

**Institute for Excellence in Higher Education (IEHE),
Bhopal (MP)**



**NAAC Re-accredited (Third Cycle) Autonomous College
Under the UGC Scheme with 'A' Grade (CGPA-3.10)**

**Program Outcomes (POs),
Program Specific Outcome (PSOs)
&
Course Outcomes (COs)
of
Department of Mathematics**

**B.Sc. (Honours) Mathematics
&
M.Sc. Mathematics**

(Session: 2022-2023)

Programmes offered in the Institute

Under Graduate Programmes

- B.Com. (4-Year UG programme under NEP-2020)
- B.Com. Honours (Management/Account) (3-Year UG programme under old pattern)
- B.A. (Major: Economics/History/Psychology/Sociology/Political-Science/English-Literature/Hindi-Literature/Geography/Fashion Designing) (4-Year UG programme under NEP-2020)
- B.A. Honours (Economics/History/Psychology/Sociology/Political Science/English-Literature/Hindi-Literature/Geography/Fashion-Designing) (3-Year UG programme under old pattern)
- **B.Sc. (Major: Physics/Chemistry/Computer-Science/Mathematics/Electronics/Biotechnology/Geography/Forensic-Science/Clinical Nutrition and Dietetics)** (4-Year UG programme under NEP-2020)
- **B.Sc. Honours** (Physics/Chemistry/Computer-Science/ Mathematics/Electronics/Biotechnology/Geography/Forensic-Science) (3-Year UG programme under old pattern)
- B.B.A. (4-Year UG programme under NEP-2020) (New)
- B.P.E.S. (3-Year UG programme) (New)

Post Graduate Programmes

- MA (Economics)
- MA (English)
- MA (Hindi) (New)
- MA (History)
- MA (Political Science)
- MA (Psychology) (New)
- MA (Public Administration)
- MA (Sociology) (New)
- MA (Social Work)
- M.Sc. (Biotechnology)
- M.Sc. (Chemistry)
- **M.Sc. (Mathematics)**
- M.Sc. (Physics)
- M.Com. (Marketing Management)

Courses offered by Vocational Cell (IEHE)

Diploma Courses (14)

1. Diploma in Financial Services (**DFS**)
2. Diploma in Human Resources Development (**DHRD**)
3. Diploma in Communicative English (**DCE**)
4. Diploma in Counselling Psychology (**DCP**)
5. Diploma in Industrial Work & Management System (**DIWMS**)
6. Diploma in Statistical Analysis (**DSA**)
7. Diploma in Taxation (**DIT**)
8. Diploma in Creative Arts (**DCA**)
9. Diploma in Computer Application (**DCA**)
10. Diploma in Tourism & Hospitality Management (**DTHM**)
11. Diploma in Forensic Science (**DFSc.**)
12. Diploma in Hostel Management (**DHM**)
13. Diploma in Banking Financial Services and Insurance (**DBFSAI**)
14. Diploma in Retail Marketing Management (**DRMM**)

Certificate Courses (10)

1. Certificate Courses in English Creative Writing (**CECW**)
2. Certificate Courses in Embedded System (**CES**)
3. Certificate Courses in Research Methodology (**CRM**)
4. Certificate Courses in Instrumentation & Electronic Maintenance (**CIEM**)
5. Certificate Courses in Cyber Security (**CCS**)
6. Certificate Courses in Spoken English (**CSE**)
7. Certificate Courses in French Language (**CFL**)
8. Certificate Courses in Hostel Management (**CHM**)
9. Certificate Courses in Retail Marketing Management (**CRMM**)
10. Certificate Courses in Banking Financial Services and Insurance (**CBFSAI**)

Training Courses (06)

1. 45 Hours Training Programme in Food Processing & Preservation
2. 30 Hours Training Programme in **MATLAB**
3. 30 Hours Training Programme in **SPSS**
4. 30 Hours Training Programme in Tally
5. 30 Hours Training Programme in Traditional Art
6. CII-IWN-IEHE Finishing School

Special Courses

- Foundation Course in Civil Services Examinations (**FCCSE**)
- Joint Admission Test for M.Sc. (**JAM**)

Program Outcomes (PO) of the Under-Graduate Courses Offered

- PO1: Domain Knowledge:** Capable of demonstrating comprehensive knowledge & understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO2: Critical Thinking:** Critically evaluate practices, policies and theories by following scientific approach to knowledge development. Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO3: Problem Solving and Analytical Skills:** Ability to think rationally, analyse situations and solve problems adequately.
- PO4: Information and Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO5: Communication Skills:** The capacity to communicate effectively using appropriate media, to present complex information in a clear & concise manner. Acquire the learning abilities by focusing on LSRW (Listening, Speaking, Reading & Writing skill, which provide a stage to the students to sharpen their capacity to learn more.
- PO6: Social Interaction and sensitivity towards the societal issues:** Work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO7: Self-directed & Life-long Learning:** Acquire the potential to engage in independent & life-long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.
- PO8: Environment and Sustainability:** Understand the issues of environmental contexts & sustainable development.
- PO9: Moral and Ethical Awareness:** Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO10: Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO11: Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and effective relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Efficiency to apply one's learning to real life situations or in interdisciplinary areas.
- PO12: Leadership and Management Skills:** Competence to use skills in organizing for people to reach a shared goal. During leading a project, ability to motivate others to complete a series of tasks, often according to a schedule.
- PO13: Employability and Entrepreneurial Skill:** Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

PROGRAMME OUTCOMES (PO): B.Sc.

Predefined Programme Outcomes	<i>Students taking admission to this program of B.Sc. get equipped with following outcomes:</i>
PO1	Domain Knowledge: Acquiring knowledge of fundamentals, basic Mathematics, domain knowledge of proper scientific models and Computing Specialization from defined problems and explaining the basic scientific principles and methods.
PO2	Scientific thinking: Inculcating scientific thinking and awareness, getting an ability to use necessary current techniques, skills, and modern tools.
PO3	Problem Analysis: Identifying, formulating, & analysing complex problems, reaching substantiated conclusions using first principles of Mathematics, natural sciences and electronic sciences.
PO4	Communication: Communicate concepts, designs, and solutions of scientific activities effectively and professionally with society at large.
PO5	Information & Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO6	Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to support the values required for collaborative work such as mutual trust & fairness.
PO7	Environment & Sustainability: Understanding the impact of scientific solutions on societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO8	Self-Directed and Life-Long Learning: Acquire the ability to engage in independent and life- long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.
PO9	Research-Related Skills: <ul style="list-style-type: none"> • Acquiring familiarity with emerging areas of different subjects in science and their applications in various spheres of sciences and getting appraise of its relevance in future studies. • Getting ability to apply various statistical tools to research problems and ability to build statistical knowledge and knowing the statistical organization in India and abroad. • Developing scientific intuition, ability and techniques to tackle problems either theoretical or experimental in nature.
PO10	Employability Skill: Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

Department of Mathematics

Programme Specific Outcomes (PSO): **BSc (Honours) Mathematics** (*Honours/Major Subject*)

Programme Specific Outcomes	<i>The students taking up this program of B.Sc. with Mathematics (Honours/Major) as a special subject of study, receive the following outcomes:</i>
PSO-1	Strong Foundation in Knowledge: Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps learners to acquire good knowledge and understanding in advanced areas of mathematics for further higher studies.
PSO-2	Research-Related Skills: Capability for inquiring about appropriate questions relating to the concepts in various fields of mathematics and to know about the advances in various branches of mathematics.
PSO-3	Self-Directed Learning: Ability to work independently and do in-depth study of various notions of mathematics.
PSO-4	Abstract Skills: Evaluate hypotheses, theories, methods and evidence within their proper contexts
PSO-5	Problem Solving Skills: Solve complex problems by critical understanding, analysis and synthesis
PSO-6	Competency in Skills: The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, can also be utilised in modelling and solving real life problems.
PSO-7	Interdisciplinary Skills: Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
PSO-8	Proficiency in Employments: This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

Mapping of PSOs of BSc Mathematics (Honours/Major) with POs of (Under-Graduate)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
PSO-1	√	√	√	√	√	√	√	√	√	√			
PSO-2		√		√	√		√	√	√				
PSO-3			√			√		√		√			
PSO-4	√	√		√	√		√			√			
PSO-5	√		√		√	√	√	√	√				
PSO-6		√		√		√			√	√			
PSO-7		√	√		√		√	√		√			
PSO-8	√		√	√		√		√	√	√			
PSO-9													
PSO-10													

Course Outcomes (CO)s

Semester: I

Title: Algebra, Vector Analysis and Geometry Code: MJS-161 (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the Characteristic equation, eigen values and corresponding eigen vectors of a given matrix.
CO-2	Understanding^[2] consistent and inconsistent system of linear equations by the row echelon form of the augmented matrix by using rank of matrix.
CO-3	Applying^[3] row operations and matrix operations to solve the matrix equation $Ax=b$
CO-4	Analyzing^[4] vector functions to find limits, derivatives, tangent lines, integrals, arc length, curvature etc.
CO-5	Understanding^[2] geometrical terminology for angles, triangles, quadrilaterals and circles.
CO-6	Applying^[3] the knowledge of three-dimensional geometrical figures(<i>i.e.</i> cone and cylinders)

Semester: I

Title: Calculus Code: MNS-162 (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic concept of calculus and their daily life uses.
CO-2	Understanding^[2] the derivatives concept in Optimization, Social sciences, Physics and Life sciences etc.
CO-3	Applying^[3] its mathematical properties in the different coordinate systems of reference to sketch curves in a plane.
CO-4	Analyzing^[4] various Mathematical models.

Semester: I

Title: Linear Programming Code: GES-161 (Generic Elective) BA/BSc/BCom

Course Outcomes	<i>The students taking up this course of B.A./B.Sc./B.Com. with Mathematics, Generic Elective-I (b) (Theory) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the LPP along with graphical solution method.
CO-2	Understanding^[2] the optimal solution for linear optimization problems subject to certain constraints.
CO-3	Applying^[3] Simplex method and Big-M method to Solve the system of linear equations.
CO-4	Evaluating^[5] dual to a production problem with profits to be maximized and to keep total cost down.
CO-5	Creating^[6] the mathematical model and find solutions through LPP.

Semester: II

Title: Calculus and Differential Equations Code: MJS-261 (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic concept of calculus and differential equations and their daily life uses.
CO-2	Understanding^[2] the derivatives concept in Optimization, Social sciences, Physics and Life sciences etc.
CO-3	Applying^[3] its mathematical properties in the different coordinate systems of reference to sketch curves in a plane.
CO-4	Analyzing^[4] various Mathematical models using differential equations techniques.
CO-5	Creating^[6] the differential equations for various Mathematical models.

Semester: II

Title: Differential Equations Code: MNS-262 (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic concept of differential equations and their daily life uses.
CO-2	Understanding^[2] the method of variations of parameters.
CO-3	Applying^[3] Linear differential equations with constant coefficients.
CO-4	Analyzing^[4] various Mathematical models using differential equations techniques.
CO-5	Creating^[6] the differential equations for various Mathematical models.

Semester: II

Title: Logic and Sets Code: GES-261 (Generic Elective) BA/BSc/BCom

Course Outcomes	<i>The students taking up this course of BA/BSc/BCom with Mathematics, Generic Elective (OA) (Theory) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the statements, logic, sets and their operations.
CO-2	Understanding ^[2] the principles of logic to distinguish between sound and unsound reasoning in discourse of everybody.
CO-3	Applying ^[3] the appropriate set theoretic concepts, thinking process, tools and techniques in the solution to various conceptual or real-world problems.
CO-4	Analyzing ^[4] the logical structure of statements symbolically, including the proper use of logical connectives, predicates, and quantifiers
CO-5	Evaluating ^[5] the problems and write proofs by using the concepts of set theory, including the methods of Venn diagrams and truth tables.
CO-6	Creating ^[6] the truth tables for logical expressions and represent Mathematical statements in the predicate language.

Semester: III

Abstract Algebra & Linear Algebra (Paper Code: MJS-361) (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Abstract Algebra & Linear Algebra (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the algebraic structure, rank of a matrix, eigenvalues and eigenvectors of a matrix.
CO-2	Understanding ^[2] the linear transformations, rank and nullity, matrix of a linear transformation, algebra of transformations and change of basis.
CO-3	Applying ^[3] the basic diagonalization result for obtaining eigenvalues, eigenvectors.
CO-4	Analyzing ^[4] the subgroups of cyclic groups and whether a finite set of vectors in a vector space is linearly independent.
CO-5	Evaluating ^[5] the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces.

Semester: III

Advance Calculus (Paper Code: MNS-362) (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with Advance Calculus (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concept of limits, derivatives, maxima and minima.
CO-2	Understanding ^[2] the many properties of the real line \mathbb{R} and sequences.
CO-3	Applying ^[3] the various tests to determine convergence and absolute convergence of an infinite series of real numbers.
CO-4	Evaluating ^[4] the limit superior, the limit inferior, and the limit of a bounded sequence.

Semester: III

Statistics & Probability (Paper Code: GES-361) (Generic Elective)

Course Outcomes	<i>The students taking up this course of B.Sc. with Statistics & Probability (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concept of mean, median, mode and probability.
CO-2	Understanding ^[2] the terminology of probability, basic ideas of linear regression and correlation.
CO-3	Applying ^[3] the addition and multiplication rules to Calculate probabilities.
CO-4	Analyzing ^[4] the Student's t test, chi-square goodness-of-fit, F and Z test.
CO-5	Evaluating ^[5] the correlation coefficient.

Semester: III

Mathematical Logic (Paper Code: Voc/SEC-XXX) (Voc/SEC)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematical Logic (Voc/SEC) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the statements, logic, sets and their operations.
CO-2	Understanding ^[2] the principles of logic to distinguish between sound and unsound reasoning in discourse of everybody.
CO-3	Applying ^[3] the appropriate set theoretic concepts, thinking process, tools and techniques in the solution to various conceptual or real-world problems.
CO-4	Analyzing ^[4] the logical structure of statements symbolically, including the proper use of logical connectives, predicates, and quantifiers
CO-5	Evaluating ^[5] the problems and write proofs by using the concepts of set theory, including the methods of Venn diagrams and truth tables.
CO-6	Creating ^[6] the truth tables for logical expressions and represent Mathematical statements in the predicate language.

Semester: IV

Advance Calculus & Partial Differential Equation (Paper Code: MJS-461) (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Advance Calculus & Partial Differential Equation (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concept of limits, derivatives, maxima and minima.
CO-2	Understanding ^[2] the many properties of the real line \mathbb{R} and sequences.
CO-3	Applying ^[3] the various tests to determine convergence and absolute convergence of an infinite series of real numbers.
CO-4	Analyzing ^[4] the solutions in a physical context, such as identifying travelling waves, standing waves, and shock waves, Heat equation.
CO-5	Evaluating ^[5] the practical PDE problems with finite difference methods, implemented in code, and analyse the consistency, stability and convergence properties of such numerical methods.
CO-6	Creating ^[6] the physical problems as PDEs using conservation laws.

Semester: IV

Partial Differential Equation (Paper Code: MNS-462) (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with Partial Differential Equation (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic knowledge of partial differential equations (PDEs), modelling and the general structure of solutions.
CO-2	Understanding^[2] the analogies between mathematical descriptions of different (wave) phenomena in physics and engineering.
CO-3	Applying^[3] the analytical methods and physically interpret the solutions.
CO-4	Analyzing^[4] the solutions in a physical context, such as identifying travelling waves, standing waves, and shock waves, Heat equation.
CO-5	Evaluating^[5] the practical PDE problems with finite difference methods, implemented in code, and analyse the consistency, stability and convergence properties of such numerical methods.
CO-6	Creating^[6] the physical problems as PDEs using conservation laws.

Semester: IV

History of Indian Mathematics & Vedic Mathematics (Paper Code: GES-461) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with History of Indian Mathematics & Vedic Mathematics (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic knowledge of Indian Mathematics.
CO-2	Understanding^[2] the meaning of mathematical sutras in Sanskrit.
CO-3	Applying^[3] the Vedic sutras to solve the multiplication.
CO-4	Analyzing^[4] the distinguish between modern and Vedic squaring methods.

Semester: IV

Tracing of Curves (Paper Code: Voc/SEC-XXX) (Voc/SEC)

Course Outcomes	<i>The students taking up this course of BSc with Tracing of Curves (Voc/SEC) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering^[1] the basic concept of curves.
CO-2	Understanding^[2] the curve tracing.
CO-3	Applying^[3] the curve tracing technique to trace the various types of curves.
CO-4	Analyzing^[4] the various types of curves.

Semester: V

Advanced Mechanics (Paper Code: S-561) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, Honours-I as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concepts of forces, Parallel forces, Moments, Couples and analytical conditions of equilibrium of coplanar forces
CO-2	Understanding ^[2] the reduction of force system in three dimensions to a resultant force acting at a base point and a resultant couple.
CO-3	Applying ^[3] the equilibrium relationships for non-accelerating particles acted on by forces.
CO-4	Analyzing ^[4] systems of interconnected rigid bodies and find the forces generated by the constraints.
CO-5	Evaluating ^[5] the effect of forces and motion of a particle and calculate centroids and moments of inertia of bodies.

Semester: V

Real Analysis (Paper Code: S-562(A)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, Honours-II(A)/Subsidiary(A) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
CO-2	Understanding ^[2] the properties of the real line \mathbb{R} and learn to define sequences in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
CO-3	Applying ^[3] the ratio, root, comparison tests etc, and the convergence of an infinite series, absolute convergence of alternating series of real numbers.
CO-4	Evaluating ^[5] the Convergence and Divergence of Infinite Series.

Semester: V

Abstract Algebra (Paper Code: S-562(B)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, Honours-II(B)/Subsidiary(B) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the concepts of vector spaces, subspaces, basis, dimension and properties.
CO-2	Understanding ^[2] the concepts of the null space, range, and matrix of a linear transformation and how to determine whether a linear transformation is one-to-one and onto.
CO-3	Applying ^[3] the concept of eigenvectors and eigen spaces to determine the diagonalizability of a linear transformation.
CO-4	Evaluating ^[5] the eigen values and eigen vectors of linear transformations.

Semester: VI

Advanced Abstract Algebra (Paper Code: S-661) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, Honours-I as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concepts of group and ring with their applications.
CO-2	Understanding ^[2] the Group Automorphism, Conjugacy relation, polynomial rings and fundamental properties of finite field extensions.
CO-3	Analyzing ^[4] the Counting principle, class equation of a finite group and Eisenstein's criterion.

Semester: VI

Linear Algebra (Paper Code: S-662(A)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, (Honours-II(A)/Subsidiary(A) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the rank of a matrix, eigenvalues and eigenvectors of a matrix.
CO-2	Understanding ^[2] the linear transformations, rank and nullity, matrix of a linear transformation, algebra of transformations and change of basis.
CO-3	Applying ^[3] the basic diagonalization result for obtaining eigenvalues, eigenvectors.
CO-4	Analyzing ^[4] the finite set of vectors in a vector space is linearly independent.
CO-5	Evaluating ^[5] the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces.

Semester: VI

Real and Complex Analysis (Paper Code- S-662(B))

Course Outcomes	<i>The students taking up this course of B.Sc. with Mathematics, Honours-II(B)/Subsidiary(B) as a special subject of study receive the following outcomes:</i>
CO-1	Remembering ^[1] the basic concepts of convergency, divergency and complex plane.
CO-2	Understanding ^[2] the properties of Riemann integrable functions and the applications of the fundamental theorems of integration.
CO-3	Applying ^[3] the various tests to find the convergency of improper integrals.
CO-4	Analyzing ^[4] the Mobius Transformations and Cross Ratio.

A brief note on Bloom's Taxonomy:

According to the revised version of Bloom's Taxonomy there are six levels of cognitive learning. Each level is conceptually different. The six levels are (1) remembering, (2) understanding, (3) applying, (4) analyzing, (5) evaluating, and (6) creating. We follow the Bloom's Taxonomy in deciding the course outcome & the levels (1/2/3/4/5/6) are displayed in the mapping table of COs with the PSOs of each program of NEP-2020. Details of the terms used in the levels are as follows:

Level-1: **REMEMBER** - this level include:

cite, define, describe, identify, label, list, match, name, outline, quote, recall, report, reproduce, retrieve, show, state, tabulate, and tell.

Level-2: **UNDERSTAND** - this level include:

abstract, arrange, articulate, associate, categorize, clarify, classify, compare, compute, conclude, contrast, defend, diagram, differentiate, discuss, distinguish, estimate, exemplify, explain, extend, extrapolate, generalize, give examples of, illustrate, infer, interpolate, interpret, match, outline, paraphrase, predict, rearrange, reorder, rephrase, represent, restate, summarize, transform, and translate.

Level-3: **APPLY** - this level include:

apply, calculate, carry out, classify, complete, compute, demonstrate, dramatize, employ, examine, execute, experiment, generalize, illustrate, implement, infer, interpret, manipulate, modify, operate, organize, outline, predict, solve, transfer, and use.

Level-4: **ANALYZE** - this level include:

analyze, arrange, break down, categorize, classify, compare, contrast, deconstruct, detect, diagram, differentiate, discriminate, distinguish, divide, explain, identify, integrate, inventory, order, organize, relate, separate, and structure.

Level-5: **EVALUATE** - this level include:

appraise, apprise, argue, assess, compare, conclude, consider, contrast, convince, criticize, critique, decide, determine, discriminate, evaluate, grade, judge, justify, measure, rank, rate, recommend, review, score, select, standardize, support, test, and validate.

Level-6: (highest level): **CREATE** - this level include:

arrange, assemble, build, collect, combine, compile, compose, constitute, construct, create, design, develop, devise, formulate, generate, hypothesize, integrate, invent, make, manage, modify, organize, perform, plan, prepare, produce, propose, rearrange, reconstruct, reorganize, revise, rewrite, specify, synthesize, and write.

Programme: B.Sc. (Major/Honours-I)

Subject: Mathematics

Mapping of COs with PSOs for Semester – I (Major)

Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Algebra, Vector Analysis and Geometry Paper Code: MJS-161	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5	2									
	CO6					3					

Mapping of COs and PSOs for Semester – II (Major)

Paper Title: Calculus and Differential Equations Paper Code: MJS-261	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						6				

Mapping of COs and PSOs for Semester – III (Major)

Paper Title: Abstract Algebra & Linear Algebra Paper Code: MJS-361	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				

Mapping of COs and PSOs for Semester – IV (Major)

Paper Title: Advance Calculus & Partial Differential Equation Paper Code: MJS-461	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				
	CO6						6				

Mapping of COs and PSOs for Semester – V (Honours-I)

Paper Title: Advanced Mechanics Paper Code: S-561	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				

Mapping of COs and PSOs for Semester – VI (Honours-I)

Paper Title: Advanced Abstract Algebra Paper Code: S-661	CO1	1									
	CO2	2									
	CO3		4								

Programme: B.Sc. (Minor/Honours-II/Subsidiary) Subject- Mathematics

Mapping of COs with PSOs for Semester-I (Minor)

Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Calculus Paper Code: MNS-162	CO1	1									
	CO2	2				3					
	CO3										
	CO4		4								

Mapping of COs and PSOs for Semester-II (Minor)

Paper Title: Differential Equations Paper Code: MNS-262	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						6				

Mapping of COs and PSOs for Semester-III (Minor)

Paper Title: Advanced Calculus Paper Code: MNS-362	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								

Mapping of COs and PSOs for Semester-IV (Minor)

Paper Title: Partial Differential Equation Paper Code: MNS-462	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				
	CO6						6				

Mapping of COs and PSOs for Semester- V (Honours-II/Subsidiary)

Paper Title: Real Analysis Paper Code: S-562(A)	CO1	1									
	CO2	2									
	CO3					3					
	CO4						5				

Mapping of COs and PSOs for Semester- V (Honours-II/Subsidiary)

Paper Title: Abstract Algebra Paper Code: S-562(B)	CO1	1									
	CO2	2									
	CO3					3					
	CO4						5				

Mapping of COs and PSOs for Semester- VI (Honours-II/Subsidiary)

Paper Title: Linear Algebra Paper Code: S-662(A)	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				

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Mapping of COs and PSOs for Semester-VI (Honours-II/Subsidiary)

Paper Title: Real and Complex Analysis Paper Code: S- 662(B)	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								

Programme: **BA/BSc/BCom (Generic Elective/Vocational)**

Subject: Mathematics

Mapping of COs with PSOs for Semester-I (Generic Elective I(a) (Theory))

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Paper Title: Linear Programming Paper Code: GES-161(OB)	CO1	1									
	CO2	2									
	CO3					3					
	CO4						5				
	CO5						6				

Mapping of COs and PSOs for Semester-II (Generic Elective II(a) (Theory))

Paper Title: Logic and Sets Paper Code: GES-261	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				
	CO6						6				

Mapping of COs and PSOs for Semester-III (Generic Elective)

Paper Title: Statistics & Probability Paper Code: GES- 361	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				

Mapping of COs and PSOs for Semester-IV (Generic Elective)

Paper Title: History of Indian Mathematics & Vedic Mathematics Paper Code: GES-461	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5										

Mapping of COs and PSOs for Semester-III (Voc/SEC) (Vocational)

Paper Title: Mathematical Logic Paper Code: Voc/SEC-XXX	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								
	CO5						5				
	CO6						6				

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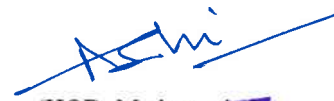
Mapping of COs and PSOs for Semester-IV (Voc/SEC) (Vocational)											
Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Tracing of Curves Paper Code: Voc/SEC-XXX	CO1	1									
	CO2	2									
	CO3					3					
	CO4		4								



(IQAC Coordinator)



(Convenor, Academic Committee)



(HOD, Mathematics)

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अकादमिक समिति
उच्चशिक्षा उत्कृष्टता संस्थान
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