



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-૧નો 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. ૧૬.૧૦.૨૦૨૪નાં પરિપત્ર નં: ૧૩૮૯/૨૦૨૪માં બોટની અભ્યાસક્રમમાં ફેરફાર કરવામાં આવેલ છે.



[Signature]
18/6/2025

પ્રાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૨૮૩/૨૦૨૫

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

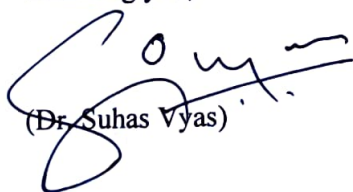
Sub: Submission of revised syllabus of Botany sem 1 to 4

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- I)

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. 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.

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 Honors 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 inter-disciplinary 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 Honors 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-1

SN	Category of Course	Title of the Course	Course Credit
1	Major – I (Discipline Specific Core Courses)	Major-1 (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 – II (Discipline Specific Core Courses)	Major-2 (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 - I (Discipline Specific minor Courses)	Minor-1 (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 other than Major discipline out of the above list)	4 (3+1)
4	MDC-1 (Multidisciplinary course)	MDC-1 (Theory) [1) Chemistry 2) Physics 3) Mathematics 4) Botany 5) Zoology 6) Microbiology 7) Biochemistry 8) Biotechnology]. Any paper from approved online platforms. (A Student has to select any one paper other than Major & minor subject out of the above list)	4 (3+1)
5	Ability Enhancement Course (AEC)	AECC-101: Foundation English (Sem I)	02
6	Skill Enhancement Course (SEC)/Internship	SEC-101 (Sem I) (All Board shall prepare Course Basket)	02
7	Value Added Course (VAC)	VAC-101: Indian Knowledge System (Sem I)	02
Total			22

CONCEPTUAL FRAMEWORK FOR SEMESTER-1

Sr. No.	Course Group	Course (Paper) Title	Credit	Teaching Hours/Week	Exam Hours	Marks		Total Marks
						Internal	External	
1	MAJOR – 1 THEORY	Microbiology	3	3	2	25	50	100
2	MAJOR – 1 PRACTICAL	Microbiology	1	2	2:30	25		
3	MAJOR – 2 THEORY	Phycology	3	3	2	25	50	100
4	MAJOR – 2 PRACTICAL	Phycology	1	2	2:30	25		
5	MINOR – 1 THEORY	Phycology	3	3	2	25	50	100
6	MINOR – 1 PRACTICAL	Phycology	1	2	2:30	25		
7	MULTIDISCIPLINARY - 1 THEORY	Microbiology	3	3	2	25	50	100
8	MULTIDISCIPLINARY - 1 PRACTICAL	Microbiology	1	2	2:30	25		
9	ABILITY ENHANCEMENT COURSES	AECC-101	2	-	-	25	25	50
10	SKILL ENHANCEMENT COURSES	Horticulture	2	2	1	25	25	50
11	A	VAC-101	2	-	-	25	25	50
	Total		22	22				550

Total Scheme of evaluation

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

BHAKTA KAVI NARSINH MEHTA UNIVERSITY, JUNAGADH
THEORY EXAMINATION

BOTANY

SEMESTER - 1

BOTANY MAJOR - 1: MICROBIOLOGY

BOTANY MAJOR - 2: PHYCOLOGY

BOTANY MINOR - 1: PHYCOLOGY

BOTANY MULTIDISCIPLINARY - 1: MICROBIOLOGY

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 MCQ 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

Theory Examination Paper Style NEP 2020

Time: 2 Hours

Total Marks: 50

EXTERNAL ASSESSMENT BY UNIVERSITY			50 Marks
Que. No.	Particulars	Unit	Marks
Que-1	Question (1) (2)	1	05 05
	OR		
	Question (1) (2)		05 05
Que-2	Question (1) (2)	2	05 05
	OR		
	Question (1) (2)		05 05
Que-3	Question (1) (2)	3	05 05
	OR		
	Question (1) (2)		05 05
Que-4	Question (1) (2)	4	05 05
	OR		
	Question (1) (2)		05 05
Que-5	Question (1) (2)	1 & 2	05 05
	OR		
	Question (1) (2)	3 & 4	05 05

Program Outcomes

The student graduating with the Degree B.Sc. (Honors) 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 equipment's 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.

MAJOR/MULTI DISCIPLINE SPECIFIC CORE COURSE:
SEM-I: MAJOR - 1 / MULTIDISCIPLINARY - 1 BOTANY:
MICROBIOLOGY

Programme specific Learning Outcomes:

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

- Examine the general characteristics of bacteria and their cell reproduction/recombination.
- Increase the awareness and appreciation of human friendly viruses, bacteria, algae and their economic importance.
- Develop understanding on the concept of microbial nutrition.
- Understand structure of viruses based on their characteristics.

MAJOR/MINOR DISCIPLINE SPECIFIC CORE COURSE:
SEM-I: MAJOR - 2 / MINOR - 1 BOTANY: PHYCOLOGY

Programme specific Learning Outcomes: On completion of the course, the students will be able to:

- Develop understanding of general characteristics of different class of algae.
- Examine the different species of algae according to syllabus.
- Conduct experiments using skills appropriate to subdivisions.

SKILL ENHANCEMENT COURSE:
SEM-I: SEC-1 BOTANY: HORTICULTURE

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

- Understand the different classifications of horticultural crops, nursery management, and use of technology in horticulture.
- Develop their competency on pre and post-harvest technology in horticultural crops.
- Analyze the different methods of weed control and harvest treatments of horticultural crops.
- Examine the economic implications of cultivation of tropical and sub-tropical vegetable crops.
- Evaluate the importance of floriculture and contribution of spices and condiments to the economy.

SEMESTER – I

MAJOR / MINOR / MULTIDISCIPLINARY COURSE OUTCOMES (THEORY):

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

- Develop understanding about the classification and diversity of different microbes including viruses & Algae and their economic importance.
- Develop conceptual skill about identifying microbes and algae.
- Gain knowledge about developing commercial enterprise of microbial products.
- Learn host –pathogen relationship and disease management.
- Learn Presentation skills (oral & writing) in Botany by usage of computer of computer & multimedia.
- Gain Knowledge about uses of microbes in various fields.
- Understand the structure and reproduction of certain selected bacteria and algae.
- Gain Knowledge about the economic values of this lower group of plant community.
- Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

Course outcomes (Practical):

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

- Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.
- Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.
- Practical skills in the field and laboratory experiments in Microbiology & Pathology.
- Learn to identify Algae.
- Can initiate his own Plant & Seed Diagnostic Clinic and Can start own enterprise on microbial products.

INFORCE FROM JUNE 2023

BOTANY DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.Sc. I	MAJOR-1	Microbiology	3 T	45	50 Marks	25 Marks

Core Paper I

BOTANY MAJOR PAPER – I MICROBIOLOGY

Unit – I VIRUSES – 1

- I.1** Introduction to microbial world, microbial nutrition, growth and metabolism.
- I.2** Discovery, General characteristics of virus.
- I.3** Classification (Baltimore), general account of viroids and prions.
- I . 4** Replication (general account), DNAAvirus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).

UNIT – II VIRUSES – 2

- II.1** Economic importance of viruses
 - II.1.1** vaccine production
 - II.1.2** Role of viruses in research (medicine and diagnostics)
- II.2** Diseases caused by viruses
 - II.2.1** Bunchy top of Banana
 - II.2.1** Leaf curl of papaya
 - II.2.1** Mild mosaic of potato

UNIT – III BACTERIA – I

- III.1** Discovery, general characteristics, types- archaeobacteria, eubacteria,
- III.2** Wall-less forms (mycoplasma and spheroplasts), cell structure.

III.3 Reproduction-vegetative, asexual

III.4 Recombination (conjugation, transformation and transduction).

UNIT – IV BACTERIA – II

I V. 1 Economic importance of Bacteria.

IV.2 **Cyanobacteria:** - General characteristics, cell structure. Morphology and life-cycle of Nostoc.

IV.3 Role of Cyanobacteria in nitrogen fixation.

IV. 4 Evolutionary significance of Prochloron.

Suggested Readings:

1. Campbell, N.A., Reece J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
2. Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw Hill International.

BOTANY DISCIPLINE SPECIFIC CORE COURSE						
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	PRACTICAL Group A		
				Credits	Lectures	Internal
Certificate Course	B.SC. - 1	MAJOR-1	Microbiology	1 P	30	25 Marks

1. To study virus using electron micrographs/ Models/charts: Structure of **TMV**.
2. To study virus using electron micrographs/ Models/ charts: Structure of **T₄**.
3. To study virus using electron micrographs/ Models/charts: Lytic cycle in **T₄** Phage.
4. To study virus using electron micrographs/ Models/charts: Lysogenic cycle in **λ** Phage
5. To study **Bacteria** using electron micrographs/ Models/charts: Types of Bacteria based on flagella.
6. To study cell structure of **Chlamydomonas** through chart/permanent slide.
7. To study the Life history of **Nostoc** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of - Thallus and Reproductive structure (Heterocyst).
8. To study plant diseases:
 - a. Bunchy top of Banana
 - b. Leaf curl of papaya
 - c. Mild mosaic of potato

BOTANY DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.Sc. I	MAJOR - 2	PHYCOLOGY	3 T	45	50 Marks	25 Marks

BOTANY MAJOR PAPER – II PHYCOLOGY

UNIT – I ALGAE

- I.1** General characteristics; Ecology and distribution;
- I.2** Range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; and methods of reproduction,
- I.3** Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups);

UNIT – II CHLOROPHYTA

- II.1** General characteristics
- II.2** Occurrence, range of thallus organization cell structure and reproduction with reference to Chlamydomonas, Volvox and Coleochaete.
- II.3** Life history of Oedogonium with reference to: Systematic position with reasons up to family Habit and Habitat, Vegetative structure and Reproduction.

UNIT – III CHAROPHYTA AND XANTHOPHYTA

- III.1 Charophyta:-** General characteristics; occurrence, morphology, cell structure and life-cycle of Chara; evolutionary significance.
- III.2 Xanthophyta:-** General characteristics; Occurrence, morphology and life-cycle of Vaucheria.

UNIT – IV PHAEOPHYTA AND RHODOPHYTA

IV.1 Phaeophyta:-Characteristics, occurrence, cell structure and reproduction.

Morphology and life-cycles of Ectocarpus.

IV.2 Rhodophyta:-General characteristics, occurrence, cell structure and reproduction. Morphology and life-cycle of Polysiphonia.

IV.3 Role of algae in the environment, agriculture, biotechnology and industry.

Text Books:

- Singh, Pandey and Jain (2017). Microbiology and Phycology, Rastogi Publication, Meerut.

Reference Books:

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
3. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
4. P. R. Vasista (2017) Botany for Degree student, Algae, S. Chand Publication, New Delhi.
5. B. K. Mishra (2018) Microbiology and Phycology, Kalynai Publishers, New Delhi.

BOTANY DISCIPLINE SPECIFIC CORE COURSE						
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	PRACTICAL Group B		
				Credits	Lectures	Internal
Certificate Course	B.SC. - 1	MAJOR-2	Phycology	1 P	30	25 Marks

- (1) To study cell structure of *Chlamydomonas* through chart/permanent slide.
- (2) To study the Life history of *Nostoc* through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of - Thallus and Reproductive structure (Heterocyst).
- (3) To study the Life history of *Volvox* through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (4) To study the Life history of *Oedogonium* through:
 - a. Mountings - Thallus and Reproductive structure.
- (5) Permanent Slides of – Thallus, Cap cell, sex organ - oogonium.
- (6) To study the Life history of *Ectocarpus* through:
 - a. Mountings - Thallus and Reproductive structure
 - b. Permanent - Slides of – Thallus, Unilocular and plurilocular sporangia.
- (7) To study the Life history of *Batrachospermum* through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (8) To study the Life history of *Chara* through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (9) To study the Life history of *Polysiphonia* through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.

Practical Paper Style for major- 1 (Microbiology)

Time: 2:30 Hrs.

Marks: 25

Sr. No	Group A	Marks
1	Identify and describe with labeled diagram using electron micrograph/models / chart (structure of TMV or T4 phase)	05
2	Identify and describe with labeled diagram using electron micrograph/models / chart (Replication of T4 or λ viruses)	05
3	Identify and describe with labeled diagram using electron micrograph/models / chart (types of bacteria based on flagella)	05
4	Spotting / Rotation Identify and describe Electron micrograph / model / chart – A and B (Chlamydomonas/Nostoc/Plant diseases)	06
5	Certified journals	04

Practical Paper Style for major- 2 (Phycology)

Time: 2:30 Hrs.

Marks: 25

Sr. No	Group B	Marks
1	Identified & Describe with Label Diagram using chart/specimen	05
2	Identified & describe the reproductive organ, including a diagram using chart / specimen	06
3	Spotting / Rotation Identify and describe with diagram Specimen /Permanente slide A, B and C (Volvox - Reproductive structure / Nostoc- heterocyst/ Chara - sex organ / Batrachospermum and polysiphonia - cystocarp)	09
4	Certified journals	05

INFORCE FROM JUNE 2023

BOTANY DISCIPLINE SPECIFIC COURSES (MINOR)							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.Sc. I	MINOR - 1	Phycology	3 T	45	50 Marks	25 Marks

BOTANY MINOR PAPER – I PHYCOLOGY

UNIT – I ALGAE

- I.1** General characteristics; Ecology and distribution;
- I.2** Range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; and methods of reproduction,
- I.3** Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups);

UNIT – II CHLOROPHYTA

- II.1** General characteristics
- II.2** Occurrence, range of thallus organization cell structure and reproduction with reference to Chlamydomonas, Volvox and Coleochaete.
- II.3** Life history of Oedogonium with reference to: Systematic position with reasons up to family Habit and Habitat, Vegetative structure and Reproduction.

UNIT – III CHAROPHYTA AND XANTHOPHYTA

- III.1** **Charophyta:** - General characteristics; occurrence, morphology, cell structure and life-cycle of Chara; evolutionary significance.
- III.2** **Xanthophyta:-** General characteristics; Occurrence, morphology and life- cycle of Vaucheria.

UNIT – IV PHAEOPHYTA AND RHODOPHYTA

IV.1 Phaeophyta: -Characteristics, occurrence, cell structure and reproduction.

Morphology and life-cycles of Ectocarpus.

IV.2 Rhodophyta: -General characteristics, occurrence, cell structure

and reproduction. Morphology and life-cycle of Polysiphonia.

IV.3 Role of algae in the environment, agriculture, biotechnology and industry.

Text Books:

- Singh, Pandey and Jain (2017). Microbiology and Phycology, Rastogi Publication, Meerut.

Reference Books:

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
3. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
4. P. R. Vasista (2017) Botany for Degree student, Algae, S. Chand Publication, New Delhi.
5. B. K. Mishra (2018) Microbiology and Phycology, Kalynai Publishers, New Delhi.

BOTANY DISCIPLINE SPECIFIC MINOR COURSE						
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	PRACTICAL		
				Credits	Lectures	Internal
Certificate Course	B.SC. - 1	MINOR – 1	Phycology	1 P	30	25 Marks

- (1) To study cell structure of ***Chlamydomonas*** through chart/permanent slide.
- (2) To study the Life history of ***Nostoc*** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of - Thallus and Reproductive structure (Heterocyst).
- (3) To study the Life history of ***Volvox*** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (4) To study the Life history of ***Oedogonium*** through:
 - a. Mountings - Thallus and Reproductive structure.
- (5) Permanent Slides of – Thallus, Cap cell, sex organ - oogonium.
- (6) To study the Life history of ***Ectocarpus*** through:
 - a. Mountings - Thallus and Reproductive structure
 - b. Permanent - Slides of – Thallus, Unilocular and plurilocular sporangia.
- (7) To study the Life history of ***Batrachospermum*** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (8) To study the Life history of ***Chara*** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.
- (9) To study the Life history of ***Polysiphonia*** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of – Thallus and cystocarp.

Practical Paper Style for Minor- 1

Time: 2:30 Hrs.

Marks: 25

Sr. No	Phycology	Marks
1	Identified & Describe with Label Diagram using chart/specimen	05
2	Identified & describe the reproductive organ, including a diagram using chart / specimen	06
3	Spotting / Rotation Identify and describe with diagram Specimen /Permanente slide A, B and C (Volvox - Reproductive structure / Nostoc- heterocyst/ Chara - sex organ / Batrachospermum and polysiphonia - cystocarp)	09
4	Certified journals	05

BOTANY INTER/MULTIDISCIPLINARY COURSE							
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	THEORY			
				Credits	Lectures	External	Internal
Certificate Course	B.Sc. I	MDC - 1	MICROBIOLOGY	3 T	45	50 Marks	25 Marks

BOTANY INTER/ MULTIDISCIPLINARY PAPER – I MICROBIOLOGY

Unit – I VIRUSES – 1

- I.1** Introduction to microbial world, microbial nutrition, growth and metabolism.
- I.2** Discovery, General characteristics of virus.
- I.3** Classification (Baltimore), general account of viroids and prions.
- I . 4** Replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).

UNIT – II VIRUSES – 2

- II.1** Economic importance of viruses
 - II.1.1** vaccine production
 - II.1.2** Role of viruses in research (medicine and diagnostics)
- II.2** Diseases caused by viruses
 - II.2.1** Bunchy top of Banana
 - II.2.1** Leaf curl of papaya
 - II.2.1** Mild mosaic of potato

UNIT – III BACTERIA - I

- III.1** Discovery, general characteristics, types- archaebacteria, eubacteria,
- III.2** Wall-less forms (mycoplasma and spheroplasts), cell structure.
- III.3** Reproduction-vegetative, asexual
- III.4** Recombination (conjugation, transformation and transduction).

UNIT – IV BACTERIA – I I

I V . 1 Economic importance of Bacteria.

IV.2 **Cyanobacteria:-** General characteristics, cell structure. Morphology and life-cycle of Nostoc.

IV.3 Role of Cynobacteria in nitrogen fixation.

IV. 4 Evolutionary significance of Prochloron.

Text Books:

- Singh, Pandey and Jain (2017). Microbiology and Phycology, Rastogi Publication, Meerut.

Reference Books:

1. Prescott, L.M., Harley J.P., Klein D. A. (2010). Microbiology, McGraw- Hill, India. 8th edition.
2. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
3. Pelczar et al. (2011) Microbiology, 8th edition, Tata McGraw-Hill Co, New Delhi.
4. Willey, Sherwood and Christopher. Laboratory exercises in Microbiology. McGraw-Hill, India. 9th edition.
5. B. K. Mishra (2018) Microbiology and Phycology, Kalynai Publishers, New Delhi.

BOTANY MULTIDISCIPLINE COURSE						
COURSE	SEMESTER	COURSE GROUP	COURSE TITLE	PRACTICAL		
				Credits	Lectures	Internal
Certificate Course	B.SC. 1	MDC - 1	Microbiology	1 P	30	25 Marks

1. To study virus using electron micrographs/ Models/charts: Structure of **TMV**.
2. To study virus using electron micrographs/ Models/ charts: Structure of **T₄**.
3. To study virus using electron micrographs/ Models/charts: Lytic cycle in **T₄** Phage.
4. To study virus using electron micrographs/ Models/charts: Lysogenic cycle in **λ** Phage
5. To study **Bacteria** using electron micrographs/ Models/charts: Types of Bacteria based on flagella.
6. To study cell structure of **Chlamydomonas** through chart/permanent slide.
7. To study the Life history of **Nostoc** through:
 - a. Mountings - Thallus and Reproductive structure.
 - b. Permanent Slides of - Thallus and Reproductive structure (Heterocyst).
8. To study plant diseases:
 - a. Bunchy top of Banana
 - b. Leaf curl of papaya
 - c. Mild mosaic of potato

Practical Paper Style for Multidisciplinary - 01

Time: 2:30 Hrs.

Marks: 25

Sr. No	Microbiology	Marks
1	Identify and describe with labeled diagram using electron micrograph/models / chart (structure of TMV or T₄ phase)	05
2	Identify and describe with labeled diagram using electron micrograph/models / chart (Replication of T₄ or λ viruses)	05
3	Identify and describe with labeled diagram using electron micrograph/models / chart (types of bacteria based on flagella)	05
4	Spotting / Rotation Identify and describe Electron micrograph / model / chart – A and B (Chlamydomonas/Nostoc/Plant diseases)	06
5	Certified journals	04