Program Learning Outcomes (POs) in 3-year MDC Botany (NEP 2020)

The student who completes 3-year MDC Botany should be able to-

- Generate a strong knowledgebase in the subject of Botany, as well as related subject areas, ensuring their fundamental competency in these fields. The students will demonstrate the capability to categorise primary plant groups and analyse the distinguishing features of lower (e.g. algae and fungus) and higher (angiosperms and gymnosperms) plants, and elucidate diverse plant processes and functions, metabolic activities, concepts of genes and genome, as well as how the functioning of organisms is impacted at the cellular, tissue, and organ levels.
- Learn various hands-on techniques enabling them practically equipped for biotechnological industries.
- Showcase their proficiency in the experimental techniques and methodologies specific to their specialised field of Botany.
- Utilize scientific methodologies to solve varied questions which involves establishing hypotheses, collecting data, and critically analysing the facts to determine the extent to which their scientific work corroborates their hypotheses.
- Improve their ethical and moral views and develop the ability to address psychological vulnerabilities.
- Acquire collaboration and cooperation skills to work as a team thereby effectively contributing to institutions, industry, and society.
- Establish themselves as independent learner by gaining subject-specific abilities. In the field of botany, the programme outcome will provide information and skills that may be applied to pursue higher education, competitive tests, and employment opportunities. An outcomes-based curriculum would guarantee uniform academic standards across and provide a comprehensive assessment of students' abilities.

Core Courses (CC) & Skill Enhancement Course (SEC) for 3-year MDC

Botany

Sl. No.	POs	CC-1	CC-2	SEC-1
1	Generate a strong knowledgebase in the subject	√	√	√
2	Learn hands-on techniques for industrial applications	-	-	√
3	Showcase the proficiency in the experimental techniques	-	-	√
4	Utilize scientific methodologies to solve varied questions	√	√	√
5	Improve their ethical and moral views	√	√	√
6	Acquire collaboration and cooperation skills to work as a team	-	√	√
7	Establish themselves as independent learner	√	√	√

Course Learning Outcomes (CLO)

Core Courses

Plant diversity (BOT-MD-CC1-1-Th, BOT-MD-CC1-1-P)

The course will enable the students to –

- Acquire an understanding of various algal and fungal groups including their diagnostic characters, examples and economic value.
- Accomplish an idea of lichens, as well as a curiosity for the adaptive characteristics of these organisms.
- Demonstrate a grasp of bryophytes, their life history and economic importance.
- Gain knowledge of the morphology and reproduction procedures of pteridophytes, and gymnosperms
- Develop a foundation on the origin of plant cells and importance of plants as food, fuel etc.
- Acquire a grasp of angiosperm morphology, especially of flower and fruits.
- Grasp practical knowledges to the collection, systematic study and identification of plants.

Plant systematics (BOT-MD-CC2-2-Th, BOT-MD-CC2-2-P)

At the end of this course, students will be able to -

- The theory of plant systematics and recognize the significance of herbarium and virtual herbarium
- Evaluate the importance of herbaria and botanical gardens
- Interpret the rules of ICN in botanical nomenclature
- Learn the concepts associated with Numerical taxonomy and Phylogenetic classification.
- Generalize the characteristics of the families under the classification scheme developed by Bentham and Hooker.
- Grasp practical knowledges to the collection, systematic study and identification of plants.

Skill Enhancement Courses

Mushroom Cultivation Technology (BOT-MD-SEC-1-Th, BOT-MD-SEC-1-P)

Students will be able to –

- Recognize multiple types and categories of mushrooms, their health beneficial values and idea of poisonous mushrooms.
- Showcasing several kinds of mushroom cultivation technologies including the knowledge and industrial designs and required appliances for cultivation of mushroom.
- Explore the procedures of multiple stages of mushroom cultivation and their variability in different types of mushrooms.
- Learn the management strategies to overcome the mushroom diseases and the postharvest processing technologies for increasing the shelf life.
- Assess the financial aspects related to the production of mushrooms and create innovative techniques and plans to boost the yield of mushrooms.

Course credits summary

Course	Credits		
	Theory	**Practical**	**Total**
CC-1. Plant diversity	03	01	04
CC-2. Plant systematics	03	01	04
SEC-1. Mushroom Cultivation Technology	03	01	04

Course Learning Outcomes B.Sc. (Minor+MDC) CHEMISTRY

The course learning outcomes are aligned with program learning outcomes but these are specific-to-specific courses offered in a program. The course level learning shall be reflected as program level learning. The core courses shall be the backbone of this framework whereas discipline electives, generic electives and skill enhancement courses would add academic excellence in the subject together with multi-dimensional and multidisciplinary approach.

In course learning outcomes, the student will attain subject knowledge in terms of individual course as well as holistically. The example related to core courses and their linkage with each other is stated below:

Sl. No.	**POs**	CC1 (MINOR+MDC)	CC2 (MINOR+MDC)
1	Fundamental understanding of the field	√	√
2	Application of basic Chemistry concepts	√	√
3	Linkages with related disciplines	√	√
4	Procedural knowledge for professional Subjects	√	√
5	Skills in related field of Specialization	√	√
6	Ability to use in Chemistry problems	√	√
7	Skills in Mathematical modeling	√	-
8	Skills in performing analysis and Interpretation of data	√	√
9	Develop investigative Skills	-	√
10	Skills in problem solving Chemistry and related discipline	√	√
11	Develop Technical Communication skills	-	-
12	Developing analytical skills and popular communication	√	√
13	Developing ICT skills	-	-

14	Demonstrate Professional behavior with respect to attribute like objectivity, ethical values, self-reading etc	√	√

PAPER: CHEM-H-CC1-1-Th/ CHEM-MD-CC1-1-Th
(Credit: Theory -03, Practical – 01)

Chemistry Minor – I/Chemistry MDC- I

Course learning outcome (COs)

On completion of this course, the students will be able to understand:

Learning objective:

1. **Extra nuclear structure of atoms and Periodicity**
2. **Basics of Organic Chemistry Bonding and Physical Properties:**
   Valence Bond Theory,
   Electronic displacement,
   MO Theory,
   Physical properties
3. **Stereochemistry**
4. **Thermodynamics**
5. **Chemical Kinetics**

PAPER : CHEM-H-CC1-1-P/ PAPER: CHEM-MD-CC1-1-P

(1) Calibration and use of apparatus.
(2) Preparation of primary standard solutions (Oxalic Acid and K2Cr2O7)

Acid-Base Titrations:

(3) Standardization of NaOH standard oxalic acid solution.
(4) Estimation of carbonate and bicarbonate present together in a mixture
(5) Estimation of acetic acid in commercial Vinegar.

Oxidation-Reduction Titrimetry:

(6) Standardization of KMnO4 standard oxalic acid solution.
(7) Estimation of Fe(II) using standardized KMnO4 solution.
(8) Estimation of Fe(III) using standard K2Cr2O7 solution.
(9) Estimation of Fe(II) and Fe(III) in a given mixture using standard K2Cr2O7 solution.

CHEM-H-CC2-2-Th/CHEM-MD-CC2-2-Th

(Credit: Theory -03, Practical – 01)

Chemistry Minor – II/Chemistry MDC- II

Course learning outcome (COs)

On completion of this course, the students will be able to understand:
Learning objective:

1. **Kinetic Theory and Gaseous state**
2. **Real gas and Virial equation**
3. **Chemical Bonding –** Ionic bond, Covalent bond
4. **Stereochemistry**
5. **General Treatment of Reaction Mechanism**
   Reactive intermediates, Reaction thermodynamics, Reaction kinetics, Substitution Reaction

PAPER: CHEM-H-CC2-2-P/ CHEM-MD-CC2-2-P

(1) Standardization of $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution.

Iodo-/ Iodimetric Titrations

(2) Estimation of Vitamin C

(3) Estimation of (i) arsenite and (ii) antimony iodimetrically

(4) Estimation of available chlorine in bleaching powder.

Estimation of metal content in some selective samples

(5) Estimation of Cu in brass.

(6) Estimation of Cr and Mn in Steel.

(7) Estimation of Fe in cement

Programme Learning Outcome (POs) in B.A./ B.Sc. Economics (MDC)

Under CCF (Sem I & Sem II)

Each programme vividly explains its nature and promises the outcomes that are to be accomplished by studying the courses. The Bachelor of Arts (Programme) with Economics states the attributes that it aims to inculcate at the point of graduation. These attributes encompass values related to wellbeing, emotional stability, critical thinking, social justice and skills for employability. On completion of the programme studentsare expected to have learnt the skills of effective communication, critical thinking, social research methods and social outreach. The qualities expected from the graduates of B.A. (Programme) with Economics as subject are:

- A holistic knowledge and understanding of basic concepts in economics and will be exposed to the real-world data related to industries and society, identifying the problems and working towards their solutions through various analytical andstatistical techniques.
- The capacity to identify, understand and solve the problems of society.
- The ability to collect, analyse, interpret and present the data and bring out the meaning, correlations and interrelationships.
- Team building and leadership skills, communication, creative and critical thinking skills and innovative problem-solving skills.

Objectives of the Programme

1. To imbibe strong foundation of economics in students.
2. To update students with statistical tools that aid in economic theory.
3. To teach/strengthen students' concepts related to Microeconomics and Macroeconomics.
4. To promote application-oriented pedagogy by exposing students to real world data.
5. To prepare students for projects which form them for jobs.

Core Course and SEC Paper for Economics (MDC)

S. No.	Pos	CC-I	CC-II	SEC I/II/ II
1	To develop analytical ability among students	X	X	X
2	To have an idea about how the Government functions	X	X	X
3	To Maximize standard of living and to achieve stable Economic Growth	X	X	X
4	To understand and apply core Economic Principles related to consumers, producers and market	X	X	
5	To understand and apply basic Principles of Macroeconomics		X	
6	To know policy making mechanism related to money and currency from an applied finance context	X	X	
7	Application of Statistics and Mathematics in Economics usually used for forecasting	X	X	X
8.	Use of case study for the better understanding of the topics	X	X	X

Course Learning Outcomes (CLO)
Core Courses (CC)

CC1 (Introductory Microeconomics)

(Credits: 03, Tutorial – 01)

Students will be able to

- Develops understanding of how economy functions.
- Develops in general analytical ability among students.
- Students learn to analyze certain real- life events.
- This course is a stepping stone for the students that help them to understand more complicated economic theories in the future.

CC2: Introductory Macroeconomics

(Credits: 03, Tutorial – 01)

In this course, students gain important insights in the basic and initial concepts of macroeconomics such as

- the basic concepts of National Income accounting - The Circular Flow, Concepts of GNP, GDP, NNP, and NDP at market price and at factor cost. National Income measurement methods, concepts of Corporate Income, Corporate Savings, Personal, Income, Personal Disposable Income and Personal Savings. Relation of Saving-Investment gap with budget deficit and trade surplus, Cost of Living.
- the Simple Keynesian Model of Income Determination in a closed economy – concepts of consumption and savings function, paradox of thrift, Simple Keynesian Multiplier, stability of equilibrium, SKM in a closed economy with government, the associated multipliers, the budget surplus tax changes, government purchases and the full employment budget surplus
- Basic ideas of Classical Macroeconomics; Say‘s Law and QTM, Loanable fund theory; Classical Theory of Income and Employment

determination; notions of full employment, wage-price flexibility, Classical Dichotomy and Neutrality of Money

- Investment function: Concepts of Marginal productivity, marginal efficiency of capital (MEC) and marginal efficiency of investment (MEI)- Jorgenson's Neo-classical theory, Acceleration principle and the Multiplier-Accelerator interaction.
- Concepts and types of inflation.

SEC I: Economic Data analysis and report writing
(for Sem I/II/III)

(Credits: 03, Tutorial – 01)

Students will be able to

- Find out and observe descriptive statistics of data set by using statistical tools
- Gather knowledge about descriptive statistics
- Learn about details of sampling survey method, sampling distribution and estimation of statistics and parameters in question.
- Learn about elements of report writing.

Program Learning Outcomes (POs) in B.A/B.Sc MDC in Geography

The student graduating with the Degree B.A. or B.Sc MDC in Geography should be able to:

- To understand the physical aspects of earth comprising of land, water and air, their structure, composition, classification, distributional patterns and developmental processes. It helps the students to identify and analyse the various facets of geography, geographical features and processes.

- Completion of this course highlights the purpose of enhancing the capability of the students in perceiving, creating and analyzing sound geographical bases and concepts. This is how they have found the different linkages of geographical knowledge with other disciplines.

- To study human population and their activities, distribution of resources and mapping of different types of land use. It also focuses on globalization that affects the settlement as well as the cultural landscape with help of multiple innovations.

- To develop an understanding about the theoretical concepts of the different methodologies in Geography which are mainly necessary in field researches. The main components are identification of problems, data collection and compilation, use of survey instruments, diagrams and maps.

- To provide them an understanding of the basic principles of updated technology based on Remote Sensing, Geographical Information System, Global Navigation Satellite System along with the conventional knowledge of coordinate systems and map projections and applications of basic as well as advanced survey instruments.

- To develop the skill and ability to draw and interpret different types of maps (Land use Map, Thematic Map, Topographical maps, Weather maps and Map making from Satellite Imageries).

- To make the students familiar with different types of geographical data and its analysis for determining growth rate, structure, graphical plotting and interpretation.

- Overall, this entire course has been a shift from teacher centric to student centric study by strengthening the quality of teaching and learning in the present-day real-life scenario of global, regional and local level. It is considered learning as an activity of creativity of innovations and analyzing geographical phenomena.

Core Course & Generic Elective & Discipline Specific Electives & Skill Enhancement Course for B.A/B.Sc MDC

Sl No.	PO	CC1	CC2	SEC	IDC
1	Fundamental understanding and application of basic the concept	√	√	√	√
2	Linkages with other disciplines	√	√	√	√
3	Ability to understand issues related to man-environment relation	√	√	√	
4	Developing problem solving techniques			√	
5	Understanding of different kinds of maps and satellite images and interpretation	√	√	√	√
6	Map making skills	√			√
7	Analysis & interpretation of data	√	√	√	√
8	Construction, measurements and drawing of diagrams and graphs	√	√		√
9	Theoretical application and use of geographical instruments	√		√	√
10	Understanding the concepts of growth, change and development in geographical perspective	√	√	√	√
11	Globalization, conservation & management		√		

Physical Geography - GEOG-CC/MD-CC-1/3-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

After going through the course, the student should be able to:

- Understand the concepts related to Cartography, Geotectonics, Geomorphology, Climatology, Soil Geography, Biogeography and Geography of Hazards which are important sub-disciplines of the of Geography.
- Highlights the structure of the earth's interior and different endogenetic forces like seismic waves.
- Study the major types of weathering, various exogenetic agents, processes and the evolution of different landforms curved out by river.
- Study in detail about the atmospheric stratification and circulation in form of planetary winds and jet streams.
- Understand the factors of soil formation and development of an ideal soil profile.
- Learn about the different plant adaptations and distribution in terms of water availability.
- Highlights the nature and classification of the hazards and disasters in reference to Indian subcontinent.
- The practical part includes graphical construction of scale, delineation of drainage basins from any selected topographical map (R.F = 1:50,000) for determining stream ordering and bifurcation ratio followed by extraction of drainage patterns and channel features along with proper interpretation and lastly, construction and interpretation of wind rose diagram.

Human Geography - GEOG-CC02/MD-CC02-2/4-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

After going through the course, the student should be able to:

- Understand the concepts related to Social Geography, Population Geography, Settlement Geography and Urban Geography which are important sub-disciplines of the human part of Geography.
- Provide a proper description of the nature, scope and recent trends in Human Geography.
- Studies the different geographical school of thought and approaches like Resource, Locational, Landscape and Environment.
- Learn about the factors of evolution of different human societies like hunting and food gathering, pastoral nomadism, subsistence farming, and industrial society and their comparisons with special focus on post-industrial urban societies.
- Study the different tribes Chenchu, Toda, and Gond and their physical, socio-economic and cultural life styles.
- Highlight the various stages of Demographic Transition Theory and the concept & significance of demographic dividend.
- Discuss about the distribution, density, and growth of population in India.
- Studies about definition and characteristics of urban and rural settlements along with site, situation, types, patterns of rural settlements and size-class classification of urban settlements (Census of India).
- The practical part includes calculation of arithmetic growth rate of population, drawing of choropleth map using the population density of Indian states or West Bengal, nearest neighbour analysis of rural settlement from Indian topographical maps (R.F = 1:50,000) and construction of proportional squares depicting number of houses.

Methods in Geography GEOG-SEC01/MD-SEC01-1/2/3-Th
(Credits: 04, Theory-04)

Course learning outcome (COs):

After going through the course, the student should be able to:

- Understands the concepts and strategies required for conducting any field survey and post-field analysis. This course emphasizes on data collection and compilation and basic and advanced methodologies involved in research in Physical and Human Geography.
- Learning about how to identify the existing research problems in any field area and based on that, design a primary survey for conducting the research. Students must know the significance of pilot survey prior to any primary survey and also the various methods of sampling necessary to identify the samples before the survey.
- Discuss the steps of preparing a questionnaire and interview schedule for collecting data from the sample population, followed by data entry into master table in computer platform and forming the tabulation required for statistical analysis of data (frequency, central tendency and dispersion).
- Highlights the methods of data collection and analysis in Physical Geography using minor survey instruments like Brunton compass, Distometer, smartphone levelling applications and textural analysis of grains using sieves.
- Studies the topographical maps, satellite imageries and DEM data for extraction and mapping of flooded areas, areal and linear extents of riverbank and coastline shift.
- Provides the theoretical understanding of the different methods applied in Human Geography like identification of Dominant and Distinctive functions in any region, construction of Ternary Diagram showing distribution of occupational patterns, drawing of accessibility maps and flow charts that uses road and transport data.

Geomatics and Spatial Analysis GEO-IDC01-1/2/3-Th & P
(Credits: 03, Theory-02, Practicals-01)

Course learning outcome (COs):

After going through the course, the student should be able to:

- Understands the basic concepts of Cartography, Surveying, Remote Sensing (RS), Geographical Information System (GIS) and Global Navigation Satellite System (GNSS) with their diverse applications in geographical studies.
- Studies the definition, concept, components and classification of Maps, Scales and Projections with special emphasis on properties and uses of simple conical projection and Universal Transverse Mercator (UTM).
- Learns about the different types of Bearing and the concept of geoid and spheroid with special reference to WGS-84.
- Highlights the basic concepts of three survey instruments, their features and uses: Dumpy level, Theodolite and lastly, Total Station which is the most updated survey instrument.
- Discuss about the definition and principles of Remote Sensing which includes mainly the satellites and sensors with special reference to space missions undertaken by Indian Space Research Organization (IRS) and National Aeronautics and Space Administration in U.S.A (Landsat missions).
- Develop the skill to understand and interpret the standard false colour composition of satellite images (FCC).
- Provide basic knowledge about the principles and significance of supervised image classification.
- Differentiate between various data structures like spatial and non-spatial, raster and vector with emphasis on metadata.
- Studies the basic principles of preparing an attribute table, data manipulation, query operation and overlay analysis in GIS.
- The practical part includes construction of simple conical projection with one standard parallel, traverse survey and plotting UTM coordinates using selected smartphone GNSS application, identification of land use / land cover features from satellite

imagery and detection of change (in area & perimeter) of riverbank or coastline shift from multi-dated maps and images.

THREE -YEAR (SIX-SEMESTER)

MULTIDISCIPLINARY COURSE

WITH MATHEMATICS

UNDER

CURRICULUM AND

CREDIT

FRAMEWORK

(CCF)

Graduate Attributes in Mathematics

The aspiring mathematician embarks on a journey woven from logic, proof, and the boundless beauty of numbers. As they progress, they cultivate a unique set of attributes, becoming not just masters of calculation, but architects of knowledge and contributors to the advancement of science and society.

1. **Disciplinary Expertise:** A deep understanding of the fundamental concepts, theories, and techniques across various subfields of mathematics forms the bedrock of their intellectual prowess. From abstract number theory to real-world applications in optimization and modeling, their knowledge empowers them to tackle diverse challenges with clarity and rigor.
2. **Algorithmic Architects:** They wield algorithms as tools, constructing computational solutions to complex problems. Be it optimizing financial models, forecasting weather patterns, or deciphering the inner workings of physical systems, their fluency in the language of algorithms equips them to bridge the gap between theory and practice.
3. **Crystal Clear Communicator:** The arcane language of mathematics becomes transparent in their articulation. They translate complex concepts into clear and concise explanations, fostering collaboration and nurturing the next generation of mathematical talent.
4. **Critical Problem Solver:** Faced with an enigmatic mathematical puzzle, their mind delves into a tapestry of logical deduction. They dissect assumptions, forge elegant solutions, and navigate intricate complexities with unwavering persistence.
5. **Inquiry Weaver:** A burning curiosity propels them forward. They craft insightful questions that challenge established paradigms and pave the way for groundbreaking discoveries. They meticulously conduct proofs, present their findings with conviction, and contribute to the ever-evolving dialogue of mathematical inquiry.
6. **Collaborative Virtuoso:** The spirit of teamwork flourishes in diverse mathematical ensembles. They seamlessly integrate their expertise, learn from fellow explorers, and cultivate a synergistic environment where knowledge thrives.
7. **Project Maestro:** Orchestrating research projects becomes an art form. They identify crucial resources, map strategic pathways, and navigate challenges with meticulous planning and unwavering ethical conduct.
8. **Digital Wizardry:** The computer becomes their laboratory, where algorithms paint vibrant landscapes of data. They wield advanced computational tools with mastery, transforming raw numbers into profound insights and unraveling the hidden patterns within.
9. **Ethical Architect:** Integrity becomes the cornerstone of their work. They identify and

navigate ethical dilemmas with transparency and fairness, upholding the highest standards of academic conduct and intellectual property.

10. **Global Citizen:** Their perspective transcends borders, embracing a deep understanding of the international landscape of mathematics. They see their contributions as threads woven into the global tapestry of scientific progress, driving advancements for the betterment of humanity.
11. **Lifelong Learner:** The quest for knowledge knows no bounds. They remain self-directed learners, constantly seeking new avenues to refine their skills, update their knowledge, and reshape their expertise. The journey through the boundless world of mathematics is a lifelong pursuit, fueled by unwavering dedication and a boundless passion for exploration.

These attributes paint a portrait of a graduate mathematician poised to make a significant impact on the world. They are not just skilled technicians, but architects of knowledge, collaborators, and leaders in the pursuit of understanding the very fabric of reality through the lens of mathematics.

Program Learning Outcomes (POs) for MDC with Mathematics

Program Learning Outcomes (POs) in a Bachelor of Science (MDC in Mathematics) program outline the specific knowledge, skills, and abilities that students are expected to acquire by the end of their studies. These outcomes reflect the overall goals of the program and serve as a guide for curriculum development and assessment. Here are some key Program Learning Outcomes for a B.Sc (MDC in Mathematics) program:

1. **Mathematical Knowledge and Understanding:** Graduates should demonstrate a comprehensive understanding of foundational mathematical concepts, theories, and principles across various branches of mathematics, including but not limited to algebra, calculus, analysis, geometry, and discrete mathematics.
2. **Problem-Solving Proficiency:** Graduates should be proficient in applying mathematical techniques to solve complex problems. This involves the ability to analyze problems, formulate mathematical models, and apply appropriate methods for solution.
3. **Mathematical Reasoning and Proof:** Graduates should possess strong mathematical reasoning skills and be able to construct rigorous mathematical proofs. This includes understanding the logical structure of mathematical arguments and the ability to communicate proofs effectively.
4. **Advanced Calculus and Analysis:** Graduates should have a deep understanding of advanced calculus and mathematical analysis, including the convergence of sequences and series, limits, continuity, and the fundamental theorems of calculus.
5. **Algebraic Structures:** Graduates should be familiar with algebraic structures such as groups, rings, and fields, and be able to apply abstract algebraic concepts to various mathematical problems.
6. **Geometry and Topology:** Graduates should have a solid understanding of geometry and topology, including concepts such as symmetry, transformations, and the properties of geometric shapes.
7. **Applied Mathematics:** Graduates should be able to apply mathematical techniques to real-world problems in various scientific and engineering domains. This includes proficiency in mathematical modeling, data analysis, and numerical methods.
8. **Mathematical Software and Technology:** Graduates should be proficient in using mathematical software and technology to aid in problem-solving, visualization, and data analysis.
9. **Effective Communication:** Graduates should be able to communicate mathematical ideas clearly and effectively, both in written and oral forms, to diverse audiences, including peers and non-specialists.
10. **Independent Research Skills:** Graduates should demonstrate the ability to conduct

independent research in mathematics. This includes formulating research questions, conducting literature reviews, and applying appropriate research methodologies.

11. **Ethical and Professional Conduct:** Graduates should adhere to ethical standards in mathematical research and practice, including proper citation of sources, integrity in data analysis, and responsible use of mathematical knowledge.
12. **Lifelong Learning:** Graduates should recognize the importance of lifelong learning in mathematics, staying abreast of new developments in the field, and continuously enhancing their mathematical skills and knowledge.

These Program Learning Outcomes collectively ensure that graduates of the B.Sc (MDC with Mathematics) program are well-prepared for a variety of career paths, including further study at the graduate level or employment in fields requiring strong analytical and mathematical skills.

Core Courses for MDC with Mathematics

S. No.	POs	CC- 1	CC- 2	CC- 3	CC- 4	CC- 5	CC- 6	CC- 7	CC- 8
1	Fundamental understanding of the field	✔	✔	✔	✔	✔	✔	✔	✔
2	Application of basic Mathematics concepts	✔	✔	✔	✔	✔	✔	✔	✔
3	Linkages with related disciplines	✔	✔	✔	✔	✔	✔	✔	✔
4	Procedural knowledge for professional subjects	✔	✔	✔	✔	✔	✔	✔	✔
5	Skills in related field of specialization	✔	✔	✔	✔	✔	✔	✔	✔
6	Ability to use in Mathematics problem	✔	✔	✔	✔	✔	✔	✔	✔
7	Skills in Mathematical modeling	✔	✔	✔	✔	✔	_	_	✔
8	Skills in performing analysis and interpretation of data	✔	✔	✔	✔	✔	✔	✔	✔
9	Develop investigative Skills	✔	✔	✔	✔	✔	✔	_	✔
10	Skills in problem solving in Mathematics and related discipline	✔	✔	✔	✔	✔	✔	✔	✔
11	Develop Technical Communication skills	✔	✔	✔	✔	-	-	✔	✔
12	Developing analytical skills and popular communication	✔	✔	✔	✔	-	-	✔	-
13	Developing ICT skills	✔	✔	✔	✔	✔	✔	_	✔
14	Demonstrate professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✔	✔	✔	✔	✔	✔	✔	✔

Minor Papers for MDC with Mathematics

S. No.	POs	MC- 1	MC- 2	MC- 3	MC- 4	MC- 5	MC- 6
1	Fundamental understanding of the field	✔	✔	✔	✔	✔	✔
2	Application of basic Mathematics concepts	✔	✔	✔	✔	✔	✔
3	Linkages with related disciplines	✔	✔	✔	✔	✔	✔
4	Procedural knowledge for professional subjects	✔	✔	✔	✔	✔	✔
5	Skills in related field of specialization	✔	✔	✔	✔	✔	✔
6	Ability to use in Mathematics problem	✔	✔	✔	✔	✔	✔
7	Skills in Mathematical modeling	✔	✔	✔	✔	✔	_
8	Skills in performing analysis and interpretation of data	✔	✔	✔	✔	✔	✔
9	Develop investigative Skills	✔	✔	✔	✔	✔	✔
10	Skills in problem solving in Mathematics and related discipline	✔	✔	✔	✔	✔	✔
11	Develop Technical Communication skills	✔	✔	✔	✔	-	-
12	Developing analytical skills and popular communication	✔	✔	✔	✔	-	-
13	Developing ICT skills	✔	✔	✔	✔	✔	✔
14	Demonstrate professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✔	✔	✔	✔	✔	✔

Skill Enhancement Course (SEC) Papers for MDC with Mathematics

Sl. No	POs	SEC 1	SEC 2.2	SEC 3
1	Fundamental understanding of the field	✔	✔	✔
2	Application of basic Mathematical concepts	✔	✔	✔
3	Linkages with related disciplines	✔	✔	✔
4	Procedural knowledge for professional subjects	✔	✔	✔
5	Skills in related field of specialization	✔	✔	✔
6	Ability to use in Mathematics problem	-	✔	✔
7	Skills in Mathematical modeling	-	✔	✔
8	Skills in performing analysis and interpretation of data	-	✔	✔
9	Develop investigative Skills	-	✔	✔
10	Skills in problem solving in Mathematics and related discipline	✔	✔	✔
11	Develop Technical Communication skills	✔	✔	✔
12	Developing analytical skills and popular communication	✔	✔	✔
13	Developing ICT skills	✔	✔	✔
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self-reading, etc	✔	✔	✔

Interdisciplinary Course (IDC) for MDC with Mathematics

Sl. No	POs	IDC
1	Fundamental understanding of the field	✔
2	Application of basic Mathematical concepts	✔
3	Linkages with related disciplines	✔
4	Procedural knowledge for professional subjects	-
5	Skills in related field of specialization	✔
6	Ability to use in Mathematics problem	✔
7	Skills in Mathematical modeling	-
8	Skills in performing analysis and interpretation of data	✔
9	Develop investigative Skills	-
10	Skills in problem solving in Mathematics and related discipline	✔
11	Develop Technical Communication skills	-
12	Developing analytical skills and popular communication	✔
13	Developing ICT skills	✔
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self-reading, etc	✔

Course Learning Outcomes (CLO)

Core Courses (CC)

MATH-MD-CC1-1-Th
(same for MATH-MD-MC 1-3-Th)
Calculus, Geometry & Vector Analysis
Full Marks: 100 (Theory: 75 and Tutorial: 25)

Course learning outcome (COs):

Upon successful completion of this course, students will be able to:

Group A: Calculus

- Define and apply the concept of differentiability for functions at a point and in an interval.
- Interpret the meaning of the sign of a derivative and its relationship to increasing/decreasing behavior.
- Differentiate hyperbolic functions, higher order derivatives, and functions involving exponential and logarithmic terms.
- Utilize Leibnitz's rule for differentiation and apply it to specific types of functions.
- Identify and handle indeterminate forms using L'Hopital's rule.
- Derive and apply reduction formulae to integrate trigonometric functions, logarithmic functions, and product of trigonometric functions.
- Find the arc length of curves, including parametric curves, and calculate the area under a curve and the volume of a surface of revolution.

Group B: Geometry

- Analyze and categorize second-degree equations using rotation of axes and the discriminant.
- Represent conics (ellipses, parabolas, hyperbolas) in both rectangular and polar forms, and find tangents and normals for these curves.
- Define and identify various types of three-dimensional surfaces, including spheres, cylinders, and conicoids.
- Analyze plane sections of conicoids and identify surfaces such as cones, cylinders, ellipsoids, hyperboloids.
- Classify quadric surfaces based on their geometric properties.

Group C: Vector Analysis

- Perform the triple product and apply vector equations to solve problems in geometry and mechanics.
- Analyze and solve problems involving concurrent forces in a plane, theory of couples, and systems of parallel forces.
- Define and analyze vector-valued functions, including limits, continuity, differentiation, and integration.
- Utilize derivatives and integrals of vector functions to solve problems in various contexts.

Additional Outcomes:

- Students will develop strong problem-solving skills and critical thinking abilities within the realm of calculus, geometry, and vector analysis.
- They will enhance their communication skills by effectively demonstrating mathematical concepts verbally and through written representation.
- Students will gain a deeper appreciation for the interconnectedness of different areas of mathematics and their relevance to various fields of study.

MATH-MD-CC2-2-Th
(same for MATH-MD-MC 2-4-Th)
Basic Algebra
Full Marks: 100 (Theory: 75 and Tutorial: 25)

Course learning outcome (COs):

Upon successful completion of this course, students will be able to:

Group A: Complex Numbers and Equations

- **Complex Numbers:**
  - Represent complex numbers in polar forms and find n-th roots of unity.
  - Apply De Moivre's theorem to solve problems involving rotations and powers of complex numbers.
  - Analyze and differentiate functions of a complex variable (exponential, logarithmic, trigonometric, and hyperbolic).
- **Theory of Equations:**
  - Understand the relationship between roots and coefficients of polynomial equations.
  - Apply techniques like Descartes' rule of signs and Sturm's theorem to analyze the nature of roots.
  - Solve cubic and biquadratic equations using methods like Cardano's and Ferrari's formulas.
- **Inequalities:**
  - Utilize key inequalities like AM-GM and Cauchy-Schwartz to solve inequality problems.

Group B: Relations, Mappings, and Number Theory

- **Relations:**
  - Distinguish and analyze different types of relations (equivalence, partial order, linear order).
  - Understand equivalence classes and partitions associated with equivalence relations.
- **Mappings:**
  - Compose mappings and analyze their relationship with set operations.
  - Interpret and apply the concept of a preimage for a mapping and subset.
- **Number Theory:**

- Apply the well-ordering property of integers and principles of mathematical induction to prove theorems.
- Utilize the division algorithm and Euclidean algorithm to analyze divisibility and find greatest common divisors.
- Understand and apply properties of prime numbers, including Euclid's theorem and the Fundamental Theorem of Arithmetic.
- Solve systems of congruences using the Chinese remainder theorem.
- Explore and utilize specific arithmetic functions like phi, tau, and sigma.

Group C: Linear Systems and Vector Spaces

- **Linear Systems:**
  - Solve systems of linear equations (homogeneous and non-homogeneous) and determine their existence and uniqueness.
  - Utilize the matrix equation Ax = b and row reduction techniques to find solutions and analyze echelon forms.
  - Understand the concepts of rank, invertible matrices, and pivot positions.
  - Represent solutions parametrically and interpret them geometrically.
- **Vectors and Vector Spaces:**
  - Perform operations on vectors in R^n and understand their algebraic and geometric properties.
  - Represent linear systems with vectors and analyze their solutions based on linear combinations.
  - Visualize the geometry of linear combinations and spanned subsets.
  - Understand the concepts of linear independence and its algebraic and geometric characterizations.

Additional Outcomes:

- Develop computational skills for solving various algebraic problems efficiently.
- Enhance proficiency in using mathematical software and technology for representing and analyzing mathematical concepts.
- Appreciate the historical development of certain mathematical ideas and their connections to scientific and engineering applications.

MATH-MD-SEC 1-1-Th

C Language with Mathematical Applications
Full Marks: 100 (Theory: 75 and Tutorial: 25)

Course learning outcome (COs):

Upon successful completion of this course, students will be able to:

Programming Fundamentals:

- Explain the fundamental concepts of computer architecture and programming languages, including machine code, assembly language, high-level languages, and object-oriented languages.
- Demonstrate a strong understanding of constants, variables, data types, operators, and expressions in C programming.
- Apply decision-making constructs (if, if-else, switch) and control flow statements (while, do-while, for) to create structured programs.
- Effectively utilize arrays (one-dimensional, two-dimensional, and multi-dimensional) to organize and manipulate data.

Function Design and Implementation:

- Define and implement user-defined functions in C, understanding scope, return values, parameter passing, and recursion.
- Apply library functions from standard C libraries (stdio.h, math.h, string.h, stdlib.h, time.h) to perform common tasks.

Problem-Solving and Programming Skills:

- Analyze programming problems and design algorithms using appropriate C constructs and techniques.
- Write well-structured, readable, and efficient C programs to solve a variety of computational problems, including:
    - Numerical calculations (arithmetic, series summation, approximations)
    - Data processing (array manipulation, sorting, searching)
    - Mathematical problems (quadratic equations, linear systems, geometric calculations)
    - Text processing (strings, anagrams)
    - Decision-making and branching based on user input or data conditions

- File I/O operations (reading and writing data files)

Practical Application and Communication:

- Develop practical C programming skills through hands-on exercises and assignments, including the creation of a practical notebook.
- Demonstrate clarity and precision in writing C code and explaining programming concepts.
- Apply C programming skills to solve real-world problems in various domains, such as finance (compound interest), geometry, and problem-solving challenges.

MATH-MD-SEC 2.2-2-Th
Artificial Intelligence
Full Marks: 100 (Theory: 75 and Tutorial: 25)

Course learning outcome (COs):

Upon successful completion of this course, students will be able to:

Unit 1: Introduction to Artificial Intelligence

- Define AI and its scope within the broader context of computer science.
- Trace the historical development of AI and identify key milestones and influential figures.
- Distinguish between artificial and human intelligence, outlining their distinctive characteristics and limitations.

Unit 2: AI Subfields and Technologies

- Explain the core principles of various machine learning approaches, including supervised, unsupervised, and reinforcement learning.
- Analyze the structure and function of deep learning neural networks, recognizing their strengths and challenges.
- Identify and describe applications of natural language processing (NLP) and computer vision in AI systems.

Unit 3: Applications of AI

- Discuss the utilization of AI in healthcare diagnostics, treatment planning, and medical image analysis.
- Evaluate the use of AI in financial applications like fraud detection, algorithmic trading, and risk assessment.
- Analyze the potential and challenges of autonomous vehicles and AI-powered traffic optimization in transportation systems.
- Critically examine the role of AI in customer service chatbots and its impact on user experience.
- Explore the development of personalized learning platforms and intelligent tutoring systems in the field of education.

Unit 4: Ethical and Social Implications of AI

- Identify and analyze potential biases and fairness concerns associated with AI algorithms and data.
- Discuss privacy and data protection issues arising from the development and deployment of AI systems.
- Evaluate the potential impact of AI on employment and job displacement, proposing mitigation strategies.
- Analyze the relationship between AI and social inequality, identifying potential risks and promoting responsible development.

Unit 5: Other Important Issues

- Critically assess existing ethical guidelines and best practices for responsible AI development and implementation.
- Discuss the role of AI in driving innovation and transformation across various sectors.
- Identify and analyze emerging trends and future directions in the field of AI.
- Explore the intersection of AI and creativity, including generative models and their potential artistic applications.

Additional Outcomes:

- Develop critical thinking and analytical skills through evaluating real-world AI applications and their implications.
- Enhance communication skills by effectively presenting arguments, insights, and concerns related to AI technology.
- Cultivate an informed and responsible perspective on the development and deployment of AI in society.

MATH-MD-SEC 3-3-Th

Linear Programming and Rectangular Games

Full Marks: 100 (Theory: 75 and Tutorial: 25)

Course learning outcome (COs):

Upon successful completion of this course, students will be able to:

Unit 1: Introduction to Linear Programming

- Define linear programming problems and formulate them from real-life examples involving inequalities.
- Graphically solve simple linear programming problems and identify basic feasible solutions.
- Understand the concepts of matrix formulation, degeneracy, and non-degeneracy in B.F.S.

Unit 2: Convexity and Extreme Points

- Explain the concepts of hyperplanes, convex sets, cones, extreme points, convex hulls, and convex polyhedra.
- Analyze the relationship between feasible solutions of an L.P.P. and its convex set, extreme points, and optimal values.
- Differentiate between bounded and unbounded feasible regions and their implications for optimality.

Unit 3: The Simplex Method and Duality

- Implement the simplex method and two-phase method to solve linear programming problems.
- Understand the theoretical basis of feasibility and optimality conditions in the simplex method.
- Identify and resolve degeneracy issues in linear programming problems.
- Apply duality theory to understand the relationship between primal and dual problems and their optimal values.

Unit 4: Post-Optimal Analysis and Applications

- Analyze the impact of changes in cost and requirement vectors, coefficient matrix, and addition of variables/constraints on optimal solutions.
- Solve transportation and assignment problems using mathematical justifications and Hungarian method.

- Understand the Traveling Salesman problem and its complexity.

Unit 5: Rectangular Games and Interrelations

- Explain the concept of game problems and rectangular games with pure and mixed strategies.
- Identify and analyze saddle points and their existence in rectangular games.
- Determine optimal strategies and values of the game, applying necessary and sufficient conditions.
- Utilize dominance concepts and the fundamental theorem of rectangular games to solve problems.
- Compare and contrast the relationships between game theory and linear programming.

Additional Outcomes:

- Proficiently utilize software packages to formulate and solve linear programming problems.
- Develop a practical notebook documenting internal assignments and solutions for partial course fulfillment.
- Effectively communicate mathematical concepts and problem-solving techniques in both written and spoken forms.
- Apply critical thinking skills to analyze complex optimization scenarios and develop creative solutions.

MATH-MD-IDC-1-Th
(same for MATH-MD-IDC-2-Th & MATH-MD-IDC-3-Th)
Mathematics in Daily Life
Full Marks: 75(Theory: 50 and Tutorial: 25)

Course learning outcome (COs):

Overall:

Upon successful completion of "Mathematics in Daily Life," students will be able to:

- Recognize and apply foundational mathematical concepts to solve practical problems and make informed decisions in various everyday scenarios.
- Develop critical thinking and problem-solving skills by analyzing real-world data and situations through a mathematical lens.
- Effectively communicate and explain mathematical reasoning and solutions in a clear and understandable way.
- Appreciate the relevance and power of mathematics in diverse aspects of daily life, from personal finance and budgeting to understanding news and making responsible choices.

Specific Group-Level Outcomes:

Group A: Basics of Set Theory

- Organize and categorize information based on set operations like union, intersection, and complement, applicable to sorting items, managing schedules, or planning events.
- Visualize relationships between sets using Venn diagrams to understand connections and overlap in diverse contexts, like comparing dietary options or analyzing social groups.
- Utilize the formula for number of elements to estimate quantities or make informed decisions in daily situations.

Group B: Understanding Integers

- Apply divisibility rules to quickly assess quantities in shopping, cooking, or other activities involving calculations.
- Solve linear Diophantine equations to optimize resource allocation or find optimal combinations in scenarios like recipe balancing or budget planning.
- Utilize congruence of integers to create scheduling arrangements, game plans, or even solve puzzles, demonstrating its practical applications beyond abstract

mathematics.

Group C: Mathematical Logic

- Analyze information and arguments critically using logical connectives like OR, AND, and NOT, improving decision-making in daily life scenarios like evaluating news claims or weighing options.
- Identify tautologies and contradictions in everyday arguments to enhance critical thinking and logical reasoning skills.

Group D: Basics of Operations Research

- Formulate simple real-world problems as linear programs, such as optimizing travel routes, planning schedules, or allocating resources, and visualize solutions using the graphical method.
- Understand the concept of game theory and apply it to analyze competitive situations in daily life, like negotiations, resource sharing, or even game strategies.

Group E: Financial Mathematics

- Calculate and compare different interest rates for loans, investments, or savings, making informed financial decisions based on mathematical calculations.
- Apply annuity concepts to understand loan repayments, pension plans, or investment schemes, planning for their financial future.
- Navigate tax calculations and optimize financial decisions using basic mathematical principles.

Additional Outcomes:

- Develop confidence and comfort applying mathematical knowledge to real-world challenges.
- Foster a sense of curiosity and exploration, actively seeking and appreciating the presence of mathematics in everyday life.
- Communicate the value and relevance of mathematics beyond academic settings, showcasing its practical applications and empowering students to make informed decisions.

Program Learning Outcomes (POs) in MDC B.Sc Physics

The student graduating with the MDC B.Sc degree should be able to

- **Acquire**

  (i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics and interdisciplinary areas.

  (ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research anddevelopment, teaching and government/public service;
  (iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.

- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.

- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.

- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevanttheories of Physics.

- Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent investigation of Physics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.

- Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment, (v) constitutional values, (vi) Indian Knowledge System

Discipline Specific Course for 3 year
Multidisciplinary Course: B.Sc Physics

S. No.	POs	Minor-1	Minor-2	SEC	IDC
1	Fundamental understanding of the field	X	X	X	X
2	Application of basic Physics concepts	X	X	X	X
3	Linkages with related disciplines	X	X	X	X
4	Procedural knowledge for professional subjects	X	X	X	-
5	Skills in related field of specialization	X	X	X	-
6	Ability to use in Physics problem	X	X	X	X
7	Skills in Mathematical modeling	X	X	X	-
8	Skills in performing analysis and interpretation of data	X	X	X	-
9	Develop investigative Skills	X	X	-	-
10	Skills in problem solving in Physics and related discipline	X	X	X	-
11	Develop Technical Communication skills	X	X	X	X
12	Developing analytical skills and popular communication	X	X	X	X
13	Developing ICT skills	-	-	X	-
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading,etc	X	X	X	X

Course Learning Outcomes (CLO)

Minor 1: BASIC PHYSICS-I
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

Students will be able to

- Revise the knowledge of calculus, SI system, plotting, vectors, vector calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.
- Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.
- Learn homogenous differential equations, partial derivatives which have applications in all branches of physics.
- Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. She will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
- Understand the dynamics of system of particles and idea about center of mass and laboratory frames and their correlation.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit,through the study of law of Gravitation, central force.
- Understand simple principles of fluid flow and the equations governing fluid dynamics.
- In the laboratory course, the student shall perform experiments to measure Modulus of Rigidity, moment of inertia, vertical height using Sextant, determining coefficient of viscosity. Know about the basic theory of errors, their analysis, estimation with examples of simple experiments in Physics

Course Learning Outcomes (CLO)

Minor 2: BASIC PHYSICS-II
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

Students will be able to

- Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to various systems.
- Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electriqotential, electric potential energy) formalisms of electrostatics.
- Articulate knowledge of electrostatic energy.
- Basic knowledge of Loretnz force and operational principle of cyclotron.
- Describe the basics of magnetostatics, Bio-Savart Law.
- Application of Ampere's circuital law, concept of magnetic dipole etc.
- Learn the microscopics and macroscopic description of matter, postulates of kinetic theory of gases, Maxwell-Boltzman distribution law.
- Comprehend the basic concepts of thermodynamics, the zeroth, first and the second law of thermodynamics, the concept of entropy and the associated theorems.
- In the laboratory course the student will get an opportunity to study the conversion of Ammeter to Voltmeter and vice versa.
- Should be able to determine the unknown resistance using Carey-Foster bridge, measurement of current using potentiometer..
- Measure the pressure coefficient and coefficient of thermal expansion.

Course Learning Outcomes (CLO)

Skill Enhancement Course

SEC1: Introduction to Computer Programming and Graph Plotting (Credits: 04, Theory-0, Practicals-04)

Course learning outcome (COs):

Students will be able to

- Perform 2D graph plotting using GNUPLOT
- They will have basic idea about Python Programming, its basic operations, conditional statements, built in function etc.
- Idea about different data structures like list, tuple, string, set etc and their usage in writing programmes.
- They will be able to solve simple physical problems involving sorting, matrix operations, and differential equations as well as finding the roots of equations.

Course Learning Outcomes (CLO)

Interdisciplinary Course

IDC: Frontiers in Physics
(Credits: 03, Theory-02, Tutorial-01)

Course learning outcome (COs):

Students will be able to gain qualitative knowledge about

- Basic Nature of Science, reasoning and universality of physics experimentation.
- The Universe, its creation and evolution, celestial laws.
- Matter and its constitutions, thermodynamics and radioactivity.
- Basic laws of nature, dual property of light and introduction to quantum mechanics and relativity.

Programme Learning Outcomes (PO) in B.Sc. (MDC) Zoology (under CCF)

1. Demonstrate (i) in-depth knowledge and understanding about the fundamental concepts, principles and processes underlying the academic field of Zoology and its different sub-fields (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal biotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases, apiculture, aquarium fish keeping, medical diagnostics, and sericulture) (ii) procedural knowledge that creates different types of professionals in the field of Zoology and related fields such as, apiculture, aquarium fish keeping, medical diagnostics, and sericulture, etc.(iii) skills related to specialization areas within Zoology as well as within sub-fields of Zoology, including broader interdisciplinary sub-fields (Chemistry, Physics and Mathematics).
2. Appreciate the complexity of life processes, their molecular, cellular and physiological processes, their genetics, evolution and behaviour and their interrelationships with the environment.
3. Study concepts, principles and theories related with animal behaviour and welfare.
4. Understand and interpret data to reach a conclusion
5. Design and conduct experiments to test a hypothesis.
6. Understand scientific principles underlying animal health, management and welfare.
7. Accept the legal restrictions & ethical considerations placed for animal welfare.
8. Understand fundamental aspects of animal science relating to management of animals.
9. Assess problems and identify constraints in management of livestock.

Course Learning Outcomes (CO) in B.Sc. (MDC) Zoology (under CCF)

CC1 Cell Biology

1. Students get the knowledge about cell structure and function to understand the life sustaining processes.
2. Students understand the normal and abnormal conditions of cell functioning,get basic knowledge about caner
3. Students get familiar with different tools and techniques in cell biology like microscopy, cell culture, cell fractionation, Freeze fracture replication, Freeze etching etc.
4. Students learn the techniques of cell measurement, cell staining and study cell viability.

CC-2 Biochemistry

1. Students get knowledge about the structural materials (Carbohydrate, Protein, Lipid, Nucleic acids) of living body.
2. Students understand the molecular structure of the organic body materials and functioning of the materials at molecular level.
3.Students become familiar with the control system of chemical reactions undergoing inside living body through the action of enzymes and feedback mechanism.

4. Students learn to identify organic materials through qualitative tests.
5. Students learn the techniques of quantitative estimations of organic materials.