



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN - 384 265

FACULTY OF SCIENCE

B.Sc. BOTANY

Semesters: VI

SYLLABUS

Curriculum as per UGC Guideline

With Semester/CBCS/Grading Pattern

With effect from June - 2022 (and thereafter)

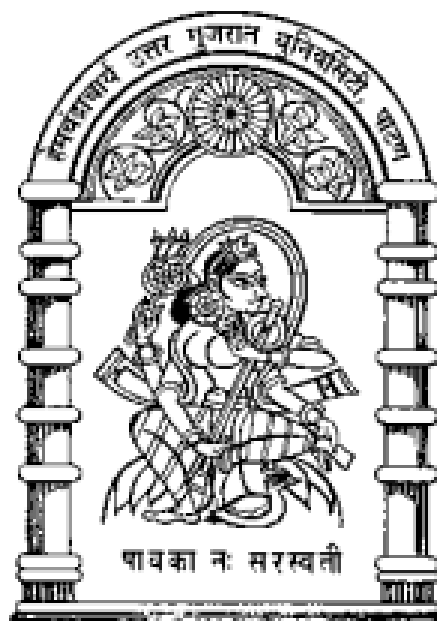
DATE: June, 2022

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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN - 384 265.



U.G. (B.Sc.) Programme

CBCS:: Semester :: Grading Pattern

With effect from: June 2022

FACULTY OF SCIENCE

Subject: BOTANY

B. Sc. Semesters: VI

Total Pages: 01 to 25

Submitted on

Date: 20/10/2021

SUMMARY OF THE PROGRAMME

Summary of the Programme

✓ Syllabus duration	Semester pattern i.e., Six months
✓ No. of core compulsory (CC) course	04 (in each semester)
✓ Credits per CC course	03
✓ Total credits for CC course	12/Semester
✓ Theory lectures per CC course	03 / Week
✓ Total Theory lectures for CC course	12 / Week
✓ No. of Practical courses per semester	04 (each from CC course)
✓ Practical lectures	03 /Week/course/batch
✓ Total Practical lectures	12 / Week/ batch
✓ Credits per Practical course	1.5
✓ Total Credits of Practical course	06 /Semester
✓ No. of Practical course (in Uni. Exam.)	03 /Semester
✓ No. of Elective Subjective (ES) course	01 (in each semester)
✓ Credits for ES course	02 (in each semester)
✓ Theory lectures per ES course	02/Week
✓ No. of Elective Generic (EG) course	01
✓ Credits for EG course	02
✓ Theory lectures per EG course	02/ Week
✓ Examination (including Preparation)(weeks)	05
✓ No. of Days per week	06
✓ Weeks (days) available for Teaching	15 (90)
✓ Duration of each lecture (minutes)	55
✓ No. of students/batch	20 (on approval of AC and Exam. unit)

Under Choice Based Credit System-Semester-Grading System pattern
UG (B. Sc.) Programme in Botany
Semester - VI

Salient Features:

- CBCS in UG programme in **Botany Semester VI** shall be offered from the Academic year **June 2022**.
- Botany subject in the Universities/Affiliated Colleges shall offer undergraduate programme in Faculty of Science from the Academic year 2022-23.
- A student will have to get enrolled a **Core course** depending upon his/her requirement of a degree in the said discipline of study. A student will have a choice of selecting an **Elective** as well as **Foundation** courses from a pool of courses.
- Each course shall be assigned a specific number of **Credits**.
- A Core course is the course which should compulsorily be studied by a candidate as a Core requirement so as to get degree in a said discipline of study.
- There shall be four **Core Compulsory** courses (Theory) each with **3 credits** in each semester and their practical's each with **1.5 credits**. Thus, a credit weight -age in **B Sc** programme for each semester core course shall be of **18 credits**. In short, **4.5** credits multiplied by **4** subjects equal to total of **18 credits**.
- In addition to the Core courses, a student will have to choose Elective as well as Foundation courses from a pool of courses.
- **Two** courses of **Elective**, one each from **Generic Elective (02 credit)** and Interdisciplinary / Multidisciplinary / **Subject centric electives (02 credit)** shall have to be offered. Hence, a total credit weight-age for Elective courses shall be of **04 credits**.
- One **Foundation** (English Language L.L.) course shall have to be offered. The credit weight-age for Foundation course shall be of **02 credits**.
- Each course shall have a unique Course code. The Core courses, Elective courses and the Foundation courses shall be abbreviated respectively as **CC, PC, EG, ES and FC**.
 1. Core Compulsory **CC**
Practical Core (Core Elective) **PC**
 2. Elective Generic **EG**
Elective Subject **ES**
 3. Foundation Compulsory **FC**

- 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 course with **4 credits** shall be of **60 hrs** (15 weeks x 4 credits) duration. The course with **3 credits shall** be of **45 hrs** (15 weeks x 3 credits) duration. The course with **2 credits** shall be of **30 hrs** (15 weeks x 2 credits) duration.
- **A general framework for Bachelor of Science (B.Sc.) programme shall be as follows:**

Semester wise credits						Total credits of the Programme
I	II	III	IV	V	VI	
24	24	24	24	24	24	144

- **The semester wise weight age of core, elective and foundation courses shall be as follows:**

Academic year	Core compulsory Courses	Elective courses	Foundation courses
Semester I & II	65-75%	15-20%	10-15%
Semester III & IV	65-75%	15-20%	10-15%
Semester V & VI	65-75%	15-20%	10-15%

- **Attendance:**

The Attendance Rules as per the norms of Hemchandracharya North Gujarat University.

- **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.

- **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.* core, discipline electives, generic electives and skill enhancement courses are to be considered as parameters for assessing the achievement of students in botany. 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. The oral and written examinations (Scheduled and surprise tests).
2. Closed-book and open-book tests.
3. Problem-solving exercises.
4. Practical assignments and laboratory reports.
5. Observation of practical skills.
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews are majorly adopted assessment methods for this curriculum.
9. The computerized adaptive testing, literature surveys and evaluations, peers and self-assessment, outputs from individual and collaborative work are also other important approaches for assessment purposes.
10. A student shall be evaluated through Comprehensive Continuous Assessment (CCA)/ **(Internal Evaluation)** as well as the **End of Semester examination (External Evaluation)**. The weight-age of CCA shall be 30%, whereas the weight-age of the Semester end examination shall be 70%. There will be **no internal evaluation in practical courses**.
11. In Semester assessment (CCA)/ **(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 weight-age for CCA. The assessment is to be done by various means including:
 - ✓ Written Tests
 - ✓ MCQs based Tests/Quiz
 - ✓ Presentations/Seminars
 - ✓ Project work/Field work
 - ✓ Group discussions/Group activities
 - ✓ Assignments, etc.

12. The distribution of **Internal Evaluation** is given as per criteria given below for **30** marks:

CORE COURSE:

Written Test...	20 marks
Assignments/MCQs/Very Short questions...	05 marks and Attendance
Regularity, Punctuality...	05 marks.

ELECTIVE (SUBJECTIVE) COURSE:

Written Test...	15 marks
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13. The **End of Semester examination (External Evaluation)** shall have an assessment based upon following perspective with respect to all the courses:

- a. Evaluation with respect to Knowledge
- b. Evaluation with respect to Understanding
- c. Evaluation with respect to Skill
- d. Evaluation with respect to Application
- e. Higher Order Thinking Skills

14. With respect to all the above components, there shall be following types of Questions from each unit of the course.

- a. MCQs/Fill in the blanks/ Match the pairs, etc
- b. Short answer questions
- c. Medium answer questions
- d. Long answer questions
- e. Examples/ Problems, etc.

15. 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.

16. 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 **40%** as decided by concern Board of Studies in Botany.

17. 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.

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.

SUBMISSION:

Instead of submission of Herbarium sheets and/or specimens at the time of final (Uni.) practical examination student may submit photographs/drawings or CD having such photographs/drawings of plant species to conserve plant species in their natural habitats and to avoid any damage to plant species and its natural habitat.

ELECTIVE (SUBJECTIVE) COURSE:

For semester-V and VI a list of two courses is given below.

1. Elective (Subject) Course :: ES BOT-601 :: FLORICULTURE

SELECTION OF ELECTIVE (GENERIC) COURSE:

- For semester-V and VI a separate consists of courses is offered by university. Students may select **any one** of them from offered courses in Semester-V and Semester-VI separately.

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.
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.

SEM-VI: CC-BOT-601: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

LEARNING OUTCOME:

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

- 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: CC-BOT-602: PLANT PHYSIOLOGY

LEARNING OUTCOME:

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

- 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.

SEM-VI: CC-BOT-603: PLANT METABOLISM

LEARNING OUTCOME:

On completion of this 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

SEM-VI: CC-BOT-604: PLANT BIOTECHNOLOGY

LEARNING OUTCOME:

On the 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

SEM-VI: ES-BOT-601: FLORICULTURE

LEARNING OUTCOME:

After completing this course the learner will be able to;

- Develop conceptual understanding of gardening from historical perspective
- Analyze various nursery management practices with routine garden operations.
- Distinguish among the various Ornamental Plants and their cultivation
- Evaluate garden designs of different countries
- Appraise the landscaping of public and commercial places for floriculture.
- Diagnoses the various diseases and uses of pests for ornamental plants.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
B.Sc. Programme with 144 credits CBCS-Semester-Grading Pattern

w.e.f. June-2022

General Pattern/ Scheme of study components along with credits for Science faculty.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN						
B.Sc. three year (General) Programme with 144 credits						
Semester-V and VI in BOTANY w.e.f. June-2022 and December-2022 respectively						
General Pattern/Scheme of study components along with credits						
Study Components	Ins. Hrs/ Week	Examination			Credits	
		Internal Marks	Uni. Exam. Marks	Total Marks		
Semester-V						
	Core Compulsory Course(CCC)					
CC-I-7	Core Course-I (Paper-7)	3	30	70	100	3
CC-I-8	Core Course-I (Paper-8)	3	30	70	100	3
CC-I-9	Core Course-II (Paper-9)	3	30	70	100	3
CC-I-10	Core Course-II(Paper-10)	3	30	70	100	3
	Practical Core Course (PCC)					
PC-I-7	Practical Core Course-I (Paper-7)	3		50	50	1.5
PC-I-8	Practical Core Course-I (Paper-8)	3		50	50	1.5
PC-I-9	Practical Core Course-II (Paper-9)	3		50	50	1.5
PC-I-10	Practical Core Course-II (Paper-10)	3		50	50	1.5
	Foundation Course (FC)					
FC-5	Compulsory English (L.L.)	2	15	35	50	2
	Elective Course (EC)					
EG-9	Elective (Generic) Course- I	2	15	35	50	2
ES-10	Elective (Subject) Course- I	2	15	35	50	2
		30	165	585	750	24
Semester-VI						
	Core Compulsory Course(CCC)					
CC-I-7	Core Course-I (Paper-11)	3	30	70	100	3
CC-I-8	Core Course-I (Paper-12)	3	30	70	100	3
CC-I-9	Core Course-II (Paper-13)	3	30	70	100	3
CC-I-10	Core Course-II(Paper-14)	3	30	70	100	3
	Practical Core Course (PCC)					
PC-I-7	Practical Core Course-I (Paper-11)	3		50	50	1.5
PC-I-8	Practical Core Course-I (Paper-12)	3		50	50	1.5
PC-I-9	Practical Core Course-II (Paper-13)	3		50	50	1.5
PC-I-10	Practical Core Course-II (Paper-14)	3		50	50	1.5
	Foundation Course (FC)					
FC-6	Compulsory English (L.L.)	2	15	35	50	2
	Elective Course (EC)					
EG-11	Elective (Generic) Course- I	2	15	35	50	2
ES-12	Elective (Subject) Course- I	2	15	35	50	2
		30	165	585	750	24

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B.Sc Programme (CBCS - Semester - Grading Pattern)

B. Sc.:: BOTANY :: SEMESTER END EXAMINATION

Format for Questions paper Core Compulsory Course in Botany

(B.Sc. Sem - VI)

(W.E.F. JUNE - 2022)

The university examination paper consists of four questions.

- First question is of 17 marks and will be from Unit – I.
- Second question is of 18 marks and will be from Unit – II.
- Third question is of 17 marks and will be from Unit – III.
- Fourth question is of 18 marks and will be from Unit – I TO III.

Time: 2.5 Hrs

Total Marks: 70

- | | |
|--|----|
| 1. Long answered and medium answered/short note-typed questions from Unit-I | 17 |
| a. Long answered questions (Attempt any one from two each of 10 marks) | |
| b. Medium answered or short note-typed questions (Attempt any one from two each of 8 marks) | |
| 2. Long answered and medium answered/short note-typed questions from Unit-II | 18 |
| a. Long answered questions (Attempt any one from two each of 10 marks) | |
| b. Medium answered or short note-typed questions (Attempt any one from two each of 7 marks) | |
| 3. Long answered and medium answered/short note-typed questions from Unit-III | 17 |
| a. Long answered questions (Attempt any one from two each of 10 marks) | |
| b. Medium answered or short note-typed questions (Attempt any one from two each of 8 marks) | |
| 4. a. Medium answered/short note-typed questions from Unit-I to III | 10 |
| (Attempt any two from three each of 05 marks) | |
| b. Questions such as, MCQs, Fill in the blanks, Match the pairs, very short answered questions, etc. | 08 |
| [Attempt eight questions, at least three questions from each Unit, Each of 1 Mark] | |

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B.Sc. Programme (CBCS - Semester - Grading Pattern)

B. Sc.: BOTANY :: SEMESTER END EXAMINATION

Format for Questions paper Elective Course in Botany

(B.Sc. Sem - VI)

(W.E.F. JUNE - 2022)

The university examination paper consists of three questions.

- First question is of 12 marks and will be from Unit – I.
- Second question is of 12 marks and will be from Unit – II.
- Third question is of 11 marks and will be from Unit – I & II.

Time: 2 Hrs

Total Marks: 35

Q.1 (a) Attempt any one out of two. 06 Marks

(b) Attempt any two out of three. 06 Marks

Q.2 (a) Attempt any one out of two. 06 Marks

(b) Attempt any two out of three. 06 Marks

Q.3 (a) Attempt any three out of five (SQ). 06 Marks

(b) Attempt any five out of eight. 05 Marks

Semester-VI :: BOTANY :: Core Compulsory

**For Semester-end examination there will be
FOUR theory and
TWO practical courses as
mentioned below:**

CORE COMPULSORY COURSE:

**CC BOT-601
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS**

**CC BOT-602
PLANT PHYSIOLOGY**

**CC BOT-603
PLANT METABOLISM**

**CC BOT-604
PLANT BIOTECHNOLOGY**

ELECTIVE (SUBJECT) COURSE:

ES-BOT-601: FLORICULTURE

CORE COMPULSORY PRACTICAL COURSE

**CC BOT-601
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS**

**CC BOT-602
PLANT PHYSIOLOGY**

**CC BOT-603
PLANT METABOLISM**

**CC BOT-604
PLANT BIOTECHNOLOGY**

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Under CBCS-Semester-Grading pattern

B.Sc. (Semester-VI) Programme

Core Compulsory Course in BOTANY

CC-BOT-601 Reproductive Biology of Angiosperms

Theory teaching hours: **3 Hours/week**

Credit: **3.0**

Practical teaching hours: **3 Hours/week**

Credit: **1.5**

Unit 1: Reproductive Biology-1

- History (Indian contributors- P. Maheshwari and B.M. Johri) and scope of reproductive Biology.
- Induction of flowering; flower as a modified determinate shoot.
- Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance.
- Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure.

Unit 2: Reproductive Biology-2

- NPC system; Palynology and scope (a brief account);
- Pollen wall proteins; Pollen viability, storage and germination.
- Abnormal features: Pseudomonads, polyads, massulae, pollinia.
- Methods to overcome self-incompatibility: in vitro pollination.

Unit 3: Reproductive Biology-3

- Structure and Types of ovule; Special structures–endothelium, obturator, aril, caruncle and hypostase.
- Female gametophyte– megasporogenesis (monosporic - *Polygonum*, bisporic - *Allium* and tetrasporic - *Peperomia*) and megagametogenesis.
- Structure of stigma and style; path of pollen tube in pistil; double fertilization, types of endosperm, structure and functions. General pattern of development of dicot and monocot embryo.
- Introduction; Classification; Causes and applications of Polyembryony and Apomixis.

Practical

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehiscent anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); Pollen viability: Tetrazolium test.
3. Ovule: Types-anatropous, hemianatropous, orthotropous, amphitropous, campylotropous, circinotropous, (permanent slides/specimens/photographs).
4. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
5. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
6. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

Suggested Readings

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
3. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
4. Johri, B.M. I (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Under CBCS-Semester-Grading pattern

B.Sc. (Semester-VI) Programme

Core Compulsory Course in BOTANY

CC-BOT-602 PLANT PHYSIOLOGY

Theory teaching hours: **3 Hours/week**

Credit: **3.0**

Practical teaching hours: **3 Hours/week**

Credit: **1.5**

Unit 1: Plant Physiology-1

- 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 and factors affecting transpiration, antitranspirants.
- Mechanism of stomatal movement.

Unit 2: Plant Physiology-2

- Essential and beneficial elements, macro and micronutrients.
- Methods of study and use of nutrient solutions, criteria for essentiality.
- Mineral deficiency symptoms, roles of essential elements, chelating agents.
- Transport of ions across cell membrane: passive absorption, electrochemical gradient, facilitated diffusion, active absorption. Uniport, co-transport, symport and antiport.

Unit 3: Plant Physiology-3

- Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model and Phloem loading and unloading; Source–sink relationship.
- Discovery, chemical nature (basic structure), and physiological roles of plant growth regulators (PGRs): As Growth promoters: Auxin, Gibberellins, Cytokinin &
As Growth inhibitors: Abscisic acid, Ethylene.
- Photoperiodism: Definition, types and its significance & Flowering stimulus, florigen concept. Vernalization: Definition, types and its significance.
- Seed dormancy: definition, types, causes and overcome seed dormancy .

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
4. To study the induction of amylase activity in germinating barley grains.
5. Determination of ascent of sap by ringing method.

Demonstration experiments

1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).
3. Bolting experiment/*Avena* coleoptile bioassay (demonstration).
4. To study the phenomenon of seed germination (effect of light).

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.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Under CBCS-Semester-Grading pattern

B.Sc. (Semester-VI) Programme

Core Compulsory Course in BOTANY

CC-BOT-603 PLANT METABOLISM

Theory teaching hours: **3 Hours/week**

Credit: **3.0**

Practical teaching hours: **3 Hours/week**

Credit: **1.5**

Unit 1: Photosynthesis

- Historical background of Photosynthesis, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres.
- Photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle.
- CO₂ reduction: Calvin cycle, Photorespiration. C₄ pathways, Crassulacean acid metabolism, Factors affecting CO₂ reduction.
- Synthesis and catabolism of sucrose and starch.

Unit 2: Photosynthesis & Respiration

- Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway.
- Oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle.
- Mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.
- Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase.

Unit 3: Metabolism

- Introduction, anabolic and catabolic pathways, regulation of metabolism.
- Bio-synthesis and Beta-oxidation (breakdown) of Palmitic acid.
- Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes).
- Ammonia assimilation and transamination.

Practical

1. Separation of photosynthetic pigments by paper chromatography.
2. To study the effect of light intensity on the rate of photosynthesis.
3. Effect of carbon dioxide on the rate of photosynthesis.
4. To study the effect of different wave length of light on the rate of photosynthesis.
5. to study the respiration by Ganong's respirometer.
6. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination.
7. Experimental demonstration of Hill's reaction.
8. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources.

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

Under CBCS-Semester-Grading pattern

B.Sc. (Semester-VI) Programme

Core Compulsory Course in BOTANY

CC-BOT-604 PLANT BIOTECHNOLOGY

Theory teaching hours: **3 Hours/week**

Credit: **3.0**

Practical teaching hours: **3 Hours/week**

Credit: **1.5**

Unit 1: Plant Tissue Culture

- Historical perspective; Composition of media (MS media); Nutrient and hormone requirements (role of vitamins and hormones).
- Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion.
- Tissue culture applications: Micropropagation, secondary metabolite production, haploids, triploids and hybrids.
- Tissue culture applications: Cryopreservation; Germplasm Conservation.

Unit 2: Biotechnology

- Restriction Endonucleases (History, Types I-IV, biological role and application).
- Cloning Vectors: Prokaryotic (pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).
- Recombinant DNA, Bacterial Transformation and selection of recombinant clones, cDNA libraries, PCR.
- Indirect gene transfer (Agrobacterium), Direct gene transfer (Electroporation, Microinjection, Particle bombardment & Liposome) & Selection of transgenics–selectable marker and reporter genes (Luciferase, GUS, GFP).

Unit 3: Applications of Biotechnology

- Pest resistant (Bt-cotton), herbicide resistant plants (RoundUp Ready soybean).
- Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); improved horticultural varieties (Moondust carnations).

- Role of transgenics in bioremediation (Superbug), edible vaccines, Industrial enzymes (Aspergillase, Protease, Lipase).
- Genetically Engineered Products–Human Growth Hormone, Humulin, Biosafety concerns.

Practical

1. Preparation of MS medium.
2. Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of Tobacco, *Datura*, *Brassica*, Carrot etc.
3. Study of anther, embryo and meristem culture, micro propagation by culture method.
4. Study of somatic embryogenesis & artificial seeds through photographs.
4. Study of methods of gene transfer through photographs/charts: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, particle bombardment.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
7. Restriction digestion and gel electrophoresis of plasmid DNA (Chart).

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

Under CBCS-Semester-Grading pattern

B.Sc. (Semester-VI) Programme

Elective Subjective in BOTANY

ES-BOT-601 FLORICULTURE

Theory teaching hours: **2 Hours/week**

Credit: **2**

Unit 1 : Floriculture - I

- History of gardening; Importance and scope of floriculture.
- Soil sterilization.
- Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary.
- Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 2: Floriculture - II

- Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden).
- English, Italian, French, Persian, Mughal and Japanese gardens.
- Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life. Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliium, Orchids).
- Diseases and Pests of Ornamental Plants.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

Hemchandracharya North Gujarat University, Patan

B.Sc. Semester-VI

Practical Examination, March/April (2022)

BOTANY Practical – PC- BOT-601 & 602

(Reproductive Biology of Angiosperms, and Plant Physiology)

Date:

Centre:

Time: 12:00 to 5:00

Total Marks- 100

Instruction: Students are requested to follow instructions given by the examiners.

1. **Expose and mount from given material "A".** 15
Diad / Tetrad / Tapetum
2. **Expose and mount from given material "B".** 10
Embryo with endosperm haustorium / Embryo with suspensor / various developmental stages of embryo.
3. **Determination of Osmotic potential of plant cell sap by plasmolytic method.** 10
4. **Determination of Water potential of given tissue (potato tuber) by weight method.** 10
5. **Writing exercise on: (Permanent slides/Specimens/ Photographs/ as per instruction).** 20
 - a. Spot "C" from (Acetolysis / Pollinia / Pollen wall / Pollen viability- Tetrazolium test / Percentage germination- Hanging drop method).
 - b. Spot "D" from (Types of Ovule / Endothelium / Obturator / Hypostase / Caruncle/ Aril / Embryo sac).
6. **Writing exercise on: (Permanent slides/Specimens/Photographs/as per instruction).** 20
 - a. Spot "E" from (Stomatal index / Stomatal frequency from mesophyte and xerophytes - both surfaces / Amylase activity).
 - b. Spot "F" (Suction transpiration / Fruit ripening / Rooting from cuttings / Bolting experiment / Avena coleoptile IAA bioassay).
7. a. Certified Journal 10
b. Submission and viva-voce 05

Hemchandracharya North Gujarat University, Patan

B.Sc. Semester-VI

Practical Examination, March/April (2022)

**BOTANY Practical – PC- BOT-603 & 604
(Plant Metabolism, and Plant Biotechnology)**

Date:

Centre:

Time: 12:00 to 5:00

Total Marks- 100

Instruction: Students are requested to follow instructions given by the examiners.

- 1. Chemical separation of photosynthetic pigments by paper chromatography. 15**
- 2. To study the effect of Light intensity on the rate of photosynthesis. 15**
OR
- 2. To study the effect of Carbon dioxide on the rate of photosynthesis.**
- 3. Write the procedure of Preparation of MS medium. 15**
OR
- 3. In vitro sterilization and inoculation methods using explants.**
- 4. To study of the tissue culture technique for Anther/Embryo/Endosperm culture and Micropropagation /Somatic embryogenesis / Artificial seeds. 15**
- 5. Experimental demonstration of Hill's reaction/Nitrate reductase activity/Lipases activity. 10**
- 6. Write the method of: 15**
 - a. Isolation of Protoplasts / Plasmid DNA.
 - b. Gene transfer (Agrobacterium mediated/Electroporation/Microinjection/Microprojectile bombardment).
 - c. Steps of genetic engineering (Production of Bt cotton / Golden rice / Flavr Savr tomato).
- 7. a. Certified Journal 10**
b. Submission and viva-voce 05