Department of Botany

B. Sc. Programme
Effective from Academic Session 2013-2014

Programme Outcomes (POs)	The institute tries to ensure that after completion of the course the students will inculcate the following among themselves for benefit of the society and scientific community. **PO1. Basic understanding of:** 1) Plant diversity in terms of habit and habitat, morphology, anatomy, reproductive structures and ecological relationships. 2) Plant systematics and classification. 3) Molecular biology of plants and physiological responses to environment. 4) Evolving concepts like bioinformatics and biostatistics in solving biological problems. **PO2. Development of skills related to:** 1) Logical thinking and assimilation of ideas after thorough study. 2) Ability to co-relate one subject to the next and understand the interdependencies between each aspect of plant biology. 3) Manage the evolving state of knowledge in this rapidly developing field. 4) Preparing reports or field records based on surveys or experiments conducted or a guided project work. **PO3. Laboratory and field-work skills**: 1) Students learn to conduct experiments with proper precautions and safety measures. 2) Learn to develop SOPs for practical tests included in the curriculum. 3) Hands-on exposure to basic skills such as plant identification, phyto-sociological analysis, staining and preparation of specimen, biotechnogical tools and techniques. 4) Analysing data with appropriate statistical methods and computer packages. **PO4. Transferable and applied skills:** 1) Development of

	communication and IT skills. 2) Deliberating on scientific ideas and designing experiments around them. 3) Time management, planning and organisation skills. **PO5. Use of scientific knowledge in problem analysis**: 1) To employ the knowledge of basic and life sciences in solving academic problems like identification of plants, designing studies and formulation of literature. 2) Development of products from medicinal plants based on ethnobotanical knowledge and estimation of phytochemicals important for human health. **PO6. Application of evolving tools and techniques:** Create, select, and utilize appropriate techniques, resources, and modern tools and equipment for biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations. **PO7. Contribution towards society**: 1) Assessing plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice. 2) Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. 3) Respecting ethical principles and committing to environmental ethics and responsibilities for biodiversity conservation. **PO8. Team management:** 1) Perform effectively as an individual as well as a member or leader in varied teams, and in multidisciplinary settings. 2) Ability to communicate effectively on complex scientific situations with the scientific community and with society at large. 3) To write effective reports and design documentations, preparing effective presentations, and interacting with clear instructions.

Course contents

SEMESTER I

Paper M 101 (Theory): Plant Kingdom, Algae and Fungi (Credits 6)

Paper M 102 (Theory): Bryophytes and Pteridophytes (Credits 6)

Paper M 103 (Practical): Algae, Fungi, Bryophytes, Pteridophytes, Techniques (Credits 4)

SEMESTER II

Paper M 201 (Theory):Gymnosperms, Paleobotany and Plant Anatomy (Credits 6)

Paper M 202 (Theory): Cell Biology (Credits 6)

Paper M 203 (Practical): Gymnosperm, Paleobotany, Plant Anatomy, Cell Biology (Credits 4)

SEMESTER III

Paper M 301 (Theory):Ecology, Plant Geography, Evolution(Credits 6)

Paper M 302 (Theory): Instrumentation and Laboratory Techniques (Credits 6)

Paper M 303 (Practical): Ecology, Laboratory Instrumentation and Laboratory techniques (Credits 4)

SEMESTER IV

Paper M 401 (Theory):Morphology, Palynology, Embryology of Angiosperms(Credits 6)

Paper M 402 (Theory): Plant Taxonomy (Credits 6)

Paper M 403 (Practical): Morphology, Palynology, Embryology, Plant Taxonomy (Credits 4)

SEMESTER V

Paper M 501 (Theory): Microbiology and Immunology (Credits 6)

Paper M 502 (Theory): Plant Pathology and Lichen (Credits 6)

Paper M 503 (Theory): Cytogenetics, Plant Breeding and Biometrics (Credits 6)

Paper M 504 (Theory): Applied Botany (Credits 6)

Paper M 505 (Practical): Microbiology, Plant Pathology and Lichen (Credits 6)

Paper M 506 (Practical): Cytogenetics, Plant Breeding, Biometrics and Applied Botany

(Credits 6)

SEMESTER VI

Paper M 601 (Theory): Molecular Biology and Plant Biochemistry (Credits 6)

Paper M 602 (Theory): Bioinformatics, Computer Application and Biotechnology (Credits 6)

Paper M 603 (Theory): Plant Physiology (Credits 6)

Paper M 604 (Theory): Plant Resource Utilization (Credits 6)

Paper M 605 (Practical): Molecular Biology, Biotechnology, Bioinformatics and Computer Application (Credits 6)

Paper M 606 (Practical): Plant Physiology and Plant Resource utilization (Credits 6)

COURSE OUTCOMES:

After completion of the three year degree course in B.Sc. Botany (both Major and General), we expect the students to gain insight into the basic but significant concepts of plant biology, systematics, genetics and ecology.

CO1. Imparting knowledge aboutrangeof plant diversity in terms of habit and habitat, morphology, anatomy, systematics of various classes of plants and their environmental relationships is important for preliminary understanding of the plant kingdom.

CO2. Students gain insights into the basic functioning of cell organelles, genome, arrangement and structure of genes and understanding of central dogma which forms the primary basis of any further study on cell and molecular biology.

CO3. Plant diseases and control measures increases practical knowledge about prevention and control measures against pathogen attack on plants.

CO4. Studying about Instrumentation laboratory skills and techniques helps the studentsto get acquainted with safe laboratory practices and critical measures for carrying out successful experimentation.

CO5. Documentation and preparation of experimental protocols and reports, filed visits, study tours etc. for enhancing writing skills and theoretical reference.

CO6. Gaining basic knowledge about DNA, RNA, genes, mechanism of gene interaction and Mendelian inheritance.

CO7. Study of emerging biotechnological tools and techniques; getting acquainted with concepts of bioinformatics, biostatistics and genetic engineering.

CO8: Studying about uses of plants and plant products based on ethnobotanical information and realising their significance.

PROGRAMME SPECIFIC OUTCOMES (TDC BOTANY Major):

SEMESTER-I	
Paper	**Course Learning Outcomes**
BOT M 101 (Theory):Plant Kingdom, Algae and Fungi	**CLO1**. To get a basic perception on structure and hierarchy of plant kingdom. **CLO2**. To understand the diversity, systematics, general characteristics and life cycle pattern of Algae. **CLO3**. To understand the characteristics, morphology, life history of various classes of fungi. **CLO4**. To gain information about economic and ecological importance of thallophytes.
BOT M 102 (Theory):Bryophytes and Pteridophytes	**CLO1**. To study about morphological diversity in Bryophytes. **CLO2**. To study life history of some major genera of Bryophytes, their characters, and ecological importance. **CLO3**. To study about classification, diversity, morphology, and reproductive structures of Pteridophytes.
BOT M 103 (Practical): Algae, Fungi, Bryophytes, Pteridophytes, Techniques	**CLO1.** Practical skills on preparation of types (slides, herbarium). **CLO2.** Techniques on preparation and study of permanent slides for morphological and anatomical characters.

SEMESTER-II	
Paper	**Course Learning Outcomes**
BOT M 201 (Theory):Gymnosperms, Paleobotany and Plant Anatomy	**CLO1.** To study about classification, evolutionary significance, general characteristics and life history of Gymnosperms. **CLO2.** To gain knowledge on paleobotany, study of fossils, types, and process of identification. **CLO3.** Basic knowledge on plant anatomy, models and components of cell wall and cell membrane. **CLO4.** To study about tissues, tissue systems, theories of structural development.
BOT M 202 (Theory): Cell Biology	**CLO1.** To gain primary knowledge on cell cycle, its phases and checkpoints. **CLO2.** To know about structures of DNA and RNA. **CLO3.**To understands the structure and composition of chromosomes, chromatin and nucleus. **CLO4.** Significance and structures of different cell organelles and cell signalling mechanism.
BOT M 203 (Practical): Gymnosperm, Paleobotany, Plant Anatomy, Cell Biology	**CLO1.**Practical knowledge on study of fossil specimens and to determine their morphological features. **CLO2**. To gain hands-on expertise on techniques of preparing plant anatomical specimen, using thin sections and staining. **CLO3**. Practically studying the stages of mitosis and meiosis using root tip and flower bud smears, followed by appropriate staining technique.

SEMESTER-III	
Paper	**Course Learning Outcomes**
BOT M 301 (Theory):Ecology, Plant Geography, Evolution	**CLO1.** To understand structure of an ecosystem, its functions and various components. **CLO2.** To increase understanding of population and community ecology and the measures to study population or community. **CLO3.** To gain knowledge on the different phyto-geographical regions of India, factors responsible for geographic divisions and characteristic vegetation. **CLO4.** Sources of environmental pollution, impact on ecosystem and its biotic components. **CLO5.** To understand the theories of evolution and the factors acting as evolutionary forces.
BOT M 302 (Theory): Instrumentation and Laboratory Techniques	**CLO1.** Insight into different instruments and techniques used in studying various biological mechanisms. **CLO2.** To understand the working principles, types and uses of various techniques of biological science, such as microscopy, chromatography, spectrophotometry etc. **CLO3.** Basic knowledge on various solutions, fixativesand staining techniques employed in biological experiments. **CLO4.** To know about various taxonomic techniques used in field studies and procedure of plant specimen preservation to be used as reference materials.

BOT M 303 (Practical): Ecology, Laboratory Instrumentation and Laboratory techniques	**CLO1.** To gain knowledge on methods to study phyto-sociological parameters such as abundance and frequency of plant species in a population. **CLO2.**Biological oxygen content of polluted and non-polluted water; thereby understanding the difference of biological oxygen demand caused by pollution. **CLO3.**Practically studying the anatomical adaptations of plants in various climatic or physiographic conditions. **CLO4.**Knowledge on preparation of different molar or normal solutions used in various experiments.
SEMESTER-IV	
Paper	**Course Learning Outcomes**
BOT M 401 (Theory): Morphology, Palynology, Embryology of Angiosperms	**CLO1.** To gain a more detailed understanding of the most advanced and most predominant plant division i.e. Angiosperms. **CLO2.** To understand the floral morphology of angiosperms and different theories related to the evolution of advanced leaf like or floral parts of plants. **CLO3.** To know about the science of palynology, its aspects and prospects, and techniques of studying pollen abundance, diversity, and structure. **CLO4.** To understand the concept of embryology and to study each major step involved in development of an embryo in angiosperms.
BOT M 402 (Theory): Plant Taxonomy	**CLO1.**Detailed knowledge on basics of plant systematics, classification, nomenclature and taxonomy.

	CLO2. To understand the different systems of taxonomic classification of plants. **CLO3.** Knowledge on the principles and rules of binomial nomenclature, priority of publication, rules and principles of ICBN, taxonomic names and types. **CLO4.** To study the modern trends in plant taxonomy and evolving branches such as molecular taxonomy, numerical taxonomy, chemotaxonomy etc. **CLO5.**Basic knowledge on affinities, phylogeny, economic importance and comparative studies of different plant families belonging to both monocots and dicots.
BOT M 403 (Practical): Morphology, Palynology, Embryology, Plant Taxonomy	**CLO1.** To understand about scientific processes of studying and recording morphological characters of plant specimen. **CLO2.** Practical observation of morphology and types of pollen grains in different types of samples and preparation of permanent slides. **CLO3.**Embryological study of different types of ovules, anthers, embryo sac, endosperm etc. from permanent slides. **CLO4.** Practical knowledge on taxonomy through field study and herbarium preparation, and scientific methods to identify the plant species based on taxonomic keys.
SEMESTER-V	
Paper	**Course Learning Outcomes**
BOT M 501 (Theory): Microbiology and	**CLO1.** Detailed insight into study of microbes, their classification, diversity, mode of nutrition and scope of microbiology.

Immunology	**CLO2.** To understand the role of microbes in biogeochemical cycles, mode of microbial nutrition, reproduction and biological nitrogen fixation. **CLO3.** To understand the concept of immunology and theinteraction of antigen-antibody for the development of immune responses. **CLO4.** To study about nature of viruses, their types, classification, replication and mode of transmission.
BOT M 502 (Theory): Plant Pathology and Lichen	**CLO1.** To get an overall view of plant-pathogen interaction, common symptoms of plant diseases. **CLO2.** To know about concept of disease cycle, mechanism of disease development and dissemination and range of defense responses exhibited by plants against pathogen attack. **CLO3.**Knowledge on disease cycle and control measures of diseases of some common crops and study of measures and techniques of plant disease management **CLO4.** To study about diversity, characteristics and types of lichens.
BOT M 503 (Theory): Cytogenetics, Plant Breeding and Biometrics	**CLO1.**Basic principles of cytogenetics, Mendelian inheritance and deviations to Mendel's laws. **CLO2.** To study about evolutionary significance of chromosomal aberrations and numerical changes, linkage and crossing over. **CLO3.** To gain knowledge on principles of plant breeding, genetic basis of plant breeding. **CLO4.** Introduction to biometrics and common bio-statistical parameters such as mean, median, standard deviation etc.

BOT M 504 (Theory): Applied Botany	**CLO1.** To understand about the useful and harmful microbes and their significance and economic importance. **CLO2.** Knowledge on application of algae, fungi and bacteria as food, medicine, soil fertility and various commercial products. **CLO3.** To understand the impact of deforestation and its role towards climate change. **CLO4.** To gain information on different methods and techniques of plant propagation, such as layering, grafting, bonsai etc.
BOT M 505 (Practical): Microbiology, Plant Pathology and Lichen	**CLO1.** Practical knowledge on the different methods of isolation of microbes and their culture using different culture media. **CLO2.** To develop understanding on the maintenance of aseptic conditions for growth and maintenance of microbes. **CLO3.** To get hands-on expertise on methods of microbial cell count and gram staining. **CLO4.** Field study based on collection and identification of various diseased plant samples attacked by various pathogens. **CLO5.** To observe various types of lichens and their ecological niche.
BOT M 506 (Practical): Cytogenetics, Plant Breeding, Biometrics and Applied Botany	**CLO1.** Chromosomal study of plants using karyotyping. **CLO2.** Tounderstand the numerical and structural changes of chromosomes by studying chromosomal aberrations. **CLO3.** To know the technique of emasculation and artificial-pollination in plants. **CLO4.** To gain knowledge on the interactions of multiple genes which

	control different quantitative traits. **CLO5.** Practical idea on solving bio-statistical problems using different metrics.
SEMESTER-VI	
Paper	**Course Learning Outcomes**
BOT M 601 (Theory): Molecular Biology and Plant Biochemistry	**CLO1.**To study about structure and organisation of gene, genetic code and operon concept. **CLO2.** A more detailed knowledge of structure of DNA, RNA, and central dogma (replication, transcription and translation) **CLO3.** Types of mutation and its role in genetic variations among organisms and various diseases caused by genetic mutations. **CLO4.**Basic knowledge of enzymes, nitrogen metabolism, carbohydrate metabolism, amino acid metabolism and protein synthesis.
BOT M 602 (Theory): Bioinformatics, Computer Application and Biotechnology	**CLO1.** To get oriented with science of computational biology, in silico processing, storage and retrieval of biological data. **CLO2.** To learn about biological databases, application of bioinformatics in drug designing, molecular phylogeny and crop improvement. **CLO3.** Basics of biotechnology and its techniques, such as various types of tissue culture methods, development of transgenic plants. **CLO4.** To study the techniques and applications of various plant genetic engineering approaches.
BOT M 603 (Theory):	**CLO1.** Toget an understanding of major physiological processes that

Plant Physiology	drives the metabolic pathways in plants. **CLO2.** To study about mineral nutrition, absorption of minerals, and translocation of mineral solutes and water inside plant body. **CLO3.** To gain detailed knowledge on photosynthesis and respiration and significance of these processes in plant anabolism and catabolism. **CLO4.** Role of plant growth regulators and their application in agriculture and horticulture. **CLO5.** Growth and development related physiological aspects such as circadian rhythm, photoperiodism and vernalization.
BOT M 604 (Theory): Plant Resource Utilization	**CLO1.** To know about origin and evolution of crop plants with special reference to process of cultivation and utilization of plant products. **CLO2.** Knowledge on medicinal plants and pharmacognosy, preparation of crude drug and possibility of modification of drugs. **CLO3**. Study of beverage crops, spices and condiments, fibre yielding plants and timber yielding plants. **CLO4.** Conceptof ethnobotany- utilization of plants by communities for their daily needs and usage.
BOT M 605 (Practical): Molecular Biology, Biotechnology, Bioinformatics and Computer Application	**CLO1.**Study on extraction and estimation of sugar, protein, chlorophyll and other phytochemical contents. **CLO2.** Learningmethods to prepare culture media for micropropagationincluding aseptic tissue culture. **CLO3.** Hands-on study of data retrieval from biological databases and construction of phylogenetic tree. **CLO4.** Study of modern biotechnological and genetic engineering

	tools and techniques, their application and limitations.
BOT M 606 (Practical): Plant Physiology and Plant Resource utilization	**CLO1.** Practical knowledge on determination of osmotic potential, RQ, stomatal index etc. from various samples. **CLO2.**Separation of plant pigments through chromatography. **CLO3.** To know the chemical tests for determination of tannins and alkaloids, and histochemical tests in plant samples.

Marks Rationale:

In **Non-CBCS Syllabus** the first 4 semester's theory paper 60 marks is allocated for each paper and 15 marks for internal assessment(Total=75) and for practical paper 40 marks is allocated for each theory paper and 10 marks for internal assessment (Total=50). In the 5th and 6th semesters both theory and practical paper carries 60 marks for each paper and 15marks is allocated for internal assessment (Total=75).

Marks Rationale:

In **CBCS Syllabus** the core courses consists of 4 credit for theory and 2 credits for practical in each papers of all the semesters (Total Credit 4+2=6). The skill enhancement course consists of 4 credit in each paper of 3rd and 4th semester (Total Credit=4). Discipline Specific Elective papers in 5th and 6th semester consists of 4 credit for theory and 2 credits for practical in each papers (Total Credit 4+2=6).

The Internal assessments are assessed by the following process-

- Class test : 15 marks
- Assignment: 10 Marks
- Sessional: 30 Marks
- Project: 25 Marks
- Seminar: 10 Marks
- MCQ etc.