



પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે લાઈફ સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગત બોટની વિષય સેમેસ્ટર-૨નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજૂરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન, ૨૦૨૩ થી અમલવારી કરવાની રહે છે. લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

નોંધ: તા. ૨૩.૧૨.૨૦૨૩ નાં પરિપત્રનં: ૨૧૪૩/૨૦૨૩માં બોટની અભ્યાસક્રમમાં ફેરફાર કરવામાં આવેલ છે.



18/12/2025
ખાસ ફેરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૨૮૪/૨૦૨૫

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,

સરકારી પોલીટેકનિક કેમ્પસ,

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,

ખડીયા, જૂનાગઢ-૩૬૨૨૬૩

તા.૧૮.૦૬.૨૦૨૫

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાના:-

- માન.કુલપતિશ્રી/ કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જૂનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થે:

- સીસ્ટમ મેનેજરશ્રી, આઈ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)





DEPARTMENT OF LIFE SCIENCES

Bhakta Kavi Narsinh Mehta University

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Ref.DLS/2025/460

04/06/2025

To,

Academic officer,

Bhakta Kavi Narsinh Mehta University,

Junagadh

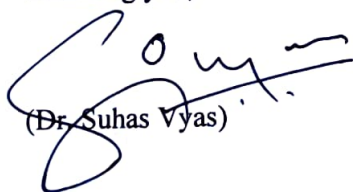
Sub: Submission of revised syllabus of Botany sem 1 to 4

Sir,

With reference to the subject mentioned above, it was noted in the recent Board of Studies (BoS) meeting of the Botany department that a minor revision is required in the Semester I to IV syllabus. The revised syllabus has been submitted to the Academic Section. You are kindly requested to take the necessary steps for its implementation. The revised syllabus shall be effective henceforth for the concerned subject.

Regards,

Thanking you,


(Dr. Suhas Vyas)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH



BOARD OF STUDIES

FACULTY OF LIFE SCIENCE

SYLLABUS FOR BOTANY (HONOURS)

PROGRAMME (SEMESTER- II)

EFFECTIVE FROM JUNE, 2023

Preamble

This National Education Policy 2020 is the first education policy of the 21st century and aims to address the many growing developmental imperatives of our country. individual. It is based on the principle that education must develop not only cognitive capacities - both the 'foundational capacities' of literacy and numeracy and 'higher-order' cognitive capacities, such as critical thinking and problem solving – but also social, ethical, and emotional capacities and dispositions.

The rich heritage of ancient and eternal Indian knowledge and thought has been a guiding light for this Policy. The pursuit of knowledge (Jnan), wisdom (Pragyaa), and truth (Satya) was always considered in Indian thought and philosophy as the highest human goal. The aim of education in ancient India was not just the acquisition of knowledge as preparation for life in this world, or life beyond schooling, but for the complete realization and liberation of the self. World-class institutions of ancient India such as Takshashila, Nalanda, Vikramshila, Vallabhi, set the highest standards of multidisciplinary teaching and research and hosted scholars and students from across backgrounds and countries. The Indian education system produced great scholars such as Charaka, Susruta, Aryabhata, Varahamihira, Bhaskaracharya, Brahmagupta, Chanakya, Chakrapani Datta, Madhava, Panini, Patanjali, Nagarjuna, Gautama, Pingala, Sankardev, Maitreyi, Gargi and Thiruvalluvar etc.

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.

This 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.

Nowadays 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.

This National Education Policy envisions an education system rooted in Indian ethos that contributes directly to transforming India, that is Bharat, sustainably into an equitable and vibrant knowledge society, by providing high-quality education to all, and thereby making India a global knowledge superpower. The Policy envisages that the curriculum and pedagogy of our institutions must develop among the

students a deep sense of respect towards the Fundamental Duties and Constitutional values, bonding with one's country, and a conscious awareness of one's roles and responsibilities in a changing world. The vision of the Policy is to instill among the learners a deep-rooted pride in being Indian, not only in thought, but also in spirit, intellect, and deeds, as well as to develop knowledge, skills, values, and dispositions that support responsible commitment to human rights, sustainable development and living, and global well-being, thereby reflecting a truly global citizen. We tried our level best to fulfill the vision of NEP by providing Botany syllabus for first year students to transform our Indian knowledge system with modern concept of life sciences. The new curriculum of B.Sc. in Science (Botany) offers essential knowledge and technical skills to study plants in a holistic manner. Students would be trained in all areas of plant biology using a unique combination of core, elective and vocational papers with significant interdisciplinary components. Students would be exposed to cutting-edge technologies that are currently used in the study of plant life forms, their evolution and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of plants and their relevance to the national economy. B.Sc. Botany Programme covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. Infield, outstation activities and projects are also required to be organized for real-life experience and learning. Candidates who have curiosity in plants kingdom, ecosystem, love exploring exotic places and wish to work as researchers or professions like Botanist, Conservationist, Ecologist, etc. can choose B.Sc. Botany course.

Sem	Credit Structure-Science Faculty (Honours)														
	Ability Enhancement Course		Value Added Course		Skill Enhancement Course/Internship/		Multidisciplinary, Interdisciplinary		Major		Minor		On Job Training	Total	
	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Credit	Papers	Credit
1	1	2	1	2	1	2	1	4	2	8	1	4	--	7	22
2	1	2	1	2	1	2	1	4	2	8	1	4	--	7	22
3	1	2	1	2	1	2	1	4	3	12	0	--	--	7	22
4	1	2	1	2	1	2	0	0	3	12	1	4	--	7	22
5	--	--	--	--	1	2	0	0	3	12	2	8	--	6	22
6	1	2	--	--	1	4	0	0	3	12	1	4	--	6	22
Total (UG)	5	10	4	08	6	14	3	12	16	64	06	24	--	40	132
7	--	--	--	--	--	--	0	0	3	12	1	4	6	4	22
8	--	--	--	--	--	--	0	0	3	12	1	4	6	4	22
Total	5	10	4	08	6	14	3	12	22	88	08	32	12	48	176

*Summer Internship will be held for only those students who want to exit after completion of First year (Sem-II) and Second Year (Sem-IV).

Sem	Credit Structure-Science Faculty UG Honours with Research														
	Ability Enhancement Course		Value Added Course		Skill Enhancement Course/Internship/		Multidisciplinary, Interdisciplinary		Major		Minor		Dissertation / Research Project	Total	
	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Papers	Credit	Credit	Papers	Credit
1	1	2	1	2	1	2	1	4	2	8	1	4	--	7	22
2	1	2	1	2	1	2	1	4	2	8	1	4	--	7	22
3	1	2	1	2	1	2	1	4	3	12	0	--	--	7	22
4	1	2	1	2	1	2	0	0	3	12	1	4	--	7	22
5	--	--	--	--	1	2	0	0	3	12	2	8	--	6	22
6	1	2	--	--	1	4	0	0	3	12	1	4	--	6	22
Total (UG)	5	10	4	08	6	14	3	12	16	64	06	24	--	40	132
7	--	--	--	--	--	--	0	0	3	12	1	4	6	4	22
8	--	--	--	--	--	--	0	0	3	12	1	4	6	4	22
Total	5	10	4	08	6	14	3	12	22	88	08	32	12	48	176

*Summer Internship will be held for only those students who want to exit after completion of First year (Sem-II) and Second Year (Sem-IV).

SEMESTER-2

SN	Category of Course	Title of the Course	Course Credit
1	Major – III (Discipline Specific Core Courses)	Major-3 (Theory + Practical) [1) Chemistry 2) Physics 3) Mathematics 4) Botany 5) Zoology 6) Microbiology 7) Biochemistry 8) Biotechnology]. (A Student has to select any one subject as Major discipline out of the above list)	4 (3+1)
2	Major – IV (Discipline Specific Core Courses)	Major-4 (Theory + Practical) [1) Chemistry 2) Physics 3) Mathematics 4) Botany 5) Zoology 6) Microbiology 7) Biochemistry 8) Biotechnology]. (A Student has to select any one subject as Major discipline out of the above list)	4 (3+1)
3	Minor-2 (Discipline Specific minor Courses)	Minor-2 (Theory + Practical) [1) Chemistry 2) Physics 3) Mathematics 4) Botany 5) Zoology 6) Microbiology 7) Biochemistry 8) Biotechnology]. (A Student has to continue the minor subject as opted in the SEM-1 out of the above list)	4 (3+1)
4	MDC-2 (Multidisciplinary course)	MDC-2(Theory + Practical) [1) Chemistry 2) Physics 3) Mathematics 4) Botany 5) Zoology 6) Microbiology 7) Biochemistry 8) Biotechnology] or any paper from approved online platforms. (A Student has to select any one paper other than Major/minor discipline out of the above list)	4 (3+1)
5	Ability Enhancement Course (AEC)	AECC-201: Foundation English	02
6	Skill Enhancement Course (SEC)/Internship	SEC-201 (All Board shall prepare Course Basket)	02
7	Value Added Course (VAC)	VAC-201: Environmental Studies	02
		Total	22

CONCEPTUAL FRAME WORK FOR SEMESTER -2

Sr. No.	Course Group	Course (Paper) Title	Credit	Teaching Hours/Week	Exam Hours	Marks		Total
						Internal	External	
1	MAJOR – 3 THEORY	BIOMOLECULE	3	3	2	25	50	100
2	MAJOR – 3 PRACTICAL	BIOMOLECULE	1	2	2:30	25		
3	MAJOR – 4 THEORY	CELL BIOLOGY	3	3	2	25	50	100
4	MAJOR – 4 PRACTICAL	CELL BIOLOGY	1	2	2:30	25		
5	MINOR – 2 THEORY	BIOMOLECULE	3	3	2	25	50	100
6	MINOR – 2 PRACTICAL	BIOMOLECULE	1	2	2:30	25		
7	MULTIDISCIPLINARY - 2 (THEORY)	CELL BIOLOGY	3	3	2	25	50	100
8	MULTIDISCIPLINARY-2 PRACTICAL	CELL BIOLOGY	1	2	2:30	25		
9	ABILITY ENHANCEMENT COURSES	AECC- 201	2	-	-	25	25	50
10	SKILL ENHANCEMENT COURSES	NATURAL RESOURCE MANAGEMENT	2	2	1	25	25	50
11	VALUE ADDED COURSES	VAC- 201	2	-	-	25	25	50
	Total		22	22				550

Pattern of Examination:

Students will have to attend theory and practical both during the semester and at the end of semester, University exams will be conducted. Examination contains 70% external and 30% internal marks. A student's performance during every practical session is assessed and marks for a maximum of 15 is recorded. External practical evaluation will carry 35 marks, so total 50 marks for each practical per paper examination will be counted. Internal assessment for theory can be following any one as mention below.

Total Scheme of evaluation

Subject	Theory						Practical	
Semester – I and Semester - II	Internal (Total 50 Marks)					External	Performance during practical session	Total
	Theory Exam	Assignment	Lab Work/ Presentation/ Slip Test/ Classroom participation / Viva-Voce	Attendance	TOTAL			
Major/Minor	10	05	05	05	25	50	25	100
Multidisciplinary Course	10	05	05	05	25	50	25	100
Skill Enhancement Course	13	05	05	02	25	25	-	50

BHAKT KAVI NARSINH MEHTA UNIVERSITY, JUNAGADH

THEORY EXAMINATION

BOTANY

SEMESTER – II

BOTANY MAJOR – 3 BIOMOLECULES

BOTANY MAJOR - 4 CELL BIOLOGY

BOTANY MINOR – 2 BIOMOLECULES

BOTANY MULTIDISCIPLINARY - 2 CELL BIOLOGY

Time: 2 Hours

Total Marks: 50

Instructions:

1. Illustrate your answer with neat and labelled diagrams.
2. Figure to the right side indicates full marks of questions.

Question-1 (This question is taken from Unit-1) Question-2 (This

question is taken from Unit-2) Question-3 (This question is taken

from Unit-3) Question-4 (This question is taken from Unit-4)

Question-5 (This question is taken from Unit-1, 2, 3 & 4)

- Any type of MCQs is not included in this paper style.
- There are 5 questions containing sub questions (A), (B).
- Question 1, 2, 3 and 4 carries 40 marks
- Question 5 carries 10 marks

BHAKTA KAVI NARSINH MEHTA UNIVERSITY, JUNAGADH

Theory Examination Paper Style NEP 2020

Time: 2 Hours

Total Marks: 50

Instructions: 1. Illustrate your answer with neat and labelled diagrams.

2. Figure to the right side indicates full marks of questions.

QUESTION-1: (From UNIT-1) (10 Marks)

(1)..... (05)

(2)..... (05)

OR

QUESTION-1: (From UNIT-1) (10 Marks)

(1)..... (05)

(2)..... (05)

QUESTION-2: (From UNIT-2) (10 Marks)

(1)..... (05)

(2)..... (05)

OR

QUESTION-2: (From UNIT-2) (10 Marks)

(1)..... (05)

(2)..... (05)

QUESTION-3: (From UNIT-3) (10 Marks)

(1)..... (05)

(2)..... (05)

OR

QUESTION-3: (From UNIT-3) (10 Marks)

(1)..... (05)

(2)..... (05)

QUESTION-4: (From UNIT-4) (10 Marks)

(1)..... (05)

(2)..... (05)

OR

QUESTION-4: (From UNIT-4) (10 Marks)

(1)..... (05)

(2)..... (05)

QUESTION-5: (From UNIT-1 and UNIT-2) (10 Marks)

(1)..... (05)

(2)..... (05)

OR

QUESTION-5: (From UNIT-3 and UNIT-4) (10 Marks)

(1)..... (05)

(2)..... (05)

Program Outcomes

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

PO 1: Knowledge:

1. 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.
2. 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.
3. 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.
4. Students will be able to understand adaptation, development and behavior of different forms of life.
5. The understanding of networked life on earth and tracing the energy pyramids through nutrient flow is expected from the students.
6. 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: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

PO 4: The Botanist and society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice

PO 5: Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for

sustainable development.

PO 6 Ethics: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

PO 7 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO 8: 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.

Course Outcomes of B.Sc. Botany

CO1. Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.

CO2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

CO3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.

CO4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.

CO5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.

CO6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.

CO7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations.

CO8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and from other forms of life.

CO9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.

CO10. Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, Flower development. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.

CO11. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.

CO12. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

DISCIPLINE SPECIFIC CORE COURSE:

SEM- II: MAJOR - 3/ MINOR - 2 BOTANY:

BIOMOLECULES SEM – II: MAJOR-4/ MDC-2

BOTANY: CELL BIOLOGY

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

- Develop understanding on chemical bonding among molecules.
- Identify the concept that explains chemical composition and structure of cell wall and membrane.
- Classify the enzymes and explain mechanism of action and structure.
- The eukaryotic cell cycle and mitotic and meiotic cell division
- Structure and organization of cell membrane and membrane models
- Describe the relationship between the structure and function of biomolecules.

SKILL ENHANCEMENT COURSE:

SEC- 2 BOTANY: NATURAL RESOURCE MANAGEMENT

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

- Understand the concept of different natural resources and their utilization.
- Critically analyze the sustainable utilization land, water, forest and energy resources.
- Evaluate the management strategies of different natural resources.
- Reflect upon the different national and international efforts in resource management and their conservation.

SEMESTER – II Major and Minor

Course outcomes (Theory):

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

- To help the students to gain knowledge on the activities in which the giant molecules and miniscule structures that inhabit the cellular world of life are engaged.
- This will provide inside into the organization of cell, its features and regulation at different levels.
- Through the study of biomolecules and cell organelles, they will be able to understand the various metabolic processes such as respiration, photosynthesis etc. which are important for life.

Course outcomes (Practical):

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

- To help the students to gain knowledge on the activities in which the giant molecules and miniscule structures that inhabit the cellular world of life are engaged.
- This will provide inside into the organization of cell, its features and regulation at different levels.
- Through the study of biomolecules and cell organelles, they will be able to understand the various metabolic processes such as respiration, photosynthesis etc. which are important for life.

BOTANY DISCIPLINE SPECIFIC CORE COURSE (Major)							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.SC. II	MAJOR - 3	Biomolecules	3 T	45	50 Marks	25 Marks

Core Paper III

BOTANY MAJOR PAPER – III BIOMOLECULES

UNIT – I CONCEPTUAL UNDERSTANDING

- I.1** Biomolecules and Bioenergetics: Types and significance of chemical bonds;
- I.2** Structure and properties of water;
- I.3** pH and buffers.
- I.4** Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions.

UNIT – II BIOMOLECULES – I

- II.1** Carbohydrates: Nomenclature, classification and function of Monosaccharides; Disaccharides, Oligosaccharides and polysaccharides.
- II.2** Proteins: Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, tertiary and quaternary; Isoelectric point; Protein denaturation and biological roles of proteins.

UNIT – III BIOMOLECULES – II

- III.1** Lipids: Definition and major classes of storage and structural lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties.
- III.2** Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.

UNIT – IV ENZYMES

- IV.1** Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group;
- IV.2** Classification of enzymes;
- IV.3** Features of active site, substrate specificity,
- IV.4** Mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation,
- IV.5** Enzyme inhibition and factors affecting enzyme activity.

Text Books:

- P. K. Gupta (2017). Biomolecules and Cell Biology, Rastogi Publication, Meerut.

Reference Books:

1. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
2. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition. W.H. Freeman and Company.

BOTANY DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	PRACTICAL		
				Credits	Lectures	External
Certificate Course	B.Sc. II	MAJOR – 3	Biomolecules	1 P	30	25 Marks

1. Preparation of solutions and plant juices to determine their pH using Universal indicator/pH meter.
2. Estimation of Free Fatty acids by titration method.
3. Bio-Molecules: Tests for detection of Carbohydrates: The following tests are to be performed to detect the nature of carbohydrates available in the supplied sample (Glucose, Fructose, Maltose & Sucrose).
 1. Molisch's test, 2. Benedict's test, 3. Barfoed's test,
 1. Seliwanoff's test, 5. Iodine test, 6. Cobalt chloride test.
4. Tests for detection of Lipids *i.e.*, Fats and Oils: Micro- chemical tests on sections of Plant materials- Sudan III stain, Solubility test.
5. Tests for detection of Proteins: Biuret test/Xanthoprotic test.

BOTANY DISCIPLINE SPECIFIC CORE COURSE (Major)							
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.SC. II	MAJOR - 4	Cell Biology	3 T	45	50 Marks	25 Marks

Core Paper IV

BOTANY MAJOR PAPER – IV CELL BIOLOGY

UNIT – I THE CELL

- I.1** Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).
- I.2** Cell theory
- I.3** Contribution of major scientists in cell biology.
- I.4** Cell division: Eukaryotic cell cycle, different stages of mitosis and meiosis. Cell cycle, Regulation of cell cycle.

UNIT – II CELL ORGANELLES – I

- II.1** Chemistry, structure and function of Plant Cell Wall.
- II.2** Overview of membrane function; fluid mosaic model; Chemical composition of membranes;
- II.3** Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

UNIT – III CELL ORGANELLES – II

- III.1** Structural organization and functions of mitochondria
- III.2** Structural organization and functions of chloroplast
- III.3** Semiautonomous nature of mitochondria and chloroplast.
- III.4** Endoplasmic Reticulum, Golgi Apparatus, Lysosomes,

UNIT – IV CELL ORGANELLES – III

- IV.1** Nucleus; Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.
- IV.2** Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Text Books:

- V. B. Rastogi (2016). Introductory Cytology, KedarNath & RamNath, Meerut

Reference Books:

1. K. Sahoo (2017) Biomolecules and Cell Biology, Kalynai Publishers, New Delhi.
2. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of theCell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

BOTANY DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	PRACTICAL		
				Credits	Lectures	External
Certificate Course	B.Sc. II	MAJOR - 4	Cell Biology	1 P	30	25 Marks

1. Akaryota - Bacteriophage, Prokaryota - Cyanophycean cell & Eukaryota - typical Animal & Plant cell.
2. To study the various types of cell organelles through micrographs / charts (As per theory syllabus).
3. Study of mitosis from onion root tip using squash method.
4. Study of different stages of meiosis (Chart/Permanent Slides).

Practical Paper Style for major- 03 (Biomolecules)

Time: 2:30 Hrs.

Marks: 25

Sr. No	Group A	Marks
1	Measure the pH of given sample. Write its nature and show it to examiner.	03
2	Perform the detection of organic molecules (Carbohydrates) in given solution. Write and show result to examiner.	06
3	Perform the detection of organic molecules (Lipid / Protein) in given solution. Write and show result to examiner.	06
4	(a) Viva voice	05
	(b) Certified journals	05

Practical Paper Style for major-04 (Cell Biology)

Time: 2:30 Hrs.

Marks: 25

Sr. No	Group B	Marks
1	Prepare a temporary mounting of mitosis/meiosis from given material. Show stage(s) of cell division and write the stage(s) with diagrams	06
2	Identify and describe as per given instructions. 1. Specimen A: Types of cells (Akaryotic/Prokaryotic/Eukaryotic) – chart/ Permanent slide. 2. Specimen B & C: Organelles (Mitochondria/Chloroplast/ER/Golgi body/Nucleus) – chart/ Permanent slide	09
3	a) Viva voice	05
	b) Certified journals	05

BOTANY DISCIPLINE SPECIFIC COURSE (MINOR)							
COURSE	SEMESTER	COURSE GROUP	COURE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.SC. II	MINOR - 2	Biomolecules	3 T	45	50 Marks	25 Marks

BOTANY MINOR PAPER – II BIOMOLECULES

UNIT – I CONCEPTUAL UNDERSTANDING

- I.1** Biomolecules and Bioenergetics: Types and significance of chemical bonds;
- I.2** Structure and properties of water;
- I.3** pH and buffers.
- I.4** Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions.

UNIT – II BIOMOLECULES – I

- II.1** Carbohydrates: Nomenclature, classification and function of Monosaccharides; Disaccharides, Oligosaccharides and polysaccharides.
- II.2** Proteins: Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, tertiary and quaternary; Isoelectric point; Protein denaturation and biological roles of proteins.

UNIT – III BIOMOLECULES – II

- III.1** Lipids: Definition and major classes of storage and structural lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties.
- III.2** Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.

UNIT – IV ENZYMES

- IV.1** Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group;
- IV.2** Classification of enzymes;
- IV.3** Features of active site, substrate specificity,
- IV.4** Mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation,
- IV.5** Enzyme inhibition and factors affecting enzyme activity.

Text Books:

- V. B. Rastogi (2016). Introductory Cytology, KedarNath & RamNath, Meerut

Reference Books:

1. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
2. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition. W.H. Freeman and Company.

BOTANY DISCIPLINE SPECIFIC COURSE MINOR						
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	PRACTICE		
				Credits	Lectures	Internal
Certificate Course	B.Sc. II	MINOR - 2	Biomolecules	1 P	30	25 Marks

(1) Preparation of solutions and plant juices to determine their pH using Universal indicator/pH meter.

(2) Estimation of Free Fatty acids by titration method.

(3) Bio-Molecules: Tests for detection of Carbohydrates: The following tests are to be performed to detect the nature of carbohydrates available in the supplied sample (Glucose, Fructose, Maltose & Sucrose).

1. Molisch's test, 2. Benedict's test, 3. Barfoed's test,
4. Seliwanoff's test, 5. Iodine test, 6. Cobalt chloride test.

(4) Tests for detection of Lipids *i.e.*, Fats and Oils: Micro- chemical tests on sections of Plant materials- Sudan III stain, Solubility test.

(5) Tests for detection of Proteins: Biuret test/Xanthoprotic test.

Practical Paper Style for Minor- 02

Time: 2:30 Hrs.

Marks: 25

Sr. No	Biomolecules	Marks
1	Measure the pH of given sample. Write its nature and show it to examiner.	03
2	Perform the detection of organic molecules (Carbohydrates) in given solution. Write and show result to examiner.	06
3	Perform the detection of organic molecules (Lipid / Protein) in given solution. Write and show result to examiner.	06
4	(a) Viva voice	05
	(b) Certified journals	05

BOTANY INTER/MULTIDISCIPLINARY COURSE							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.Sc. II	MDC - 2	CELL BIOLOGY	3 T	45	50 Marks	25 Marks

BOTANY MULTIDISCIPLINARY PAPER – IV CELL BIOLOGY

UNIT – I THE CELL

- I.1** Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).
- I.2** Cell theory
- I.3** Contribution of major scientists in cell biology.
- I.4** Cell division: Eukaryotic cell cycle, different stages of mitosis and meiosis. Cell cycle, Regulation of cell cycle.

UNIT – II CELL ORGANELLES – I

- II.1** Chemistry, structure and function of Plant Cell Wall.
- II.2** Overview of membrane function; fluid mosaic model; Chemical composition of membranes;
- II.3** Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

UNIT – III CELL ORGANELLES – II

- III.1** Structural organization and functions of mitochondria
- III.2** Structural organization and functions of chloroplast
- III.3** Semiautonomous nature of mitochondria and chloroplast.
- III.4** Endoplasmic Reticulum, Golgi Apparatus, Lysosomes,

UNIT – IV CELL ORGANELLES – III

- IV.1** Nucleus; Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.
- IV.2** Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

BOTANY INTER/MULTIDISCIPLINARY COURSE						
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	PRACTICLE		
				Credits	Lectures	Internal
Certificate Course	B.Sc. II	MDC - 2	Cell biology	1 P	30	25 Marks

- (1) Akaryota - Bacteriophage, Prokaryota - Cyanophycean cell & Eukaryota - typical Animal & Plant cell.
- (2) To study the various types of cell organelles through micrographs / charts (As per theory syllabus).
- (3) Study of mitosis from onion root tip using squash method.
- (4) Study of different stages of meiosis (Chart/Permanent Slides).

Practical Paper Style for Multidisciplinary - 02

Time: 2:30 Hrs.

Marks: 25

Sr. No	Cell Biology	Marks
1	Prepare a temporary mounting of mitosis/meiosis from given material. Show stage(s) of cell division and write the stage(s) with diagrams	06
2	1. Identify and describe as per given instructions. 2. Specimen A: Types of cells (Akaryotic/Prokaryotic/Eukaryotic) – chart/ Permanent slide. 3. Specimen B & C: Organelles (Mitochondria/Chloroplast/ER/Golgi body/Nucleus) – chart/ Permanent slide	09
3	a) Viva voice	05
	b) Certified journals	05