HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

PATAN - 384 265

NAAC "B" (2.21) State University

FACULTY OF SCIENCE

B.Sc. (Honours) BOTANY

(With Research/without Research)

SCIUG103

Semesters: V and VI

(with multiple entry & exit option)

DEGREE SYLLABUS

Curriculum as per UGC Guideline

Framed according to National Education Policy (NEP) - 2020

With effect from June – 2025 (and thereafter)

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC "B" (2.21) State University

PATAN - 384 265

BOARD OF STUDIES (BOS) IN BOTANY

References: No. AK/AxS/2125/2020 Dt. 28/08/2020.
No. AK/AxS/2315/2020 Dt. 04/09/2020.
No. AK/AxS/3006/2020 Dt. 01/10/2020.
No./KCG/NEP/2024-25/1368 Dt. 29/09/2023.

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B.Sc. Semester V Courses :: BOTANY ::

SEMESTER: FIFTH	TYPES OF THE COURSES	PAPER NO.	PROGRAMME CODE	TITLE OF THE COURSE	CREDITS (T=TEACHING P=PRACTICAL)
	MAJOR THEORY (credits: 4)	VII	SCIUG103	ECOLOGY AND PLANT SYSTEMATICS (SC23MJDSCBOT501)	4T
	IKS MAJOR THEORY (credits: 4)	VIII		ANCIENT INDIAN BOTANY: A LIVING TRADITION (SC23MJDSCBOT501AIKS)	4T
	MAJOR PRACTICAL (credits: 4)	VII		ECOLOGY AND PLANT SYSTEMATICS (SC23PMJDSCBOT501)	4P
	MINOR THEORY (credits: 4)	IV		PLANT MORPHOLOGY, INSTRUMENTATION AND METHODOLOGY (SC23MiDSCBOT502)	4T
	MINOR PRACTICAL (credits: 4)	IV		PLANT MORPHOLOGY, INSTRUMENTATION AND METHODOLOGY (SC23PMiDSCBOT502)	4P
	SKILL ENHANCEMENT THEORY (credits: 2)	V		NURSERY AND GARDENING (SC23SECBOT506)	2T

B.Sc. Semester VI Courses :: BOTANY ::

SEMESTER: SIXTH	TYPES OF THE COURSES	PAPER NO.	PROGRAMME CODE	TITLE (COURSE CODE)	CREDITS (T=TEACHING P=PRACTICAL)
	MAJOR THEORY (credits: 4+4)	IX	SCIUG103	PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY (SC23MJDSCBOT601)	4T
		X		PLANT METABOLISM AND PHYSIOLOGY (SC23MJDSCBOT601A)	4T
	MAJOR PRACTICAL (GROUP A & B) (credits: 2+2)	IX		PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY (SC23PMJDSCBOT601)	2P
		X		PLANT METABOLISM AND PHYSIOLOGY (SC23PMJDSCBOT601A)	2P
	MINOR THEORY (credits: 2)	V		PLANT METABOLISM (SC23MiDSCBOT602)	2T
	MINOR PRACTICAL (credits: 2)	V		PLANT METABOLISM (SC23PMiDSCBOT602)	2P
	ABILITY ENHANCEMENT THEORY (credits: 2)	IV		FROM POOL OF COURSE (Language) (SC23AECBOT604)	2T
	INTERNSHIP (credits: 4)	I		INTERNSHIP (SC23INTBOT607)	4

CONTENTS

SEMESTER: V
SUMMARY OF THE PROGRAMME

SYLLABUS DURATION	**SEMESTER PATTERN *I.E.*, SIX MONTHS (single major)**
THEORY	
No. of Discipline Specific Major Core Courses (MJDSC) & IKS Major Core Courses (IKSDSC)	***01/Semester***
Credits per Discipline Specific Major Core Course (MJDSC) & IKS Major Core Courses (IKSDSC)	*04*
Total credits for Discipline Core Major Course (MJDSC) & IKS Major Core Courses (IKSDSC)	***04/Semester***
Theory lectures per Discipline Major Core Course (MJDSC) & IKS Major Core Courses (IKSDSC)	*04/week*
No. of Minor Disciplinary Courses (MiDSC)	***01/Semester***
No. of Skill Enhancement Courses (SEC)	***01/Semester***
Credits per Minor Disciplinary Courses (MiDC) & *Credits per Skill Enhancement Courses (SEC)*	*04* *02*
Total credits for Minor Disciplinary Courses (MiDSC) & *Total credits for Skill Enhancement Courses (SEC)*	***04/Semester*** ***02/Semester***
Theory lectures per Minor Disciplinary Courses (MiDSC) & *Theory lectures per Skill Enhancement Courses (SEC)*	*04/week* *02/week*
PRACTICAL	
No. of Practical courses *per Discipline Specific Major Core Courses (MJDSC)(GROUP A+GROUP B)*	***01 (in each semester)***
Credits per Practical course	***04***
Total Credits of Practical course	*04/Semester*
Total Practical lectures	*08/week/ batch*
No. of Practical course (in Uni. Exam.)	***01****/Semester*
No. of Practical courses *per Minor Disciplinary Courses (MiDSC)*	***01 (in each semester)***
Credits per Practical course	***04***
Total Credits of Practical course	*04/Semester*
Total Practical lectures	*08/week/ batch*
No. of Practical course (in Uni. Exam.)	***01****/Semester*
EVALUATION	
Examination (including Preparation - week)	***5***
No. of Days per week	***6***
Week (days) available for Teaching	***15*** *(90)*
Duration of each lecture (minutes)	***55***
No. of students/batch	*As per approval of AC and Exam. Unit*

Framed according to National Education Policy (NEP) - 2020

Under Choice Based Credit System-Semester-Grading System pattern

UG (B. Sc.) Programme in Botany

Semester-V and VI

PREAMBLE:

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. The upgradation of undergraduate programmes in the line of NEP, 2020 will play an extremely important role in promoting human as well as societal well-being and in developing India as envisioned in its Constitution - a democratic, just, socially conscious, cultured, and humane nation upholding liberty, equality, fraternity, and justice for all. A holistic and multidisciplinary education would aim to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. Such an education will help develop well-rounded individuals that possess. Such changes will further result in learning outcome based curriculum in order to maximize the benefits of the newly designed curriculum. The learning outcome based curriculum in general and in Botany in particular will definitely help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. It is pertinent to mention here that the purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this.

The template as developed has the provision of ensuring the integrated personality of the students in terms of providing opportunity for exposure to the students towards core courses, discipline specific courses, generic elective courses, ability enhancement courses and skill enhancement courses with special focus on technical, communication and subject specific skills through practical and other innovative transactional modes to develop their employability skills. The template of learning outcome based framework has categorically mentioned very well defined expected outcomes for the programme like core competency, communication skills, critical thinking, affective skills, problem-solving, analytical, reasoning, research-skills, teamwork, digital literacy, moral and ethical awareness, leadership readiness and so on along with very specific learning course outcomes at the starting of each course. Therefore, this template on Learning Outcomes based Curriculum Framework (LOCF) for B.Sc. with Botany/ Botany Honours under the University will be in the line of NEP, 2020 – more

flexible, multi-disciplinary, holistic and will definitely be a landmark in the field of outcome based curriculum construction.

Today plant science is a fusion of the traditional components with the modern aspects of biochemistry, molecular biology and biotechnology. Over the years, plant science (Botany) has shown enormous gain in information and applications owing to tremendous inputs from research in all its aspects. With global recognition of the need for conservation, field plant biologists have contributed significantly in assessing plant diversity. Taxonomists have explored newer dimensions for the classification of plants. New insights have been gained in functional and structural aspects of plant development by utilizing novel tools and techniques for botanical research. Challenging areas of teaching and research have emerged in ecology and reproductive biology. Concern for ever increasing pollution and climate change is at its highest than ever before. Keeping these advancements in view, a revision of the curriculum at the undergraduate level is perfectly timed. From the beginning of the session, the Botany students across Indian Universities shall have the benefit of a balanced, carefully-crafted course structure taking care of different aspects of plant science, namely plant diversity, physiology, biochemistry, molecular biology, reproduction, anatomy, taxonomy, ecology, economic botany and the impact of environment on the growth and development of plants. All these aspects have been given due weightage over the six semesters. It is essential for the undergraduate students to acquaint themselves with various tools and techniques for exploring the world of plants up to the sub- cellular level. A paper on this aspect is proposed to provide such an opportunity to the students before they engage themselves with the learning of modern tools and techniques in plant science. Keeping the employment entrepreneurship in mind, applied courses have also been introduced. These courses shall provide the botany students hands on experience and professional inputs. On the whole, the curriculum is a source of lot of information and is supported by rich resource materials. It is hoped that a student graduating in Botany with the new curriculum will be a complete botanist at Honours level.

NEP-2020:

NEP, 2020 aims at a new and forward-looking Vision for India's Higher Education System. This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student centric learning pedagogy, which is entirely multidisciplinary outcome-oriented and curiosity-driven. To avoid rote -learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework

focuses on pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works. The platform aims at equipping the graduates with necessary skills for botany-related careers, careers with general graduate-level aptitude and for higher education in Botany and allied subjects. Augmented in this framework are graduate attributes including critical thinking, basic psychology, scientific reasoning, moral ethical reasoning and so on, qualification descriptors that are specific outcomes pertinent to the discipline of botany, learning outcomes for the two programmes these frameworks have been developed, learning outcomes for individual courses, pedagogical methods and assessment methods. Looking at all these new concepts and progress, the detailed syllabus of B.Sc. (H) – Botany sem. III & IV has been designed and decided to be implemented from the academic session from June 2024-25.

APPROACH TO CURRICULUM PLANNING:

While designing these frameworks, emphasis is given on the objectively measurable teaching-learning outcomes to ensure employability of the graduates. In line with recent trends in education section, these frameworks foster implementation of modern pedagogical tools and concepts such as flip-class, hybrid learning, MOOCs and other e-learning platforms. In addition, the framework pragmatic to the core; it is designed such a way to enable the learners implementing the concepts to address the real world problems. A major emphasis of these frameworks is that the curriculum focuses on issues pertinent to India and also of the west; for example, biodiversity and conservation of endemic and threatened species that are found in India, Indian climatological variables, Indian biodiversity and so on. Above all, these frameworks are holistic and aim to mould responsible Indian citizen who have adequate skills in reflective thinking, rational skepticism, scientific temper, digital literacy and so on such that they are equipped to fight immediate social issues apropos to Indian milieu, including corruption and inequity.

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications such as a Bachelor's Degree (Hons) programmes are earned and awarded on the basis of (a) demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and (b) academic standards expected of graduates of a programme of study.

Learning outcomes-based frameworks in any subject must specify what graduates completing a particular programme of study are (a) expected to know, (b) understand and (c) be able to do at the end of their programme of study. To this extent, LOCF in Botany is committed to

allowing for flexibility and innovation in (i) programme design and syllabi development by higher education institutions (HEIs), (ii) teaching-learning process, (iii) assessment of student learning levels, and (iv) periodic programme review within institutional parameters as well as LOCF guidelines, (v) generating framework(s) of agreed expected graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes. HEIs, on their turn, shall address to the situations of their students by identifying relevant and common outcomes and by developing such outcomes that not only match the specific needs of the students but also expands their outlook and values.

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN BOTANY (HONOURS):

A bachelor's degree in Botany with Research or without Research is a 4 year degree course which is divided into 8 semesters.

Sl. No.	NCRF Credit Levels	Type of Award	Stage of Exit	Mandatory Credits to be secured for the Award
1	4.5	Certificate in the Discipline	After successful completion of 1st Year	44
2	5.0	Diploma in the Discipline	After successful completion of 1st and 2nd Years	88
3	5.5	B.Sc. Degree in Botany	After successful completion of 1st, 2nd and 3rd Years	132
4	6.0	B.Sc. (Honours with Research)/ (without Research) in Botany	After successful completion of 1st, 2nd, 3rd and 4th Years	176

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures 176 Credits. Similarly, for certificate, diploma and degree, a student needs to fulfil the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field

of study/profession. Thus, B.Sc. (Honours) Course in Botany aims to equip students to qualify for joining a profession or to provide development opportunities in particular employment settings. Graduates are enabled to enter a variety of jobs or to continue academic study at a higher level.

AIMS:

1. To transform curriculum into outcome-oriented scenario.
2. To develop the curriculum for fostering discovery-learning.
3. To equip the students in solving the practical problems pertinent to India.
4. To adopt recent pedagogical trends in education including e-learning, flipped class, hybrid learning and MOOCs (Massive Open Online Courses).
5. To mold responsible citizen for nation-building and transforming the country towards the future.
6. To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects.
7. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A Botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
8. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
9. To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

PROGRAMME LEARNING OUTCOMES:

Learning Outcome Curriculum Framework (LOCF) aims to equip students with knowledge, skills, values, attitudes, leadership readiness/qualities and lifelong learning. The fundamental premise of LOCF is to specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. Besides this, students will attain various 21st century skills like critical thinking, problem solving, analytic reasoning, cognitive skills, self-directed learning etc.. A note on LOCF for undergraduate education is available on the UGC website www.ugc.ac.in. It can serve as

guiding documents for all Universities undertaking the task of curriculum revision and adoption of outcome based approach.

The student graduating with the Degree B.Sc. (Honours) Botany should be able to acquire:

PO 1: Knowledge: 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 behavior 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.

PO 2: 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.

PO 3: Digitally equipped: Students will acquire digital skills and integrate the fundamental concepts with modern tools.

PO 4: Ethical and Psychological strengthening: Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

PO 5: Team Player: Students will learn team workmanship in order to serve efficiently institutions, industry and society.

PO 6: 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. The Bachelor program in Botany and Botany honours may be mono-disciplinary or multidisciplinary.

PO 7: 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.

SALIENT FEATURES:

- B.Sc. (Honours) Botany in UG programme - **Semester V and VI** shall be offered from the Academic year, June **2025**.
- Botany subject in the Universities/Affiliated Colleges shall offer undergraduate programme in Faculty of Science from the Academic year 2025-26.
- A student will have to get enrolled a **Discipline Specific Core Course (DSC)** depending upon his/her requirement of a degree in the said discipline of study. A student will have a choice of selecting a **IKS-Major Disciplinary Course (IKSDSC), Minor Disciplinary Course (MiDSC), Ability Enhancement Course (AEC), Skill Enhancement Course (SEC)** as well as **Internship.** ***Academic Bank of Credits (ABC)*** is an academic service mechanism as a digital/virtual/online entity established and managed by MOE/UGC. This will facilitate students to become its academic account holders and paving the way for seamless student mobility between or within degree-granting Higher Education Institutions (HEIs) through a formal system of credit recognition, credit accumulation, credit transfers and credit redemption to promote distributed teaching- learning from various recognized institutions, approved ODL and other sources to increase their knowledge, capacities and skills. ABC shall be established on the lines of "National Academic Depository" (NAD) as a Special Purpose Vehicle (SPV). It shall have a dynamic website providing all details of ABC, operational mechanism for the use of all stakeholders of higher education.
- Each course shall be assigned a specific number of **Credits**.
- Discipline Specific Core Course **(DSC)** is the course which should compulsorily be studied by a candidate as a Major and Minor requirement so as to get degree in a said discipline of study.
- There shall be a **Major (MJDSC) Compulsory** course (Theory) with **4 credits/major** and their practical with **4 credits**.
- There shall be an **IKS-Major (MJDSC) Compulsory** course (Theory) with **4 credits/IKS.**

- Two **Minor (MiDSC) Compulsory** course (Theory), with **4 credits** in semester V and their practical's with total **4 credits.**
- One **Minor (MiDSC) Compulsory** course (Theory) with 2 **credits** in semester VI and their practical's with **2 credits.**
- **AEC (sem. VI)** and **SEC (sem. V) courses** shall have to be offered. The credit weight-age for **AEC 2** credit, **SEC 2** credit course shall be offered.
- **Internship offered in semester VI with 4 credits** with **120 hours.** NEP-2020 emphasizes on Vocationalization of Education. A key aspect of the new UG programme is its utility into a real life situation. All students are expected to do Internships/Apprenticeships/OJT in a firm, industry, or organization. Students will be provided the opportunities for do Internships/Apprenticeships/OJT with local industry, business organizations, health, and allied areas, local governments (such as panchayats, and municipalities), local Police Stations, Parliament or elected representatives, media organizations, artists, crafts persons, and a wide range of organizations so that students may engage with the practical side of their learning, which will improve their employability.
- Internship/ Apprenticeship in 6th Semester with 4 credit, it will be counted under Major course and hence internship can be done in major specific courses only.
- The credit weightage for Internship is suggested to be **30 hrs.** per credit if they have only practical exposure or lab-based activities. Accordingly, the students must dedicate required number of hours for the same. The guidelines offer scope for providing hands on learning with classroom experience. In case of field visit or experiential learning, 1 credit is equivalent to **40-45 Hours**. Both HEIs & Industries can decide mutually for the duration of classroom lecture and industry visit.
- **For internship, evaluation and credit frame work, hours strictly follows HNGU rules and regulations.**

INTERNSHIP/APPRENTICESHIP/OJT PATHWAY

Step 1: The University/Institute shall decide subjects to be offered or linked with Internship. The learning outcomes of every subject needs to be defined and mapped.

Step 2: Considering the subject and learning outcomes, institute/college should look for concerned industry who shall provide on-job-training/internship to students.

Step 3: Exchange a letter of Intent/ MOU with the concerned industry/employer (also called Skill Knowledge Partner) mentioning the assignment to be given to the students, nature of work, duration of work per day, total duration, stipend, and honorarium paid to the students, evaluation, and certification process.

Step 4: Assign the industry to the students in lieu with their profile and the requirement of industries

Step 5: Evaluation of the students during and at the end of assignment shall be done jointly with industry supervisor and faculty of the Higher Education Institution (HEI).

Step 6: Issue of certificate/ Letter of Assignment Completion, based on result of the valuation.

- Each course shall have a unique Course code. The Discipline Specific Core Course, Inter/Multi-Disciplinary Course, Ability Enhancement Course, Value Added Course and Skill Enhancement Course shall be abbreviated respectively as **DSC, MiDSC, AEC, and SEC.**
    1. Discipline Specific Core Course DSC**-** Major **(MJDSC) &** Minor **(MiDSC)**
       Practical Discipline Specific Core Course **PDSC- PMJDSC & PMiDSC.**
    2. Discipline Specific Core Course DSC**-** Indian Knowledge System **(IKS).**
    3. Ability Enhancement Course **AEC**
    4. Skill Enhancement Course **SEC**

➢ Each Academic year shall consist of **two** semesters, each of **15 weeks** of teaching equivalent to **90 working days**. The Odd semester period shall be from **July to November** and the Even semester period shall be from **December to April**.

➢ The theory course with **4 credits** shall be of **60 hrs** (15-week x 4credits) duration and the course with **2 credits** shall be of **30 hrs** (15-week x 2 credits) duration.

➢ The **Practical** course **with 4 credits** shall be of **120 hrs** (15-week x 8 hours) duration and the **Practical** course **with 2 credits** shall be of **60 hrs** (15-week x 4 hours) duration.

GENERAL FRAMEWORK:

➢ *A general framework for Bachelor of Science (B. Sc.) with Honours programme with Research/without Research shall be as follows:*

Semester wise credits								Total credits of the Programme
I	II	III	IV	V	VI	VII	VIII	
22	22	22	22	22	22	22	22	176

ATTENDANCE:

The attendance rules as per the norms of Hemchandracharya North Gujarat University, Patan.

To be able to appear for the SEE, a student must comply with the following conditions:

1. Should have at least 75% of attendance in all the courses put together.
2. Should have at least 70% of attendance in each course/subject.
3. Should not have any disciplinary proceedings pending against him/her.
4. Should have no pending due.

MEDIUM OF INSTRUCTION:

The Medium of Instruction shall be of **Gujarati medium**. Student is free to write answers either in **Gujarati** and/or **English** language.

TEACHING LEARNING PROCESS:

Teaching and learning in this programme involve classroom lectures as well tutorials. It allows-

- The tutorials allow a closer interaction between the students and the teacher as each student gets individual attention.
- Written assignments and projects submitted by students
- Project-based learning
- Group discussion
- Home assignments
- Quizzes and class tests
- PPT presentations, Seminars, interactive sessions
- Diversity survey
- Co-curricular activity etc.
- Industrial Tour or Field visit

LANGUAGE OF QUESTION PAPER:

Question paper should be drawn in **Gujarati** language and its **English** version should be given.

EVALUATION METHODS:

Academic performance in various courses *i.e.* **MJDSC, MiDSC, AEC, SEC,** and **RP/OJT** are to be considered as parameters for assessing the achievement of students in the Botany subject. A number of appropriate assessment methods of Botany will be used to determine the extent to which students demonstrate desired learning outcomes.

Following assessment methodology should be adopted:

1. A student shall be evaluated through **Continuous and Comprehensive Evaluation (CCE)/ (*Internal Evaluation*)** and as well as the **Semester End Evaluation (SEE) (*External Evaluation*)**. The weightage of theory and practical is ***25 marks per credit***. **CCE** shall be **50%**, whereas the weightage of the **SEE** shall be **50%**.

Sr. No.	Evaluation	4 credits subjects (Marks)	2 credits subjects (Marks)
1	**CCE (50%)** Classroom & Mid-Term Evaluation	50	25
2	**SEE (50%)**	50	25
	Total	**100**	**50**

2. The grade/marks for **Internship/Apprenticeship/OJT shall be provided by the X Supervisor and faculty guide in the ratio of 60% and 40%** respectively.
3. The concerned SKP can issue a certificate or letter for work completion after successful completion of OJT/Internship/Apprenticeship activities by students.
4. In the **Continuous and Comprehensive Evaluation (CCE)/ (Internal Evaluation)** is spread through the duration of the course and is to be done by the Teacher teaching the course. BoS of the subjects will decide various criteria and their weightage for CCE. The assessment is to be done by various means including:

Written Mode	Oral Mode	Practical Mode	Integrated Mode
1. Semester Exam 2. Class Test 3. Open book exam/test 4. Open note exam/test 5. Self-test/ Online test 6. Essay/Article writing 7. Quizzes/Objective test 8. Class assignment 9. Home assignment 10. Reports Writing 11. Research/Dissertation 12. Case Studies	1. Viva/Oral exam 2. Group Discussion 3. Role Play 4. Authentic Problem Solving 5. Quiz 6. Open Book Reading 7. Interview	1. Lab work 2. Computer simulation/ Virtual labs 3. Craft work 4. Co-curricular work	1. Paper presentation/ Seminar 2. Field Assignment 3. Poster presentation

NATURE AND OBJECTIVES OF VARIOUS TYPES OF EVALUATION::

Written Mode		
Evaluation Type	Nature	**Objectives**
Semester Exam	Traditionally essay type	For depth and planned preparation
Class test	Traditionally essay type	Fixed date forces students to learn
Open book test	Allowed choice of reference book	Measures what students can do with resources, less stress on memory
Open note test	To get used to the system	Encourage good note taking
Self-test	For subjective and objective items	Mastery learning occurs with proper feedback
Article/essay writing	Individual long written assignment	Individual expression and creativity
Quizzes/Objective test	Short duration structured test	Excellent validity as greater syllabus coverage
Class assignment	With defined time	Student's performance to make decision
Home assignment	With undefined time	Reinforce learning and facilitate mastery of specific skills
Reports Writing	On activities performed or event observed	Develop a key transferable skill
Research/ Dissertation	Detailed research-based report	To judge creativity and research skills
Case Studies	**Analyse a given case (real or fictional)**	To assess thinking, value, and attitude

Oral Mode		
Evaluation Type	**Nature**	**Objectives**
Viva/Oral exam	Individually or in small group	Practical experience towards job interview situation
Group discussion	Small group of 2-5 members work on a joint task	Encourage teamwork
Role Play	Small group of 2-5 members work on a joint task	Develop personality
Authenticate problem solving	Small group of 2-5 members work on a joint task	Communication of ideas
Quiz	Small group of 2-5 members work on a joint task	Assess memory power
Interview	Individually	Judge the personal confidence level

Practical Mode		
Evaluation Type	**Nature**	**Objectives**
Lab work	Component of working with one's hand	Keep the students on the task
Computer simulation/virtua	Component of working with one's hand	To understand the practical exposure
Craft work	Component of working with one's hand	Encourage application of concepts learnt
Co-curricular work	Component of working with one's hand	For immediate feedback

Integrated Mode		
Evaluation Type	**Nature**	**Objectives**
Paper presentation/ Seminar	Group or individual work	Learn from others presentation
Field Assignment	Field visit with report	Develop observation and recording skills
Poster presentation	Group or individual work	Develop research, creativity, and discussion skills

MODELS OF EVALUATION:

Based on the types of evaluation, various models of evaluation implementation are suggested for theory, practical, self-study and work-based learning. The focus of these models is to encourage the students to improve on skills and performance.

Model for Theory Courses	
CCE- 50% (50)	**SEE- 50% (50)**
Exam Pattern	**Marks**
Class Test (Best 2 out of 3)	15
Quiz (Best 3 out of 4)	15
Active Learning	05
Home Assignment	05
Class Assignment	05
Attendance	05
Continuous and Comprehensive Evaluation(CCE)	**50**
Semester-End Evaluation (SEE)	**50**

Model for Practical Courses	
CCE- 50% (50)	**SEE- 50% (50)**
Exam Pattern	**Marks**
Lab work assessment (Best 4 out of 5)	20
Viva voce/Lab quiz (Best 4 out of 5)	20
Attendance	10
Continuous and Comprehensive Evaluation(CCE)	**50**
Semester-End Evaluation(SEE)	**50**

Model for Project/Self Model for Project/Self-study course-study/ Model for work experience course	
CCE- 50% (50)	**SEE- 50% (50)**
Exam Pattern	**Marks**
Project Evaluation (Best 3 out of 5)	30
Participation in discussion	10
Attendance	10
Continuous and Comprehensive Evaluation(CCE)	**50**
Semester-End Evaluation(SEE)	**50**

13. CCE and SEE shall be of 2 ½ hours for 4 credits course and 2 hours in case of 2 credits courses.

14. ***CERTIFIED JOURNAL:***

The End of Semester Examination will be conducted by the University. A ***certified journal*** of the respective practical course **must be produced** at the time of practical examination by the student.

15. It will be compulsory for a candidate to obtain ***passing percentage*** in both Internal as well as External Evaluation. The passing marks for each course shall be **36%** as decided by concern Board of Studies (BoS) in Botany.

16. Promotion, Re-Admission and Time for Completion of course, Procedure for awarding grades, Provision for appeal, etc. as decided by the ***Hemchandracharya North Gujarat University, Patan(Gujarat)***.

STUDY TOUR:

Botanical excursion/study tour may be arranged (by the concern faculty with prior permission of **HoD and/or Principal**) within state and/or outside the state to explore/study plant diversity in its natural habitats.

COMPUTATION OF SGPA:

SGPA is computed from the grades as a measure of the student's performance in each semester. It is the ratio of the sum of the product of the number of credits with the grade points and the sum of the number of credits. i.e.

$$\mathbf{SGPA\ (Si) = \sum (Ci\ X\ Gi) / \sum Ci}$$

Where Si is the SGPA for ith course, Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

CUMULATIVE GRADE POINT AVERAGE (CGPA):

The CGPA is based on the grades in all the courses taken after joining the programme of study. It is the ratio of the sum of the products of total credits scored in a particular semester with the SGPA scored by the student in that semester and the sum of the total number of credits of each semester. i.e.

$$\mathbf{CGPA = \sum (Ci\ X\ Si) / \sum Ci}$$

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

DEGREE COURSE								
Part/Class	Subject code	Study Components	Instruction Hrs/Week	Examination Marks			Credits	Exam Duration (Hours)
				CCE	SEE	Total		
B.Sc. Semester -V		**Semester-V**						
		Discipline Specific Core Course(DSC)						
	SC23MJDSCBOT501	Major Discipline Specific Core Courses (MJDSC)	4	50	50	100	4	02:30
	SC23MJDSCBOT501A IKS	IKS-Major Discipline Specific Core Courses (IKSDSC)	4	50	50	100	4	
	SC23MiDSCBOT502	Minor Discipline Specific Core Courses (MiDSC)	4	50	50	100	4	
		Practical Course(PDSC)						
	SC23PMJDSCBOT501	Major Discipline Specific Core Courses (PMJDSC)	8	50	50	100	4	05:00
	SC23PMiDSCBOT502	Minor Discipline Specific Core Courses (MiDSC)	8	50	50	100	4	
		Skill Enhancement Course (SEC)						
	SC23SECBOT506	Skill Enhancement Course (SEC)	2	25	25	50	2	02:00
			30	**275**	**275**	**550**	**22**	
B.Sc. Semester -VI		**Semester-VI**						
		Discipline Specific Core Course(DSC)						
	SC23MJDSCBOT601	Major Discipline Specific Core Courses (MJDSC)	4	50	50	100	4	02:30
	SC23MJDSCBOT601A	Major Discipline Specific Core Courses (MJDSC)	4	50	50	100	4	
	SC23MiDSCBOT602	Minor Discipline Specific Core Courses (MiDSC)	2	25	25	50	2	02:00
		Practical Course(PDSC)						
	SC23PMJDSCBOT601& SC23PMJDSCBOT601A	Major Discipline Specific Core Courses (PMJDSC)(GROUP A & B)	8 (4+4)	50	50	100	4 (2+2)	05:00
	SC23PMiDSCBOT602	Minor Discipline Specific Core Courses (PMiDSC)	4	25	25	50	2	02:30
		Ability Enhancement Course (AEC)						
	SC23AECBOT604	Ability Enhancement Courses (AEC) (Language)	2	25	25	50	2	02:00
		Internship						
	SC23INTBOT607	Internship	30/Credit	50	50	100	4	
			144	**275**	**275**	**550**	**22**	

SEMESTER: V

DISCIPLINE SPECIFIC CORE COURSES:

SEM-V: SC23MJDSCBOT501: ECOLOGY AND PLANT SYSTEMATICS

Programme specific Learning Outcomes:

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

- Understand core concepts of biotic and abiotic factors.
- Classify the soils on the basis of physical, chemical and biological components.
- Analysis the phytogeography or phytogeographical division of India.
- Evaluate energy sources of ecological system.
- Assess the adaptation of plants in relation to soil and water.
- Conduct experiments using skills appropriate to subdivisions.
- Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium.
- Evaluate the Important herbaria and botanical gardens.
- Interpret the rules of ICBN in botanical nomenclature.
- Assess terms and concepts related to Phylogenetic Systematics.
- Generalize the characters of the families according to Bentham & Hooker'system of classification.

INDIAN KNOWLEDGE SYSTEM-MAJOR DISCIPLINE SPECIFIC CORE COURSES(IKS):

SEM-V: SC23MJDSCBOT501AIKS: ANCIENT INDIAN BOTANY: A LIVING TRADITION

Programme specific Learning Outcomes:

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

- To create awareness on significance of historical Indian botanical practices
- To gain knowledge on ancient Indian botanical classification systems
- To understand value of ancient medicinal practices of Charaka, Sushruta and Ayurveda
- To learn traditional agriculture practices of seed saving, crop rotation and rain water harvesting
- To cultivate respect for spiritual plant conservation methods and traditional ecological knowledge
- To integrate ancient Indian practices and modern practices for betterment of society.

MINOR DISCIPLINE SPECIFIC CORE COURSES:

PROGRAMME CODE: SCIUG103

SEM-V: SC23MiDSCBOT502: PLANT MORPHOLOGY, INSTRUMENTATION AND METHODOLOGY

Programme specific Learning Outcomes:

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

- Understand Plant Structure: Demonstrate comprehensive knowledge of the external structure of various plant organs including roots, stems, leaves, flowers, fruits, and seeds.
- Differentiate Plant Forms: Identify and differentiate among various plant forms based on their morphological characteristics.
- Recognize Modifications: Analyze the morphological adaptations and modifications in plants that support survival in different environments.
- Correlate Form and Function: Establish relationships between the form and function of different plant parts.
- Use Morphology in Classification: Apply morphological characteristics for the identification and classification of plants.
- Appreciate Plant Diversity: Understand the morphological diversity of angiosperms and other plant groups.
- Apply Field Knowledge: Gain practical skills in plant identification through field studies and herbarium techniques.
- Develop Scientific Approach: Develop observation, analytical, and documentation skills essential for morphological studies.
- Support Ecological Understanding: Use morphological knowledge to understand ecological relationships and plant adaptations.
- Prepare for Advanced Studies: Build a strong foundation for further studies in botany, plant systematics, ecology, and related fields.
- To introduce students to the principles, design, and applications of key laboratory instruments.
- To familiarize students with essential biotechnological techniques and their real-world applications.

- To develop students' skills in conducting fieldwork and maintaining scientific documentation like herbarium and field reports.
- To strengthen students' understanding of basic statistical tools used for analyzing biological data.
- To encourage scientific thinking, precise observation, and data-driven report writing through practical and theoretical exposure.

SKILL ENHANCEMENT COURSE:

PROGRAMME CODE: SCIUG103

SEM-V: SC23SECBOT506: NURSERY AND GARDENING

Programme specific Learning Outcomes:

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

- Understand the process of sowing seeds in nursery.
- List the various resources required for the development of nursery.
- Distinguish among the different forms of sowing and growing plants.
- Analyse the process of Vegetative propagation.
- Appreciate the diversity of plants and selection of gardening
- Examine the cultivation of different vegetables and growth of plants in nursery and gardening.

(Effective from June 2025-26 UNDER NEP-2020)

<table>
<tr><td colspan="8">MAJOR DISCIPLINE SPECIFIC CORE COURSE (MJDSC)
Programme Code: SCIUG103</td></tr>
<tr><td rowspan="2">COURSE</td><td rowspan="2">SEMESTER</td><td rowspan="2">COURSE CODE</td><td rowspan="2">COURSE TITLE</td><td rowspan="2">Credits</td><td rowspan="2">Lectures</td><td colspan="2">THEORY</td></tr>
<tr><td>CCE</td><td>SEE</td></tr>
<tr><td>Degree Course</td><td>B.Sc. V</td><td>SC23MJ DSCBOT 501</td><td>ECOLOGY AND PLANT SYSTEMATICS</td><td>4</td><td>T=60hrs</td><td>50%</td><td>50%</td></tr>
<tr><td>Course outcomes:</td><td colspan="7">Programme specific Learning Outcomes:
On completion of this course, the students will be able to:
• Demonstrate an understanding of plant ecology and phytogeography of India.
• Develop critical understanding on angiospermic plants.
• Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of phytogeography and plant taxonomy.

Pedagogy: Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.</td></tr>
<tr><td>THEORY UNIT</td><td colspan="5">TOPIC</td><td colspan="2">NO. OF LECTURES (60hrs)</td></tr>
<tr><td>Unit 1</td><td colspan="5">Plant Ecology: I
• Soil: Structure and type, properties (Physical, Chemical and Biological), profile.
• Water: States of water in the environment, Precipitation types (rain, fog, snow, hail, dew), Hydrological Cycle.
• Trophic organisation: Basic source of energy, autotrophy, heterotrophy, Food chains and Food webs; Ecological pyramids.
• Models and Cycling: Principles of energy flow, Biogeochemical cycles: Carbon, Nitrogen and Phosphorus.</td><td colspan="2">15</td></tr>
</table>

Unit 2	**Plant Ecology: II** • **Symbiosis** (Mutualism, Commensalism), **Antagonism** (Parasitism, Predation). • **Characters of communities:** Analytical and Synthetic. • **Phytogeography:** Regions of India. • **Ecological adaptations:** Hydrophytes (*Hydrilla*), Mesophytes (*Sunflower*) and Xerophytic (*Capparis*).	
Unit 3	**Plant systematics: I** • **Introduction to systematics**: Plant identification and Classification. • **Taxonomic evidences**: From anatomy and embryology. • **Field inventory:** Herbarium technique, Important herbaria of the world (any five) and India (any five), Botanical gardens of the India (any five) and Gujarat (Waghai). • **Virtual herbarium**: E-flora and Documentation.	**15**
Unit 4	**Plant systematics: II** • **Introduction:** Principles, typification and rules of priority, (ICBN). • **Classification system:** Bentham & Hooker classification. • **Study of Dicotyledon Families:** **Polypetalae:** Malvaceae, Rutaceae, Fabaceae. **Gamopetalae:** Asteraceae (Compositae), Solanaceae, Lamiaceae (Labiatae). **Monochlamydae:** Euphorbiaceae, Amaranthaceae. • **Study of Monocotyledon Families:** Amaryllidaceae and Poaceae (Gramineae).	**15**

Suggested Readings :

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.
6. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition.
7. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
8. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
9. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
10. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.

<table>
<tr><td colspan="8">MAJOR DISCIPLINE SPECIFIC CORE COURSES- INDIAN KNOWLEDGE SYSTEM (IKS)
Programme Code: SCIUG103</td></tr>
<tr><td rowspan="2">COURSE</td><td rowspan="2">SEMESTER</td><td rowspan="2">COURSE CODE</td><td rowspan="2">COURSE TITLE</td><td rowspan="2">Credits</td><td rowspan="2">Lectures</td><td colspan="2">THEORY</td></tr>
<tr><td>CCE</td><td>SEE</td></tr>
<tr><td>Degree Course</td><td>B.Sc. V</td><td>SC23MJ DSCBOT 501AIKS</td><td>ANCIENT INDIAN BOTANY: A LIVING TRADITION</td><td>4T</td><td>T=60hrs</td><td>50%</td><td>50%</td></tr>
<tr><td>Course outcomes:</td><td colspan="7">On completion of the course, the students will be able to:
• Students will understand the significance of Indian Knowledge System in plant science.
• The course will create awareness on relevant use of ancient Indian literature of botany.
• It will provide understanding on use of Ayurveda, Siddha, and Unani systems to know medicinal properties of plants.
• To learn how to classify and identify plants based on their medicinal and therapeutic applications.
• To develop skills on conservation of plants using traditional methods such as scared groves, herbal gardens, and agroforestry
• To learn the ecological, cultural and spiritual roles of sacred plants and their associated practices in Indian traditions.
• To gain skills in recording and documenting local plant knowledge using ethnobotanical methodologies.
• To adapt sustainable agricultural practices such as mixed cropping, crop diversification, and soil fertility management rooted in Indian traditions.
Pedagogy: Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.</td></tr>
<tr><td>THEORY UNIT</td><td colspan="6">TOPIC</td><td>NO. OF LECTURES (30hrs)</td></tr>
<tr><td>Unit 1</td><td colspan="6">• Scientist and their roles:
• Charaka and Sushruta: Role in ancient Ayurveda.
• Bapalal G. Vaidya and Jay Krushna Indarajit Thakur: Role in herbal medicine.
• Sir J. C. Bose: Sensitive instrument and plant response.
• Dr. S. K. Jain: Role in Ethnobotany.</td><td>15</td></tr>
</table>

Unit 2	• **Ancient medicinal system:** • **Nature:** Vata, Pitta and Kapha. • **The Pancha Mahabhutas:** Prithvi, Jala, Agni, Vayu, Akasha. • **Traditional systems:** Ayurveda, Siddha and Homeopathy. • **Traditional drugs:** Decoction, paste, powders, oil and infusions.	**15**
Unit 3	• **Ancient knowledge:** • Pest management practices using natural predators, herbal pesticides, and Agnihotra. • **Cultural and Agricultural practices:** Soil fertility improvement using green manure, vermiculture, animal dung, crop residues. • **Astro theme garden:** Nakshatra Vaidic Van (Plants: Local Name, Scientific name, medicinal uses)**.** • **Astrological garden:** Zodiac Sign Grove (Plants: Local Name, Scientific name, medicinal uses)**.**	**15**
Unit 4	• **Herbal Medicine:** • **Active ingredients:** Scientific names and uses of *Aloe*, *Calotropis*, *Gymnosporia* (Mountain Spike Thorn) and Babul. • **Complicated relationship:** Poisonous and Allergen plants (3 plants of each). • **Herbal practice:** Local Vaidyas and Bhagats (5 plants). • **Ayurveda treatment:** Panchakarma, Abhyanga, Basti, Yoga and Meditation.	**15**

Suggested Readings:

1. Ethanobotany of India by S. K. Jain
2. Indian Herbal Remedies: The Ultimate Reference to the Medicinal Herbs of India" by C. P. Khare
3. A Dictionary of Indian Folk Medicine and Ethnobotany" by K. C. Joshi
4. The Vedic Flora" by S. M. M. Deshmukh
5. The Book of Indian Herbs" by R. K. Suri
6. Sacred Plants of India" by N. P. Sharma
7. Ayurvedic Plants" by K. S. R. Anjaneyulu
8. Indian Farming: Traditional Techniques and Practices" by R. K. P. Prakash
9. Ayurvedic Medicinal plants by Vasant Lad
10. Traditional Indian Medicine and Herbology" by K. R. Kirtikar and B. D. Basu.
11. "Ayurveda: The Science of Self-Healing" – Dr. Vasant Lad
12."The Charaka Samhita" – Translated by P.V. Sharma
13."Siddha Medicine: Fundamentals and Practice" – Dr. K. Sivaraman
14."Vrikshayurveda: The Science of Plant Life" – Surapala (Translated by Nalini Sadhale)
15."Pashu Ayurveda: Traditional Indian Veterinary Science" – S.K. TiwariAyurvedic Medicinal plants by Vasant Lad

MAJOR DISCIPLINE SPECIFIC CORE COURSE -PRACTICAL (PMJDSC) *Programme Code: SCIUG103*						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***CCE***	***SEE***
Degree Course	***B.Sc. V***	***SC23PMJ DSCBOT 501***	**ECOLOGY AND PLANT SYSTEMATICS**	**4 (120 hrs)**	***50%***	***50%***
Course outcomes:	After the completion of the course the students will be able: 1. Understand the instruments, techniques, lab etiquettes and good lab practices for working in Molecular Biology and Genetics. 2. Practical skills in the field and laboratory experiments Molecular Biology and Genetics. 3. Can start own enterprise in molecular biology. **Pedagogy:** Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.					

PRACTICALS	***NO. OF LECTURES (120 hrs)***
1. Study of instruments used to measure microclimatic variables: Soil thermometer and rain gauge. 2. Determination of pH of various soil. 3. Analysis for carbonates, nitrates and base deficiency from three soil samples by rapid field tests (0 to 5 scale). 4. Comparison of water holding capacity of three soil samples. 5. Determination of minimum size of quadrat and minimum number of quadrat for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed). 6. Quantitative analysis of herbaceous vegetation (any five) in the college campus for frequency and comparison with Raunkiaer's frequency distribution law. 7. Quantitative analysis of herbaceous vegetation (Any five) for density and abundance in the college campus. 8. Ecological adaptations: Hydrophytes (*Hydrilla* stem), Mesophytes (Sunflower stem) Xerophytic (*Capparis* stem). 9. Biotic Interactions between living organisms: Mutualism: Root nodules (specimen)	**120**

Commensalism: Orchid (specimen)

Parasitism: *Cuscuta* (specimen), *Loranthus* (specimen)

Predation: *Nepenthes* (specimen)

10. Study of vegetative and floral characters of the following families (Habitat and Botanical Description, V.S. flower, section of ovary, floral diagram/s, floral formula and systematic position according to Bentham & Hooker's system of classification):
    - Malvaceae
    - Rutaceae,
    - Fabaceae
    - Asteraceae (Compositae)
    - Solanaceae
    - Lamiaceae (Labiatae)
    - Euphorbiaceae
    - Amaranthaceae
    - Amaryllidaceae
    - Poaceae (Gramineae)

Suggested Readings :

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.
6. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition.
7. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
8. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
9. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
10. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

CBCS - Semester - Grading Pattern

(Effective from June 2025-26 UNDER NEP-2020)

B. SC. :: BOTANY PRACTICAL(MAJOR) :: SEMESTER-V

Programme Code: SCIUG103

ECOLOGY AND PLANT SYSTEMATICS

SC23PMJDSCBOT 501

Date: **Place:**

Time: 5 Hrs **Total Marks: 50**

Instructions: Strictly follow the instructions given by examiner(s).

1. Determine the **minimum size of quadrate/ number of quadrate** by species area curve 08

or

Calculate the **Density/Abundance/Frequency (**any five species).

2. Determine the **pH/Carbonate/Nitrate/Base deficiency/Water holding capacity** from **three** soil samples**.** 07

3. To study and comments upon the **ecological adaptations** from specimen **"A".** 07

4. Refer to respective **families** with giving reasons from specimens **"B" and "C".** Including floral formula and floral diagram. 12

5. Writing exercise on: 06

Comment upon spot **"D"** - (Soil thermometer/rain gauge).

Comment upon spot **"E"** - (Biotic Interactions)

6. a. Certified Journal 05

b. Submission and viva-voce 05

MINOR DISCIPLINE SPECIFIC CORE COURSES (MiDC) *Programme Code: SCIUG103*							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***Credits***	***Lectures***	***THEORY***	
						CCE	***SEE***
Degree Course	***B.Sc. V***	***SC23MiDSC BOT502***	**PLANT MORPHOLOGY, INSTRUMENTATION AND METHODOLOGY**	**4T**	**T=60hrs**	***50%***	***50%***

Course outcomes :

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

- Identify and describe the external features of various plant organs.
- Differentiate between types of roots, stems, and leaves based on morphology. Understand the structural adaptations of plants to different environments.
- Analyze the form and function of reproductive parts in flowering plants. Apply morphological knowledge to classify and identify plant species.
- Explain the working principles, designs, and applications of major laboratory instruments like autoclave, incubator, and centrifuge.
- Demonstrate proficiency in performing key biotechniques such as PCR, chromatography, gel electrophoresis, and microtomy.
- Plan and conduct field studies using simple field equipment and prepare and maintain herbarium specimens effectively.
- Analyze biological data using statistical measures such as mean, median, mode, standard deviation, chi-square test, and variance.
- Write concise and structured laboratory and fieldwork reports by applying appropriate scientific methods.

- **Pedagogy:** Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

THEORY UNIT	*TOPIC*	*NO. OF LECTURES* **(60hrs)**
Unit 1	• **FLOWER** • **Bracts:** Definition and types of Bracts (Foliaceous, Petaloid, Spathe, Involucre and Epicalyx.) • **Inflorescence**- Definition and its Types. • **Recemose**: Definition and Types - Raceme, Spike, Umbel, Capitulum. • **Cymose**: Definition and its Types - Solitary, Monochasial (Helicoid & Scorpoid), Dichasial and Polychasial Cyme. • **Special Inflorescence**: Cyathium, Verticillaster and Hypanthodium • **Flower**- Definition and parts of Flower. • **Kinds of Flower**: Actinomorphic & Zygomorphic • Tri-, Tetra-, and Pentamarous Flower. • Hypogynous, Perigynous and Epigynous Flower. • **Calyx, Corolla and Perianth** – Numbers and Unity. • **Aestivation**: Definition and Types: Valvate, Twisted. Imbricate, Quinquencial, Vexillary. • **Androecium**: Cohesion of stamen -Monodelphous, Didelphous, Polydelphous. • **Attachment of filament to the anther**- Adnate, Dorsifixed, Basifixed , Sagittate and Versatile. • **Gynoecium**: Free and united, Number. • **Placentation**: Definition and Types - Marginal, Parietal, Axile, Free central and Basal.	**15**
Unit 2	• **FRUITS** • Definition, parts of fruits, True and False Fruits. • **Simple Fruits:** • Indehiscent – Caryopis, Samara • Dehiscent – Capsule-Loculicidal, Septicidal • Schizocarpic- Lomentum, Regma. • Fleshy Fruits – Drupe, Berry. • **Aggregate Fruit-** Etaerio of berry. • **Composite Fruit**- Sorosis.	**15**

Unit 3	• **INSTRUMENTATION** • Principle, design, procedure and application of following: • Laminar Air Flow • Autoclave • Incubator • Oven	**15**
Unit 4	• **METHODOLOGY** • PCR • Thin layer chromatography • Gel electrophoresis • Microtomy	**15**

Suggested Readings:

1. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition.
2. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
5. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.
6. Arumugam, N. & Kumaresan, V. (2015). Biotechniques. 1st Edition, Saras Publication, India.
7. Ragland, A. & Kumare3san, V. (2010). Taxonomy of Angiosperms- Systematic Botany, economic Botany and Ethnobotany. Saras Publication, India.
8. Ramakrishnan, P. (2007). Biostatistics. Saras Publication, India.
9. Banerjee, P. K. (2008). Introduction to Biostatistics. S. Chand & Company Ltd., New Delhi, India.

MINOR DISCIPLINE SPECIFIC CORE COURSES -PRACTICAL (PMiDSC) *PROGRAMME CODE: SCIUG103*						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*CCE*	*SEE*
Degree Course	*B.Sc. V*	*SC23PMiDSC BOT502*	**PLANT MORPHOLOGY, INSTRUMENTATION AND METHODOLOGY**	**4 (120hrs)**	*50%*	*50%*

Course outcomes:

After the completion of the course the students will be able to:

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

1. Demonstrate an understanding of plant ecology and phytogeography of India.
2. Develop critical understanding on angiospermic plants.
3. Demonstrate proficiency in the experimental techniques, methods of appropriate analysis of phytogeography and plant taxonomy.

Apply theoretical knowledge in utilization, and report generation of economical and medicinal plants. Create awareness on conservation of medicinal plants and use of natural plant products as alternatives to synthetic products.

Pedagogy: Lectures, Tutorials, Assignments, Demonstrations, live specimens, Herbarium specimens, Videos, Team based learning, Field visit and report writing.

PRACTICALS	*NO. OF LECTURES* **(120 hrs)**
Unit 1& 2	**60**

MORPHOLOGY OF FLOWER

❖ **Bracts**:

Foliaceous Bract – *Adhatoda vasica*
Petaloid Bract – *Bougainvillea spectabilis*
Spathe Bract - *Rhoeo*
Involucre Bract – *Helianthus anuus*
Epicalyx Bract – *Hibiscus rosa- sinensis*

❖ **Inflorescence**-.

Racemose:

Raceme - *Caesalpinia*
Spike – *Achyranthes*

Umbel – Simple- onion,
compound- *coriander*
Capitulum - Sunflower

Cymose:

Solitary – Terminal – *Datura*
Axillary – Shoe Flower
Monochasial Cyme (Helicoid – *Hamelia* &
Scorpoid - *Heliotropium*)
Dichasial Cyme - *Clerodendrum*
Polychasial Cyme- *Calotropis*

Special Inflorescence:

Cyathium – *Euphorbia*
Verticillaster - *Ocimum*
Hypanthodium - *Ficus*

❖ **Kinds of Flower** :

Actinomorphic Flower- Shoe Flower
Zygomorphic Flower – Pes /Bean
Trimarous Flower - *Crinum*
Tetramarous Flower - Mustard
Pentamarous Flower – Shoe Flower
Hypogynous Flower - *Datura*
Perigynous Flower - Rose
Epigynous Flower.- *Coccinia*

Calyx :

Polysepalous – Mustard
Gamosepalous - *Datura*

Corolla :

Polypetalous – Mustard
Gamopetalous - *Datura*

Perianth – *Crinum*

Aestivation:

Valvate – Calyx of Datura
Twisted – Corolla of *Hibiscus*
Imbricate - Corolla of *Caesalpinia*
Quinquencial – Calyx of *Thevetia*
Vexillary- *Butea*

Androecium :

Monodelphous Androecium – Shoe Flower
Didelphous Androecium – Pea / Bean
Polydelphous Androecium – *Bombax* / *Lemon*
Adnate Anther - *Anona*
Dorsifixed Anther - *Sesbania*
Basifixed Anther – *Adhatoda*
Sagittate Anther - *Thevetia*
Versatile Anther – *Crinum* / Grass

	Gynoecium : Apocarpous ovary – Rose Syncarpous ovary – Shoe Flower **Placentation** : Marginal – Pea / Bean Parietal - *Argemone* Axile – Shoe Flower Free central - *Portulaca* Basal – Sunflower **FRUITS :** **Simple Fruits:** Indehiscent – Caryopis- Maize/ Wheat Samara –*Holoptelea* Dehiscent – Capsule Loculicidal- Cotton Septicidal-*Aristolochia* Schizocarpic- Lomentum – *Acacia nilotica* Regma - *Ricinus* Fleshy Fruits – Drupe- Mango Berry- Tomato / Brinjal **Aggregate Fruit-** Etaerio of berry- *Anona squamosa* **Composite Fruit-** Sorosis – Pineapple / *Morus*	
Unit **3 & 4**	• Principle, design, procedure and application of following: • Laminar Air Flow • Autoclave • Incubator • Oven • PCR • Thin layer chromatography • Gel electrophoresis • Microtomy	**60**

Suggested Readings:

1. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
2. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
3. Arumugam, N. & Kumaresan, V. (2015). Biotechniques. 1st Edition, Saras Publication, India.
4. Ragland, A. & Kumarsan, V. (2010). Taxonomy of Angiosperms- Systematic Botany, economic Botany and Ethnobotany. Saras Publication, India.
5. Ramakrishnan, P. (2007). Biostatistics. Saras Publication, India.
6. Banerjee, P. K. (2008). Introduction to Biostatistics. S. Chand & Company Ltd., New Delhi, India

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

CBCS - Semester - Grading Pattern

(Effective from June 2025-26 UNDER NEP-2020)

B. Sc. :: BOTANY PRACTICAL :: SEMESTER-V

(MINOR DISCIPLINE SPECIFIC CORE COURSES)

Programme Code: SCIUG103

PLANT MORPHOLOGY,

INSTRUMENTATION AND METHODOLOGY

SC23PMiDSCBOT502

Date: **Place:**

Time: 05:00 Hrs **Total Marks: 50**

Instructions: Strictly follow the instructions given by examiner(s).

1. Identify and describe: (each specimen obtain 3 marks) 18
   - specimen **A** (Types of Bracts)
   - specimen **B** (Types of inflorescence)
   - specimen **C** (Types of flower)
   - specimen **D** (Androecium/Gynoecium)
   - specimen **E** (Placentation)
   - specimen **F** (Types of Fruits)

2. Identify and describe with its principle and application (specimen/chart/ photograph): 24
   - specimen **G**
   - specimen **H**
   - specimen **I**
   - specimen **J**

3. a. *Viva-voce* 03

   b. Journal 05

DETAILED SYLLABUS OF B.Sc. THIRD YEAR FOR DEGREE COURSE IN BOTANY

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

(Effective from June 2025-26 UNDER NEP-2020)

<table>
<tr><td colspan="8">SKILL ENHANCEMENT COURSE (SEC)
Programme Code: SCIUG103</td></tr>
<tr><td rowspan="2">COURSE</td><td rowspan="2">SEMESTER</td><td rowspan="2">COURSE CODE</td><td rowspan="2">COURSE TITLE</td><td rowspan="2">CREDITS</td><td rowspan="2">LECTURES</td><td colspan="2">THEORY</td></tr>
<tr><td>CCE</td><td>SEE</td></tr>
<tr><td>Degree Course</td><td>B.Sc. V</td><td>SC23SEC BOT506</td><td>NURSERY AND GARDENING</td><td>2T</td><td>T=30hrs</td><td>50%</td><td>50%</td></tr>
<tr><td>Course outcomes:</td><td colspan="7">On completion of the course, the students will be able to:
• Career Opportunities: Roles in landscaping, garden maintenance, nursery management, or as a horticulturist.
• Entrepreneurship: Start your own plant nursery, landscaping business, or organic gardening venture.
• Skill Development: Gain expertise in plant care, soil management, pest control, and sustainable gardening.
• Personal Use: Enhance home gardening, kitchen gardens, or terrace farming.
• Further Education: Foundation for advanced studies in horticulture, botany, or agricultural sciences.

Pedagogy: Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.</td></tr>
<tr><td>THEORY UNIT</td><td colspan="6">TOPIC</td><td>NO. OF LECTURES (30hrs)</td></tr>
<tr><td>Unit 1</td><td colspan="6">Nursery
• Definition, objectives, scope and nursery management.
• Planning and seasonal activities - Planting - direct seeding and transplant.
• Seed storage: Seed banks, factors affecting seed viability.
• Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady’s finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.</td><td>15</td></tr>
</table>

Unit 2	**Gardening** • Definition, objectives and scope - different types of gardening - landscape and home gardening. • Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. • Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. • Hardening of plants - green house - mist chamber, shed root, shade house and glass house.	**15**

Suggested Readings:

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National _Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

SEMESTER: VI
SUMMARY OF THE PROGRAMME

SYLLABUS DURATION	**SEMESTER PATTERN *I.E.*, SIX MONTHS (single major)**
THEORY	
No. of Discipline Specific Major Core Courses (MJDSC)	***02/Semester***
Credits per Discipline Specific Major Core Course (MJDSC)	*04*
Total credits for Discipline Core Major Course (MJDSC)	***08/Semester***
Theory lectures per Discipline Major Core Course (MJDSC)	*04/week*
No. of Minor Disciplinary Courses (MiDSC), ***No. of Ability Enhancement Courses(AEC),*** ***&*** ***Internship***	***01/Semester***
Credits per Minor Disciplinary Courses (MiDSC), *Credits per Ability Enhancement Courses(AEC)*	*02*
Internship	*04*
Total credits for Minor Disciplinary Courses (MiDSC), *Total credits for Ability Enhancement Courses(AEC)*	***02/Semester***
Internship (30 hrs. per credit, In case of field visit or experiential learning, 1 credit is equivalent to 40-45 Hours)	***04/Semester***
Theory lectures per Minor Disciplinary Courses (MiDC), *Theory lectures per Ability Enhancement Courses(AEC)*	*02 /week*
PRACTICAL	
No. of Practical courses *per Discipline Specific Major Core Courses (MJDSC)(GROUP A+GROUP B)*	***01 (in each semester)***
Credits per Practical course	***04(GROUP A:2+GROUP B:2)***
Total Credits of Practical course	*04/Semester*
Total Practical lectures	*08/week/ batch*
No. of Practical course (in Uni. Exam.)	***01****/Semester*
No. of Practical courses *per Discipline Specific Minor Disciplinary Courses (MiDSC)*	***01 (in each semester)***
Credits per Practical course	***02***
Total Credits of Practical course	*02/Semester*
Total Practical lectures	*04/week/ batch*
No. of Practical course (in Uni. Exam.)	***01****/Semester*
EVALUATION	
Examination (including Preparation - week)	***5***
No. of Days per week	***6***
Week (days) available for Teaching	***15*** *(90)*
Duration of each lecture (minutes)	***55***
No. of students/batch	*As per approval of AC and Exam. Unit*

SEMESTER: VI

MAJOR DISCIPLINE SPECIFIC CORE COURSE:

PROGRAMME CODE: SCIUG103

SEM- VI: SC23MJDSCBOT601: PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY

Programme specific Learning Outcomes:

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

- Understand the core concepts and fundamentals of plant biotechnology and genetic engineering
- Develop their competency on different types of plant tissue culture.
- Analyze the enzymes and vectors for genetic manipulations.
- Examine gene cloning and evaluate different methods of gene transfer.
- Critically analyze the major concerns and applications of transgenic technology.
- Recall the history of reproductive biology of angiosperms & recognize the importance of genetic and molecular aspects of flower development.
- Understand structure and functions of anther wall and pollen wall Evaluate the special structures of Ovule.
- Solve Self-incompatibility in Pollination and fertilization & relate between Embryo, Endosperm and Seed.
- Comprehend the causes of Polyembryony and apomixes with its classification.

SEM- VI: SC23MJDSCBOT601A: PLANT METABOLISM AND PHYSIOLOGY

Programme specific Learning Outcomes:

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

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

MINOR DISCIPLINE SPECIFIC CORE COURSE:

PROGRAMME CODE: SCIUG103

SEM- VI: SC23MiDSCBOT602: PLANT METABOLISM

Programme specific Learning Outcomes:

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

- Differentiate anabolic and catabolic pathways of metabolism.
- Recognize the importance of Carbon assimilation in photorespiration
- Explain the ATP-Synthesis.
- Interpret the Biological nitrogen fixation in metabolism.

INTERNSHIP:

PROGRAMME CODE: SCIUG103

SEM- VI: SC23INTBOT 607: INTERNSHIP IN BOTANY

Programme specific Learning Outcomes:

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

- Identify and classify various plant species with scientific accuracy.
- Demonstrate practical knowledge of plant anatomy and physiology.
- Apply laboratory techniques for plant analysis and experimentation.
- Conduct fieldwork, collect plant samples, and maintain herbarium records.
- Analyze ecological interactions and biodiversity in different habitats.
- Utilize tools such as microscopes and GPS for botanical research.
- Understand the role of plants in agriculture, medicine, and industry.
- Communicate scientific findings through reports and presentations.
- Collaborate effectively in research teams and field projects.
- Develop awareness of environmental conservation and sustainability.

Types of Internships in Botany:

1. **Research Internships** – Working in labs or research institutes like CSIR, ICAR, or BSI (Botanical Survey of India).
2. **Field Internships** – Assisting in biodiversity surveys, ecological fieldwork, or forest research.
3. **Industry Internships** – Interning with pharmaceutical, agricultural, or biotech companies.

4. **Herbarium/Plant Conservation** – Interning in museums or conservation centers managing plant specimens and databases.
5. **Academic Projects** – Working under professors or researchers on specific botanical topics (e.g., plant physiology, taxonomy, phytochemistry etc.).

General Titles (suggestions):

1. Botany Research
2. Plant Biology
3. Herbarium and Plant Documentation
4. Field Botany
5. Ecological Survey
6. Plant Taxonomy
7. Plant Physiology
8. Botanical Conservation
9. Ethnobotany
10. Flora Identification

Lab or academic-based ship:

1. Phytochemical Analysis
2. Molecular Botany Research
3. Plant Tissue Culture
4. Genetic Diversity Analysis (Botanical Focus)
5. Plant Pathology

Industry-related (agriculture, pharma, etc.):

1. Medicinal Plant Research
2. Agro-Botany
3. Botanical Product Development
4. Plant Breeding and Biotechnology
5. Agricultural Research (Botany Division)

AICTE INTERNSHIP POLICY: GUIDELINES & PROCEDURES

UGC Guidelines for Internship/Research Internship for Undergraduate Students

UGC Guidelines on Apprenticeship Embedded Degree Programme (AEDP) 2025.

MAJOR DISCIPLINE SPECIFIC CORE COURSE (MJDSC) *Programme Code: SCIUG103*							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***Credits***	***Lectures***	***THEORY***	
						CCE	***SEE***
Degree Course	***B.Sc. VI***	***SC23MJDSCBOT601***	**PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY**	**4**	**T=60hrs**	***50%***	***50%***
Course outcomes:	On completion of the course, the students will be able to: • Work in agri-biotech and seed companies on crop improvement. • Pursue higher studies or research in plant biotechnology. • Join teaching or academic roles after qualifying exams. • Contribute to conservation and sustainable agriculture. • Gain skills in tissue culture, genetic engineering, and molecular biology. **Pedagogy:** Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations.						
THEORY UNIT	***TOPIC***						***NO. OF LECTURES* (60hrs)**
Unit 1	**Plant Tissue Culture** • Historical perspective; Gottlieb Haberlandt work, types of tissue culture; Composition of media (MS media). • Totipotency; Organogenesis; Embryogenesis (somatic and zygotic). • Protoplast isolation, Anther culture and Meristem culture, Artificial seeds. • Tissue culture applications: Micropropagation, Cryopreservation; Germplasm Conservation.						**15**

Unit 2	**Biotechnology** • **Biotechnology:** History, Karoly Ercky work (world, Kiran Majumdar Shaw (India)), Restriction Endonucleases (Types I-IV, biological role and application). • **Cloning Vectors:** Prokaryotic (pBR322); Eukaryotic Vectors (YAC), Techniques: Recombinant DNA, PCR. • **Gene transfer:** Indirect gene transfer (Agrobacterium- Ti and Ri plasmid), Direct gene transfer (Particle bombardment), selectable marker (Ampicillin & Tetracycline resistant in pBR322) and reporter genes (Luciferase, GFP). • **Application of Biotechnology:** Pest resistant (Bt-cotton), Transgenic crops with improved quality traits (Flavr Savr tomato, Golden Rice); Genetically Engineered Product: Humulin.	15
Unit 3	**Reproductive Biology-I** • **History** (Indian contributors- P. Maheshwari and B.M. Johri) and scopes of reproductive Biology. • **Anther wall:** Structure and its functions, Male gametophyte – microsporogenesis (PMC to microspore formation), Microgametogenesis (Pollen, wall structure, MGU (male germ unit). • **Morphological framework:** NPC system, Pollen viability. • **Abnormal features:** Pseudomonads, polyads, massulae, pollinia.	15
Unit 4	**Reproductive Biology-II** • Structure and Types of ovule; Special structures– endothelium, obturator, aril, caruncle and hypostase. • Female gametophyte– megasporogenesis (mega spore mother cell – MMC to mega spore formation), Mega gametogenesis (Embryo sac: monosporic - Polygonum, bisporic - Allium and tetrasporic - Peperomia.	15

	• Double fertilization, types of endosperm and its functions, General pattern of development of dicot and monocot embryo. • Introduction; Classification; Causes and applications of Polyembryony and Apomixis.	

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
(Effective from June 2025-26 UNDER NEP-2020)

MAJOR DISCIPLINE SPECIFIC CORE COURSE (MJDSC) *Programme Code: SCIUG103*							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***Credits***	***Lectures***	***THEORY***	
						CCE	***SEE***
Degree Course	***B.Sc. VI***	***SC23MJ DSCBOT 601A***	**PLANT PHYSIOLOGY AND PLANT METABOLISM**	**4**	**T=60hrs**	***50%***	***50%***
Course outcomes:	On completion of the course, the students will be able to: • Understand the functional mechanisms of plant systems, including water transport, photosynthesis, and respiration. • Gain insights into nutrient uptake, hormone regulation, and stress responses in plants. • Develop skills to analyze metabolic pathways and energy flow within plant cells. • Apply knowledge to improve crop productivity, sustainability, and biotechnology practices. • Build a strong foundation for careers or research in plant sciences, agriculture, and environmental biology. **Pedagogy:** Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.						
THEORY UNIT	***TOPIC***					***NO. OF LECTURES* (60hrs)**	
Unit 1	**Plant Physiology-I** • Water Potential and its components, water absorption by roots. • Pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation and Ascent of sap– cohesion-tension theory. • Transpiration by stomata and factors affecting transpiration. • Essential and beneficial elements and its deficiency symptoms: macronutrients (C, N, K, P) and micronutrients (Fe, Zn, Mo, Mn).					**15**	

Unit 2	**Plant Physiology-II** • Transport of ions across cell membrane: passive absorption (facilitated diffusion), active absorption (ion pumps) Uniport, Symport and Antiport. • Phloem as the site of sugar translocation, Discovery and physiological roles of plant growth regulators (PGRs): As Growth promotors: Auxin, Gibberellins, Cytokinin & As Growth inhibitors: Abscisic acid, Ethylene. • Photoperiodism and Vernalization: Definition, types and its significance, Seed dormancy: definition, types, causes and overcome seed dormancy.	**15**
Unit 3	**Photosynthesis** • Historical background of Photosynthesis, photosynthetic pigments. • Photochemical reactions, photosynthetic electron transport (photolysis of water) and photophosphorylation (PS-I & PS-II), Chemiosmotic mechanism, ATP synthase (photophosphorylation). • Calvin cycle, Photorespiration, factors affecting photosynthesis. • C4 pathways, Crassulacean acid metabolism.	**15**
Unit 4	**Respiration and Metabolism** • Glycolysis, fermentation (anaerobic respiration- alcoholic and lactic acid), oxidative pentose phosphate pathway. • Aerobic respiration-TCA cycle and Oxidative phosphorylation(ETS), chemiosmotic mechanism, ATP synthases (oxidative phosphorylation). • Factors affecting respiration, Respiratory quotient (carbohydrates, lipid and protein) • Amphibolic pathway, anabolic and catabolic pathways, regulation of metabolism, Bio-synthesis and Beta-oxidation (breakdown) of Palmitic acid, biological nitrogen fixation.	**15**

Suggested Readings:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

<table>
<tr><td colspan="6">MAJOR DISCIPLINE SPECIFIC CORE COURSE -PRACTICAL (PMJDSC)
Programme Code: SCIUG103</td></tr>
<tr><td rowspan="2">COURSE</td><td rowspan="2">SEMESTER</td><td rowspan="2">COURSE CODE</td><td rowspan="2">COURSE TITLE</td><td colspan="2">PRACTICAL</td></tr>
<tr><td>Credits</td><td>CCE</td><td>SEE</td></tr>
<tr><td>Degree Course</td><td>B.Sc. VI</td><td>SC23PMJDSCBOT601</td><td>PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY, PLANT METABOLISM AND PHYSIOLOGY</td><td>4 (120 hrs)</td><td>50%</td><td>50%</td></tr>
<tr><td>Course outcomes:</td><td colspan="5">After the completion of the course the students will be able:
• Gained hands-on experience in plant tissue culture, genetic transformation, and micropropagation techniques.
• Understood mechanisms of plant reproduction including embryogenesis and pollination biology.
• Acquired practical skills in analyzing photosynthesis, respiration, and nutrient transport in plants.
• Learned techniques to study plant hormones, secondary metabolites, and stress responses.
• Developed the ability to design and conduct experiments in plant physiology and biotechnology for research applications
Pedagogy: Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations.</td></tr>
<tr><td colspan="5">PRACTICALS</td><td>NO. OF LECTURES (120 hrs)</td></tr>
<tr><td colspan="6">GROUP A</td></tr>
<tr><td colspan="5">1. Preparation of MS medium.
2. Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of Datura, Brassica.
3. Study of anther and meristem culture, micro propagation by culture method.
4. Study of somatic embryogenesis & artificial seeds through photographs.</td><td>60</td></tr>
</table>

5. Study of methods of gene transfer through photographs/charts: indirect (Agrobacterium-mediated), direct (particle bombardment). 6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs. 7. Cloning vectors: pBR322, YAC and Techniques: Recombinant DNA, PCR. 8. Anther: Wall and its ontogeny; Tapetum; spore tetrads, and male germ unit (MGU) through photographs and schematic representation. 9. Pollen grains: pseudomonads, polyads, pollinia (slides/photographs/ fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test(TTZ). 10. Structure and types of Ovule: anatropous, hemianatropous, orthotropous, amphitropous, campylotropous, circinotropous (permanent slides/specimens/photographs). 11. Female gametophyte through permanent slides/ photographs: ultrastructure of mature embryo sac. 12. Endosperm: Dissections of developing seeds for endosperm with haustoria. 13. Embryogenesis: Study of development of dicot embryo through permanent slides/ photographs; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.	
GROUP B	
14. Determination of osmotic potential of plant cell sap by plasmolytic method. 15. Determination of water potential of given tissue (potato tuber) by weight method. 16. To study the induction of amylase activity. 17. Determination of ascent of sap by ringing method. 18. Separation of photosynthetic pigments by paper chromatography. 19. To study the effect of light intensity on the rate of photosynthesis. 20. Effect of carbon dioxide on the rate of photosynthesis. 21. To study the effect of different wave length of light on the rate of photosynthesis.	**60**

Demonstration experiments 22. To demonstrate suction due to transpiration. 23. Fruit ripening/Rooting from cuttings (Demonstration). 24. Bolting experiment/*Avena* coleoptile bioassay (demonstration). 25. To study the phenomenon of seed germination (effect of light). 26. To study the respiration by Ganong's respirometer (Demonstration). 27. Experimental demonstration of Hill's reaction.	

Suggested Readings:

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
6. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
7. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
8. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
9. Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
11. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
12. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
CBCS - Semester - Grading Pattern
(Effective from June 2025-26 UNDER NEP-2020)
B. SC. :: BOTANY PRACTICAL(MAJOR) :: SEMESTER-VI
Programme Code: SC23PMJDSCBOT601
PLANT BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY, PLANT METABOLISM AND PHYSIOLOGY
(GROUP A & GROUP B)

Date: **Place:**

Time: 5 Hrs **Total Marks: 50**

Instructions: Strictly follow the instructions given by examiner(s).

1. Write the procedure of Preparation of MS medium/*In vitro* sterilization/ inoculation methods using explants. 07

OR

To study of the tissue culture technique for Anther/Embryo/Endosperm culture and Micropropagation /Somatic embryogenesis/Artificial seeds.

2. Expose and mount from given material "A"(Diad / Tetrad / Tapetum). 07

OR

Expose and mount from given material "B". (Embryo with endosperm haustorium/ Embryo with suspensor/various developmental stages of embryo).

3. To study the effect of Light intensity/Carbon dioxide/different wave length of light on the rate of photosynthesis. 07

OR

Determination of Osmotic potential (plasmolytic method)/Water potential (potato tuber-weight method).

4. Separation of photosynthetic pigments by paper chromatography. 07

OR

Determination of ascent of sap by ringing method

5. Writing exercise on: (Permanent slides/Specimens/Photographs/as per instruction). 12

a. Vector: Plasmid DNA/genetic engineering (Production of Bt cotton/Golden rice/Flavr Savr tomato).

OR

Techniques: Recombinant DNA/PCR/Gene transfer (Agrobacterium mediated/ Particle bombardment).

b. Pollinia / Pollen wall / Pollen viability- Tetrazolium test .

OR

Types of Ovule/ Embryo sac.

c. Experimental demonstration of Hill's reaction/Amylase activity.

OR

To demonstrate suction due to transpiration./Fruit ripening/Rooting from cuttings Bolting experiment/*Avena* coleoptile bioassay/ To study the respiration by Ganong's respirometer/Experimental demonstration of Hill's reaction.

6. a. Certified Journal 05
   b. Submission and viva-voce 05

<table>
<tr><td colspan="7">MINOR DISCIPLINE SPECIFIC CORE COURSE (MiDSC)
Programme Code: SCIUG103</td></tr>
<tr><td rowspan="2">COURSE</td><td rowspan="2">SEMESTER</td><td rowspan="2">COURSE CODE</td><td rowspan="2">COURSE TITLE</td><td rowspan="2">Credits</td><td rowspan="2">Lectures</td><td colspan="2">THEORY</td></tr>
<tr><td>CCE</td><td>SEE</td></tr>
<tr><td>Degree Course</td><td>B.Sc. VI</td><td>SC23Mi DSCBOT 602</td><td>PLANT METABOLISM</td><td>2</td><td>T=30hrs</td><td>50%</td><td>50%</td></tr>
<tr><td>Course outcomes:</td><td colspan="6">On completion of the course, the students will be able to:
• Understanding of biochemical pathways involved in photosynthesis, respiration, and nutrient assimilation in plants.
• Ability to analyze metabolic regulation and its impact on plant growth and development.
• Knowledge of secondary metabolites and their roles in plant defense and human use.
• Insight into stress responses, including how plants adapt metabolically to environmental changes.
• Foundation for biotechnological applications in agriculture, such as crop improvement and metabolic engineering
Pedagogy: Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.</td></tr>
<tr><td>THEORY UNIT</td><td colspan="5">TOPIC</td><td>NO. OF LECTURES (30hrs)</td></tr>
<tr><td>Unit 1</td><td colspan="5">Photosynthesis
• Historical background of Photosynthesis, photosynthetic pigments.
• Cyclic and noncyclic photophosphorylation, Chemiosmotic mechanism of ATP synthase (photophosphorylation).
• Calvin cycle, Photorespiration, factors affecting photosynthesis.
• C_4 pathways, Crassulacean acid metabolism.</td><td>15</td></tr>
</table>

Unit 2	**Respiration and Metabolism** • Glycolysis, fermentation (anaerobic respiration- alcoholic and lactic acid), oxidative pentose phosphate pathway. • Aerobic respiration-TCA cycle and Oxidative phosphorylation(ETS). • Factors affecting respiration, Respiratory quotient (carbohydrates, lipid and protein) • Amphibolic pathway, anabolic and catabolic pathways, regulation of metabolism, Bio-synthesis and Beta-oxidation (breakdown) of Palmitic acid, biological nitrogen fixation.	**15**

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

(Effective from June 2025-26 UNDER NEP-2020)

MINOR DISCIPLINE SPECIFIC CORE COURSE -PRACTICAL (PMiDSC) ***Programme Code: SCIUG103***							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***Credits***	***Lectures***	***PRACTICAL***	
						CCE	***SEE***
Degree Course	***B.Sc. VI***	***SC23PMiDSCBOT602***	**PLANT METABOLISM**	**2**	**P=60hrs**	***50%***	***50%***
Course outcomes:	On completion of the course, the students will be able to: • Gained hands-on experience in analyzing key metabolic processes in plants, including photosynthesis and respiration. • Understood the role of enzymes and coenzymes in plant metabolic pathways. • Learned to measure and interpret factors affecting plant growth and energy conversion. • Developed skills in using laboratory techniques for studying metabolic functions. • Applied theoretical knowledge to real-world plant physiology experiments **Pedagogy:** Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.						
THEORY UNIT	***TOPIC***						***NO. OF LECTURES* (60hrs)**
PRACTICALS	• Separation of photosynthetic pigments by paper chromatography. • Effect of carbon dioxide on the rate of photosynthesis. • To study the effect of different wave length of light on the rate of photosynthesis. **Demonstration experiments** • To study the respiration by Ganong's respirometer (Demonstration). • Experimental demonstration of Hill's reaction.						**60**

Suggested Readings:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

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CBCS - Semester - Grading Pattern

(Effective from June 2025-26 UNDER NEP-2020)

B. SC. :: BOTANY PRACTICAL(MAJOR) :: SEMESTER-VI

Programme Code: SC23PMiDSCBOT 602

PLANT METABOLISM

Date: **Place:**

Time: 5 Hrs **Total Marks: 25**

Instructions: Strictly follow the instructions given by examiner(s).

1. Separation of photosynthetic pigments by paper chromatography.	06
2. Effect of carbon dioxide/ different wave length of light on the rate of photosynthesis.	06
3. Writing exercise on: 1) To study the respiration by Ganong's respirometer. 2) Experimental demonstration of Hill's reaction.	06
4. a. Submission and viva-voce b. Certified Journal	02 05

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

(Effective from June 2025-26 UNDER NEP-2020)

<table>
<tr><th colspan="8">MINOR DISCIPLINE SPECIFIC CORE COURSE -PRACTICAL (PMiDSC)
Programme Code: SCIUG103</th></tr>
<tr><th rowspan="2">COURSE</th><th rowspan="2">SEMESTER</th><th rowspan="2">COURSE CODE</th><th rowspan="2">COURSE TITLE</th><th rowspan="2">Credits</th><th rowspan="2">Hours/ Sem</th><th colspan="2">PRACTICAL</th></tr>
<tr><th>CCE</th><th>SEE</th></tr>
<tr><td>Degree Course</td><td>B.Sc. VI</td><td>SC23INT BOT 607</td><td>INTERNSHIP IN BOTANY</td><td>4</td><td>120 hrs</td><td>50%</td><td>50%</td></tr>
<tr><td>Course objectives:</td><td colspan="7">• To provide students with hands-on experience in the practical aspects of Botany.
• To bridge the gap between theoretical knowledge and field/lab applications.
• To develop technical skills in plant identification, collection, preservation, and documentation.
• To expose students to research methodologies, tools, and instruments used in botanical studies.
• To promote environmental awareness and conservation ethics through field exposure.
• To build competencies in scientific observation, recording, and reporting.
• To cultivate a professional attitude, teamwork, and interpersonal communication in a work environment.
• To inspire interest in higher studies, research, or careers in plant sciences.</td></tr>
<tr><td>Course outcomes:</td><td colspan="7">On completion of the course, the students will be able to:
• Apply theoretical knowledge of botany to real-world situations through hands-on work in laboratory, field, or institutional settings.
• Demonstrate practical skills in plant identification, specimen collection, herbarium techniques, and documentation.
• Develop competencies in laboratory techniques related to plant physiology, tissue culture, or molecular botany (as applicable).
• Analyze ecological or agricultural practices and understand their impact on plant growth and biodiversity.
• Enhance communication, observation, and data recording skills through scientific reporting and daily work documentation.
• Exhibit professional behavior, teamwork, and responsibility in a botanical or research setting.
Pedagogy: Experiential Learning, Field-Based Learning, Mentorship and Supervision, Skill-Based Training, Daily Work Journal, Collaborative Learning, Report Preparation and Presentation.</td></tr>
</table>

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
B.Sc. Programme (CBCS - Semester - Grading Pattern)
(Effective from June 2025-26 UNDER NEP-2020
B. Sc.:: BOTANY :: SEMESTER END EXAMINATION
PROGRAMME CODE: SCIUG103
FORMAT FOR QUESTIONS PAPER FOR 4 CREDITS COURSE IN BOTANY

(B.Sc. Sem. – V & VI)

The university examination paper consists of four questions.

- First question is of 12 marks and will be from Unit – I.
- Second question is of 13 marks and will be from Unit – II.
- Third question is of 12 marks and will be from Unit – III.
- Fourth question is of 13 marks and will be from Unit – IV.

No. of Printed Pages:___

Name of Subject : BOTANY		**Paper Code : MJDSCBOT-501, 501A, 601, 601A MiDSCBOT-502**
Name of Paper :		
Total Hours : 02:30 Hrs		**Total Marks : 50**
Instructions: (1) This question paper contains four questions. (2) All questions are compulsory. (3) Figures at right side indicate the marks of question. (4) Illustrate your answer with labelled diagram.		
Que.1 (A)	**Describe in detail:(any one)** (1) (2)	**08**
(B)	**Write a short note on:(any one)** (1) (2)	**04**
Que.2 (A)	**Describe in detail:(any one)** (1) (2)	**09**
(B)	**Write a short note on:(any one)** (1) (2)	**04**
Que.3 (A)	**Describe in detail:(any one)** (1) (2)	**08**
(B)	**Write a short note on:(any one)** (1) (2)	**04**
Que.4(A)	**Describe in detail:(any one)** (1) (2)	**09**
(B)	**Write a short note on:(any one)** (1) (2)	**04**

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
B.Sc. Programme (CBCS - Semester - Grading Pattern)
(Effective from June 2025-26 UNDER NEP-2020
B. Sc.:: BOTANY :: SEMESTER END EXAMINATION
PROGRAMME CODE: SCIUG103
FORMAT FOR QUESTIONS PAPER FOR 2 CREDITS COURSE IN BOTANY

(B.Sc. Sem. – V & VI)

The university examination paper consists of three questions.

- First question is of **10** marks and will be from **Unit – I.**
- Second question is of **10** marks and will be from **Unit – II.**
- Third question is of **05** marks and will be from **Unit – I & II.**

No. of Printed Pages: ___

Name of Subject : BOTANY	**Paper Code:** **MiDSCBOT-602** **AEC -604** **SECBOT- 506**
Name of Paper :	
Total Hours : 02:00 Hrs	**Total Marks : 25**

Instructions: (1) This question paper contains three questions.
(2) All questions are compulsory.
(3) Figures at right side indicate the marks of question.
(4) Illustrate your answer with labelled diagram.

		Marks
Que.1(A)	**Describe in Detail (any one).** (1) (2)	**06**
(B)	**Write a short note on (any one).** (1) (2)	**04**
Que.2(A)	**Describe in Detail (any one).** (1) (2)	**06**
(B)	**Write a short note on (any one).** (1) (2)	**04**
Que.3	**Do as directed (five out of seven).** (1) (2) (3) (4) (5) (6) (7)	**05**