley-Eastern Pub. Co., NewDelhi. 4. Walter Rudin: Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505043001]

B.Sc. Mathematics 5th Semester (Minor)

Course: MH-ME-501: Numerical Methods -1

Course Code	MH-ME-501
Course Title	Numerical Methods -1
Credit	2
Teaching per Week	2 Hrs

<table>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2025</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the concepts of Numerical Methods.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Numerical Methods</td></tr>
<tr><td>Course Outcomes</td><td>This course will enable the students to:
CO1: Explain the Numerical solutions of the equations .
CO2: Assimilate Solutions of Algebraic and Transcendental Equations.
CO3: Solve Algebraic and Transcendental Equations.
CO4 : Elaborate Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols.
CO5: Learn . Newton’s Forward and Backward Formulae.
CO6 : Apply numerical methods in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Numerical Solutions of Algebraic and Transcendental Equations : Bisection Method, Method of False position, Iteration Method, Newton-Raphson’s Method.
Unit II:
Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Newton’s Forward and Backward Formulae.</td></tr>
<tr><td>Reference Books</td><td>1. S.S.Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.;5th Edition.
2. M.K.Jain, Iyenger,Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel,Mittal: Numerical Analysis, Pragati Prakashan, Meerut.
4. KaiserA.Kunz: Numerical Analysis, Mc Graw Hill Book Co.,London.
5. JamesI.Buchanan, Peter R.Turner: Numerical Methods and Analysis, McGraw Hill BookCo., London.
6. P.C.Biswal: Numerical Analysis,Prentice-HallofIndia,2008.
7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co.,2005.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

[Subject Code-2503000505043002]

B.Sc. Mathematics 5th Semester (Minor)

Course: MHP-ME-501: Practical based on MH-ME-501

Course Code	**MHP-ME-501**
Course Title	Practical based on MH-ME-501
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Numerical Methods.
Course Objective	To make students acquainted with concepts of Numerical Methods
Course Outcomes	This course will enable the students to: CO1: Explain the Numerical solutions of the equations . CO2: Assimilate Solutions of Algebraic and Transcendental Equations. CO3: Solve Algebraic and Transcendental Equations. CO4 : Elaborate Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols. CO5: Learn . Newton's Forward and Backward Formulae. CO6 : Apply numerical methods in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■	■			■
CO4	■	■		■		■		■
CO5	■	■	■	■				■
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Numerical Solutions of Algebraic and Transcendental Equations : Bisection Method Practical-2 Numerical Solutions of Algebraic and Transcendental Equations : Method of False position Practical-3 Numerical Solutions of Algebraic and Transcendental Equations : Iteration Method Practical-4 Numerical Solutions of Algebraic and Transcendental Equations : Newton-Raphson's Method Practical-5 Finite Differences and its applications Practical-6 Symbolic relations between operators Practical-7 Newton's forward difference interpolation Practical-8 Newton's backward difference interpolation
Reference Books	1. S.S.Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.;5th Edition. 2. M.K.Jain, Iyenger,Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel,Mittal: Numerical Analysis, Pragati Prakashan, Meerut. 4. KaiserA.Kunz: Numerical Analysis, Mc Graw Hill Book Co.,London. 5. JamesI.Buchanan, Peter R.Turner: Numerical Methods and Analysis, McGraw Hill BookCo., London.

	6. P.C.Biswal: Numerical Analysis,Prentice-HallofIndia,2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co.,2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505053001]

B.Sc. Mathematics 5th Semester (Minor)

Course: MH-ME-502: Matrix Algebra

Course Code	MH-ME-502
Course Title	Matrix Algebra
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Matrix Algebra.
Course Objective	To make students acquainted with concepts of Matrix Algebra
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of matrix algebra and Elementary row operations. CO2 : Assimilate the homogeneous and non-homogeneous system of linear equations CO3 :Solve homogeneous and non-homogeneous system of linear equations using Row-reduced Echelon form CO4 : Elaborate Characteristic equation of a matrix Caley-Hamilton theorem and its application to find an inverse of a matrix. CO5 :Find determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix. CO6 : Apply Matrix Algebra in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■	■			■
CO4	■	■		■				■
CO5	■	■	■	■	■			
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	**Unit 1:**

	Revision of basic concepts of matrix algebra and Elementary row operations. Solution of homogeneous and non-homogeneous system of linear equations using Row-reduced Echelon form **Unit 2:** Characteristic equation of a matrix, Method to find characteristic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Caley-Hamilton theorem and its application to find an inverse of a matrix.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., NewDelhi. 2. Kreysig: Advanced Engineering Mathematics, Wiley India(P) Ltd., 2009 3. B.S. Vasta and SuchiVasta: Theory of Matrices;4th Edition-2014, New Age International(P) Ltd. Publishers, New delhi 4. Shantinarayan: Text book of Matrices; S. Chand and Co., New Delhi 5. N. P. Bhamore& et el : Mathematics Paper I–II, Popular Prakashan,Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2503000505053002]

B.Sc. Mathematics 5th Semester (Minor)

Course: MHP-ME-502: Practical based on MH-ME-502

Course Code	MHP-ME-502
Course Title	Practical based on MH-ME-502
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Matrix Algebra .
Course Objective	To make students acquainted with concepts of Matrix Algebra
Course Outcomes	This course will enable the students to: CO1: Explain the insight of matrix algebra and Elementary row operations. CO2 : Assimilate the homogeneous and non-homogeneous system of linear equations CO3 : Solve homogeneous and non-homogeneous system of linear equations using Row-reduced Echelon form CO4 : Elaborate Characteristic equation of a matrix Caley-Hamilton theorem and its Application to find an inverse of a matrix. CO5 : Find determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix. CO6 : Apply Matrix Algebra in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs	<table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Examples on operations on matrix and elementary row operations Practical-2 System of Homogeneous linear equations Practical-3 System of Non-Homogeneous linear equations Practical-4 Characteristic equation of a matrix Practical-5 Eigen values a matrix Practical-6 Eigen vector of a matrix Practical-7 Verification of Caley-Hamilton theorem Practical-8 Inverse of a matrix using Caley-Hamilton theorem
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., NewDelhi. 2. Kreysig: Advanced Engineering Mathematics, Wiley India(P) Ltd.,2009 3. B.S. Vasta and SuchiVasta: Theory of Matrices;4th Edition-2014, New Age International(P) Ltd. Publishers, New delhi 4. Shantinarayan: Text book of Matrices; S. Chand and Co., New Delhi 5. N. P. Bhamore& et el : Mathematics Paper I–II, Popular Prakashan,Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-26030005060430 01]

B.Sc. Mathematics 6th Semester (Minor)

Course: MH-ME-601: Numerical Methods -2

Course Code	MH-ME-601
Course Title	Numerical Methods -2
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theconcepts ofNumerical Methods.
Course Objective	To make students acquainted with concepts of Numerical Methods
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of Finite difference with unequal interval. CO2 : Assimilate the Lagrange's Interpolation Formula, Divided Differences. CO3: Calculate 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae.

<table>
<tr><td></td><td>CO4 : Elaborate Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae.
CO5 :Find General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule.
CO6 : Apply numerical methods in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula.
Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae.

Unit II:
Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule.Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.</td></tr>
<tr><td>Reference Books</td><td>1. S.S.Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.;5th Edition.
2. M.K.Jain, Iyenger,Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel,Mittal: Numerical Analysis, Pragati Prakashan, Meerut.
4. KaiserA.Kunz: Numerical Analysis, Mc Graw Hill Book Co.,London.
5. JamesI.Buchanan, Peter R.Turner: Numerical Methods and Analysis, McGraw Hill BookCo., London.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

[Subject Code-2603000506043002]

B.Sc. Mathematics 6th Semester (Minor)

Course: MHP-ME-601: Practical based on MH-ME-601

Course Code	**MHP-ME-601**
Course Title	Practical based on MH-ME-601
Credit	2

Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Numerical Methods.
Course Objective	To make students acquainted with concepts of Numerical Methods
Course Outcomes	This course will enable the students to: CO1: Explain the insight of Finite difference with unequal interval. CO2 : Assimilate the Lagrange's Interpolation Formula, Divided Differences, CO3 : Calculate 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. CO4 : Elaborate Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. CO5: Find General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule. CO6 : Apply numerical methods in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■	■			
CO4	■	■		■		■		■
CO5	■	■	■	■	■			
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Lagrange's Interpolation Formula Practical-2 Newton's divided differences Interpolation Formula Practical-3 1st and 2nd order derivatives based on Newton's forward difference interpolation formula Practical-4 1st and 2nd order derivatives based on Newton's backward difference interpolation formula Practical-5 Numerical Integration: Trapezoidal Rule Practical-6 Numerical Integration: Simpson's 1/3-Rule, Simpson's 3/8-Rule Practical-7 Solution of Ordinary Differential Equations by Taylor's series method Practical-8 Solution of Ordinary Differential Equations by Picard's approximation method, Euler's method.
Reference Books	1. S.S.Sastry: Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.;5th Edition. 2. M.K.Jain, Iyenger,Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel,Mittal: Numerical Analysis, Pragati Prakashan, Meerut. 4. KaiserA.Kunz: Numerical Analysis, Mc Graw Hill Book Co.,London. 5. JamesI.Buchanan, Peter R.Turner: Numerical Methods and Analysis, McGraw Hill BookCo., London.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2603000506043003]

B.Sc. Mathematics 6th Semester (Minor)

Course: MH-ME-602: Statistical Methods

Course Code	MH-ME-602
Course Title	Statistical Method
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theconcepts ofStatistics.
Course Objective	To make students acquainted with concepts of Statistics
Course Outcomes	This course will enable the students to: CO1: Explain the insight of the Measure of Central Tendency. CO2 : Assimilate the Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode. CO3: Calculate the Quartiles Deciles and Percentiles. CO4: Elaborate Correlation and Methods of Studying Correlation. CO5 :Find Scatter diagram method, Karl's Pearson's Method, Spearmen's Rank Correlation. CO6 : Apply Statistics in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■	■			
CO4	■	■		■		■		■
CO5	■	■	■	■	■			
CO6						■	■	■

Pre-requisite	Basics of Mathematics
Course Content	**Unit 1:** Measure of Central Tendency: Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode, Quartiles Deciles and Percentiles. **Unit 2:** Correlation: Definitions, Types of Correlation, Coefficient of Correlation, Methods of Studying Correlation: Scatter diagram method, Karl's Pearson's Method, Spearmen's Rank Correlation.
Reference Books	1. Dr. K. R. Kachot :Numerical and Statistical Methods. Mahajan Publication house 5th addition, Dec 25-2015 2. 2Dr. R.C. Shah : Numerical and Statistical Methods. Book India Publication Second Addition, 2017.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

[Subject Code-2603000506043004]

B.Sc. Mathematics 6th Semester (Minor)

Course: MHP-ME-602: Practical based on MH-ME-602

Course Code	MHP-ME-602
Course Title	Practical based on MH-ME-602
Credit	2
Teaching per Week	4 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2025
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Statistics.
Course Objective	To make students acquainted with concepts of Statistics
Course Outcomes	This course will enable the students to: CO1: Explain the insight of the Measure of Central Tendency. CO2: Assimilate the Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode. CO3: Calculate the Quartiles Deciles and Percentiles. CO4: Elaborate Correlation and Methods of Studying Correlation. CO5: Find Scatter diagram method, Karl's Pearson's Method, Spearmen's Rank Correlation. CO6 : Apply Statistics in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Practical-1 Calculation of Mean Practical-2 Calculation of Median Practical-3 Calculation of Mode Practical-4 Quartiles Deciles and Percentiles Practical-5 Correlation by Karl's Pearson's Method (I) Practical-6 Correlation by Karl's Pearson's Method (II) Practical-7 Spearmen's Rank Correlation Practical-8 Coefficient of Correlation
Reference Books	1. Dr. K. R. Kachot :Numerical and Statistical Methods. Mahajan Publication house 5th addition, Dec 25-2015 2. Dr. R.C. Shah : Numerical and Statistical Methods. Book India Publication Second Addition, 2017.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■							
CO2	■	■	■	■				■
CO3	■	■	■	■	■			
CO4	■	■		■		■		■
CO5	■	■	■	■	■			
CO6						■	■	■

Instruction: Select only one minor subject in semester-6 from the basket of two minor subjects