

Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
Empowered Autonomous Institution



**Structure and Curriculum of Four Year Multidisciplinary
Degree (Honors/Research) Programme with Multiple
Entry and Exit option**

Undergraduate Programme of Science & Technology
B.Sc. (Honors/Research) in Botany

Board of Studies
in
Botany
Rajarshi Shahu Mahavidyalaya, Latur
Empowered Autonomous Institution
(UG I Year)

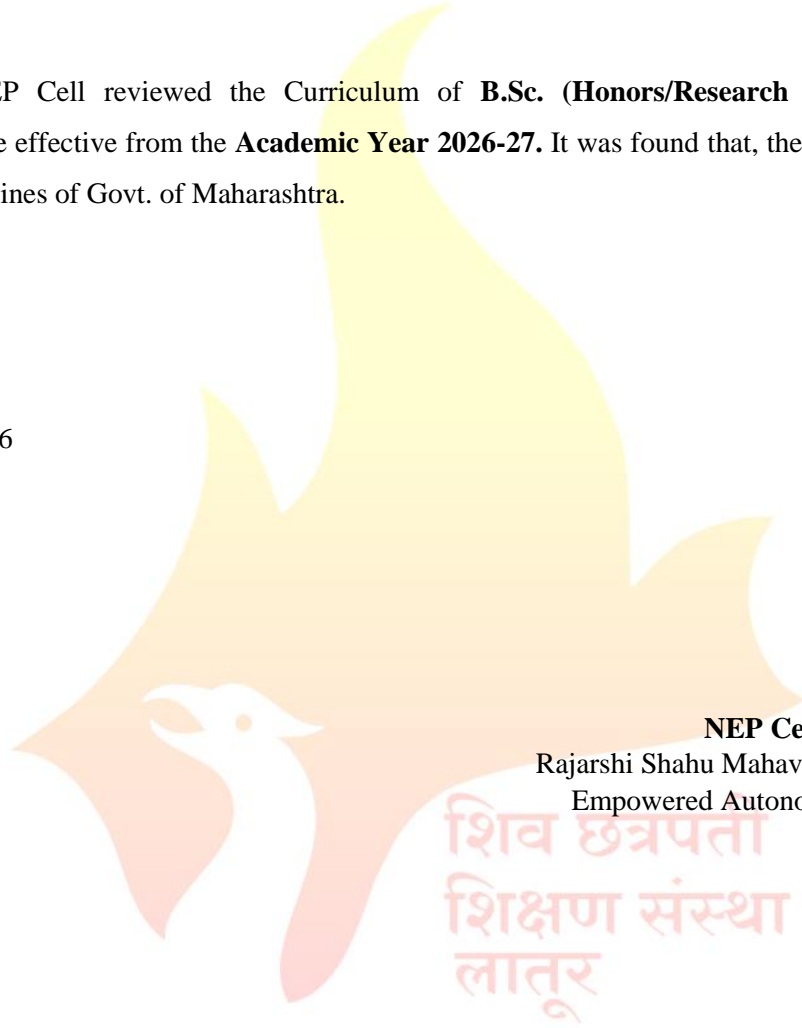
w.e.f. June, 2026
(In Accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc. (Honors/Research /Degree) in Botany** Programme to be effective from the **Academic Year 2026-27**. It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 15/04/2026

Place: Latur



NEP Cell

Rajarshi Shahu Mahavidyalaya, Latur
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CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors/Research) in Botany** Programme to be effective from the **Academic Year 2026-27**.

Date: 15/04/2026

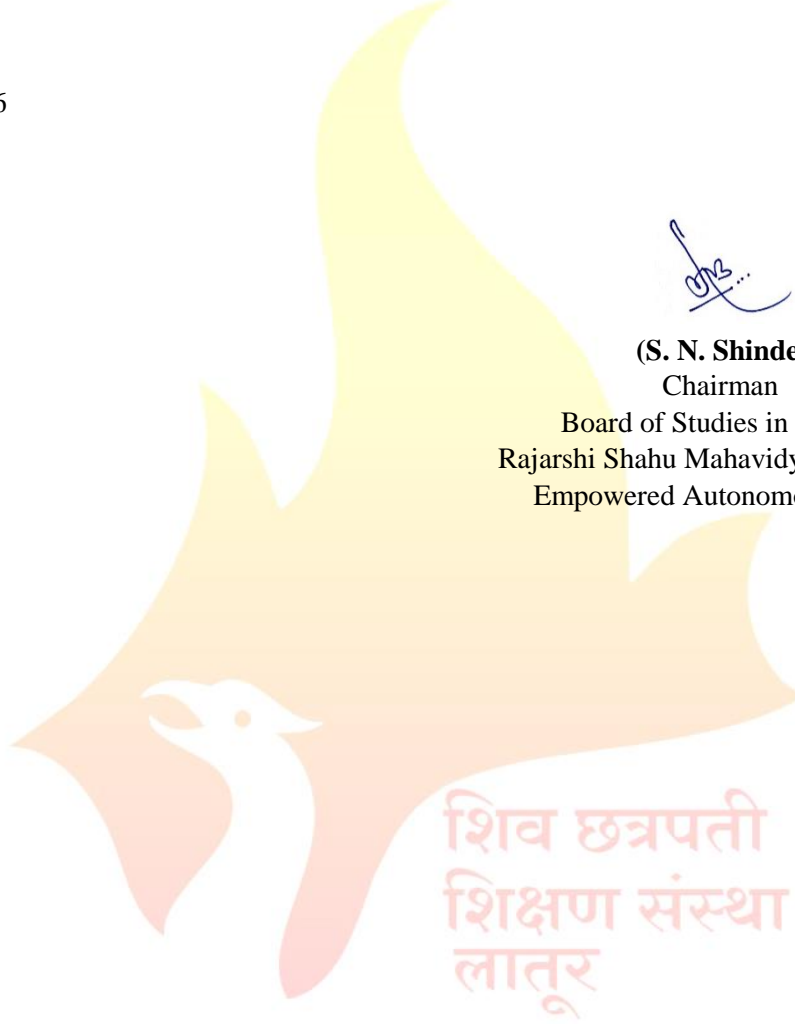
Place: Latur



(S. N. Shinde)

Chairman

Board of Studies in Botany
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Shiv Chhatrapati Shikshan Sanstha's

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Members of Board of Studies in the Subject Botany
Under the Faculty of Science and Technology

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2.	Dr. B. S. Survase, Director, School of Life Sciences, S. R. T. M. U. Nanded	Member	V.C. Nominee
3.	Prof. Dr. A. S. Dhabe, Head, Department of Botany, Dr. B. A.M. University, Chhatrapati Sambhajinagar	Member	Expert from outside for Special Course
4.	Prof. Dr. A. B. Ade, Head, Department of Botany, Savitribai Phule Pune University, Pune	Member	Academic Council Nominee
5.	Dr. C. S. Swami, Head, Department of Botany, Dayanand Science College, Latur	Member	College Alumni
6.	Dr. S.H. Nile, National Agri-Food Biotechnology Institute, Mohali, India	Member	Expert from outside for Special Course
7.	Dr. K. D. Savant, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department
8.	Shri. D. R. Awad, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department
9.	Ms. P. V. Kumbhar, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department
10.	Ms. P. S. Maskepatil, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department
11.	Ms. P. B. Gore, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department
12.	Ms. N. S. Kamble, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur	Member	Member from same Department

From the Desk of the Chairperson...

The Department of Botany is established in 1971. It is one of the leading departments in the field of teaching and student centric activities. After Autonomy, in keeping pace with the advances in various aspects of plant sciences, the department has introduced the courses like Molecular Biology, Cell Biology, Plant Biotechnology, Bioinformatics, Genetics, Instrumentation in Botany, Pharmacognosy, Gardening and Landscaping, Plant Breeding, Biostatistics, Forensic Botany etc. The Department has academic autonomy and has been revising its curriculum regularly. The department has successfully implemented the Choice Based Credit System (CBCS) for grading the students. The Curriculum of the B.Sc. and M.Sc. has been designed by considering NET, SET, GATE and others competitive examinations.

Institution's Motto, *Aroha Tamaso Jyoti* (The Journey from Dark to Light), the Mission, *Pursuit of Excellence*, the Vision, to evolve as a World Class Dynamic Center of Higher Education, and the Core Values have been frequently reflected in the present curriculum.

The Higher Education System in India and all over the world has undergone paradigm shift in both qualitative and quantitative aspects. Its best example is National Education Policy (NEP-2020). The National Education Policy 2020 emphasizes on developing overall personality of students by incorporating Humanitarian and Constitutional values, creativity and critical thinking, harnessing innovation, use of modern technology and interaction with various stakeholders. It recognizes that the pedagogy should evolve to make education more experiential, holistic, integrated, learner-centric, flexible and developing skill, etc. to shape the student that can face the challenges of the future, the new policy also envisages the refinement and improvement in the Learning Outcome based Curriculum Framework.

Botany is one of the most fundamental branches of Life Sciences. It is the broad subject encompassing classical and modern systemic aspects of plant diversity as well as contemporary subjects like Molecular Biology, Bioinformatics, Biotechnology, etc. to foster comprehensive understanding about various aspects of plant sciences. The present learning outcome based curriculum framework for B. Sc. (Honors/Research) in Botany is designed to provide a focused learning outcome based syllabus at the Honors level providing structured teaching-learning experiences catering to needs of the students. The honors course in Botany will prepare the students both academically and in terms of employability. This program also inculcates various attributes like Problem solving, Research skills, Critical thinking etc. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability.

As per the Institutional policy it is decided to upgrade the curriculum and syllabi of UG after every three year and PG after two years progressively. Accordingly, the curriculum and syllabi UG-I & PG-I upgraded and UG-IV newly designed keeping in mind the aspirations of the students, changing nature of the subject as well as the learning environment. Minor changes have been introduced in the syllabus of UG-II, UG-III and PG-II as per the need and the suggestions of the stakeholders. Courses of Botany have been designed to incorporate recent advancements, techniques to upgrade the skills of students. The new structure is expected to enhance the level of understanding among students and maintain the standard of Honors Degree in Botany across the country. The efforts have been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process. This framework offers flexibility and innovation in syllabi designing and in methods adopted for teaching-learning process and learning assessment.

The present structure comprises Discipline specific courses (DSC), Discipline Specific Electives (DSE), Discipline Specific Minor Course (DSM), Generic/Open Electives (GE/OE), Vocational Specific Course (VSC), Skill Enhancement Course (SEC), Major Mandatory Course (MMC). Major Elective Course (MEC) Research Methodology Course (RMC) etc. The discipline specific courses (DSC) and Major Mandatory Course (MMC) are compulsory and the elective courses can be chosen from the given Basket. Most of the courses comprise theory and practicals.

The project work is specially emphasized in this structure. The project will mainly involve experimental work. The students will be asked their choice for project. The Generic Electives will be offered to the students of other departments of the college. The students will have the option to choose one generic elective from the given Basket. The generic elective comprises theory as well as practical. The students will also undertake one Vocational Specific Course (VSC) and one Skill Enhancement Course (SEC) of two credits each. The VSC and SEC also comprise theory and practicals. These courses will be chosen by the students from the concerned basket.

One DSC- Ayurveda and Medicinal Botany is specified for Indian Knowledge Systems (IKS) which is a strong foundation in Indian Medicinal System Culture, Philosophy and Spirituality and have evolved through thousands of years. These knowledge systems are applicable in the modern world in several ways.

These courses offer skills to pursue research and teaching in the field of Botany and thus would produce best minds to meet the demands of society. This curriculum framework for B.Sc. (Honors) in Botany is developed keeping in view of the students centric learning Pedagogy, which is entirely outcome oriented. The curriculum framework focuses on the pragmatist approach whereby practical application of theoretical concepts is covered through Laboratory and Field works.

The new curriculum offers knowledge of wide areas in Botany including Diversity, Plant Systematics, Plant Biotechnology, Cell Biology, Genetics, Environmental Biology, Plant Physiology, Bioinformatics, and Medicinal Plants. Plant disease management etc. This new syllabus has been prepared keeping in view the unique requirement of B.Sc. (Honors) Botany students. The contents of the syllabi have been drawn to accommodate the widening horizons of the Botany discipline and reflect the changing needs of the students. The semester wise course distribution and detailed syllabus for each course is appended with a list of suggested references

The major objective of this curriculum is to elevate the subject knowledge of the students, making them critical thinkers and able to solve problems and issues related to Botany logically and efficiently.

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Rajarshi Shahu Mahavidyalaya
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(S. N. Shinde)
Chairman

Board of Studies in Botany
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Faculty of Science & Technology
Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Botany
Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT, FP, CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	2	3		4	5	6	7	8	9	10
I 4.5	I	DSC I: 04 Cr. DSC II: 04 Cr.	NA	NA	GE-I: 04 Cr.	VSC-I: 02 Cr. SEC-I: 02 Cr.	AEC-I MIL: 02 Cr. VEC-I: 02 Cr.	CC-I: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-I: 02 Cr. (SES-I)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	44 Cr. UG Certificate
	II	DSCIII: 04 Cr. DSC IV: 04 Cr. (IKS)	NA	NA	GE-II: 04 Cr.	VSC-II: 02 Cr. SEC-II: 02 Cr.	AEC- II MIL: 02 Cr. VEC- II: 02 Cr.	CC-II: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-II: 02 Cr. (SES-II)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	
	Cum. Cr.	16	-	-	08	04+04= 08	04+02 +02=0 8	04	44	

Exit Option: Award of UG Certificate in Major with 44 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor

Abbreviations:

1. DSC : Discipline Specific Core (Major)
2. DSE : Discipline Specific Elective (Major)
3. DSM : Discipline Specific Minor
4. GE/OE : Generic/Open Elective
5. VSEC : Vocational Skill and Skill Enhancement Course
6. VSC : Vocational Skill Courses
7. SEC : Skill Enhancement Course
8. AEC : Ability Enhancement Course
9. MIL : Modern Indian Languages
10. IKS : Indian Knowledge System
11. FSRCE : Fostering Social Responsibility & Community Engagement
12. VEC : Value Education Courses
13. OJT : On Job Training
14. FP : Field Projects
15. CEP : Community Engagement and Service
16. CC : Co-Curricular Courses
17. RP : Research Project/Dissertation
18. SES : Shahu Extension Services

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Faculty of Science & Technology

B.Sc. (Honors/Research) Botany

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.	
I 4.5	I	101BOT1101 (DSC-I)	Biodiversity of Cryptogams and Gymnosperms	03	45	
		101BOT1103	Lab Course – I	01	30	
		101BOT1102 (DSC-II)	Cell Biology and Molecular Biology	03	45	
		101BOT1104	Lab Course – II	01	30	
		GE-I	From Basket	04	60	
		101BOT1501 (VSC-I)	Nursery and Lawn Management	01+01	45	
		(SEC-I)	From Basket	02	30	
		(AEC-I)	From Basket	02	30	
		(VEC-I)	Constitution of India	02	30	
		AIPC/OJT-I	Mini Project - I	02	60	
	Total Credits				22	
	II	101BOT2101 (DSC-III)	Fundamentals of Genetics	03	45	
		101BOT2103	Lab Course – III	01	30	
		101BOT2102 (DSC-IV)	Histology, Anatomy and Embryology of Angiosperms	03	45	
		101BOT2104	Lab Course – IV	01	30	
		GE-II	From Basket	04	60	
		101BOT2501 (VSC-II)	Organic Farming	01+01	45	
		(SEC-II)	From Basket	02	30	
		(AEC-II)	From Basket	02	30	
		(VEC-II)	FSRCE (CBPR)	02	30	
		AIPC/OJT-II	Mini Project – II (IKS)	02	60	
	Total Credits				22	
Total Credits (Semester I & II)				44		



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Faculty of Science & Technology

Department of Botany

Programme Outcomes (POs) for B.Sc. Botany	
PO 1	Disciplinary Knowledge Students will acquire comprehensive knowledge of plant sciences, including taxonomy, physiology, genetics, ecology, microbiology, and biotechnology, forming a strong academic foundation.
PO 2	Scientific Temper and Research Skills Students will develop scientific thinking, research aptitude, and the ability to design experiments, analyze data, and interpret results using appropriate methodologies.
PO 3	Practical and Technical Skills Students will demonstrate proficiency in laboratory and field techniques such as microscopy, plant identification, tissue culture, and use of scientific instruments.
PO 4	Critical Thinking and Problem Solving Students will apply logical reasoning and analytical skills to identify, evaluate, and solve problems related to plant sciences and environmental challenges.
PO 5	Communication Skills Students will communicate scientific knowledge effectively through oral presentations, reports, and scientific writing using appropriate terminology.
PO 6	Digital and Data Literacy Students will utilize modern tools, software, and statistical techniques for data analysis, documentation, and presentation in biological sciences.
PO 7	Environment and Sustainability Awareness Students will understand ecological principles, biodiversity conservation, and sustainable use of plant resources to address environmental issues.
PO 8	Ethics and Social Responsibility Students will adhere to ethical principles in scientific practices and demonstrate responsibility towards society, environment, and biodiversity conservation.
PO 9	Entrepreneurship and Innovation Students will explore entrepreneurial opportunities in plant-based industries such as agriculture, horticulture, and biotechnology, fostering innovation and self-employment.
PO 10	Lifelong Learning and Professional Development Students will develop self-directed learning abilities, adaptability, and professional competence to pursue higher education and careers in diverse fields.



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Empowered Autonomous Institution

Department of Botany

Programme Specific Outcomes (PSOs) for B.Sc. Botany (Honors/Research)	
PSO No.	Programme Specific Outcomes (PSOs)
PSO 1	Academic Competence Students will acquire comprehensive knowledge of fundamental and advanced concepts in Botany, including plant diversity, physiology, genetics, ecology, and biotechnology. They will develop a strong theoretical foundation along with practical skills to understand plant structure, function, and interactions, enabling them to pursue higher studies and professional careers in plant sciences and related fields.
PSO 2	Scientific Research Competence Students will develop the ability to design and conduct basic scientific investigations in plant sciences, formulate hypotheses, collect and analyze data, and interpret results using appropriate tools and techniques. They will gain exposure to research methodologies, scientific writing, and critical evaluation of literature, enabling them to contribute to research and innovation in botany and allied fields.
PSO 3	Practical Skills Students will acquire hands-on experience in laboratory and field techniques such as microscopy, plant identification, tissue culture, physiological experiments, and data analysis. They will demonstrate proficiency in the use of scientific instruments, sample collection, preservation, and documentation, ensuring accuracy, safety, and reliability in experimental work.
PSO 4	Critical Thinking & Problem Analysis: Students will develop the ability to critically analyze biological problems related to plant sciences, interpret experimental data, and apply scientific reasoning to propose logical and sustainable solutions. They will be able to evaluate ecological, agricultural, and biotechnological issues using evidence-based approaches and demonstrate problem-solving skills in real-life situations.
PSO 5	Personal and Professional Competence Students will develop effective communication, teamwork, and leadership skills along with problem-solving and decision-making abilities. They will cultivate lifelong learning habits, adaptability, and professionalism required for careers in education, research, industry, and environmental management.
PSO 6	Ethical Entrepreneurship Students will understand the principles of ethics, sustainability, and environmental responsibility in the application of plant sciences. They will be encouraged to explore entrepreneurial opportunities in areas such as plant nurseries, herbal products, agriculture, and biotechnology, while adhering to ethical practices and contributing to socio-economic development.

Mapping of POs with PSOs:

Scale:

1 = Low 2 = Moderate 3 = High

PO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1: Advanced Disciplinary Knowledge	3	2	2	1	1	2
PO2: Research Competence & Scientific Inquiry	2	3	2	2	1	1
PO3: Experimental & Technical Expertise	2	2	3	2	1	1
PO4: Critical Thinking & Analytical Skills	1	2	2	3	2	2
PO5: Scientific Communication	1	2	1	2	3	1
PO6: Digital & Computational Skills	1	2	3	2	2	1
PO7: Environmental & Sustainability Awareness	2	2	1	2	2	3
PO8: Ethical Values & Professional Integrity	1	1	1	2	2	3
PO9: Entrepreneurship & Innovation	1	1	1	2	2	3
PO10: Leadership & Lifelong Learning	2	2	1	2	3	2



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Semester - I

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Faculty of Science and Technology

Department of Botany

UG I Sem I

Course Type: DSC-I

Course Title: Biodiversity of Cryptogams and Gymnosperms

Course Code: 101BOT1101

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To understand the Origin, evolution, and genetic diversity of microbial life.
- LO 2. To analyse the linkage between microbial diversity.
- LO 3. To become familiar with Cryptogams.
- LO 4. To evaluate different types of spore in Pteridophytes.
- LO 5. To aware about the importance of Cryptogams and Gymnosperms.

Course Outcomes:

After completion of course, the student will be able to-

- CO 1. Identify microorganisms and their role in various environments.
- CO 2. Distinguish between reproductive stages of cryptogams.
- CO 3. Examine the morphology and life cycles of certain genera of Cryptogams and Gymnosperms.
- CO 4. Analyze the economic importance of Cryptogams and Gymnosperms.

Unit No.	Title of Unit & Contents	Hrs.
I	Bacteria and Viruses	12
	A) Bacteria: <ol style="list-style-type: none">1. Introduction2. General characters.3. Size, Shape and Ultra structure.4. Mode of Nutrition5. Reproduction:<ol style="list-style-type: none">i. Asexualii. Sexual (Genetic Recombination):<ol style="list-style-type: none">a. Conjugationb. Transformationc. Transduction6. Economic importance. B) Viruses: <ol style="list-style-type: none">1. Introduction2. General characters.3. Classification4. Viroids and Prions5. Transmission of plant viruses6. Ultra-structure of TMV.7. Economic importance.	
	Unit Outcomes: <ol style="list-style-type: none">UO 1. Classify microorganisms on the basis of host.UO 2. Identify microorganisms and their role in various environments.	

Unit No.	Title of Unit & Contents	Hrs.
II	Fungi	10
	<ol style="list-style-type: none"> 1. Introduction 2. General characters 3. Classification (Alexopolous and Mims, 1979). 4. Different forms of asexual reproduction in fungi. 5. Study of life cycle of <i>Agaricus</i> (Developmental stages not expected) 6. Study of life cycle of <i>Aspergillus</i> (Developmental stages not expected) 7. Economic importance. 8. Mycorrhiza: <ol style="list-style-type: none"> i General characters ii Types iii Economic importance 9. Lichens: <ol style="list-style-type: none"> i General characters ii Types iii Economic importance. 	
	<p>Unit Outcome: UO 1. Correlate the economic importance of Fungi, Mycorrhiza and Lichens.</p>	
III	Algae and Bryophytes	10
	<p>A) Algae:</p> <ol style="list-style-type: none"> 1. Introduction 2. General characters. 3. Classification (F.E. Fritsch, 1935) 4. Pigmentation and Store food material 5. Thallus organization 6. Study of life cycle (Developmental stages not expected): <ol style="list-style-type: none"> i) <i>Nostoc</i> ii) <i>Chara</i> 7. Economic importance <p>B) Bryophytes:</p> <ol style="list-style-type: none"> 1. Introduction 2. General characters 3. Classification (N.S. Parihar) 4. Asexual Reproduction 5. Study of life cycle (Developmental stages not expected): <ol style="list-style-type: none"> i) <i>Riccia</i> ii) <i>Funaria</i> 6. Economic importance 	
	<p>Unit Outcome: UO 1. Acquire practical skills to identify, classify and distinguish microbes and nonvascular cryptogams and their importance.</p>	
IV	Pteridophytes and Gymnosperms	13
	<p>A) Pteridophytes:</p> <ol style="list-style-type: none"> 1. Introduction 2. General characters. 3. Classification (N.S. Parihar) 4. Stellar Evolution 5. Study of life cycle (Developmental stages not expected) <ol style="list-style-type: none"> i <i>Lycopodium</i> ii <i>Nephrolepis</i>(Fern) 6. Economic importance 	

Unit No.	Title of Unit & Contents	Hrs.
	B) Gymnosperms: 1. Introduction 2. General characters 3. Classification (Arnold, 1948) 4. Morphology of vegetative and reproductive structures and life cycle of (Developmental stages are not expected) <ul style="list-style-type: none"> i <i>Cycas</i> ii <i>Pinus</i> 5. Economic importance.	
	Unit Outcome: UO 1. Examine the morphology and life-cycles of certain genera of algae, fungi and bryophytes, Pteridophytes and Gymnosperms.	

Learning Resources:

1. An introduction to Paleobotany- Arnold, C.A - McGraw Hill Book Company Inc. 1972
2. An Introduction to Pteridophyta- Parihar, N.S. - Central Book Depot, 1962
3. An introduction to Pteridophytes. - Rashid, A. (1978) Vikas Publishing House (P) Ltd., 1999
4. Biology and Morphology of Pteridophytes- Parihar N.S. Central Book Depot, Allahabad.1996
5. Botany for Degree Students – Pteridophytes- Vashishta, B.R. S. Chand Publishing, 2006
6. Comparative morphology of vascular plants- Eames, A. J. and E. M. Giffard- Madroño; a West American Journal of Botany (1960)
7. Gymnosperms- Vashishta P.C., A.R. Sinha, Anil Kumar, S.Chand-Publishing House-2006
8. Indian Fossil Pteridophytes- Surange, K.R. - Alexander Doweld, 1966
9. Morphology of Gymnosperms- J.M. & Chamberlain C.J. Central Book Depot, Allahabad. 1978
10. Morphology of Pteridophytes- Sporne, K.R., Hutchinson University Library, 1962
11. Morphology of Vascular plants- Bierhorst, D.W. MacMillan Co.; First Edition (January 1, 1971)
12. Principles of Paleobotany- Darroh, W.C. -Chronica Botanica Company, 1939
13. Pteridophytes and Gymnosperms-K.U.Kramer, P.S.Green, Springer Verlag, New York 2003
14. Pteridophytes- Vashishta P.C, S. Chand- Publishing House-2006
15. The Gymnosperms (Fossils& Living)- Kakkar, R. K. and Kakkar, B.R. Central Publishing House, Allahabad. 1995
16. The Gymnosperms- Biswas, C & Johri, B.N., Narosa Publishing House, New Delhi. Coulter. 2004
17. The Phylogeny and Classification of ferns Jermy- A. G. - Academic Press Inc. (1 December 1973)
18. <https://cbaj.in/index.php/index>
19. <https://www.mygreatlearning.com/blog/what-is-artificialintelligence/#WhatisArtificialIntelligence>
20. <https://i0.wp.com/innspub.net/wp-content/uploads/2022/05/JBES-2021-V19.webp?resize=224%2C300&ssl=1>

Internal Examination Pattern: Continuous Assessment Test (CAT):

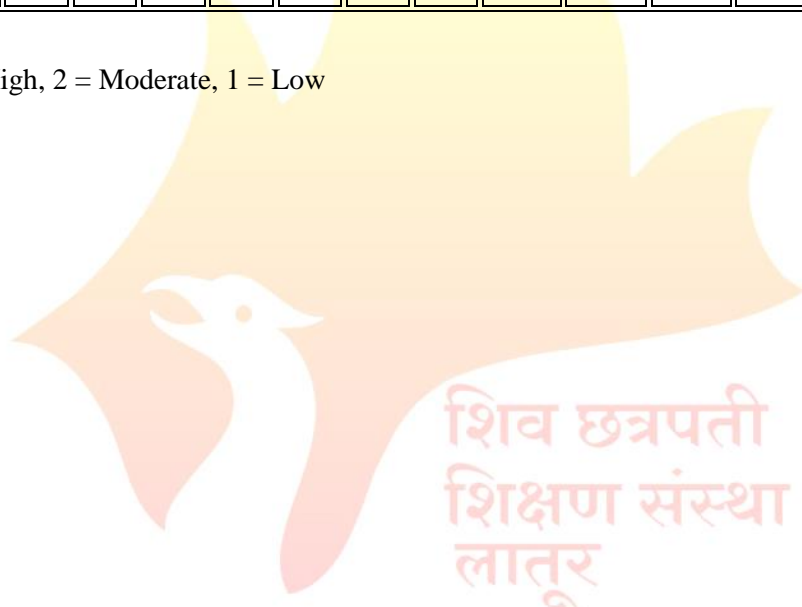
CAT-I: Book Reading/ Preparation of Herbaria/ Collection of Specimens

CAT-II: Open book test/ Surprise test / Descriptive test

❖ **Mapping of Cos with POs & PSOs:** DSC-I: Biodiversity of Cryptogams and Gymnosperms

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	1	2	2	2	1	2	3	2	3	2	1	2
CO2	3	2	2	3	1	1	1	2	1	2	3	2	2	3	1	1
CO3	3	2	3	2	2	2	2	2	1	2	3	2	3	2	2	1
CO4	3	2	2	3	2	2	3	3	2	3	3	3	2	3	2	3

Scale: 3 = High, 2 = Moderate, 1 = Low



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लातूर

॥ आरोह तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science and Technology

Department of Botany

UG I Sem I

Course Type: Lab Course

Course Title: Lab Course –I (Based on DSC-I)

Course Code: 101BOT1103

Credit: 01

Max. Marks: 50

Hours: 30

Learning Objectives

- LO 1. To classify the different microbes.
- LO 2. To compare the different types of plant groups.
- LO 3. To understand that the role of bryophytes and lichens in pollution indicators.
- LO 4. To describe the medicinal role of Fungi, lichens, Algae, etc.
- LO 5. To illustrate internal structure of thallus/stem of cryptogams and Gymnosperms.

Course outcomes:

After completion of course, the student will be able to-

- CO 1. Classify the different microbes.
- CO 2. Categorize the different types of algae, bryophytes, Pteridophytes, Gymnosperms etc.
- CO 3. Explain the diversity of Microbes, Cryptogams and Gymnosperms.
- CO 4. Analyse the distinguishing characters of Microbes, Cryptogams and Gymnosperms

Sr. No.	Practicals
1	Study compound Microscope
2	Study forms of Bacteria.
3	Study external features and classification of <i>Agaricus</i> .
4	Study external features and classification of <i>Aspergillus</i> .
5	Study types of Lichens (Crustose, Foliose and Fructicose)
6	Study external features and classification of <i>Nostoc</i> .
7	Study external features and classification of <i>Chara</i> .
8	Study external, internal features and classification of <i>Riccia</i> .
9	Study external, internal features and classification of <i>Funaria</i> .
10	Study external, internal features and classification of <i>Lycopodium</i> .
11	Study external, internal features and classification of <i>Nephrolepis</i> .
12	Study external, internal, reproductive features and classification of <i>Cycas</i> .
13	Study external, internal, reproductive features and classification of <i>Pinus</i> .
14	Botanical excursions (one short, one long excursion and visit to Research laboratory, Field etc. is compulsory)

N.B.: Any Ten Practical from the above list.

Learning Resources:

1. A text book of Practical Botany-I, Bendre and Kumar, Rastogi Publication, 2019
2. A text book of Practical Botany-I, S. N. Pandey and B. P. Pandey, S.Chand Publication 2019
3. A text book of Practical Botany-II, Bendre and Kumar, Rastogi Publication, 2019
4. A text book of Practical Botany-II, S. N. Pandey and B. P. Pandey, S. Chand Publication 2019

Mapping of Cos with POs & PSOs: Course: Lab Course – I

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	1	2	1	2	1	2	2	2	3	2	1	1
CO2	3	2	3	2	1	2	2	2	1	2	3	2	3	2	1	1
CO3	3	2	2	2	2	2	2	2	1	2	3	2	2	2	2	1
CO4	3	2	3	3	2	2	2	2	1	3	3	3	3	3	2	1

Scale: 3 = High, 2 = Moderate, 1 = Low



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Faculty of Science and Technology

Department of Botany

UG I Sem I

Course Type: DSC-II

Course Title: Cell and Molecular Biology

Course Code: 101BOT1102

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives

- LO 1. To differentiate cell and cell organelles.
- LO 2. To understand the biomolecules.
- LO 3. To identify the different stages of cell division.
- LO 4. To describe the process of central dogma.
- LO 5. To evaluate the abnormalities of chromosomes.

Course outcomes

After completion of course, the student will be able to-

- CO 1. Identify organism using karyotype and ideograms.
- CO 2. Describe the structure and functions of cell organelles.
- CO 3. Explain the process of cell division and differentiate different stages of mitosis and meiosis.
- CO 4. Analyze the structure, components, organization, and functions of a typical chromosome.

Unit No.	Title of Unit & Contents	Hrs.
I	Cell Biology	13
	<ol style="list-style-type: none">1. Introduction2. Ultra-structure of Prokaryotic cell3. Ultra-structure of Eukaryotic cell4. Structure and functions of Cell wall5. Structure and functions of Plasma membrane6. Structure and functions of cell organelles:<ol style="list-style-type: none">i Nucleusii Golgi apparatusiii Endoplasmic reticulumiv Ribosomev Lysosome	

Unit No.	Title of Unit & Contents	Hrs.
	vi Mitochondria vii Chloroplast 7. Structure of Flagella.	
	Unit Outcomes: UO 1. Identify and differentiate various cell organelles. UO 2. Evaluate the functions of different cell organelles.	
II	Chromosome	10
	1. Introduction and Organization of Chromosome (Nucleosome Solenoid Model). 2. Morphology, chemical composition, structure and function of typical chromosome 3. Types of chromosome. 4. Giant chromosomes: i. Polytene ii. Lambrush 5. Chromosomal Aberrations i. Structural: a) Deletion b) Duplication c) Inversion d) Traslocation ii. Numerical: - A.) Aneuploidy: a) Monosomy b) Trisomy c) Tetrasomy d) Nullisomy B.) Euploidy: a) Monoploidy b) Diploid c) Polyploidy	
	Unit Outcomes: UO 1. Examine Morphology, chemical composition, structure and function of typical chromosome. UO 2. Describe the Chromosomal aberrations.	
III	Cell Division	10
	1. Introduction 2. Cell Cycle: Inter phase G ₁ - S - G ₂ -M phase and G ₀ phase 3. Mitosis: Different phases and significance 4. Meiosis: Different phases, (Synaptonemal complex and Crossing over) and significance. 5. Difference between Mitosis and Meiosis 6. Cell senescence and Cell death (Apoptosis): i. Programmed cell death ii. Mechanism of cell death iii. Significance	
	Unit Outcomes:	

Unit No.	Title of Unit & Contents	Hrs.
	UO 1. Justify between mitosis and meiosis. UO 2. Explain the process of cell division.	
IV	Molecular Biology	12
	1. Introduction 2. Structure of DNA (Watson and Crick's model) 3. Types of DNA 4. Replication of DNA (Semi-conservative) 5. Structure, function and types of Non genetic RNA (r-RNA, t-RNA, m-RNA) 6. Genetic code: Properties and importance (Wobble Hypothesis) 7. Protein synthesis: Prokaryotes & Eukaryotes	
	Unit Outcome: UO 1. Correlate the structural aspect of DNA and RNA	

Learning Resources:

- Biochemistry and Molecular Biology of Plants- Buchanan, Grissem and Jones, American Soc. Plant Biologists, Waldorf 2000
- Cell and Molecular Biology (VIII)- De Robertis and De Robertis –B.I. Waverly Pvt. Ltd., New Delhi 1997
- Cell and Molecular Biology- De Robertis and De Robertis, 8 edition, Info-Med, Hongkong. 1988
- Cell and Molecular Biology- E.J. Dupraw –Academic Press, London 1970
- Cell and Molecular Biology: Concepts & Experiments- Karp, G. John Wiley and Sons, Inc., USA. 1999.
- Cell Biology- C. B. Powar –: Himalaya Publishing House 1992.
- Cell Biology- Johnson Lewys, Sarup and sons, New Delhi 2004
- Cytogenetics - C. P. Swanson, T. Merz, and W.J. Young –; Prentice – Hall of India Pvt. Ltd., New Delhi India 1982
- Molecular biology of the cell (4th Ed.) - Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P., New York: Garland Science 2002
- Molecular Cell Biology- Lodish S, Baltimore B, Berk, C and Lawrence K, ,3rd editions, Scientific American Books, N.Y. 1995
- The Cell: Molecular Approach- Lewin, B. GENE VII. Oxford University Press, New York, USA
Cooper G M and Hausman R E, 4thEdn, Sinauer Associates, USA. 2007
- <https://onlinelibrary.wiley.com/journal/15824934>
- https://juniperpublishers.com/ijcsmb/images/fraction-slider/IJCSMB_.jpg
- <https://www.sciencedirect.com/journal/journal-of-molecular-biology>
- <https://www.springer.com/journal/18/>
- <https://www.mdpi.com/journal/cimb>
- <https://www.peerreviewcentral.com/ads/image/AJBGMB.png>.

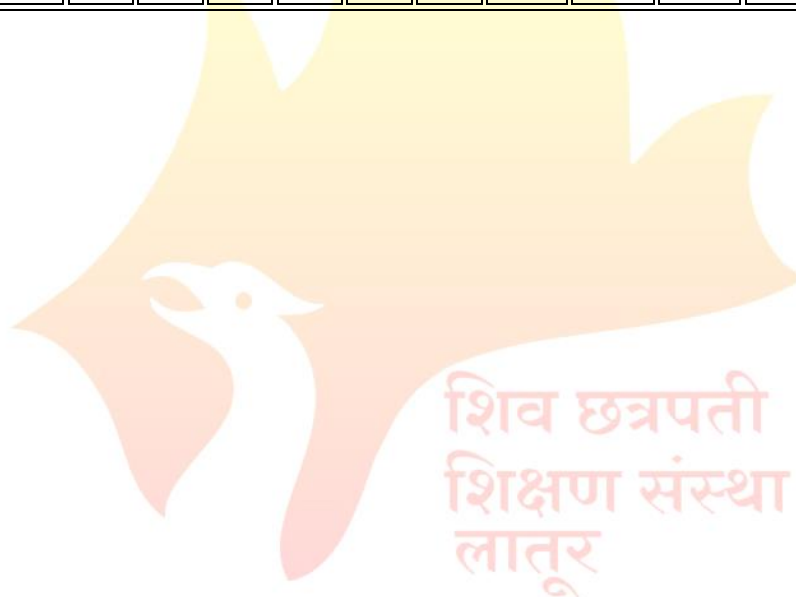
Internal Examination Pattern: Continuous Assessment Test (CAT):

CAT-I: Book Reading/ Woolen Model

CAT-II: Open book test/ Descriptive test

Mapping of Cos with POs & PSOs: Course: Cell and Molecular Biology

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	1	3	1	2	1	2	3	2	2	2	1	1
CO2	3	2	2	2	2	2	1	2	1	2	3	2	2	2	2	1
CO3	3	2	3	2	2	2	1	2	1	2	3	2	3	2	2	1
CO4	3	3	2	3	2	3	1	2	1	3	3	3	2	3	2	1



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Faculty of Science and Technology

Department of Botany

UG I Sem I

Course Type: Lab Course

Course Title: Lab Course –II (Based on DSC-II)

Course Code: 101BOT1104

Credit: 01

Max. Marks: 50

Hours: 30

Learning Objectives:

- LO 1. To differentiate the cell and cell organelles.
- LO 2. To determine the mega-biomolecules.
- LO 3. To identify the different stages of cell division.
- LO 4. To analyse the different types of Chromosome.

Course outcomes:

After completion of course, the student will be able to-

- CO 1. Identify the different Cell organelles.
- CO 2. Evaluate the different stages of cell division.
- CO 3. Analyze a karyotype to develop an accurate ideogram.
- CO 4. Correlate the prokaryotic and eukaryotic cell.

Sr. No.	Practicals
1	Study of Prokaryotic cell
2	Study of Eukaryotic cell
3	Study of cell organelles with the help of photocopies / slides
4	Study of structure and function of typical chromosome
5	Study of Giant chromosomes: i. Polytene ii. Lampbrush
6-7	Study of mitosis (Onion/Garlic Root tips)
8	Study of Mitotic index (Onion/Garlic Root tips)
9-10	Study of Meiosis from onion floral buds or any other available material.
11-12	Study of karyotype and ideogram from photocopies of Onion / Aloe plant
13	Estimation of plant DNA
14	Botanical excursions (one short, one long excursion and visit to Research laboratory, Field etc. is compulsory)

N.B.: Any Ten Practical from above.

Learning Resources:

1. A text book of Practical Botany-I, Bendre and Kumar, Rastogi Publication, 2019
2. A text book of Practical Botany-I, S. N. Pandey and B. P. Pandey, S. Chand Publication, 1980
3. A text book of Practical Botany-II, Bendre and Kumar, Rastogi Publication, 2019
4. A text book of Practical Botany-II, S. N. Pandey and B. P. Pandey, S. Chand Publication, 1999
5. Cell and Molecular biology: A lab Manual, K.V. Chaitanya, 2013
6. Cell biology and Cytogenetics lab and physiological Hematological Lab –I, Sudha Garg, A Pragati prakashan, 2023
7. Practical manual on cytology and Cytogenetics, Dr. B. Ramesh, 2015

Mapping of Cos with POs & PSOs: Lab Course- II

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	1	2	1	2	1	2	2	2	3	2	1	1
CO2	2	3	3	3	1	2	1	2	1	2	2	3	3	3	1	1
CO3	3	2	3	2	2	3	1	2	1	2	3	2	3	2	2	1
CO4	3	2	2	3	2	2	1	2	1	2	3	2	2	3	2	1

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Faculty of Science and Technology

Department of Botany

UG I Sem I

Course Type: VSC-I

Course Title: Nursery, Lawn Management and Entrepreneurship Development

Course Code: 101BOT1501

Credits: 02

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO 1. To demonstrate the techniques in Nursery.
- LO 2. To understand the techniques of Lawn management.
- LO 3. To construct a polyhouse using appropriate materials and techniques.
- LO 4. Apply and analyze methods for the protection of ornamental plants.

Course Outcomes:

After completion of course, the student will be able to-

- CO 1. Describe the techniques of Nursery.
- CO 2. Explain the techniques of Lawn management.
- CO 3. Create the techniques of floral decoration and polyhouse.
- CO 4. Compare the methods of Lawn development and farmhouse management.

Unit No.	Title of Unit & Contents	Hrs.
I	Nursery Management	04
	<ol style="list-style-type: none">1. Introduction to Nursery.2. Tools of Nursery.3. Plant protectants in Nursery.4. Nutrient deficiency in Nursery plants.5. Importance of Nursery Management.	
	Unit Outcome: UO 1. Develops the skills of Nursery Management.	
II	Lawn Development and Farmhouse Management	04
	<ol style="list-style-type: none">1. Introduction2. Types of lawn3. Methods of Lawn development4. Making of lawn5. Farm house management	
	Unit Outcome: UO 1. Explain the Lawn development and farmhouse management.	
III	Grafting Technique	04
	<ol style="list-style-type: none">1. Introduction2. Grafting Methods & Types3. Technique of sapling from mother plant	
	Unit Outcome: UO 1. Understand the techniques and methods of Grafting.	

IV	Entrepreneurship Development	03
	<ol style="list-style-type: none"> 1. Introduction to Entrepreneurship Development 2. Polyhouse Technology 3. Bonsai and its types. 	
	Unit Outcome: UO 1. Explain the techniques of polyhouse and Bonsai.	
V	Practicals (Included in above 04 units)	15
	<ol style="list-style-type: none"> 1. Techniques of Seed Germination. 2. Tools, implements and containers used for propagation and nursery techniques. 3. Seed propagation- preparation of portable trays, seed treatments, sowing and seedling. 4. Methods of development of different types of Lawns. 5. Planning and designing of gardens and landscape. 6. Planning and designing of terrace gardens and landscape. 7. Identification of common garden weeds and their control methods. 8. Identification of insect, fungal, bacterial and viral pest of ornamental plants and their control methods. 9. Determination of Soil texture properties (temp, pH and texture) 10. Technique of potting. 11. Types of Bonsai and technique. 12. Preparation of Hanging basket. 13. Propagation of plants by cutting: Soft stem and hard wood. 14. Visit to nursery. 	

Learning Resources:

1. Complete gardening in India- Gopala swamiengar K.S. Revised edition. Hosali Press, Bangalore. (1935)
2. Floriculture in India-G. S. Randhawa, Allied Publishers, 1986
3. Home gardening: P. P. Trivedi, Indian Council of Agricultural Research 2010
4. Horticulture in India: P. C. Bansil CBS Publishers & Distributors. 2008
5. Horticulture Nursery Management: Dr. Surya Gunjal, Director, School of Agricultural Sciences, YCMOU, Nashik 2010
6. Management-John Mason Landlinks Press,2004
7. Ornamental gardening in India: Mishra K. K. Biotech Books. 2003
8. Plant Nursery Development and Management-PriyaLokare, Dr. Keshamma E.18 December 2021
9. Plant Nursery Management –P.K. Ray Scientific Publisher India New Delhi 2012

Internal Examination Pattern: Continuous Assessment Test (CAT):

CAT-I: Book Reading/ Submission of herbaria of diseased plants

CAT-II: Open book test/ Descriptive test

Mapping of Cos with POs & PSOs: Nursery, Lawn Management & Entrepreneurship

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	2	2	3	2	3	3	2	2	3	2	2	3
CO2	2	2	3	2	2	2	3	2	3	3	2	2	3	2	2	3
CO3	2	2	3	3	2	2	3	2	3	3	2	2	3	3	2	3
CO4	3	2	3	3	2	2	3	2	3	3	3	2	3	3	2	3



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Rajarshi Shahu Mahavidyalaya,
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Semester - II

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Faculty of Science and Technology

Department of Botany

UG I Sem II

Course Type: DSC-III

Course Title: Fundamentals of Genetics

Course Code: 101BOT2101

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To awaken the students about genetic terms.
- LO 2. To understand the principles of genetics and laws of inheritance.
- LO 3. To correlate the relationships between epistatic and non-epistatic genes.
- LO 4. To develop the awareness about genetic disorders

Course outcomes:

After completion of course, the student will be able to-

- CO 1. Explain the process of inheritance.
- CO 2. Correlate the between epistatic and non-epistatic genes.
- CO 3. Analyze the mechanisms of sex determination and extra-nuclear inheritance.
- CO 4. Evaluate Pedigree analysis and its control.

Unit No.	Title of Unit & Contents	Hrs.
I	Mendelism	13
	<ul style="list-style-type: none">1. Introduction of Genetics2. Mendel's experiments (biography of Mendel).3. Punnett Checker Board4. Rediscovery of Mendel's Work5. Genetic terminologies6. Monohybrid crosses with examples.7. Dihybrid cross with examples8. Back cross and Test cross with examples.9. Mendelian Genetics:<ul style="list-style-type: none">a) Law of Dominanceb) Law of Segregationc) Law of Independent assortment	
	Unit Outcomes: UO-1. Explain the process of inheritance. UO-2. Describe the Laws of Mendelian Genetics.	
II	Gene Interactions	10
	Interaction of Genes: A. Allelic interactions: <ul style="list-style-type: none">1. Incomplete dominance with examples of 4 'O'clock plant.2. Co- dominance with examples of coat color in cattle B. Non-Allelic interactions <ul style="list-style-type: none">I. Epistatic: Explanation and examples of<ul style="list-style-type: none">i) Dominant epistasis - 12:3:1 (Fruit colour in summer squash and Coat color in Dog)ii) Recessive epistasis - 9:3:4 (Supplementary genes) (Grain	

Unit No.	Title of Unit & Contents	Hrs.
	colour in maize/coat colour in mice) iii) Duplicate dominant epistasis - 15:1 (Seed capsule of Shepherds purse) iv) Duplicate recessive epistasis (Complementary genes) - 9:7 (Sweet pea flower color) II. Non-epistatic: Explanation and examples of Collaborator gene - 9:3:3:1 (Comb shape in fowl)	
	Unit Outcomes: UO-1. Solve the problems related to Genetics. UO-2. Describe the Allelic interactions and Non-Allelic interactions.	
III	Sex Determination	11
	1. Introduction 2. Methods of sex determination A) Haplodiploidy Method B) Single gene effect: Sex determination in Plants (<i>Asparagus</i>) C) Chromosomal Method: i. Sex determination: Discovery of sex chromosomes, ii Chromosomal theory of sex determination. iii. Sex determination in Animals/ Drosophila (XX, XY method) iv. Sex determination in insects (XO-XX method), v. Sex determination in Birds (ZW-ZZ, ZZ-ZO) 3. Linkage: i) Introduction and Definition ii) Complete Linkage iii) Incomplete Linkage Coupling Repulsion Hypothesis iv) Significance	
	Unit Outcomes: UO-1. Explain sex determination and extranuclear inheritance. UO-2. Evaluate Pedigree analysis and its control.	
IV	Sex Linked Inheritance	11
	1. Introduction: Definition 2. Types of Sex linked inheritance: i. X-linked with example ii. Y-linked with example iii. XY-linked with example 3. Sex linked inheritance in Drosophila (White eye colour) 4. Sex linked inheritance in Man: Hemophilia 5. Sex linked inheritance in Man: Colour blindness 6. Sex linked inheritance in Man: Hypertrichosis & Xeroderma pigmentosa 7. Inheritance of bobbed bristles in Drosophila 8. Gene related diseases: i. Phenylketonuria (PKU) ii. Alkaptonuria (AKU) iii. Albinism iv. Sickle Cell Anemia 9. Syndromes in Man: i. Down's syndrome ii. Klinefelter's Syndrome. iii. Patau syndrome iv. Edwards syndrome	

Unit No.	Title of Unit & Contents	Hrs.
	V. Turner syndrome	
	Unit Outcomes: UO-1. Describe the Sex linked inheritance. UO-2. Identify the gene related diseases and Syndromes.	

Learning Resources:

1. Molecular Biology Alberts, B. Bray, D. Lewis, J. Raff, M. Roberts, K. and Watson, J. D. (Ed.) Garland Publishing Inc. New York. 1989
2. The Science of Genetics Atherl, A. G., Girton, J. R. and Mc Donald, J. F. Saunders College USA. 1999
3. Discussions in Cytogenetics, Burnham, C. R. Burgess Publishing Co., Minnesota. 1962
4. Volume X. The cell nucleus: DNA part A, Busch. H. and Rothblum, L. Academic Press. 1982
5. Genetics, Gupta, P.K. Rastogi Publications, Meerut 2007
6. Genetics: Principles and Analysis (4th Ed.) Hartl, D. L. and Jones E. W. 1998
7. Cell and Molecular Biology; Concepts and Experiments, Karp, G., John Wiley and Sons Inc. USA. 1999
8. Cytogenetics of Aneuploidy, Khush, G. S. Academic Press, New York, London. 1973
9. Genetics, Pundhan Singh, Kalyani Publishers, Ludhiana 2006
10. Fundamentals of Genetics, Singh, B. D. Kalyani Publishers, Ludhiana 2015

Internal Examination Pattern: Continuous Assessment Test (CAT):

CAT-I: Book Reading/ Case study report

CAT-II: Open book test/ Descriptive test

Mapping of Cos with POs & PSOs: Fundamentals of Genetics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	2	2	1	2	1	2	3	2	2	2	2	1
CO2	3	2	2	3	1	2	1	2	1	2	3	2	2	3	1	1
CO3	3	2	2	2	2	2	1	2	1	2	3	2	2	2	2	1
CO4	3	3	2	3	2	3	1	2	1	3	3	3	2	3	2	1

Scale: 3 = High, 2 = Moderate, 1 = Low



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Department of Botany

UG I Sem II

Course Type: Lab Course

Course Title: Lab Course –III (Based on DSC-III)

Course Code: 101BOT2103

Credits: 01

Max. Marks: 50

Hours: 30

Learning Objectives:

LO 1: To apply Mendelian and non-Mendelian genetic principles to solve inheritance problems.

LO 2: To analyze sex-linked inheritance patterns in humans and Drosophila.

LO 3: To construct and interpret karyotypes and identify chromosomal syndromes.

LO 4: To evaluate genetic diseases by examining their inheritance patterns.

Course outcomes:

After completion of course, the student will be able to-

CO 1: Apply Mendelian principles to solve genetic problems.

CO 2: Analyze sex-linked inheritance patterns in humans and Drosophila, including genetic disorders.

CO 3: Interpret and construct karyotypes to identify chromosomal abnormalities and evaluate genetic syndromes.

CO 4: Examine and explain the genetic basis of metabolic and inherited disorders.

Sr. No.	Practicals
1	Problems based on Monohybrid ratio- 3:1
2	Problems based on Dihybrid ratio -9:3:3:1
3	Problems based on Dihybrid ratio – 9:3:4
4	Problems based on Dihybrid ratio – 9:7
5	Problems based on Dihybrid ratio -12:3:1
6	Problems based on Dihybrid ratio – 15:1
7	Problems based on collaborator genes- 9:3:3:1
8-9	Problems based on sex-linked inheritance- Color blindness and Hemophilia (Human being)
10	Problems based on sex-linked inheritance- White eye color (Drosophila) and Hypertrichosis (Man)
11	Study of Karyotype
12	Study of Syndromes: Down's syndrome, Klinefelter's Syndrome, Patau syndrome, Edwards syndrome and Turner syndrome
13	Study of genetic diseases- Phenylketonuria (PKU), Alkaptonuria (AKU) and Albinism
14	Botanical excursions (one short, one long excursion and visit to Research laboratory, Field etc. is compulsory)

N.B.: Any Ten Practicals from above list.

Learning Resources:

1. A text book of Practical Botany-I, Bendre and Kumar, Rastogi Publication, 2019.
2. A text book of Practical Botany-I, S. N. Pandey and B. P. Pandey, S.Chand Publication, 1979.
3. A text book of Practical Botany-II, Bendre and Kumar, Rastogi Publication, 2019.
4. A text book of Practical Botany-II, S. N. Pandey and B. P. Pandey, S.Chand Publication, 1979.
5. Cell and Molecular biology: A lab Manual, K.V.Chaitanya, 2013.
6. Cell Biology Practical Manual, Dr. Renu Gupta, Dr. Seema Makhija, Dr. Ravi.T, Prestige publisher 2018.

Mapping of Cos with POs & PSOs: Lab Course – III

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	3	1	2	1	2	1	2	2	3	3	3	1	1
CO2	3	3	2	3	2	2	1	2	1	2	3	3	2	3	2	1
CO3	3	3	3	3	2	3	1	2	1	3	3	3	3	3	2	1
CO4	3	3	2	3	2	2	1	2	1	2	3	3	2	3	2	1

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Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution
Faculty of Science and Technology
Department of Botany
UG I Sem II

Course Type: DSC- IV

Course Title: Histology, Anatomy and Embryology of Angiosperms

Course Code: 101BOT2102

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To compare role of Tissue system of plants.
- LO 2. To interpret the fertilization and development of embryo.
- LO 3. To understand and interpret the histology, anatomy, and embryology of angiospermic plants.
- LO 4. To analyse the anatomical structures of root, stem and leaf.

Course outcomes:

After completion of course, the student will be able to-

- CO 1. Analyse the different tissues and their functions.
- CO 2. Perform sectioning of various anatomical structures.
- CO 3. Describe the process of development of male and female gametophyte
- CO 4. Evaluate the post fertilization changes during fruit development.

Unit No.	Title of Unit & Contents	Hrs.
I	Histology	12
	1. Introduction of Histology 2. Plant Tissues A. Meristematic tissues and their classification based on position B. Permanent Tissues I Simple Tissues: Structure, Types and Functions i. Parenchyma ii. Collenchyma iii. Sclerenchyma II Complex Tissues: Structure and Functions i. Xylem ii. Phloem III Secretory Tissues i. Laticiferous Tissues Ex. Latex cells and Latex Vessels ii. Glandular Tissues	

Unit No.	Title of Unit & Contents	Hrs.
	a. External glands Ex. Digestive glands and Nectary glands b. Internal glands Ex. Oil glands Unit Outcomes: UO-1. Interpret the different tissues and their function. UO-2. Identify the type of tissues.	
Unit No.	Title of Unit & Contents	Hrs.
II	Anatomy	12
	1. Introduction of Anatomy 2. Anatomy of dicot Root (Sunflower) 3. Anatomy of monocot Root (Maize) 4. Anatomy of dicot Stem (Sunflower) 5. Anatomy of monocot Stem (Maize) 6. Anatomy of dicot Leaf (Sunflower) 7. Anatomy of monocot Leaf (Maize) 8. Secondary growth in dicot stem. 9. Anomalous secondary growth in <i>Dracaena</i> stem. 10. Concept of Dendrochronology Unit Outcome: UO-1. Perform sectioning and differentiates the internal structure of root, stem and Leaves.	
III	Embryology -I	11
	1. Introduction 2. Structure of a Microsporangium (T.S. of anther). 3. Concept of Palynology and Structure of a Microspore. 4. Development of male gametophyte (Microgametogenesis). 5. Structure of Ovule (Megasporangium) 6. Types of ovule: i) Orthotropous (Straight) ii) Anatropous (Inverted) iii) Hemi-anatropous iv) Campylotropous (Curved) v) Amphitropous vi) Circinotropous 7. Development of female gametophyte (Monosporic) Unit Outcomes: UO-1. Describe the process of development of male and female Gametophyte.	

Unit No.	Title of Unit & Contents	Hrs.
	UO-2. Identify the types of ovules.	
IV	Embryology -II	10
	1. Fertilization 2. Double Fertilization and its Significance 3. Post fertilization changes 4. Endosperm and its types 5. Development of dicot embryo (Crucifer type) 6. Concepts of Apomixis and Polyembryony 7. Structure of Dicot seed 8. Structure of Monocot seed	
	Unit Outcomes: UO-1. Analyse the post fertilization changes during seed and fruit development. UO-2. Understand the mechanism of double fertilization and its significance	

Learning Resources:

1. A Handbook of Taxonomic Training. Manilal, K. S. and M. S. Muktesh Kumar New Delhi. 1998
2. An Integrated System of Classification of Flowering Plants, Cronquist, A. Columbia University Press, New York. 1981
3. Families of Flowering plants. Judd W. S., Campbell, C. S., Kellogg, E. A., Stevens P. F. and M. J. Donoghue 2008.
4. Flowering Plants: Origin, Evolution and Phylogeny. Taylor, D. V. and L. J. Hickey CBS Publishers & Distributers, New Delhi. 1997
5. Plant microevolution and Conservation in Human-influenced Ecosystems. Briggs David. Cambridge University Press. 2009
6. Plant Systematics: A phylogenetic Approach Sunderland, Massachusetts, USA.1995 Press, U.S.A. 1988
7. Principles and Techniques of Contemporary Taxonomy. Quicke, Donald, L. J. Blakie Academic & Professional, London 1993
8. Principles of Angiosperm Taxonomy Davis, P. H. and V. H. Heywood Today and
9. Takhtajan, A. Flowering plants- Origin and Dispersal. 1962
10. Taxonomy and Plant conservation. Leadlay E. and S. Jury Cambridge University Press. 2006
11. Taxonomy of Angiosperms. Naik, V. N. Tata Mc Graw-Hill Publication Com. Ltd. New Delhi 1984
12. *Taxonomy of Vascular Plants*. Lawrence George H. M Oxford and IBH Publ. Co.Pvt. Ltd. New Delhi. 1951

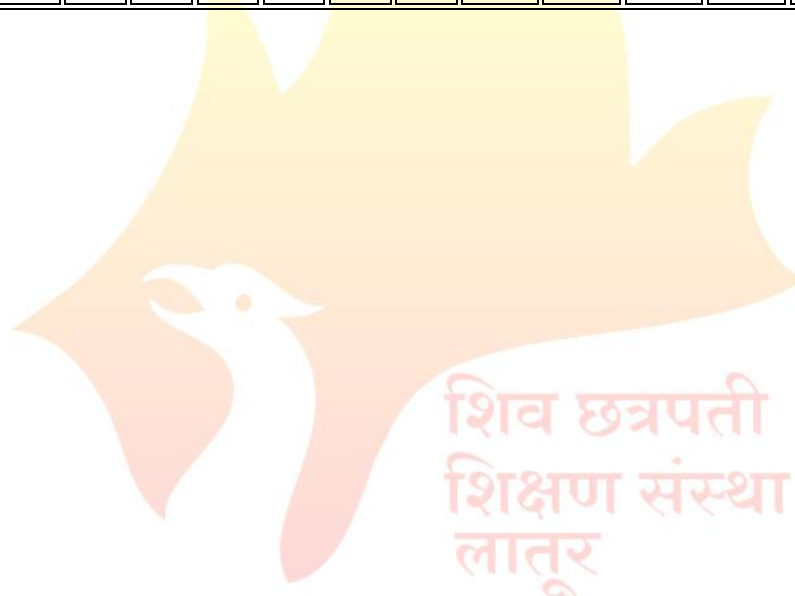
Internal Examination Pattern: Continuous Assessment Test (CAT):

CAT-I: Book Reading/ Woolen Model

CAT-II: Open book test/ Descriptive test

Mapping of Cos with POs & PSOs: Histology, Anatomy & Embryology of Angiosperms

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2	1	2	1	2	3	2	2	3	2	1
CO2	2	2	3	2	1	2	1	2	1	2	2	2	3	2	1	1
CO3	3	2	2	2	2	2	1	2	1	2	3	2	2	2	2	1
CO4	3	3	2	3	2	2	2	2	1	3	3	3	2	3	2	1



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Faculty of Science and Technology

Department of Botany

UG I Sem II

Course Type: Lab Course

Course Title: Lab Course –IV (Based on DSC-IV)

Course Code:

Credit: 01

Max. Marks: 50

Hours: 30

Learning Objectives:

- LO 1. To interpret the role of meristematic and permanent tissue.
- LO 2. To differentiate internal organization of tissue.
- LO 3. To understand the structure of anther, pollen grain and different types of ovules.
- LO 4. Analyze and classify embryological structures based on their characteristics and developmental stages.

Course outcomes:

After completion of course, the student will be able to-

- CO 1. Identify and describe meristematic, simple, complex, and secretory tissues using slides/models/charts.
- CO 2. Differentiate monocot and dicot stems through study of prepared slides (sunflower, maize, *Dracaena*).
- CO 3. Examine and interpret the structure of anther, pollen grain, and different types of ovules.
- CO 4. Compare dicot and monocot embryo and identify types of endosperm.

Sr. No.	Practicals
1	Study of meristematic tissues with the help of Permanent slides/models/ Charts /photo
2	Study of simple tissues with the help of Permanent slides/models/ Charts /photo
3	Study of Complex tissues with the help of Permanent slides/ models /Charts/ photo
4	Study of secretory tissues with the help of Permanent slides/ models /Charts/ photo
5	Study of T.S. of Anther and structure of pollen grain
6	Study of typical ovule and types of ovule with the help of Permanent slides/ models /charts/photocopies.
7	Study of Leaf anatomy of dicot.
8	Study of Leaf anatomy of dicot.
9	Preparation of double stained permanent slides of Sunflower Stem.
10	Preparation of double stained permanent slides of Maize Stem.
11	Preparation of double stained permanent slides of <i>Dracaena</i> Stem.

12	Study of typical seed of Dicot and Monocot
13	Study of types Endosperms with the help of Permanent slides/models/ Charts/photo
14	Botanical excursions (one short, one long excursion and visit to Research laboratory, Field etc. is compulsory)

N.B.: Any Ten Practicals from above.

Learning Recourses:

1. A text book of Practical Botany-I, Bendre and Kumar, Rastogi Publication, 2019
2. A text book of Practical Botany-I, S. N. Pandey and B. P. Pandey, S.Chand Publication, 1998
3. A text book of Practical Botany-II, Bendre and Kumar, Rastogi Publication, 2019
4. A text book of Practical Botany-II, S. N. Pandey and B. P. Pandey, S.Chand Publication, 1999
5. Cell biology and Cytogenetics lab and physiological Hematological Lab –I, Sudha Garg, A Pragati prakashan 2023
6. Ecology: A Practical Manual by A. C. Grubb and P. J. Edwards (1987)

Mapping of Cos with POs & PSOs: Lab Course – IV

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	1	2	1	2	1	2	2	2	3	2	1	1
CO2	3	2	3	3	1	2	1	2	1	2	3	2	3	3	1	1
CO3	3	2	3	3	2	2	1	2	1	2	3	2	3	3	2	1
CO4	3	2	2	3	2	2	1	2	1	2	3	2	2	3	2	1

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Faculty of Science and Technology

Department of Botany

UG I Sem II

Course Type: VSC-II

Course Title: Organic Farming

Course Code: 101BOT2501

Credits: 02

Max. Marks: 50

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To introduce techniques of production of high nutritional food.
- LO 2. To restate the methods of increasing long term fertility of soil.
- LO 3. To demonstrate methods of organic farming.
- LO 4. To criticize the methods of farming.

Course Outcomes:

After completion of course, the student will be able to-

- CO 1. Analyse the benefits of organic Farming.
- CO 2. Discuss the staple food crops and their cultivation practices.
- CO 3. Explain the uptake and Utilization of plant Nutrients.
- CO 4. Evaluate the composition of organic manure.

Unit No.	Title of Unit & Contents	Hrs.
I	Organic Farming	04
	i. Introduction ii. Need of Organic Farming iii. Importance of Organic Farming iv. Social aspects of Organic Farming v. Market aspects of Organic Farming	
	Unit Outcomes: UO-1. Understand the benefits of organic Farming. UO-2. Correlate the Social and Market aspects of organic Farming	
II	Organic Fertilizers	04
	i. Introduction ii. Need of Organic Fertilizer iii. Importance of Organic Fertilizer iv. Preparation of Organic Fertilizer v. Demonstration & land preparation	
	Unit Outcome: UO-1 Explain the importance of organic fertilizers.	

III	Plant Nutrients	04
	i. Introduction ii. Plant Nutrients: Micro and Macro iii. Functions of Nutrients in plant growth and Development iv. Nutrient uptake and Utilization by plant: Organics & Inorganic form v. Sources of nutrients for Organic farming (Agriculture)	
	Unit Outcomes: UO-1 Explain the importance of Nutrient uptake. UO-2. Analyse the mechanism of Utilization Nutrient.	
IV	Organic Manure	04
	i. Farmyard manures ii. Compost manures iii. Vermi compost iv. Green Manure with Leguminous crop	
	Unit Outcomes: UO-1 Classify organic manure. UO-2 Demonstrate the process of Vermicompost	
V	Practicals (Included in above 04 units)	14
	1. Preparation of farm layout for organic cultivation. 2. Preparation of mulching materials and methods. 3-5. Indigenous Technology Knowledge (ITK) for nutrient arrangement 6. Preparation of Dashparni ark / botanical extracts 7. Preparation of Farmyard Manure (FYM) 8. Demonstration of Vermicompost Preparation and Bio-composting 9. Preparation of green Manure by using leguminous crop 10. Study of compost quality parameters 11. Visit to organic farms to study the various components and their utilization	

Learning Recourses:

1. Arts & Science of Organic Farming : Sujit Chakrabarty, Sumati Narayan, Farooq Ahmad Khan, Notion Press.1995
2. Organic Business Today: Global And Local Hardcover – by Manoj Kumar Menon Tej Partap Scientific Publishers Indian, 2009
3. Organic Farming and Production of Organic Compost: NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc. 2008
4. Organic Farming: Amitava Rakshit and H B Singh, Storey Publishing LLC 2008
5. Principles of Organic Farming: E Somasundaram, D UdhayaNandhini, et al. New India Publishing Agency- Nipa. 2010
6. Principles of Organic Farming: P.L. Maliwal, Scientific Publishers Indian 2013
7. Sustainable Development of Organic Agriculture by Kimberly Etingoff, SPI, 2012

Internal Examination Pattern: Continuous Assessment Test (CAT):

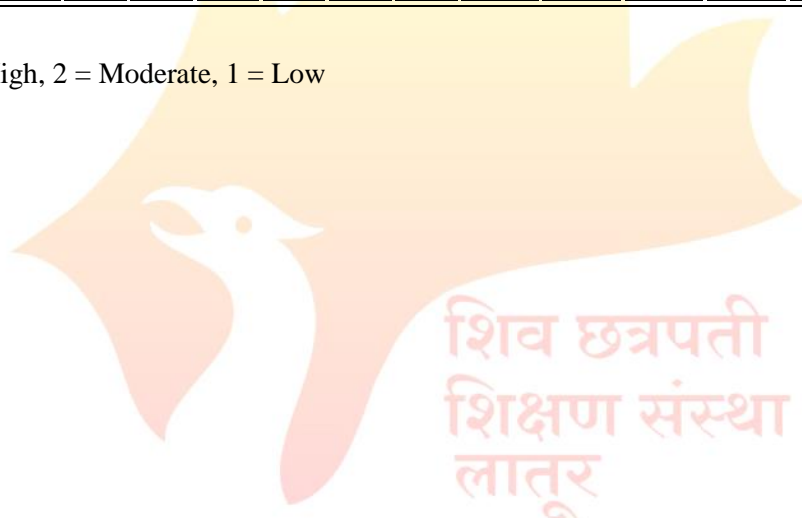
CAT-I: Book Reading/

CAT-II: Open book test/ Descriptive test

Mapping of Cos with POs & PSOs: Organic Farming

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2	3	3	2	3	3	2	2	3	2	3
CO2	3	2	3	2	2	2	3	2	2	3	3	2	3	2	2	3
CO3	3	2	2	2	2	2	3	2	1	2	3	2	2	2	2	2
CO4	3	3	2	3	2	3	3	3	2	3	3	3	2	3	2	3

Scale: 3 = High, 2 = Moderate, 1 = Low



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UG First Year

Extra Credit Activities

Sr. No.	Course Title	Credits	Hours T/P
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken English Courses	Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.

Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation

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Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
		Att.	CAT I	CAT II	CAT III	Att.	CAT			
1	2	3				4		5	6	5 + 6
DSC/DSE	75	05	10	10	15	-	-	30	45	75
Lab Course/AIPC/OJT/FP	50	-	-	-	-	05	20	-	25	50
VSC/SEC/AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

Note:

1. All Internal Exams are compulsory
2. Best score will be considered from CAT-I and CAT-II
3. Mid Term Exam will be conducted by the Exam Section
4. CAT-III is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks

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Semester End Examination Paper Pattern

Pattern - I

Course: Theory

Max. Marks: 45

Times: 2 Hrs.

- Q.1 Answer the following questions (3 Marks each) 12 Marks**
- Based on Unit - I
 - Based on Unit - II
 - Based on Unit - III
 - Based on Unit - IV
- Q.2 Answer any THREE of the following (5 Marks each) 15 Marks**
- Based on Unit - I
 - Based on Unit - II
 - Based on Unit - III
 - Based on Unit - IV
- Q.3 Answer any ONE of the following 08 Marks**
- Based on Unit - I
 - Based on Unit - II
- Q.4 Answer any ONE of the following 10 Marks**
- Based on Unit - III
 - Based on Unit - IV

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(S. N. Shinde)
Chairman

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Board of Studies in Botany
Rajarshi Shahu Mahavidyalaya, Latur
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