

DEPARTMENT OF BOTANY
GDC TANGMARG

Learning Outcomes based Curriculum Framework (LOCF)

For

Undergraduate Programme

Program Learning Outcomes

The student graduating with the Degree B.Sc with Botany should be able to acquire

- 1. Core competency:** Students will acquire core competency in the subject Botany, and in allied subject areas.

The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants.

Students will be able to use the evidence based comparative botany approach to explain the evolution of organism and understand the genetic diversity on the earth.

The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level. Students will be able to understand adaptation, development and behaviour of different forms of life.

The understanding of networked life on earth and tracing the energy pyramids through nutrient flow is expected from the students.

Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany.

- 2. Analytical ability:** The students will be able to demonstrate the knowledge in understanding research and addressing practical problems.

Application of various scientific methods to address different questions by formulating the hypothesis, data collection and critically analyze the data to decipher the degree to which their scientific work supports their hypothesis.

- 3. Critical Thinking and problem solving ability:** An increased understanding of fundamental concepts and their applications of scientific principles is expected at

the end of this course. Students will become critical thinker and acquire problem solving capabilities.

- 4. Digitally equipped:** Students will acquire digital skills and integrate the fundamental concepts with modern tools.
- 5. Ethical and Psychological strengthening:** Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.
- 6. Team Player:** Students will learn team workmanship in order to serve efficiently institutions, industry and society.
- 7. Independent Learner:** Apart from the subject specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitive examinations and employment. Learning outcomes based curriculum would ensure equal academic standards across the country and broader picture of their competencies.

Teaching Learning Outcomes

The learning outcomes based course curriculum framework of botany is designed to persuade the subject specific knowledge as well as relevant understanding of the course. The academic and professional skills required for botany-based professions and jobs are also offered by same course in an extraordinary way. In addition, the learning experiences gained from this course should be designed and implemented for cognitive development in every student. The practical associated with this course helps to develop an important aspect of the teaching-learning process. Various types of teaching and learning processes will need to be adopted to achieve the same. The important relevant teaching and learning processes involved in this course are:

Class lectures

Seminars

Tutorials

Group discussions and Workshops

Peer teaching and learning

Question preparation

i. Subjective type

Long answer

Short answer

ii. Objective type

Multiple choice questions

Short answer/Very short answer type questions

Assertion and reasoning

Practical, and project-based learning

Field-based learning

Substantial laboratory-based practical component and experiments

Open-ended project work

Games

Technology-enabled learning

Internship in industry, and research establishments

The effective teaching strategies will also need to be adopted to develop problem-solving skills, higher-order skills of reasoning and analysis. The designed course also encourages fostering the social values/responsibility for maintaining and protecting the surrounding environment for improved living conditions. A learner centric and active participatory pedagogy shall be introduced in this framework.

Learning outcomes- based curriculum framework for B.Sc. Botany

a) Hallmark Attributes of a Botany Graduate

Hallmark attributes of botany graduate under the outcome-based teaching learning framework may encompass the following:

- **Core competency:** The botany graduates are expected to know the fundamental concepts of botany and plant science. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Botany graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.
- **Critical thinking:** Botany graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various socio-cultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problemsolving philosophical approaches that are pertinent across the disciplines; Occam's Razor for instance.
- **Analytical reasoning:** Graduates are expected to formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc in fallacious arguments.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other a priori reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive cooperations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decisionmaking process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

b) Qualification Descriptors

B.Sc. Botany

The qualification descriptors for a Bachelor's degree in Botany may include following:

- (ii) To demonstrate a systematic, extensive and coherent knowledge and understanding of academic fields of study as a whole and its applications and links to disciplinary areas of the study; including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of Botany;
- (iii) To demonstrate procedural knowledge that creates different types of professionals in the field of Botany i.e. research and development, teaching government and public services. Further application of knowledge can enhance productivity of several economically important product/botanicals. Knowledge of Botany is also necessary for the development and management of forests, parks, wastelands and sea wealth.
- (iv) Develop skills and ability to use knowledge efficiently in areas related to specializations and current updates in the subject.
- (v) Demonstrate comprehensive knowledge about plants, current research, scholarly and professional literature of advanced learning areas of Botany
- (vi) Use knowledge understanding and skills for critical assessment of wide range of ideas and problems in the field of Botany.
- (vii) Communicate the results of studies in the academic field of Botany using main concepts, constructs and techniques.
- (viii) Apply one's knowledge and understanding of Botany to new/unfamiliar contexts and to identify problems and solutions in daily life

Learning Outcome Based Curriculum Framework

CORE COURSES

These are 4 courses. All courses are compulsory. These courses have the following outcomes.

Core Course 1: Biodiversity

Learning outcomes

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

- i)** Develop understanding on the concept of microbial nutrition
- ii)** Classify viruses based on their characteristics and structures
- iii)** Develop critical understanding of plant diseases and their remediation.
- iv)** Examine the general characteristics of bacteria and their cell reproduction/recombination .
- v)** Increase the awareness and appreciation of human friendly viruses, bacteria,algae and their economic importance.
- vi)** Conduct experiments using skills appropriate to subdivisions.
- vii)**Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
- viii)** Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
- ix)** Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies Identify the common plant diseases according to geographical locations and devise control measures.
- x)** Demonstrate an understanding of archegoniatae, Bryophytes, Pteridophytes and Gymnosperms.
- xi)** Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms Understanding of plant evolution and their transition to land habitat.
- xii)**Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, Gymnosperms.

Core Course 2: Plant Ecology and Taxonomy

Learning outcomes

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

- i) Understand core concepts of biotic and abiotic.
- ii) Classify the soils on the basis of physical, chemical and biological components.
- iii) Analysis the phytogeography or phytogeographical division of India

- iv) Evaluate energy sources of ecological system
- v) Assess the adaptation of plants in relation to light, temperature, water, wind and fire.
- vi) Conduct experiments using skills appropriate to subdivisions.
- vii) Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium.
- viii) Evaluate the Important herbaria and botanical gardens.
- ix) Interpret the rules of ICN in botanical nomenclature .
- x) Assess terms and concepts related to Phylogenetic Systematics.
- xi) Generalize the characters of the families according to Bentham & Hooker's system of classification.

Core Course 3: Plant Anatomy and Embryology

Learning outcomes

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

- i) Develop an understanding of concepts and fundamentals of plant anatomy.
- ii) Examine the internal anatomy of plant systems and organs.
- iii) Develop critical understanding on the evolution of concept of organization of shoot and root apex.
- iv) Analyze the composition of different parts of plants and their relationships.
- v) Evaluate the adaptive and protective systems of plants.
- vi) Develop an understanding of pollination, fertilization, post fertilisation changes in angiosperms.

Core Course 4: Plant Physiology and Metabolism

Learning outcomes

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

- i) Understand Water relation of plants with respect to various physiological processes.
- ii) Explain chemical properties and deficiency symptoms in plants.
- iii) Classify aerobic and anaerobic respiration.
- iv) Explain the significance of Photosynthesis and respiration .
- v) Assess dormancy and germination in plants.
- vi) Differentiate anabolic and catabolic pathways of metabolism , Recognize the importance of Carbon assimilation in photorespiration , Explain the ATP-Synthesis , Interpret the process of Biological nitrogen fixation in Plants.

DISCIPLINE SPECIFIC ELECTIVE COURSES

Discipline Specific Elective Course 1: Cell and Molecular Biology

Learning outcomes: On the completion of the course the students will be able to:

- i) Analyse the structures and chemical properties of DNA and RNA through various historic experiments.
- ii) Differentiate the main types of prokaryotes through their grouping abilities and their characteristic.
- iii) Evaluate the experiments establishing central dogma and genetic code.
- iv) Gain an understanding of various steps in transcription, protein synthesis and protein modification.
- v) Understanding of cell, cell structures and processes associated with cellular metabolism.

Discipline Specific Elective Course 2: Genetics and Plant

Learning outcomes: On the completion of the course the students will be able to:

- i) Have conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
- ii) Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
- iii) Develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.
- iv) Analyze the effect of mutations on gene functions and dosage.
- v) Examine the structure, function and replication of DNA.
- vi) Basic understanding of Plant Breeding and its role in crop improvement.

Skill Enhancement Course 1: Medicinal Botany I

Learning outcomes

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

- i) Recognize the basic medicinal plants.
- ii) Apply techniques of conservation and propagation of medicinal plants.
- iii) Setup process of harvesting, drying and storage of medicinal herbs.
- iv) Propose new strategies to enhance growth of medicinal herbs considering the practical.
- v) issues pertinent to India

Skill Enhancement Course 2: Seed Technology I

Learning outcomes

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

- i) Understand the theoretical orientation of seed development .
- ii) Analyse the different ways of seed processing in different plants.
- iii) Examine the various methods of Seed testing.
- iv) Understand the method of seed production in different plants.
- v) Explain the concept of hybrid seed production.

Skill Enhancement Course 3: Seed Technology II

Learning outcomes

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

- i) Understand the introduction and importance of seed pathology;
- ii) Get a brief account of seed borne fungi, bacteria, viruses and nematodes (any two examples of each group); mechanism of seed infection and transmission of seed pathogens;
- iii) Understand the influence of environmental factors on seed borne diseases; Methods of seed crop management.
- iv) Understand the introduction to seed entomology;
- v) Understand the economic importance and losses caused by insects.
- vi) Study of insect, their nature of damage and management of following crops:
Paddy – Grasshopper
Maize – Army worm
Pea – Pea pod borer
Cabbage – Caterpillar
Tomato – Leaf minor
- vii) Study the methods of insect pest control (cultural, mechanical, physical and chemical).
- viii) Study the scope, basic principles in seed farm management.
- ix) Study the concept of various production practices, field practices as tillage, green house, irrigation, sowing, plant protection, harvesting and threshing; maintenance of soil fertility, weeds and their control.
- x) Understand the concept of crop rotation; mixed cropping, multiple cropping and dry land farming.
- xi) Study the basic concepts of marketing; supply and demand; Seed market surveys; seed industry in relation to global market; concept of WTO (World Trade Organization); Seed Quarantine: introduction, objectives and importance.