PO CO STATEMENTS AND MAPPINGS: B SC MDC

MDC Botany

Program Learning Outcomes (POs) in 3-year

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.

POs in 3-year MDC Botany (NEP 2020)

PO 1. **Generate a strong knowledgebase in the subject**

PO 2. **Learn hands-on techniques for industrial applications**

PO 3. **Showcase the proficiency in the experimental techniques**

PO 4. **Utilize scientific methodologies to solve varied questions**

PO 5. **Improve their ethical and moral views**

PO 6. **Acquire collaboration and cooperation skills to work as a team**

PO 7. **Establish themselves as independent learner**

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

CO 1. Acquire an understanding of various algal and fungal groups including their diagnostic characters, examples and economic value.

CO 2. Accomplish an idea of lichens, as well as a curiosity for the adaptive characteristics of these organisms.

CO 3. Demonstrate a grasp of bryophytes, their life history and economic importance.

CO 4. Gain knowledge of the morphology and reproduction procedures of pteridophytes, and gymnosperms

CO 5. Develop a foundation on the origin of plant cells and importance of plants as food, fuel etc.

CO 6. Acquire a grasp of angiosperm morphology, especially of flower and fruits.

CO 7. Grasp practical knowledges to the collection, systematic study and identification of plants.

COs-POs Mapping

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

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√		√	√	√
CO2	√			√	√	√	√
CO3	√				√	√	√
CO4	√			√	√	√	√

CO5	√				√	√	√
CO6	√		√	√		√	√
CO7	√	√	√	√	√	√	√

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

CO 1. The theory of plant systematics and recognize the significance of herbarium and virtual herbarium

CO 2. Evaluate the importance of herbaria and botanical gardens

CO 3. Interpret the rules of ICN in botanical nomenclature

CO 4. Learn the concepts associated with Numerical taxonomy and Phylogenetic classification.

CO 5. Generalize the characteristics of the families under the classification scheme developed by Bentham and Hooker.

CO 6. Grasp practical knowledges to the collection, systematic study and identification of plants.

COs-POs Mapping

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

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√				√	√	√
CO2	√			√	√	√	√
CO3	√			√	√	√	√
CO4	√	√	√	√	√	√	√
CO5	√			√	√	√	√
CO6	√	√	√	√	√	√	√

Economic Botany (BOT-MD-CC3-3-Th BOT-MD-CC3-3-P)

CO 1. Develop a fundamental understanding of economic botany and be able to link to the environment, populations, communities, and biological ecosystems.

CO 2. Gain an in-depth comprehension of the development of the concept of organization of apex new crops and varieties, the significance of germplasm diversity, and the problems associated with access and ownership.

CO 3. Have a fundamental understanding of the taxonomic diversity and notable families of plants that are of practical utility.

CO 4. Raise people's awareness of and appreciation for the plants and plant products that they come into contact with in their daily lives.

CO 5. Recognize the wide variety of plant species and the varieties of plant products that are used by humans.

COs-POs Mapping

Economic Botany (BOT-MD-CC3-3-Th BOT-MD-CC3-3-P)

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√				√	√	√
CO2	√	√	√	√	√	√	√
CO3	√		√	√	√	√	√
CO4	√		√	√	√	√	√
CO5	√	√	√	√	√	√	√

Pharmacognosy & Ethnobotany (BOT-MD-CC4-4-Th BOT-MD-CC4-4-P)

CO 1. Be familiar with the fundamental pharmacognosy and its importance in modern medicine, crude drugs and Classification of drugs.

CO 2. Have in depth knowledge on pharmacologically active constituents and biosynthesis of various secondary metabolites.

CO 3. Learn the procedure of chemical, microscopic and histochemical tests for identification of medicinal herbs.

CO 4. Propose new strategies to implement the knowledges of ethnomedicine, taking into consideration the practical concerns that are relevant to India.

COs-POs Mapping

Pharmacognosy & Ethnobotany (BOT-MD-CC4-4-Th BOT-MD-CC4-4-P)

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√		√	√	√
CO2	√		√	√	√	√	√
CO3	√		√	√	√	√	√
CO4	√	√	√	√	√	√	√

Plant Geography, Ecology & Evolution (BOT-MD-CC5-4-Th BOT-MD-CC5-4-P)

CO 1. Understand fundamental concepts of biotic and abiotic systems

CO 2. Analyze the phytogeography or phytogeographical division of India

CO 3. Understand the cornerstones of ecological systems and community ecology

CO 4. Evaluate the process of adaptation of plants, succession stages, and phytoremediation.

CO 5. Conduct experiments using skills that are appropriate to estimate environmental health.

CO 6. Acquire an understanding of the ideas of natural selection and the mechanisms that underlie evolution.

COs-POs Mapping

Plant Geography, Ecology & Evolution (BOT-MD-CC5-4-Th BOT-MD-CC5-4-P)

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√	√	√		√	√	√
CO2	√		√	√	√	√	√
CO3	√		√	√	√	√	√
CO4	√		√	√	√	√	√
CO5	√	√	√		√	√	√
CO6	√		√	√	√	√	√

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

CO 1. Recognize multiple types and categories of mushrooms, their health beneficial values and idea of poisonous mushrooms.

CO 2. Showcasing several kinds of mushroom cultivation technologies including the knowledge and industrial designs and required appliances for cultivation of mushroom.

CO 3. Explore the procedures of multiple stages of mushroom cultivation and their variability in different types of mushrooms.

CO 4. Learn the management strategies to overcome the mushroom diseases and the postharvest processing technologies for increasing the shelf life.

CO 5. Assess the financial aspects related to the production of mushrooms and create innovative techniques and plans to boost the yield of mushrooms.

COs-POs Mapping

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

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	√		√	√	√	√	√
CO2	√		√	√	√	√	√
CO3	√	√	√	√	√	√	√
CO4	√		√		√	√	√
CO5	√	√	√	√	√	√	√

Chemistry MDC-

PROGRAMME OUTCOME OF B. SC. CHEMISTRY (MULTIDISCIPLINARY)

PO1: Core competency

PO2: Disciplinary knowledge and skill PO3:

Skilled communicator

PO4: Critical thinker and problem solver

PO5: Sense of inquiry

PO6: Team player

PO7: Skilled project manager PO8:

Digitally literate

PO9: Ethical awareness/reasoning PO10:

Lifelong learner

(Credits:Theory-03,Practicals-01) Paper:

CHEM-MD-CC1-1-Th/CHEM-MD-CC13-Th

Course learning outcome(COs):

After going through the course the student should be able to understand CO.1.Extra

nuclear structure of atoms and periodicity

CO.2.Basics of Organic Chemistry Bonding and Physical Properties: (valence bond theory, electronic displacements, MO theory, Physical properties, Stereochemistry -I)

CO. 3. Thermodynamics -I CO.4.Chemical

Kinetics -I

COs-POs Mapping

Course Code: **CHEM-MD-CC1-1-Th/CHEM-MD-CC13-Th**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	√	√	√	√	√		√			√
CO2	√	√	√	√	√					√
CO3	√	√	√	√	√					√
CO4	√	√	√	√	√			√		√

Chemistry MDC-II

(Credits:Theory-03,Practicals-01)

Paper: CHEM-MD-CC2-2-Th (P)/CHEM-MD-CC2-4-Th (P)

Course learning outcome(COs):

After going through the course the student should be able to understand

CO.1. Kinetic theory and gaseous state

CO.2. Real gas and virial equation

CO.3. Chemical bonding -I

CO.4. Stereochemistry -II

CO.5. General treatment of reaction mechanism-I

CO.6. Iodimetric titrations, estimation of metal content in some selective samples

COs-POs Mapping

Course Code: **CHEM-MD-CC2-Th/CHEM-MD-CC2-4-Th**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	√	√	√	√	√		√			√
CO2	√	√	√	√	√					√
CO3	√	√	√	√	√					√
CO4	√	√	√	√	√			√		√
CO 5	√	√	√	√	√					
CO6	√	√	√	√	√					

Chemistry MDC-III

(Credits:Theory-03,Practicals-01)

Paper: CHEM-MD-CC3-3-Th (P)/CHEM-MD-CC3-5-Th (P)

Course learning outcome(COs):

After going through the course the student should be able to understand CO.1.Aromatic substitution

CO.2.General treatment of reaction mechanism-II CO.3.

Substitution and elimination reactions CO.4. Chemistry

of alkenes and alkynes

CO.5. Identification of pure single organic compound (solid compounds, liquid compounds)

COs-POs Mapping

Course Code: **CHEM-MD-CC3-3-Th(P)/CHEM-MD-CC3-5-Th (P)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	√	√	√	√	√					√
CO2	√	√	√	√	√					√
CO3	√	√	√	√	√					√
CO4	√	√	√	√	√					√
CO5	√	√	√	√	√					√

Chemistry MDC

Paper: CHEM-MD-CC4-4: Inorganic Chemistry - I

(Credit: Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Chemical bonding–II: Molecular orbital concept of bonding, Metallic Bond, Weak Chemical Forces.

CO2: Acids and bases: Acid-Base concept, Acid-base equilibria in aqueous solution.. CO3:

Radioactivity: Nuclear stability, Nuclear Reactions, Radiocarbon dating

CO4: Complexometric Titration: Ca (II) and Mg (II) in a mixture, Hardness of water, Fe (III) and Al (III) in a mixture, Cu (II) and Zn (II) in a mixture, Cu (II) and Ni (II) in a mixture

COs-POs Mapping

CC-4: Inorganic Chemistry - I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	□
CO3	□	□		□	□				□	□
CO4	□	□	□	□	□	□			□	□

CHEMISTRY MDC (CC-5)

PAPER: CHEM-MD-CC5-4
(Credit: Theory -03, Practical – 01)

Physical Chemistry - I

Course learning outcome (COs)

CO1: Thermodynamics – II, Second Law, Systems of Variable Compositions CO2:

Applications of Thermodynamics – I, Chemical Equilibrium,

CO3: ELECTROCHEMISTRY-I, Conductance, Ionic Equilibrium

CO4: Experimentally determination of rate constant of Clock reaction, decomposition of H_2O_2, acid catalyzed hydrolysis of an ester, inversion of cane sugar

COs-POs Mapping

CC5/MN5: Physical Chemistry - I

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	□	□		□	□				□	
CO2	□	□		□	□				□	□
CO3	□	□		□	□				□	□
CO4	□	□		□	□	□		□	□	□

Chemistry MDC

Paper: CHEM-MD CC6-5: Organic Chemistry-II (Credit:

Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Stereochemistry – IV: Conformation-II, Concept of prostereoisomerism, Chirality arising out of stereoaxis.

CO2: Chemistry of carbonyl Compounds: Nucleophilic Addition to C=O, Exploitation of acidity of α-H of C=O, Nucleophilic addition to α, β-unsaturated carbonyl system, Substitution at sp2 carbon (C=O system).

CO3: Organometallics.

CO4: Qualitative analysis of single solid organic compound.

COs-POs Mapping

CC-6: Organic Chemistry-II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□					□
CO2	□	□		□	□					□
CO3	□	□		□	□					□
CO4	□	□	□	□	□		□		□	□

CHEMISTRY MDC (CC-7)

PAPER: CHEM-MD-CC7-5-Th / CHEM-MD-CC7-6-Th
(Credit: Theory -03, Practical – 01)

Physical Chemistry - II

Course learning outcome (COs)

CO1: Transport processes and Liquid State, Diffusion and Viscosity, Surface tension and energy

CO2: Solid State, Bravais Lattice and Laws of Crystallography, Crystal plane

CO3: Application of Thermodynamics – II, Colligative properties, Phase Equilibrium CO4: ELECTROCHEMISTRY-II, Electromotive Force

CO5: Surface tension measurements using Stalagmometer, Viscosity measurement using Ostwald's viscometer, Conductometric Experiments

COs-POs Mapping

CC7: Physical Chemistry - II

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	
CO3	□	□		□	□				□	□
CO4	□	□		□	□				□	
CO5	□	□	□	□	□	□		□	□	□

Chemistry MDC

Paper: CHEM-MD-CC8-6: Inorganic Chemistry - II

(Credit: Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Coordination chemistry: Basics of coordination chemistry, Valence bond theory and crystal field theory, Electronic spectra of complexes and magnetic properties.

CO2: Supramolecular chemistry.

CO3: Redox reactions: Basic principle of redox reactions, Redox titrations,

CO4: Estimation of mixtures of metal ions: Fe^{3+} and Cu^{2+} in a mixture, Fe^{3+} and Cr^{3+} in a mixture, Fe^{3+} and $Cr_2O_7^{2-}$ in a mixture, Fe^{3+} and Mn^{2+} in a mixture, Cr^{3+} and Mn^{2+} in a mixture.

COs-POs Mapping

CC-8: Inorganic Chemistry - II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	□
CO3	□	□		□	□				□	□
CO4	□	□	□	□	□	□			□	□

Chemistry MDC Minor (MN-2)

Paper: CHEM-MD-CC2-4: Fundamentals of Chemistry - II (Credit:

Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Kinetic Theory and Gaseous state, Real gas and Virial equation,

CO2: Chemical Bonding – I: i) Ionic bond, ii) Covalent bond; Theoretical principles of inorganic qualitative analysis

CO3: Stereochemistry – II, General Treatment of Reaction Mechanism–I: Reactive intermediates, Reaction thermodynamics, Reaction kinetics, Substitution Reaction

CO4: Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions (only water /acid soluble salts):

COs-POs Mapping

MN-2: Fundamentals of Chemistry - II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	□
CO3	□	□		□	□				□	□
CO4	□	□	□	□	□	□			□	□

Chemistry Minor (MN)

Paper: CHEM-H-CC4-5: Organic Chemistry – I (Credit:

Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Aromatic Substitution: Electrophilic aromatic substitution, Nucleophilic aromatic substitution, Birch Reduction of benzenoid aromatics. General Treatment of Reaction Mechanism –II: Concept of organic acids and bases, Tautomerism

CO2: Stereochemistry –III: Conformation-I , Substitution and Elimination Reactions: Nucleophilic substitution reactions , Elimination reactions .

CO3: Chemistry of alkenes and alkynes: Addition to C=C, Addition to C≡C (in comparison to C=C).

CO4: Identification of Pure Single organic Compound: Solid compounds, Liquid compounds

COs-POs Mapping

MN-3: Organic Chemistry-I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□					□
CO2	□	□		□	□					□
CO3	□	□		□	□					□
CO4	□	□	□	□	□		□		□	□

Chemistry MDC Minor (MN-4)

Paper: CHEM-MD-CC4-5: Inorganic Chemistry - I

(Credit: Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Chemical bonding–II: Molecular orbital concept of bonding, Metallic Bond, Weak Chemical Forces.

CO2: Acids and bases: Acid-Base concept, Acid-base equilibria in aqueous solution.. CO3:

Radioactivity: Nuclear stability, Nuclear Reactions, Radiocarbon dating

CO4: Complexometric Titration: Ca (II) and Mg (II) in a mixture, Hardness of water, Fe (III) and Al (III) in a mixture, Cu (II) and Zn (II) in a mixture, Cu (II) and Ni (II) in a mixture

COs-POs Mapping

MN-4: Inorganic Chemistry - I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	□
CO3	□	□		□	□				□	□
CO4	□	□	□	□	□	□			□	□

Chemistry MDC MINOR

Paper: CHEM-MD CC5-6: Physical Chemistry-I (Credit:

Theory -03, Practical – 01)

Course learning outcome (COs)

CO1: Thermodynamics - II: Second Law, Systems of Variable Compositions. CO2:

Applications of Thermodynamics – I: Chemical Equilibrium,

CO3: ELECTROCHEMISTRY-I: Conductance, Ionic Equilibrium.

CO4: Chemical Kinetics (Analytical).

COs-POs Mapping

MN-6: Physical Chemistry-I

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	□	□		□	□				□	□
CO2	□	□		□	□				□	
CO3	□	□		□	□				□	□
CO4	□	□	□	□	□	□		□	□	□

Chemistry MDC MINOR

Paper: CHEM-MD CC6-6: Organic Chemistry-II (Credit: Theory -03, Practical – 01)

Course learning outcome (COs)

CO5: Stereochemistry – IV: Conformation-II, Concept of prostereoisomerism, Chirality arising out of stereoaxis.

CO6: Chemistry of carbonyl Compounds: Nucleophilic Addition to C=O, Exploitation of acidity of α-H of C=O, Nucleophilic addition to α, β-unsaturated carbonyl system, Substitution at sp2 carbon (C=O system).

CO7: Organometallics.

CO8: Qualitative analysis of single solid organic compound.

COs-POs Mapping

CC-6: Organic Chemistry-II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	□	□		□	□					□
CO2	□	□		□	□					□
CO3	□	□		□	□					□
CO4	□	□	□	□	□		□		□	□

Program Learning Outcomes (POs) in Physics, 3 Year B.Sc MDC

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

Programme Outcomes (POs)

PO1: Fundamental understanding of the field

PO 2: Application of basic Physics concepts

PO 3: Linkages with relateddisciplines

PO 4: Procedural knowledgefor professional subjects

PO 5: Skills in related fieldof specialization

PO 6: Ability to use in Physics problem

PO 7: Skills in Mathematical modeling

PO 8: Skills in performinganalysis and interpretation of data

PO 9: Develop investigative Skills

PO 10: Skills in problem solving in Physics and related discipline

PO 11: Develop Technical Communication skills

PO 12: Developing analyticalskills and popular communication

PO 13: Developing ICT skills

PO 14: Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading,etc

Program Learning Outcomes (POs) in Physics, 3 Year B.Sc MDC

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

Programme Outcomes (POs)

PO1: Fundamental understanding of the field

PO 2: Application of basic Physics concepts

PO 3: Linkages with relateddisciplines

PO 4: Procedural knowledgefor professional subjects

PO 5: Skills in related fieldof specialization

PO 6: Ability to use in Physics problem

PO 7: Skills in Mathematical modeling

PO 8: Skills in performinganalysis and interpretation of data

PO 9: Develop investigative Skills

PO 10: Skills in problem solving in Physics and related discipline

PO 11: Develop Technical Communication skills

PO 12: Developing analyticalskills and popular communication

PO 13: Developing ICT skills

PO 14: Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading,etc

Course Outcomes (COs)

Multidisciplinary Papers

PHS-CC-1-1 / PHS-Minor3-3-1/PHS-Minor4/1-1-1/ PHS-Minor4/2-3-1: BASIC PHYSICS-I

(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

Students will be able to

CO1 : 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.

CO2 : Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.

CO3 : Learn homogenous differential equations, partial derivatives which have applications in all branches of physics.

CO4 : 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.

CO5 : Understand the dynamics of system of particles and idea about center of mass and laboratory frames and their correlation.

CO6 : Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation, central force.

CO7 : Understand simple principles of fluid flow and the equations governing fluid dynamics.

CO8: 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 Code : PHS-CC-1-1 / PHS-Minor3-3-1/PHS-Minor4/1-1-1/ PHS-Minor4/2-3-1: BASIC PHYSICS-I

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√	√	√	√				√
CO2	√	√	√	√	√	√	√		√	√	√			√
CO3	√	√	√	√	√	√	√		√	√		√		√
CO4	√	√	√	√	√	√	√		√	√	√			√
CO5	√	√	√	√	√	√			√	√		√		√
CO 6	√	√	√	√	√	√			√	√				√
CO7	√	√	√	√	√	√	√		√	√	√			√
CO8	√	√	√	√	√			√	√		√	√		√

PHS-CC-2-1 / PHS-Minor3-4-1/PHS-Minor4/1-2-1/ PHS-Minor4/2-4-1: BASIC PHYSICS-II
(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

Students will be able to

CO1 : Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to various systems.

CO2 : Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electricpotential, electric potential energy) formalisms of electrostatics.

CO3 : Articulate knowledge of electrostatic energy.

CO4 : Basic knowledge of Loretnz force and operational principle of cyclotron.

CO5 : Describe the basics of magnetostatics, Bio-Savart Law.

CO6: Application of Ampere's circuital law, concept of magnetic dipole etc.

CO7: Learn the microscopics and macroscopic description of matter, postulates of kinetic theory of gases, Maxwell-Boltzman distribution law.

CO8: Comprehend the basic concepts of thermodynamics, the zeroth, first and the second law of thermodynamics, the concept of entropy and the associated theorems.

CO9: 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.

COs - POs Mapping

Course Code : PHS-CC-2-1 / PHS-Minor3-4-1/PHS-Minor4/1-2-1/ PHS-Minor4/2-4-1

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√		√	√		√		√
CO2	√	√	√	√	√	√			√	√	√			√
CO3	√	√	√	√	√	√			√	√				√
CO4	√	√	√	√	√	√			√	√				√
CO5	√	√	√	√	√	√			√	√				√
CO 6	√	√	√	√	√	√	√		√	√		√		√
CO7	√	√	√	√	√	√	√		√	√	√	√		√
CO8	√	√	√	√	√	√	√		√	√		√		√
CO9	√	√	√	√	√			√				√		

COs - POs Mapping

Course Code : PHS-CC-2-1 / PHS-Minor3-4-1/PHS-Minor4/1-2-1/ PHS-Minor4/2-4-1

PHS-CC-3-1 / PHS-Minor3-5-1/PHS-Minor4/1-5-1/ PHS-Minor4/2-5-1: Waves and Optics
(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

CO1: Learn about the different types of mathematical oscillators and acquire knowledge about the superposition of harmonic oscillations at different conditions both graphically and analytically.

CO2: Learn about the wave motions and superposition of harmonic waves.

CO3: Gain an understanding about wave motions through strings at different conditions and be able to explain several phenomena observed in everyday life.

CO4: Learn about the reflection and refraction of light.

CO5: Understand the wave nature of light through the study of its interference and diffraction properties alongside recognize light as an electromagnetic wave by studying the polarization property.

CO6: In the laboratory course, students will gain hand on experience to perform several experiments like

(i) Determination of frequency of a tuning fork by sonometer.
(ii) Measurement of the focal length of concave lens by combination method.
(iii) Measurement of wavelength of light using Newton's ring experiments.
(iv) Measurement of thickness of paper by interference pattern created by a Wedge shaped film.
(v) Study the polarization property of light wave through polarimeter experiment.

COs - POs Mapping

Course Code : PHS-CC-3-1 / PHS-Minor3-5-1/PHS-Minor4/1-5-1/ PHS-Minor4/2-5-1

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√		√	√	√	√		√
CO2	√	√	√	√	√	√	√		√	√	√	√		√
CO3	√	√	√	√	√	√	√		√	√	√	√		√
CO4	√	√	√	√	√	√			√	√				√
CO5	√	√	√	√	√	√	√		√	√	√	√		√
CO 6	√	√	√	√	√			√	√			√		√

COs - POs Mapping

Course Code : PHS-CC-3-1 / PHS-Minor3-5-1/PHS-Minor4/1-5-1/ PHS-Minor4/2-5-1

PHS-CC-4-1/PHS-Minor3-6-1/PHS-Minor4/1-6-1/PHS-Minor4/2-6-1: Modern Physics (Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

CO1 : Understand the nature of black body and Planck's theory of blackbody radiation .

CO2 : To be introduced to the basic concepts of wave mechanics and wave particle duality.

CO3 : Developing of preliminary idea of quantum concepts and corresponding theory of quantum mechanics.

CO4 : Introduction to Schrodinger's equation and its application to solve simple problems involving one dimensional potential well, barriers.

CO5 : Use Schrodinger's equation to study the nature of a harmonic oscillator and hence evaluate the energy levels.

CO6 : Perform simple experiments in the laboratory on Photoelectric effect, tunnel diode , laser cross grating, measurement of e/m of an electron etc.

Course Code : PHS-CC-4-1/PHS-Minor3-6-1/PHS-Minor4/1-6-1/PHS-Minor4/2-6-1

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√			√	√	√	√		√
CO2	√	√	√	√	√	√	√		√	√	√	√		√
CO3	√	√	√	√	√	√	√		√	√	√	√		√
CO4	√	√	√	√	√	√	√		√	√	√	√		√
CO5	√	√	√	√	√	√	√		√	√	√	√		√
CO 6	√	√	√	√	√			√	√		√			√

PHS-CC-4-2/PHS-Minor3-6-2: Electromagnetism
(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

CO1: Learners can gather confidence regarding the basic concept of Method of Images and its application to plane Infinite metal sheet, Electric fields inside matter, Electric polarisation, bound charges, displacement density vector, linear dielectric medium, electric susceptibility and permittivity.

CO2: Interpret the Divergence and curl of magnetostatic field using Biot-Savart law, Magnetic vector potential for uniform magnetic field, Magnetic fields inside matter, magnetization, bound currents etc.

CO3: Students' can gather knowledge regarding Non-conservative nature of electric field, Faraday's law of induction and its applications in various simple cases, Self and mutual inductances in simple cases etc.

CO4: They also understand the Maxwell's equations and its applications in various cases.

CO5: They learn about Growth and decay of currents in L-R circuit, charging and discharging of capacitor in C-R circuit.

CO6: They also attain confidence about Mean and r.m.s. values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, power factor, vector diagram, resonance in a series LCR circuit, Q-factor.

CO7: In the laboratory course, students will achieve hand on experience to perform several experiments in the arena of properties of Electromagnetic fields like

1. To draw the resonance curve of a series LCR circuit.

2. Determination of horizontal component of Earth's magnetic field using magnetometer.

3. To study the ac characteristics of a series RC circuit and calculation of capacitance from current reactance graph.

4. Construction of one ohm coil by measuring resistivity of a sample wire using Carey Foster Bridge.

5. To study the variation of the magnetic field with current between pole pieces for different distances of an electromagnet using Gauss meter.

Course Code : PHS-CC-4-2/PHS-Minor3-6-2

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√		√	√	√	√		√
CO2	√	√	√	√	√	√	√		√	√	√	√		√
CO3	√	√	√	√	√	√	√		√	√	√	√		√
CO4	√	√	√	√	√	√	√		√	√	√	√		√
CO5	√	√	√	√	√	√	√		√	√	√	√		√
CO 6	√	√	√	√	√	√	√		√	√	√	√		√
CO7	√	√	√	√	√			√	√					√

Course Outcomes (COs)

PHS-CC-5-1: Electronics I

(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

This course will enable the students to

CO1 : get familiar with the basic circuits and networks and to explore the active and passive components.

CO2 : understand the semiconductor diodes and its various applications in the field of electronic devices.

CO3 : learn the various techniques of Bipolar Junction Transistor's biasing and gather the basic knowledge of Q points.

CO4 : learn about regulated power supply and its different characteristics.

CO5: study the various types of JFET and MOSFET characteristics, basic structure and principle of operation.

CO6 : learn about the different number systems, different operations in binary system, de Morgan's theorem etc.

CO7: study the digital systems and their differences and advantages over Analog circuits, fundamental logic gates.

CO8 : synthesize Boolean functions, simplification and construction of digital circuits by employing Boolean algebra and combinational circuits.

CO9 : In Laboratory course they will verify network theorems, study characteristics of different diodes and transistors, construction of basics gates using diodes and transistors and verification of de Morgan's theorems using IC chips.

Course Code : PHS-CC-5-1

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√	√	√	√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	√	√		√
CO3	√	√	√	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√	√	√	√	√	√	√	√	√		√
CO5	√	√	√	√	√	√	√	√	√	√	√	√		√
CO 6	√	√	√	√	√	√		√	√	√	√	√		√
CO7	√	√	√	√	√	√		√	√	√	√	√		√
CO8	√	√	√	√	√	√	√	√	√	√	√	√		√
CO9	√	√	√	√	√	√	√	√	√	√	√	√		√

PHS-CC-5-2/PHS-CC-6-1 : Nuclear Physics (Credits: 04, Theory-03, Tutorial-01)

Course learning outcome (COs):

This course will enable the student to

CO1 : get the idea of Atomic spectra which includes the fine structure of Hydrogen like atom, Stern-Gerlach experiment and concept of intrinsic spin, vector atom model and Zeeman effect.

CO2 : comprehend the basics of molecular spectroscopy including the study of vibrational and rotational spectra of diatomic molecule, Raman effect and its application in molecular spectroscopy.

CO3 : learn about the atomic nucleus, its size, shape, binding energy, nature of nuclear force, liquid drop model and fusion and fission .

CO4 : study about the unstable nuclei, basics of alpha, beta and gamma decay and related laws.

CO5 : get an introductory idea of particle accelerator in particular LINAC and Cyclotron.

CO6: gather a comprehensive knowledge of fundamental particles including symmetry, conservations laws and quark model.

CO7 : understand the concept of Nuclear astrophysics including primordial nucleo-synthesis, p-p chain, CNO cycle and production of elements in a qualitative way.

Course Code : PHS-CC-5-2/PHS-CC-6-1

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√	√	√	√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	√	√		√
CO3	√	√	√	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√	√	√		√	√	√	√	√		√
CO5	√	√	√	√	√	√		√	√	√	√	√		√
CO 6	√	√	√	√	√	√	√	√	√	√	√	√		√
CO7	√	√	√	√	√	√		√	√	√	√	√		√

PHS-CC-6-2: Electronics II (Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

As the successful completion of the course the student is expected to

CO1: learn to design different types of amplifiers and its frequency response.

CO2 : understand the concept of usefulness in OPAMP construction and its various applications.

CO3: understand the principles of various types of electronic communication systems and its application.

CO4 : learn about half adder, full adder etc

CO5: gain basic idea about multiplexers, de-multiplexers, encoder and decoder.

CO6: gather knowledge of sequential systems by choosing Flip Flop as a building bock- construct multivibrators, counters, registers to provide a basic idea about memory including RAM, ROM and also about memory organization.

CO7 :In the laboratory the student is expected to construct both combinational circuits and sequential circuits by employing basic gates and universal gates as building blocks and demonstrate Adders, multiplexer, Shift Registers, and different use of OPAMPs.

Course Code : PHS-CC-6-2

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√		√	√	√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	√	√		√
CO3	√	√	√	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√	√	√		√	√	√	√	√		√
CO5	√	√	√	√	√	√		√	√	√	√	√		√
CO6	√	√	√	√	√	√	√	√	√	√	√	√		√
CO7	√	√	√	√	√	√	√	√	√	√	√	√		√

Course Outcomes (COs)

PHS-Minor3-5-2: Electronics I

(Credits: 04, Theory-03, Practical-01)

Course learning outcome (COs):

This course will enable the students to

CO1 : get familiar with the basic circuits and networks and to explore the active and passive components.

CO2 : understand the semiconductor diodes and its various applications in the field of electronic devices.

CO3 : learn the various techniques of Bipolar Junction Transistor's biasing and gather the basic knowledge of Q points.

CO4 : learn about regulated power supply and its different characteristics.

CO5 : learn about the different number systems, different operations in binary system, de Morgan's theorem etc.

CO6: study the digital systems and their differences and advantages over Analog circuits, fundamental logic gates.

CO7 : synthesize Boolean functions, simplification and construction of digital circuits by employing Boolean algebra.

CO8: In Laboratory course they will verify network theorems, study characteristics of different diodes and transistors, construction of basics gates using diodes and transistors and verification of de Morgan's theorems using IC chips.

Course Code : PHS-Minor3-5-2

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√	√	√	√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	√	√		√
CO3	√	√	√	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√	√	√	√	√	√	√	√	√		√
CO5	√	√	√	√	√	√		√	√	√	√	√		√
CO6	√	√	√	√	√	√		√	√	√	√	√		√
CO7	√	√	√	√	√	√	√	√	√	√	√	√		√
CO8	√	√	√	√	√	√	√	√	√	√	√	√		√

Course Outcomes (COs)

Skill Enhancement Course

SEC1/ SEC2/ SEC3: Introduction to Computer Programming and Graph Plotting

(Credits: 04, Theory-0, Practicals-04)

Course learning outcome (COs):

Students will be able to

CO1: Perform 2D graph plotting using GNUPLOT.

CO2: They will have basic idea about Python Programming, its basic operations, conditional statements, built in function etc.

CO3: Idea about different data structures like list, tuple, string, set etc and their usage in writing programmes.

CO4: 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 Code : SEC 1/ SEC 2/ SEC 3

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√	√	√	√	√			√	√	√	√	√
CO2	√	√	√	√	√	√					√	√	√	√
CO3	√	√	√	√	√	√					√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Course Outcomes (COs)

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

CO1: Basic Nature of Science, reasoning and universality of physics experimentation.

CO2: The Universe, its creation and evolution, celestial laws.

CO3: Matter and its constitutions, thermodynamics and radioactivity.

CO4: Basic laws of nature, dual property of light and introduction to quantum mechanics and relativity.

Course Code : IDC 1/ IDC 2/ IDC 3

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	√	√	√		√				√			√		√
CO2	√	√	√		√				√			√		√
CO3	√	√	√		√				√			√		√
CO4	√	√	√		√				√			√		√

Graduate Attributes in Zoology

1. **Disciplinary knowledge and skills:** Capable of demonstrating (i) comprehensive knowledge and understanding of major concepts, theoretical principles and experimental findings in Zoology and its different subfields (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal iotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases), and other related fields of study, including broader interdisciplinary subfields such as chemistry, physics and mathematics; (ii) ability to use modern instrumentation for advanced genomic and proteomic technology.

2. Skilled communicator: Ability to impart complex technical knowledge relating to Zoology in a clear and concise manner in writing and oral skills.

3. **Critical thinker and problem solver**: Ability to have critical thinking and efficient problem solving skills in the basic areas of Zoology (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal iotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, insect, vectors and diseases etc.).

4. Sense of inquiry: Capability for asking relevant/appropriate questions relating to issues and problems in the field of Zoology, and planning, executing and reporting the results of an experiment or investigation.

5. Team player/worker: Capable of working effectively in diverse teams in both classroom, laboratory and in industry and field-based situations.

6. Skilled project manager: Capable of identifying/mobilizing appropriate resources required for a project, and manage a project to completion, while observing responsible and ethical scientific conduct; and safety and chemical hygiene regulations and practices.

7. **Digitally literate:** Capable of using computers for Bioinformatics and computation and appropriate software for analysis of genomics and proteomics data, and employing modern bioinformatics search tools to locate, retrieve, and evaluate location and biological annotation genes of different species.

8. Ethical awareness/reasoning: Capable of conducting their work with honesty and precision thus avoiding unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciating environmental and sustainability issues. Research ethics committee expects them to declare any type of conflict of interest that may affect the research. Any plan to withhold information from researchers should be properly explained with justification in the application for ethical approval.

8. **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling.

Programme Learning Outcomes (PO) in B.Sc. (Major) Zoology

A. Knowledge and Understanding

1. Demonstrate (i) in-depth knowledge and understanding about the fundamental concepts, principles and processes underlying the academic field of Zoology and its different subfields (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 subfields of Zoology, including broader interdisciplinary subfields (Chemistry, Physics and Mathematics).

2: Over the years, Zoologists were able to find many differences within the same breed of an animal species. As a Zoology professional one can study extinct animals by specializing in Paleozoology, on the different types of birds in Ornitholog; opt for studying Herpetology and Arachnology, the branches dealing with the study of snakes and spiders, respectively.

3: Appreciate the complexity of life processes, their molecular, cellular and physiological processes, their genetics, evolution and behaviour and their interrelationships with the environment.

4: Study concepts, principles and theories related with animal behaviour and welfare.

5: Understand and interpret data to reach a conclusion.

6: Design and conduct experiments to test a hypothesis.

7: Understand scientific principles underlying animal health, management and welfare.

8: Accept the legal restrictions & ethical considerations placed for animal welfare.

9: Understand fundamental aspects of animal science relating to management of animals.

10: Assess problems and identify constraints in management of livestock.

B. Subject Specific Intellectual and Practical Skills

The students will be able to
PO-1. Understand how organisms are classified and full and identified
PO-2. Demonstrate knowledge of basic zoological principles
PO-3. Use appropriate information with a critical understanding
PO-4. Learn basic laboratory and analytical skills

PO-5. Use effective methods for modifying animal behaviour
PO-6. Participate in animal management programmes in an effective manner
PO-7. Work safely and effectively in the field, in laboratories and in animal facilities.
PO-8. Demonstrate competence in handling and statistical analysis of data gained from practical
PO-9.Learn communication and IT skills, including the collation and statistical analysis of data, citing & referencing work appropriately, communicating using a range of formats

In course learning outcomes, the student will attain subject knowledge in terms of individual course as well as holistically. There are Core Courses (CC) and Skill Enhancement Courses (SEC). The example related to the courses and their outcomes are given below.

Course Outcome (CO) : CCF (Minor + MDC)
Course Code: CC1 Cell Biology

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

PO-CO Mapping- CC1-Cell Biology

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	√	√	X	X	√	X	X	X	X
CO2	√	√	X	√	√	√	√	√	√
CO3	√	√	X	√	√	√	√	√	√
CO4	√	√	X	√	√	√	√	√	√

Course Outcome (CO) : CCF (Minor+MDC))
Course Code: CC-2 Biochemistry

After successfully completing this course, the students will be able to:

CO-1: Understand about the importance and scope of biochemistry.

CO-2: Understand the structure and biological significance of carbohydrates, amino acids,proteins, lipids and nucleic acids.

CO-3:Understand the structure and function of immunoglobulins.

CO-4Understand the concept of enzyme, its mechanism of action and regulation.

CO-5: Understand the process of metabolism of carbohydrate, protein, lipid and nucleic acids.

CO-6Develop the concept of free radicals and antioxidants.

PO-CO Mapping: CCF (Major) Course: CC-2

	PO-1	PO-2	PO-3	PO-4	Po-5	Po-6	PO-7	PO-8	PO-9
CO-1	-	√	√	√	-	-	-	√	√
CO-2	-	√	√	√	-	-	√	√	√
CO-3	-	√	√	√	-	-	-	√	√
CO-4	-	√	-	√	-	-	√	√	-
CO-5	-	√	√	√	-	-	√	√	√
CO-6	-	-	-	-	-	-	√	√	√

Course Outcome (CO) : CCF (Minor+MDC)
Course Code: SEC-G Applied Zoology

CO-1 : Students learn about Agricultural Entomology, different pests and their control measures.
CO-2 : Learn about the skill development process of Sericulture, Apiculture, Vermiculture, Aquaculture and livestock management.

PO-CO Mapping of SEC-G Applied Zoology

	PO-1	PO-2	PO-3	PO-4	Po-5	Po-6	PO-7	PO-8	PO-9
CO-1	√	√	-	√	√	√	√	√	√
CO-2	√	√	-	√	√	√	√	√	√

Course Outcome (CO) : CCF (IDC) Zoology
Course Code: IDC-1 &2 Animal Biology

CO-1 : Students understand animal diversity with their taxonomic positions.
CO-2 : Understand basic principles of Genetic and sex determination.
CO-3 : Learn about Biodiversity types, measurement of Biodiversity and its conservation.

CO-4 : Develop concept of vectors and disease cycle.
CO-5 : Learn basic principle of laboratory techniques like Karyotype analysis, Microscopy, Colorimetry and Ultracentrifugation.

	PO-1	PO-2	PO-3	PO-4	Po-5	Po-6	PO-7	PO-8	PO-9
CO-1	√	-	-	√	-	-	-	-	-
CO-2	-	√	√	√	-	-	√	-	-
CO-3	-	√	√	-	-	-	√	√	√
CO-4	-	-	-	-	√	-	√	-	-
CO-5	-	-	-	-	-	-	√	√	-

Course Outcome (CO) : CCF (MDC) Zoology
Course Code: MZOO CC-3 (Cell and tissue structure)

CO-1: Come to know about different types of tissues in the body of living organisms
CO-2: Learn about abnormalities in the structure and functioning of tissues
CO-3: Understand tissue repair process and its control mechanism
CO-4: Learn the processes of tissue staining to understand histology

Mapping

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9
CO-1	-	-	-	√	-	√	√	-	-
CO-2	-	-	√	√	-	-	-	√	-
CO-3	-	√	-	-	-	√	-	-	-
CO-4	-	-	-	√	-	-	-	-	-

Course Outcome (CO) : CCF (MDC)
Course Code: SEC-G (Applied Zoology)

CO-1 : Students learn about Agricultural Entomology, different pests and their control measures.
CO-2 : Learn about the skill development process of Sericulture, Apiculture, Vermiculture, Aquaculture and livestock management.

Mapping

	PO-1	PO-2	PO-3	PO-4	Po-5	Po-6	PO-7	PO-8	PO-9
CO-1	√	√	-	√	√	√	√	√	√
CO-2	√	√	-	√	√	√	√	√	√

PART II: SEMESTER-III ; CCF: 3 yr ZOOLOGY IDC

Course Outcome (CO) : CCF: (IDC) Zoology
Course Code: IDC- 3 (Animal Biology)

CO-1 : Students understand animal diversity with their taxonomic positions.
CO-2 : Understand basic principles of Genetic and sex determination.
CO-3 : Learn about Biodiversity types, measurement of Biodiversity and its conservation.
CO-4 : Develop concept of vectors and disease cycle.
CO-5 : Learn basic principle of laboratory techniques like Karyotype analysis, Microscopy, Colorimetry and Ultracentrifugation.

	PO-1	PO-2	PO-3	PO-4	Po-5	Po-6	PO-7	PO-8	PO-9
CO-1	√	-	-	√	-	-	-	-	-
CO-2	-	√	√	√	-	-	√	-	-
CO-3	-	√	√	-	-	-	√	√	√
CO-4	-	-	-	-	√	-	√	-	-
CO-5	-	-	-	-	-	-	√	√	-

PART II: SEMESTER-IV; CCF: 3 yr ZOOLOGY MDC

Course Outcome (CO) : CCF: Zoology MDC
Course Code: MZOO CC-4 (Non-chordate structure and function)

CO-1: Develop understanding on the diversity of life with regard to protists, non- chordates and chordates.

CO-2: Group animals on the basis of their morphological characteristics/ structures.

CO_3: Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.

CO-4: Understand how morphological change due to change in

environment helps drive evolution over a long period of time.

CO-5: Develop understanding on the diversity of life with regard to non chordates

CO-6: Group animals on the basis of their morphological characteristics/ structures.

CO-7: Develop critical understanding how animals changed from a primitive cell to collection of simple cells to form a complex body plan.

CO-8: Examine the diversity and evolutionary history of a taxon

CO-9: Understand how morphological change due to change in environment helps drive.

Mapping

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9
CO-1	√	√	√	√	X	√	√	X	X
CO-2	√	√	√	√	X	√	√	X	X
CO-3	√	√	√	√	X	√	√	X	X
CO4	√	√	X	√	X	√	√	X	X
CO-5	√	√	X	√	X	X	√	X	X
CO-6	√	√	√	√	X	X	√	X	X
CO-7	√	√	X	√	√	√	√	X	X
CO-8	√	√	X	√	√	√	√	X	X
CO-9	√	√	X	√	√	√	√	X	X

Course Outcome (CO) : CCF (MDC) Zoology Course
Code: MZOO CC-5 (Ecology)

Course Outcome:

After successfully completing this course, the students will be able to:

CO 1 . Know the evolutionary and functional basis of animal ecology.
CO 2. Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.
CO 3. Engage in field-based research activities to understand well the theoretical aspects
taught besides learning techniques for gathering data in the field.
CO 4. Analyse a biological problem, derive testable hypotheses and then design experiments
and put the tests into practice.
CO 5. Solve the environmental problems involving interaction of human and natural systems at local or global level.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	√	-	-	-	-	-	√	-
CO 2	-	√	-	-	-	-	-	-
CO 3	-	-	-	√	√	-	√	√
CO 4	-	√	√	√		√	-	√
CO 5	-	-	-	√	√	√	-	√

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

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.

Sl No.	POs	CC1 (Sem 1)	CC2 (Sem 2)	CC1/CC2 (Sem 3)	CC1/CC2 (Sem 4)	CC1/CC2 (Sem 4)	SEC 1/2/3	IDC 1/2/3
1.	To develop analytical ability among students	√	√	√	√	√	√	√
2.	To have an idea about how does the Government Function	√	√	√	√			√
3.	To maximise standard of living and to achieve stable economic growth	√	√	√	√	√		√
4.	To understand and apply core Economic Principles related to consumers, producers and Market	√	√				√	√
5.	To understand and apply basic Principles of Macroeconomics		√	√	√			√
6.	To know policy making mechanism related to money and currency from an applied finance Context			√	√			√
7.	Application of Statistics and Mathematics to validate various economic theories and to carry out the surveys	√	√			√	√	√
8.	Use of case study for the better understanding of the topics	√	√	√	√	√	√	√

Core Course 1/2

CC1: Introductory Microeconomics
(Credit: 04: Theory: 03, Tutorial: 01)

Course Learning Outcome (COs):

CO1: Develop Understanding of How Economy Functions

CO2: Develop in general Analytical Ability

CO3: Learn to Analyse certain Real-life Events

CO4: Understand more Complicated Theory in Future

COs –POs Mapping
Course Code: CC 1

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√		√	√	√
CO2	√			√		√	√	√
CO3	√			√		√	√	√
CO4	√	√	√	√		√	√	√

Core Course 1/2

CC 2: Introductory Macroeconomics
(Credit: 04: Theory: 03, Tutorial: 01)

CO1: Understand Basic Concepts of Macroeconomic Factors. Idea of Estimation of National Income, Circular Flow of Income, Personal Income and Saving

CO2: Idea of Keynesian Consumption Function, Saving-Investment Function, Determination of Equilibrium Output, income. Concept of Multiplier and Its Application in Economic Structure

CO3: Understand Classical Theory of Wage and Employment, Wage-Price Flexibilty, Application into Economy

CO4: Idea of Investment Function, Its nature, Application

CO5: Understand Inflation, its Causes, Types and Effects on the Economy. Get an Idea about how to Control Inflation.

COs –POs Mapping
Course Code: CC2

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√		√			√
CO2	√	√	√		√		√	√
CO3	√	√	√		√		√	√
CO4	√	√	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√	√

Core Course 1/2
MECO-MDC-CC3: Development Economics -I
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Develop theoretical and analytical knowledge about economic growth and development of the country

CO2: Study poverty, inequality of the economy and search for maximum achievable level of standard of living thus securing stable economic growth

CO3: Think of different development strategies applicable to consumers, producers and markets by helping economy strive for development

CO4: Analyse the importance of financial inclusion and its activities by helping policy making in the path of development

CO5: Analyse the case studies from different developed and developing economies for better understanding of development economics

COs –POs Mapping
Course Code: MECO-MDC-CC

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√	√	√					√
CO3	√	√		√				√
CO4	√	√				√		√
CO5	√		√	√				√

MDC-m1 MECO-Minor

Introductory Microeconomics
(Credit: 04: Theory: 03, Tutorial: 01)

Course Learning Outcome (COs):

CO1: Develop Understanding of How Economy Functions

CO2: Develop in general Analytical Ability

CO3: Learn to Analyse certain Real-life Events

CO4: Understand more Complicated Theory in Future

COs –POs Mapping
Course Code: CC 1

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√	√		√	√	√
CO2	√			√		√	√	√
CO3	√			√		√	√	√
CO4	√	√	√	√		√	√	√

CC1/CC2
MECO-MDC-CC4: Indian Economics - I
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Develop analytical ability regarding Indian Economy

CO2: Analyse the functions of the Government for the betterment of the economy

CO3: Understand and highlight the policies of present and past which remain helpful for economy's growth and development

CO4: Study the patterns of occupational and structural changes, which are helpful to induce economic activities

CO5: Gather knowledge about various sectoral reforms and overall economic reform took place in Indian economy

CO6: Analyse case studies related to Indian economy of different time periods for better understanding of the topic

COs –POs Mapping
Course Code: MECO-MDC-CC

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√	√						√
CO3	√	√	√					√
CO4	√		√	√				√
CO5	√		√					√
CO6	√	√	√					√

CC1/CC2
MECO-MDC-CC5: Sustainable Development
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: understand the overall idea of sustainable development

CO2: Gather knowledge about the environmental policies implemented, trans-boundary environmental problems faced by the world

CO3: Study sustainable management of resources in the concept of sustainable livelihood

COs –POs Mapping
Course Code: MECO-MDC-CC

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√		√					√
CO3	√		√					√

MDC-m2 MECO-Minor

Introductory Macroeconomics
(Credit: 04: Theory: 03, Tutorial: 01)

CO1: Understand Basic Concepts of Macroeconomic Factors. Idea of Estimation of National Income, Circular Flow of Income, Personal Income and Saving

CO2: Idea of Keynesian Consumption Function, Saving-Investment Function, Determination of Equilibrium Output, income. Concept of Multiplier and Its Application in Economic Structure

CO3: Understand Classical Theory of Wage and Employment, Wage-Price Flexibilty, Application into Economy

CO4: Idea of Investment Function, Its nature, Application

CO5: Understand Inflation, its Causes, Types and Effects on the Economy. Get an Idea about how to Control Inflation.

COs –POs Mapping
Course Code: CC2

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√		√			√
CO2	√	√	√		√		√	√
CO3	√	√	√		√		√	√
CO4	√	√	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√	√

SEC-1/2/3: Economic Data Analysis and Report Writing
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Analyse the Descriptive Statistics of a Data Set using Statistical Tool

CO2: Analyse a Data Set using measures of Central Tendency, Dispersion and Its Application into the Economic Theory

CO3: Gather Knowledge about Correlation, Regression and its use

CO4: knowledge about how to write a Report of a Research Work

COs –POs Mapping
Course Code: CC2

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√			√	√		√	√
CO2	√			√	√		√	√
CO3	√				√		√	√
CO4	√	√	√		√	√	√	√

IDC-1/2/3: Elementary Economics
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Idea about Demand-Supply, Elasticities and Its Applications in the Market

CO2: Knowledge of Production, Cost and Market Mechanism

CO3: Measuring National Income of a Country

CO4: Idea about Monetary System, Banking System

CO5: Understand the Concept of Inflation, Causes, Effects and Controlling Methods

CO6: Knowledge of Fiscal, Monetary Policies, Instruments and Governments Functioning

CO7: Idea about Economic Growth and Economic Development, Indicators of Economic Development, Knowledge about Sustainable Development

CO8: Role of Economic Reform

CO9: Understand the structure and Objective of NITI AYOG

COs –POs Mapping
Course Code: IDC

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√			√	√		√	√
CO2	√			√	√			√
CO3	√	√	√		√		√	√
CO4	√	√	√	√		√	√	√
CO5	√	√	√	√		√	√	√
CO6	√	√	√		√	√	√	√
CO7	√	√	√				√	√
CO8	√	√	√				√	√
CO9	√	√	√			√	√	√

CC1/CC2
MECO-MDC-CC6: Economic History of India
(Credit: 03: Theory: 02, Tutorial: 01)

C01: History of Indian Economy is to be analysed

C02: Performance of British Government, East India Co.

C03: Indian Agriculture and Industry and their markets

C04: Policies of Indian Economy during 1857-1947

C05: Indian Trade System

C06: Different Cases as examples

COs –POs Mapping
Course Code: CC6

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√			√		√		√
CO2	√	√		√	√			√
CO3	√	√	√		√	√		√
CO4	√		√	√		√		√
CO5	√	√	√	√		√		√
CO6	√	√	√		√	√		√

CC1
MECO-MDC-CC7: Public Finance
(Credit: 03: Theory: 02, Tutorial: 01)

C01: Concepts of Public, Private, Mixed, Merit Goods and Economy

C02: Public Policies, Equity, Cost-Benefit Analysis

C03: Pareto Optimal Distribution: Maximization of Welfare

C04: Taxation System

C05: Government Policies, Non-Governmental Organisations

COs –POs Mapping
Course Code: CC6

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√					√
CO2	√	√	√	√	√			√
CO3	√	√		√			√	√
CO4	√	√	√	√	√	√		√
CO5	√	√	√			√		√

MDC-m3 MECO-Minor
Development Economics -I
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Develop theoretical and analytical knowledge about economic growth and development of the country

CO2: Study poverty, inequality of the economy and search for maximum achievable level of standard of living thus securing stable economic growth

CO3: Think of different development strategies applicable to consumers, producers and markets by helping economy strive for development

CO4: Analyse the importance of financial inclusion and its activities by helping policy making in the path of development

CO5: Analyse the case studies from different developed and developing economies for better understanding of development economics

COs –POs Mapping
Course Code: MECO-MDC-m3

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√	√	√					√
CO3	√	√		√				√
CO4	√	√				√		√
CO5	√		√	√				√

MDC-m4 MECO-Minor
Indian Economics - I
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: Develop analytical ability regarding Indian Economy

CO2: Analyse the functions of the Government for the betterment of the economy

CO3: Understand and highlight the policies of present and past which remain helpful for economy's growth and development

CO4: Study the patterns of occupational and structural changes, which are helpful to induce economic activities

CO5: Gather knowledge about various sectoral reforms and overall economic reform took place in Indian economy

CO6: Analyse case studies related to Indian economy of different time periods for better understanding of the topic

COs –POs Mapping
Course Code: MECO-MDC-m4

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√	√						√
CO3	√	√	√					√
CO4	√		√	√				√
CO5	√		√					√
CO6	√	√	√					√

CC2
MECO-MDC-CC7: Public Finance
(Credit: 03: Theory: 02, Tutorial: 01)

C01: Concepts of Public, Private, Mixed, Merit Goods and Economy

C02: Public Policies, Equity, Cost-Benefit Analysis

C03: Pareto Optimal Distribution: Maximization of Welfare

C04: Taxation System

C05: Government Policies, Non-Governmental Organisations

COs –POs Mapping
Course Code: CC6

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√					√
CO2	√	√	√	√	√			√
CO3	√	√		√			√	√
CO4	√	√	√	√	√	√		√
CO5	√	√	√			√		√

CC1/CC2
MECO-MDC-CC8: Rural Development
(Credit: 03: Theory: 02, Tutorial: 01)

C01: Picture of Rural India and its Analysis

C02: Rural Economy- Character, Agricultural & Non-agricultural Sectors

C03: Concepts of Rural Poverty and Gove Policies

C04: Rural Governance and Institutions, its roles

C05: Role of SHGs, NABARD, RRB, NGOs

COs –POs Mapping
Course Code: CC6

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√	√	√					√
CO2	√		√	√		√		√
CO3	√	√	√					√
CO4	√	√	√			√		√
CO5	√	√	√			√		√

MDC-m5 MECO-Minor
Sustainable Development
(Credit: 03: Theory: 02, Tutorial: 01)

CO1: understand the overall idea of sustainable development

CO2: Gather knowledge about the environmental policies implemented, trans-boundary environmental problems faced by the world

CO3: Study sustainable management of resources in the concept of sustainable livelihood

COs –POs Mapping
Course Code: MECO-MDC-m5

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√		√					√
CO2	√		√					√
CO3	√		√					√

MDC-m6 MECO-Minor
Economic History of India
(Credit: 03: Theory: 02, Tutorial: 01)

C01: History of Indian Economy is to be analysed

C02: Performance of British Government, East India Co.

C03: Indian Agriculture and Industry and their markets

C04: Policies of Indian Economy during 1857-1947

C05: Indian Trade System

C06: Different Cases as examples

COs –POs Mapping
Course Code: m6

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	√			√		√		√
CO2	√	√		√	√			√
CO3	√	√	√		√	√		√
CO4	√		√	√		√		√
CO5	√	√	√	√		√		√
CO6	√	√	√		√	√		√

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

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.

Program Outcomes (POs) in MDC Geography

PO 1: Fundamental understanding and application of basic the concept

PO 2: Linkages with other disciplines

PO 3: Ability to understand issues related to man-environment relation

PO 4: Developing problem solving techniques

PO 5: Understanding of different kinds of maps and satellite images

PO 6: Map making skills

PO 7: Analysis & interpretation of data

PO 8: Construction, measurements and drawing of diagrams and graphs

PO 9: Theoretical application and use of geographical instruments

PO 10: Understanding the concepts of growth, change and development in geographical perspective

PO 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:

CO 1: 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.

CO 2: Highlights the structure of the earth's interior and different endogenetic forces like seismic waves.

CO 3: Study the major types of weathering, various exogenetic agents, processes and the evolution of different landforms curved out by river.

CO 4: Study in detail about the atmospheric stratification and circulation in form of planetary winds and jet streams.

CO 5: Understand the factors of soil formation and development of an ideal soil profile.

CO 6: Learn about the different plant adaptations and distribution in terms of water availability.

CO 7: Highlights the nature and classification of the hazards and disasters in reference to Indian subcontinent.

CO 8: 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.

COs - POs Mapping

Physical Geography - GEOG-CC/MD-CC-1/3-Th & P

POs \ COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO 1	√	√	√	×	×	×	×	√	×	×	√
CO 2	√	√	×	×	√	×	×	√	×	×	×
CO 3	√	×	√	×	√	×	×	√	×	×	×
CO 4	√	√	×	×	√	×	×	√	×	×	×
CO 5	√	×	√	×	√	×	×	√	×	×	√
CO 6	√	√	√	×	×	×	×	×	×	×	√
CO 7	√	√	√	√	×	×	×	×	×	×	√
CO 8	×	×	×	×	√	√	√	√	×	×	×

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:

CO 1: 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.

CO 2: Provide a proper description of the nature, scope and recent trends in Human Geography and study the different geographical school of thought and approaches like Resource, Locational, Landscape and Environment.

CO 3: 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.

CO 4: Study the different tribes Chenchu, Toda, and Gond and their physical, socio-economic and cultural life styles.

CO 5: Highlight the various stages of Demographic Transition Theory and the concept & significance of demographic dividend.

CO 6: Discuss about the distribution, density, and growth of population in India.

CO 7: 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).

CO 8: 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.

COs - POs Mapping
Human Geography - GEOG-CC02/MD-CC02-2/4-Th & P

POs \ COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO 1	√	√	√	×	√	×	×	×	×	√	×
CO 2	√	√	√	√	×	×	×	×	×	×	×
CO 3	√	√	√	×	×	×	×	×	×	√	√
CO 4	√	×	√	×	√	×	×	×	×	√	√
CO 5	√	√	√	×	×	×	×	√	×	√	×
CO 6	√	×	√	×	√	×	×	√	×	√	×
CO 7	√	×	√	×	√	×	×	√	×	√	×
CO 8	×	×	×	×	√	√	√	√	×	×	×

Economic Geography GEOG-CC04/MD-CC03-3/5-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

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

CO 1: Understand the scope and different approaches of Economic Geography.

CO 2: Acquire knowledge about different economic aspects in special reference to Goods and services, production, exchange and consumption. And develop concepts about different economic activities like primary, secondary, tertiary, quaternary and quinary.

CO 3: Understand the theories of favorable location in special reference to Agriculture (after Von Thünen) and industry (after Weber).

CO 4: Learn in detail about different primary activities like agriculture, forestry, fishing, and mining and how they are changing with time.

CO 5: Develop the concept of Secondary activities in special reference with classification of manufacturing industries and special economic zones and technology parks. as well as Tertiary activities like transport, trade and services.

CO 6: Learn about the tertiary activities like transport, trade and services and understanding economic globalization in relation to the contemporary issues.

CO 7: Acquire knowledge about international trade, role of WTO, emergence of economic blocks and evolution and importance of BRICS.

CO 8: The practical part includes representation of gender-wise work participation rate by using bar graph and its interpretation, construction of proportional divided circles to show state-wise variation in occupational structure and its interpretation, preparation of crop calendar and its interpretation, calculation and drawing of Time series analysis and its representation in Industrial production of India by moving average.

COs - POs Mapping
Economic Geography GEOG-CC04/MD-CC03-3/5-Th & P

POs \ COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO 1	√	√	√	×	×	×	×	×	×	×	√
CO 2	√	×	√	√	×	×	×	√	×	√	√
CO 3	√	√	×	√	×	×	×	√	×	√	×
CO 4	√	√	√	×	√	×	×	√	×	×	√
CO 5	√	×	√	×	×	×	×	×	×	√	√
CO 6	√	√	×	×	×	×	×	×	×	√	√
CO 7	√	√	×	√	×	×	×	×	×	√	√
CO 8	×	×	×	×	√	√	√	√	×	×	×

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:

CO 1: 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.

CO 2: 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.

CO 3: 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).

CO 4: 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.

CO 5: 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.

CO 6: 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.

COs - POs Mapping
Methods in Geography GEOG-SEC01/MD-SEC01-1/2/3-Th

POs \ COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO 1	√	√	√	×	√	×	×	×	×	×	×
CO 2	√	√	√	√	×	×	√	×	×	×	×
CO 3	√	√	×	×	×	×	√	×	×	×	×
CO 4	√	×	×	×	×	×	×	√	√	×	×
CO 5	√	√	×	×	√	×	×	√	×	×	√
CO 6	√	√	×	×	√	√	√	√	×	×	×

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:

CO 1: 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.

CO 2: 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).

CO 3: Learns about the different types of Bearing and the concept of geoid and spheroid with special reference to WGS-84.

CO 4: 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.

CO 5: 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).

CO 6: Develop the skill to understand and interpret the standard false colour composition of satellite images (FCC) and provide basic knowledge about the principles and significance of supervised image classification.

CO 7: Differentiate between various data structures like spatial and non-spatial, raster and vector and studies the basic principles of preparing an attribute table, data manipulation, query operation and overlay analysis in GIS.

CO 8: 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.

COs - POs Mapping
Geomatics and Spatial Analysis GEO-IDC01-1/2/3-Th & P

POs \ COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO 1	√	√	×	√	×	√	×	×	√	×	×
CO 2	√	√	×	×	×	√	×	√	×	×	×
CO 3	√	×	×	×	×	√	√	√	×	×	×
CO 4	√	×	×	×	×	×	×	×	√	×	×
CO 5	√	×	×	×	√	×	×	×	×	×	×
CO 6	√	×	×	×	√	√	√	×	×	×	×
CO 7	√	×	×	×	√	×	×	×	×	×	×
CO 8	×	×	×	×	√	√	√	√	×	×	×

Geomorphology GEOG-MD-CC04-4/5/6-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course Learning Outcomes (Cos):

The students will acquire knowledge about-

CO1: Concept of time and space in Geomorphology with special reference to Schumm and Lichty's model as well as clear notion about landform ordering focusing Ga scale of Tricart and Haggett.

CO2: Basic concept about degradational processes with classification of mass wasting and resultant landforms.

CO3: Clear idea about processes of entrainment, transportation and deposition by different geomorphic agents.

CO4: Development of river network and landforms on uniclinal, folded, faulted structure as well as on Granites, Basalts, and Lime stones.

CO5: Detailed discussion about following geomorphic processes and landforms –

a) Costal
b) Glacial and glacio-fluvial
c) Aeolian and fluvio-aeolian.

CO6: Clear concept about the models on Landscape evolution focusing the views of Davis, Penck, King and Hack along with significance of systems approach.

CO7: Fundamental concept about anthropogenic role in landform development.

CO8: In the laboratory course students learn-

i) Extraction and interpretation of geomorphic features from Survey of India 1:50000 topographical map of plateau region as well as relevant morphometric analysis of the concerned map.

ii) Construction of hypsometric curve and derivation of hypsometric integer of a drainage basin of plateau region.

COs - POs Mapping
Geomorphology GEOG-MD-CC04-4/5/6-Th & P

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11
CO 1	√	√	x	√	x	x	x	√	x	x	x
CO 2	√	x	x	x	x	x	x	√	x	x	x
CO 3	√	√	√	x	x	x	x	√	x	x	x
CO 4	√	√	√	x	√	x	x	√	x	x	x
CO 5	√	x	√	x	√	x	x	√	x	x	√
CO 6	√	√	√	x	x	x	x	√	x	x	x
CO 7	√	√	√	√	x	x	x	x	x	x	√
CO 8	√	x	x	√	√	√	√	√	x	x	x

Climatology GEOG-CC06/MD-CC05-4/5/6-Th & P (Credits: 04, Theory-03, Practicals-01)

Course Learning Outcome (COs):

The students will acquire knowledge about-

CO 1: Understand the elements of weather and climate and its controlling factors like horizontal and vertical distribution of temperature, types, causes and consequences of inversion of temperature.

CO 2: Learn about process and forms of condensation; mechanism and forms of precipitation as well as Bergeron-Findeisen theory, Collision, and coalescence theory.

CO 3: Learn about the typology, origin, characteristics, and modification of air mass as well as circulation of the atmospheric winds like Planetary winds, jet streams index cycle.

CO 4: Understand the frontogenesis and frontolyzes and atmospheric disturbance like tropical and mid-latitudinal cyclones and thunderstorms.

CO 5: Develop the concept on mechanism of monsoon with special reference to India.

CO 6: Understand the causes and consequences of Climate change in special reference to Greenhouse effect as well as formation, depletion, and significance of the Ozone layer.

CO 7: Comprehend the climatic classification developed by i) Thornthwaite and ii) Oliver.

CO 8: In Laboratory course, the students learn to

i) measure mean daily temperature, air pressure, relative humidity and rainfall with the help of relevant instruments like Six's maximum and minimum thermometer, Barometer, Hygrometer and Rain Gauge respectively.
ii) Interpret Pre-monsoon, Monsoon and Post-monsoon daily weather map of India.
iii) Construction and interpretation of monthly rainfall dispersion diagram (quartile method) as well as water budget.
iv) Construct and interpret hythergraph and climograph (after Taylor)

COs - POs Mapping

Climatology GEOG-CC06/MD-CC05-4/5/6-Th & P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	√	√	√	x	x	x	x	√	x	x	x
CO2	√	√	x	x	x	x	x	√	x	x	x
CO3	√	√	x	x	x	x	x	√	x	x	x
CO4	√	√	x	x	√	x	x	√	x	x	x
CO5	√	x	√	x	√	x	x	√	x	x	x
CO6	√	√	√	x	x	x	x	√	x	x	√
CO7	√	√	√	x	x	x	x	x	x	x	x
CO8	√	x	x	√	√	√	√	√	√	x	x

Hydrology and Oceanography GEOG-CC09/MD-CC06-5-Th & P
(Credits: 04, Theory-03, Practicals-01)

The students will acquire knowledge about-

CO1: The physical and biological role on Global Hydrological cycle and its system approach.

CO2: Controlling factors of different hydrological phenomenon like run-off and ground water recharge and discharge and their circulation.

CO3: Principles of water harvesting and watershed management focusing on drainage basin as a hydrological unit.

CO 4: Physical and chemical properties of ocean water with special reference to the distribution and determinants of temperature and salinity.

CO 5: Ocean circulation, water mass, T-S diagram and wave and tides.

CO 6: Types and causes of sea level changes and its implications.

CO 7: Classification of marine resource and their sustainable utilization and issues related to pollution of ocean water.

CO 8: In laboratory course they can acquire knowledge on-

i) Construction and interpretation of rating curve, hydrographs and unit hydrographs,
ii) Construction and interpretation of monthly rainfall dispersion diagram, climatic water budget and Egrograph,
iii) Construction of Ombrothermic graph and Hyetograph,
iv) Construction of Theissen polygon from precipitation data.

COs - POs Mapping
Hydrology and Oceanography GEOG-CC09/MD-CC06-5-Th & P

x	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	√	√	√	x	x	x	x	√	x	x	X
CO2	√	x	√	x	x	x	x	√	x	x	x
CO3	√	√	√	√	x	x	x	√	x	x	√
CO4	√	√	√	x	x	x	x	√	x	x	√
CO5	√	x	√	x	√	x	x	√	x	x	√
CO6	√	x	√	x	x	x	x	√	x	x	√
CO7	√	x	√	x	x	x	x	x	x	x	√
CO8	√	x	x	√	√	√	√	√	x	x	x

Cultural and Settlement Geography GEOG-CC10/MD-CC07-5/6-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course Learning Outcomes (COs): -

After completion of the course, the students will have ability to: -

CO1: Gather sufficient knowledge about definition, scope and content of cultural geography.

CO2: Basic concept about components and structure of culture.

CO3: Secure clear concept about the following elements-

a) Cultural hearths and realms,
b) Cultural diffusion,
c) Diffusion of major world religions and languages,
d) Cultural segregation, diversity and integration

CO4: Obtain true concept about evolution and morphology of rural settlements.

CO5: Procure comprehensible cognizance regarding rural house type of India highlighting the role of social segregation.

CO6: Achieve true perception about following dimensions of urban settlements –

e) Evolution
f) Metropolitan concept
g) Concept of megalopolis
h) Concept of conurbation and agglomeration

CO7: Access actual concept of urban morphology with special reference to the models of Burgess, Hoyt and Harris & Ullman.

CO8: In laboratory course, students will learn –

i) The skill of mapping language distribution of India
ii) The required skill of representing cartograms showing roof materials used in rural houses in any state of India in the Census years 1991, 2002 and 2011.
iii) Accessibility mapping using detour index from Survey of India 1:50000 topographical maps.
iv) Nearest neighbor analysis from Survey of India 1:50000 topographical maps of plain region.

COs - POs Mapping
Cultural and Settlement Geography GEOG-CC10/MD-CC07-5/6-Th & P

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11
CO 1	√	√	x	x	x	x	x	x	x	x	√
CO 2	√	√	x	x	x	x	x	x	x	√	x
CO 3	√	x	√	x	x	x	x	√	x	√	√
CO 4	√	x	√	x	√	x	x	√	x	√	x
CO 5	√	x	√	x	√	x	x	√	x	√	x
CO 6	√	√	√	x	√	x	x	√	x	√	√
CO 7	√	x	x	√	√	x	x	√	x	x	x
CO 8	√	x	x	√	√	√	√	√	√	x	x

India and West Bengal GEOG-H-CC14/MD-CC08-6-Th & P
(Credits: 04, Theory-03, Practicals-01)

Course Learning Outcomes (COs): -

After completion of the course, the students will have ability to: -

CO 1: Understand the physical and climate related profile of the country.

CO2: Study the resource endowment and its spatial distribution and utilization for sustainable development.

CO 3: Synthesize and develop the idea of regional dimensions.

CO 4: Gather complete perception about population profile of the country with special reference to some tribal population.

CO 5: Obtain proper knowledge about agricultural regions coupled with the concept of Green revolution, white revolution and its consequences.

CO 6: Acquire detailed knowledge about the distribution and utilisation of mineral and power resources like iron ore, coal, petroleum and natural gas.

CO 7: Attain actual awareness about industrial development in relation to Automobile and information technology

CO 8: Secure thorough knowledge about physiographic and economic regionalization of India following R.L. Singh and P. Sengupta respectively.

CO 9: Acquire complete knowledge about the following aspects of West Bengal-

i) Physical and demographic perspectives,
ii) Various dimensions of resources,
iii) Development of SEZs and changing pattern of industrialization in West Bengal.
iv)Different aspects of Demography of West Bengal,
v)Regional issues highlighting Darjeeling Hills as physiographic region, Sundarban as an ecological region and Haldia as Industrial region.

CO 10: In the laboratory course, the students will get an opportunity to attain skills to

i) Compute and interpret the graphical representation of annual trend of manufacturing goods over any two decades from India or west Bengal

ii) Learn to compute Composite Index to compare developed and backward states of India.

iii) Change in mean centre of population of West Bengal over any three census years.

COs - POs Mapping

India and West Bengal GEOG-H-CC14/MD-CC08-6-Th & P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	√	√	√	x	√	x	x	x	x	x	√
CO2	√	x	√	x	√	x	x	x	x	x	√
CO3	√	√	√	x	x	x	x	x	x	√	√
CO4	√	√	√	√	x	x	x	x	x	√	√
CO5	√	x	√	x	x	x	x	x	x	√	√
CO6	√	x	√	x	x	x	x	x	x	√	√
CO7	√	x	√	x	x	x	x	x	x	√	√
CO8	√	√	x	x	x	x	x	x	x	x	x
CO9	√	√	√	√	x	x	x	x	x	√	√
CO10	√	x	x	√	√	√	√	√	x	x	x

Name of the Programme: B.Sc. Mathematics(MDC- CCF) Year of Introduction: 2023

Program Specific Outcome:

PSO1: The basic objective of studying Mathematics MDC course is to develop the mathematical reasoning power of the students and logical support behind an assumption. Throughout the entire course the students learn different branches of mathematics through which they are not only equipped with solution of different types of problems by framing a proper mathematical model but they can logically justify the model and the computational procedures with proper mathematical reasoning.

PSO2: Another objective of cultivating Mathematics MDC course is to enhance the power of critical thinking of the students by solving varieties of Mathematical problems and this programme will provide a very strong foundation in Mathematical concepts, problem- solving skills and the ability to apply mathematical knowledge in various fields.

PSO3: The entire syllabus for Undergraduate Course is framed in such a way that after successful completion of three year / four year courses phase by phase the students will be able to solve the mathematical problems with minimum error and the students will be equipped with mathematical skills and techniques which they can apply in both academic and non-academic areas in work. The students will be able to translate real-world problems into mathematical models and analyze these models to draw conclusions by developing critical thinking skills to evaluate mathematical arguments.

PSO4: The students will develop strong understanding and good grasp over the areas of Algebra, Analysis, Metric spaces and Complex analysis, Topology, Calculus and its applications, Ordinary and Partial differential equations, Mechanics, Probability and Statistics, Mathematical methods and computational skill using different computer languages. The theory and its applications will motivate the students for critical thinking towards further specialisation and to pursue research in mathematics in India and abroad including literature searches, data analysis, and formulating research problems.

PSO5: The students get a strong foundation in the subject and develop a comprehensive knowledge of all the classical and applied fields of mathematics. They will be able to apply mathematical knowledge to problems of engineering sciences, information technology, computer science and social sciences.

PSO6: The students will acquire numerical skill, logical thinking and analysing capability which they can apply in competitive examinations to come out successful. Problem solving skills will be enhanced that will help to resolve day to day problems. They will be able to teach in Educational and Research Institutions and to impart their knowledge in different service sectors as erudite consultants.

The National Education Policy, 2020 aims to nurture well-rounded individuals who can contribute to society by fostering critical thinking, creativity, and problem-solving skills. With a focus on reducing the burden of examinations and rote learning, NEP 2020 aims to create a learning environment that fosters curiosity, innovation, and lifelong learning. It also provides quality education to all by enabling an individual to study one or more specialized areas of interest at a deep level, and also to develop character, ethics and moral values. Its educational program includes the importance of informal education and traditional value systems of an Indian society in addition to the academic life. The policy aims to foster the holistic development of students, encompassing their intellectual, social, physical, emotional and moral capacities. In the context of the New Education Policy (NEP) 2020, Course Outcomes (COs) are specific, measurable learning objectives that students are expected to achieve by the end of a course, while Programme Outcomes (POs) are the broader, expected outcomes that students should demonstrate upon completion of a program. COs are the building blocks of POs, meaning that achieving the individual COs within a course contributes to the overall attainment of the program's POs. The syllabus of Mathematics MDC has been designed in a way the student gets a strong foundation in the subject and gains an in-depth knowledge. Program wise outcomes are detailed below:-

Program	**One year Certificate course with Mathematics MDC**
Participants	Students of Semester one and semester two
Program details	To complete a Certificate course with Mathematics MDC the students should study two semester courses each of 21 credits. In each of the semesters they study one core course of Mathematics MDC having credit 4, One Skill enhancement course of Mathematics MDC having credit 4, one core course of one MDC paper having credit 4, one interdisciplinary course of credit 3, one language course of credit 2 and two value added course each of credit 2.
Courses taught in Mathematics MDC	Semester 1:: (a)Core course:- Calculus, Geometry, Vector analysis; (b) SEC: C language with Mathematical Application Semester 2:: (a)Core course:- Basic Algebra; (b) SEC: Python Programming and Introduction to Latex
Program Outcome	PO1:-The students will be familiar with the basic knowledge Calculus, Geometry, Vector algebra and Basic Algebra. They will learn different applications of calculus, broad ideas of two and three dimensional geometry application of vector geometry and basics of Algebra which will help them to develop a good grasp over the basic premise of the subject. PO2:- The student will also learn two computer languages C and Python as Skill Enhancement Courses and will help them to apply in different mathematical problems. It will enhance their computational skills and develop their skill for logic management. Also by learning the basic programming constructions, they can easily switch over to any other language in future.

Program	**Two year Diploma course with Mathematics MDC**
Participants	Students of Semester Three and Semester Four after successful completion of one year certificate course
Program details	To complete a Diploma course with Mathematics MDC the students should study four semester courses with following specification:- i) In each of the first two semesters (each of credit 21) they study one core course of Mathematics MDC having credit 4, one Skill enhancement course of Mathematics MDC having credit 4, one core course of first MDC paper having credit 4, one interdisciplinary course of credit 3, one language course of credit 2 and two value added course each of credit 2. ii) In the third semester(credit 21) they should study two core courses of Mathematics MDC having credit 4, one Skill enhancement course of Mathematics MDC having credit 4, one core course of the second MDC paper having credit 4, one interdisciplinary course of credit 3 and one language course of credit 2. (iii) In the fourth semester (credit 22) they should study four core courses each of credit 4, one core course of the second MDC paper having credit 4 and one language course of credit 2.
Courses taught in Mathematics MDC	Semester 1:: (a)Core course:- Calculus, Geometry, Vector analysis; (b) SEC: C language with Mathematical Application Semester 2:: (a)Core course:- Basic Algebra; (b) SEC: Python Programming and Introduction to Latex Semester 3:- (a) Core course:- Real analysis, (b)Core course: Ordinary Differential equations-I and Group Theory-I. (c) SEC:- Linear Programming and Rectangular Games; Semester 4:- (a) Core course:- Theory of Real Functions, (b)Core course: Mechanics-I (c)Core course: Partial Differential Equations-I and Multivariate Calculus-I; (d) Core course: Group Theory-II and Ring Theory-I
Program Outcome	PO1:-The students will acquire basic knowledge of Calculus, Geometry, Vector algebra, Algebra, Real analysis, Theory of real functions, Ordinary and Partial differential equations, Mechanics and two computer languages. Thus they will be familiar with the basic branches of Mathematics. PO2: They will be conversant with the basic branches of mathematics which will help in their future study. Moreover they will be able to analyze problems in the light of Algebra, real analysis and theory of

	function which in turn develop their inner sight and a good grasp over the subject. PO3:- During the course of study the students will learn a course of Ordinary Differential Equations, Partial Differential Equations; Multivariate Calculus and Mechanics which will help them to solve different real life problems and mathematical models. PO4:- The student will also learn two computer languages C and Python as Skill Enhancement Courses, one of which is compiler based and the other is interpreter based. It will enhance their computational and analytical skills and will develop proficiency to write proper algorithm for management of a problem. Also by learning the basic programming constructs, they can easily switch over to any other language in future.

Program	**Three year Degree course with Mathematics MDC**
Participants	Students of Semester Five and Six after successful completion of two year diploma course
Program details	To complete a Degree course with Mathematics MDC the students should study six semester courses with following specification:- i) In the first semester there are one core course of Mathematics MDC having credit 4, one Skill enhancement course of Mathematics MDC having credit 4, one core course of first MDC paper having credit 4, one interdisciplinary course of credit 3, one language course of credit 2 and two value added courses each of credit 2. (ii) In the second semester there is one core course of Mathematics MDC having credit 4, one Skill enhancement course of Mathematics MDC having credit 4, one core course of first MDC paper having credit 4, one interdisciplinary course of credit 3, one language course of credit 2 and two value added courses each of credit iii) In the third semester there are two core courses of Mathematics MDC having credit4, one Skill enhancement course of Mathematics MDC having credit 4, one core course of the second MDC paper having credit 4, one interdisciplinary course of credit 3 and one language course of credit 2.

	(iv) In the fourth semester there are four core courses each of credit 4, one core course of the second MDC paper having credit 4 and one language course of credit 2. (iv) In the fifth semester there are four core courses each of credit 4, one core course of the first MDC paper having credit 4 and one core course of the second MDC paper having credit 4. (v) In the sixth semester there are three core courses each of credit 4, one core course of the first MDC paper having credit 4 and one core course of the second MDC paper having credit 4 and summer internship programme of credit 3.
Courses taught in Mathematics MDC	Semester 1:: (a)Core course:- Calculus, Geometry, Vector analysis; (b) SEC: C language with Mathematical Application Semester 2:: (a)Core course:- Basic Algebra; (b) SEC: Python Programming and Introduction to Latex Semester 3:- (a) Core course:- Real analysis, (b)Core course: Ordinary Differential equations-I and Group Theory-I. (c) SEC:- Linear Programming and Rectangular Games; Semester 4:- (a) Core course:- Theory of Real Functions, (b)Core course: Mechanics-I (c)Core course: Partial Differential Equations-I and Multivariate Calculus-I; (d) Core course: Group Theory-II and Ring Theory-I Semester 5:- (a) Core course:- Probability and Statistics (b)Core course: Ring Theory-II and Linear Algebra-I (c)Core course: Riemann Integration and Series of function; (d) Core course: Mechanics-II Semester 6:- (a) Core course:- Metric Space & Complex Analysis-I, (b)Core course: Multivariate Calculus-II and Application of Calculus (c) Core course: Numerical analysis;
Program Outcome	PO1:-In three years of study the students will gain a thorough knowledge in Mathematics by enhancing problem-solving skills to resolve day to day problems. PO2:-Three years Graduates will be able to apply their knowledge and skills in a professional setting, to communicate effectively and collaborate with others and also will be able to engage in lifelong learning and adapt to changing circumstances."

	PO3:- Acquire deep understanding about scientific methods and apply these in solving scientific problems by analysing practical data using qualitative and quantitative methods. PO4:- Develop scientific, communicative and numerical skills and make rewarding careers in Information technology, Machine learning, Industrial Mathematics and AI. PO 5:- Can develop scientific models to solve problems in the fields of Engineering and social sciences and can carry out research projects independently or in collaboration with other institutions or industries. PO 6:- In the course of six semesters the students will acquire knowledge of Calculus of single and multiple variables, Geometry of two and three dimensions, Vector algebra and calculus, Linear Modern and Classical algebra, Real and Complex analysis, Concepts of Riemann integration, Sequence and Series and functions, Probability and Statistics, Metric spaces, Ordinary and Partial differential equations, Mechanics of particle and rigid bodies, Statics, Numerical Analysis and two computer languages. Thus their course curriculum gives them a flavour of almost all the important branches of Mathematics and as such they can pursue their higher studies and research in their chosen branch so as to contribute significantly in the subject. PO7:- During these three years of study the students also learn two computer languages C and Python, one of which is compiler based and the other is interpreter based. In Numerical analysis practical they apply those languages to run a problem and find a solution. It will enhance their computational and analytical skills and will develop proficiency to write proper algorithm for management of a problem. Also by learning the basic programming constructs, they can easily switch over to any other language in future. PO8: After getting the flavour of all the basic branches of Mathematics the students will gain scientific knowledge and skills of different branches, which enable them to undertake further studies in Mathematics, Statistics or its allied areas. They will be able to analyze problems in the light of respective branch of mathematics and will be able to predict the solution of real life problems with the help of models. Thus the course will help them to develop a logical vision, a computational skill, a critical thinking power and as a whole a good grasp over the subject with which they will be able to proceed further in future life.

Course Outcome

Course: MATH-(MD-CC1, MN1)-1, (MDC-mn1, MN3)-3-TH: Calculus, Geometry & Vector Analysis

CO1: To learn to find out higher order derivatives, Leibnitz rule and its applications, L'Hospital's rule.

CO2: To learn reduction formulae. They learn to find out arc length of a curve, area under a curve, area and volume of surface of revolution.

CO3: To learn classification of conics, reduction to canonical form, tangent, normal and polar equations of conics.

CO4: To acquire detail knowledge of spheres, cylindrical surfaces, central conicoids, different quadric surfaces.

CO5: To learn application of vector equations to geometry and mechanics, differentiation and integration of vector functions.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1			✓	✓	✓	✓		
CO2	✓		✓	✓	✓	✓		✓
CO3			✓	✓	✓	✓		✓
CO4	✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓

Course: MATH-(MD-CC2 MN2)-2, (MDC-mn2, MN4)-4-TH: Basic Algebra

CO1: To learn about exponential, logarithmic, trigonometric and hyperbolic functions of complex variable.

CO2: To learn to solve cubic and biquadratic equation.

CO3: To acquire knowledge of equivalence relation, partial order relation, linear order relation, composition of mappings.

CO4: To learn well-ordering property of positive integers, division algorithm, congruence relation between integers.

CO5: To learn about existence and uniqueness of a system of linear equations, row reduction and echelon forms.

CO6: To learn about algebraic and geometric properties of vectors in n-dimensional space, linear independence of vectors, algebraic and geometric characterizations of linearly independent subsets.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓	✓	✓	✓		✓
CO2	✓		✓		✓	✓		
CO3	✓		✓	✓	✓	✓		
CO4	✓		✓	✓	✓	✓		✓

CO5	✓	✓			✓	✓		
CO6	✓	✓	✓	✓	✓	✓		✓

Course: MATH-MD-SEC-1,2,3-TH: C Language with Mathematical Applications

CO1: To learn C language in detail.

CO2: To learn to use different types of control statements and arrays.

CO3: To learn to write different types of computer programs using C language.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓			✓	✓	
CO2	✓	✓	✓			✓	✓	
CO3	✓	✓	✓			✓	✓	

Course: MATH-MD-IDC-1,2,3-TH: Mathematics in Daily Life

CO1: To learn basics of set theory.

CO2: To learn mathematics of integers behind ISBN, UPC, VISA, MASTER card nos.

CO3: To get idea of propositional logic, logical connectives,

CO4: To learn basics of linear programming problems.

CO5: To learn financial mathematics at elementary level.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓

Course: MATH-MD-CC 3-3, (MN5, MDC- mn3)-5-TH: Ordinary Differential Equations – I

and Group Theory – I

CO1: To learn formation of differential equations and solution of differential equations.
CO2: To learn methods for solving first order first degree and higher degree differential equations.

CO3: To learn methods for solving higher order linear and nonlinear differential equations.

CO4: To study algebraic structure ‘Group’, elementary properties of groups, subgroups, order of a group, cyclic group, alternating groups etc.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓		✓	✓	✓	✓		✓
CO2	✓		✓	✓	✓	✓		✓
CO3	✓		✓	✓	✓	✓		✓
CO4	✓		✓	✓	✓	✓		✓

Course: MATH-MD-CC 4-4, MDC-mn4-5-TH: Mechanics-I

CO1: To learn about principle of forces, resultant forces, resultant couple and coplanar forces.
CO2: To study rectilinear motion and simple harmonic motion.
CO3: To learn to solve problems on work, power, energy.
CO4: To study on impulsive forces and collision of elastic bodies.
CO5: To learn to solve problems of motion of a particle in two-dimension.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓

Course: MATH-MD-CC 5-4, MDC mn5-6-TH: Advanced Calculus

CO1: To learn sequence of real numbers and infinite series of constant terms.

CO2: To learn limit, continuity of real valued functions, properties of continuous functions.

CO3: To learn Rolle's theorem, mean value theorems, Taylor's and Maclaurin's infinite series.

CO4: To learn limit, continuity, differentiability, partial derivatives of real valued functions of two or three variables, chain rule of partial derivatives, Euler's theorem on homogeneous functions.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓		✓	✓	✓	✓		✓
CO2	✓		✓	✓	✓	✓		✓
CO3	✓		✓	✓	✓	✓		✓
CO4	✓		✓	✓	✓	✓		✓

Course: MATH-MD-CC 6-5, MDC mn6-6-TH: Statistics and Numerical Analysis

CO1: To learn probability theory, discrete and continuous distribution, mathematical expectations.

CO2: To learn measures of central tendency, measures of dispersion, correlation and regression.

CO3: To learn sampling theory, basic idea of some distributions used in sampling theory.

CO4: To learn estimation of parameters, point estimation, interval estimation, testing of

hypothesis, type I and type II error.

CO5: To learn interpolation and numerical integration.

CO6: To learn methods for solving transcendental equations and Gauss elimination method for solving system of linear equations.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓		✓	✓	✓	✓		
CO2	✓		✓	✓	✓	✓		
CO3	✓		✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓
CO6	✓		✓	✓	✓	✓		✓

Course: MATH-MD-CC 7-5-TH: Mathematical Methods

CO1: To learn sequence and series of functions in detail.

CO2: To learn application of differential calculus and maxima and minima of functions.

CO3: To learn Fourier series of periodic functions.

CO4: To learn Laplace transform and its application to the solution of ordinary differential of second order with constant coefficients.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓	✓	✓	✓		
CO2	✓	✓	✓	✓	✓	✓		
CO3	✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓	✓		

Course: MATH-MD-CC 8-6-TH: Discrete Mathematics

CO1: To learn Graph theory in detail.

CO2: To learn application of congruences.

CO3: To learn combinatorics, recurrence relations, generating functions.

CO4: To learn Boolean functions, Boolean polynomials, Minimal forms of Boolean polynomials, switching circuits, Logic gates.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	✓	✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓		✓