

Shiv Chhatrapati Shikshan Sanstha's

**Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)**



**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

(Autonomous)

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)

w.e.f. June, 2023

(In Accordance with NEP-2020)

Review Statement

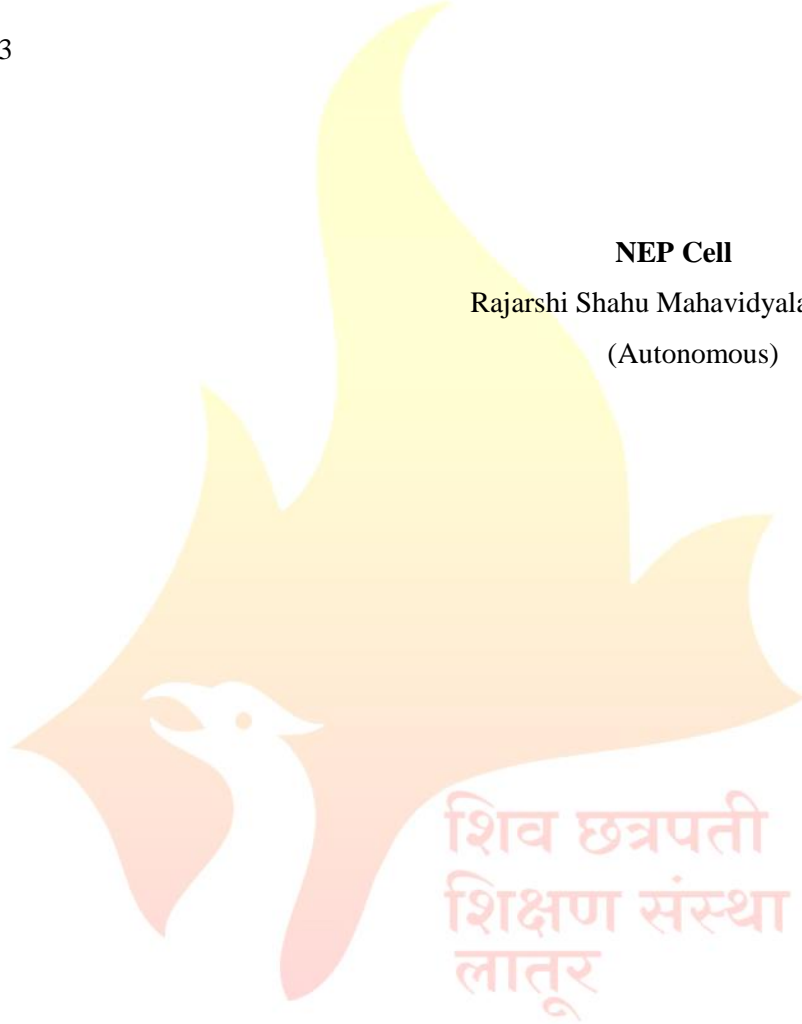
The NEP Cell reviewed the Curriculum of **B.Sc. (Honors/Research /Degree) in Botany** Programme to be effective from the **Academic Year 2023-24**. It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 09/08/2023

Place: Latur

NEP Cell

Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)



॥ आर्योह तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)

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 2023-24.**

Date: 07/07/2023

Place: Latur



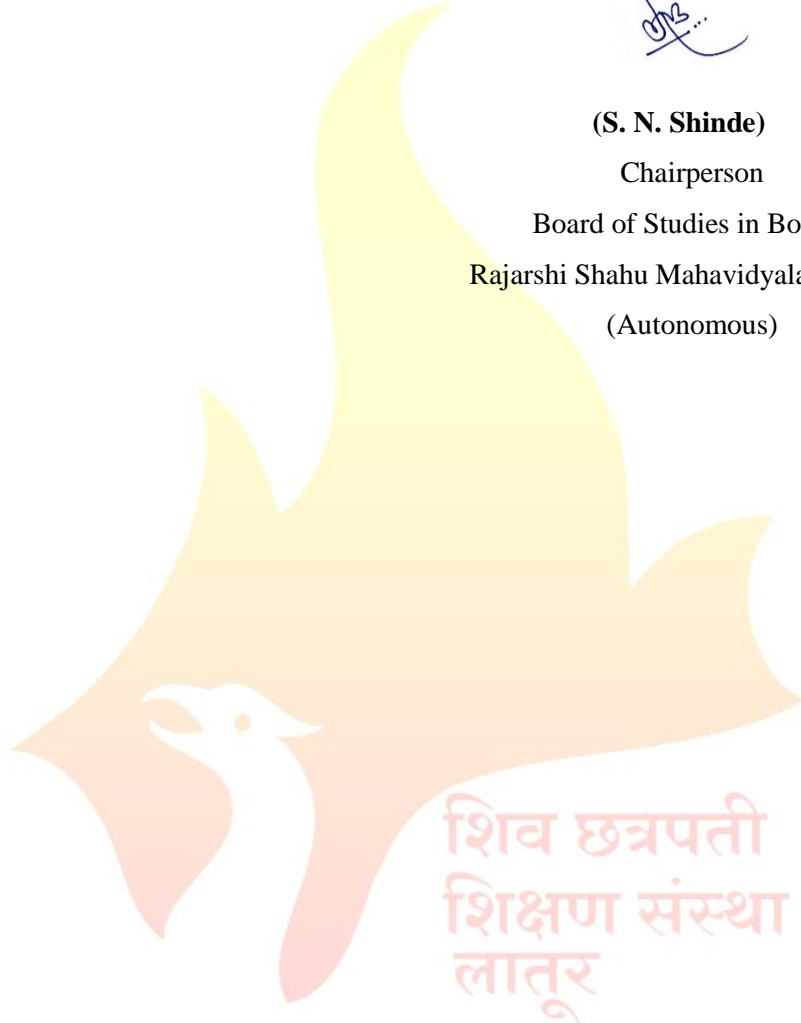
(S. N. Shinde)

Chairperson

Board of Studies in Botany

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)



॥ आर्योह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

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

Sr. No.	Name	Designation	In position
1	Shri S. N. Shinde, Head, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Chairperson	HoD
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. Babasaheb Ambedkar M. University, Aurangabad	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. V. S. Maske, Head, Department of Botany, Bahirji Smarak Mahavidyalaya, Vasmat, Dist. Hingoli	Member	Academic Council Nominee
6	Shri Laxman Done, Done's Mushrooms, Kumbhari, Dist. Latur	Member	Expert from Industry
7	Prof. Dr. N. B. Gaikwad, Department of Botany, Shivaji University, Kolhapur	Member	P.G. Alumni
8	Dr. S.H. Nile, Senior Scientist, Zhejiang Chinese Medical University, Hanzhou Zhejans	Member	Expert from outside for Special Course
9	Dr. K. D. Savant, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
10	Shri D. R. Awad, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
11	Ms. D.S. Chavan, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department

Sr. No.	Name	Designation	In position
12	Ms. P. V. Kumbhar, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
13	Ms. R.K. Mekle, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
14	Ms. R.L. Shaikh, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
15	Ms. P. S. Maskepatil, Department of Botany, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Department
16	Dr. D. V. Vedpathak, Department of Microbiology, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Faculty
17	Dr. D.G. Palke, Head, Department of Chemistry, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)	Member	Member from same Faculty

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आरोह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)

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.

The course is upgraded keeping in mind the aspirations of the students, changing nature of the subject as well as the learning environment. 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 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 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), Ability Enhancement Course (AEC) etc. The discipline specific courses (DSC) are compulsory and the elective courses can be chosen from the given Basket. Except Ability Enhancement courses, all other 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 generic elective is specified for Indian Knowledge Systems (IKS). Indian Knowledge Systems have a strong foundation in Indian Culture, Philosophy and Spirituality and have evolved through thousands of years. These knowledge systems include Ayurveda, Yoga etc. that are still 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 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.

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



(S. N. Shinde)

Chairperson
Board of Studies in Botany
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

Index

Sr. No.	Content	Page No.
1	Structure for Four Year Multidisciplinary UG Programme	1
2	Abbreviations	2
3	Courses and Credits	3
4	UG Program Outcomes	4
5	Curriculum: Semester - I	6
6	DSC I : Biodiversity of Cryptogams and Gymnosperms	7
7	Lab Course –I (Based on DSC-I)	12
8	DSC II : Cell Biology and Molecular Biology	14
9	Lab Course –II (Based on DSC-II)	17
10	VSC-I : Nursery and Lawn Management & Entrepreneurship Development	18
11	Curriculum: Semester – II	21
12	DSC-III : Fundamentals of Genetics	22
13	Lab Course –III (Based on DSC-III)	25
14	DSC-IV: Histology, Anatomy and Embryology of Angiosperms	27
15	Lab Course –IV (Based on DSC-IV)	30
16	VSC-II : Fruits and Fruit Processing	32
17	Basket I: Generic/Open Elective (GE/OE)	35
18	Basket II: Skill Enhancement Courses (SEC)	36
19	Basket III: Ability Enhancement Courses (AEC)	37
20	Extra Credit Activities	38
21	Examination Framework	40

॥ आर्योह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

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



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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	02	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	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)	Fruits and Fruit Processing	02	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		



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

Programme Outcomes (POs) for B.Sc. Programme	
PO No.	Upon completion of this programme the students will be able to
PO 1	Knowledge and Understanding of: <ol style="list-style-type: none">1. The range of plant diversity in terms of structure, function and environmental relationships.2. The evaluation of plant diversity.3. Plant classification and the flora of Maharashtra.4. The role of plants in the functioning of the global ecosystem.5. Statistics as applied to biological data.
PO 2	Intellectual Skills: <ol style="list-style-type: none">1. Think logically and organize tasks into a structured form.2. Assimilate knowledge and ideas through wide reading and the e-resources.3. Transfer appropriate knowledge and methods within the subject.4. Construct and test hypothesis.5. Plan, conduct and write a report on an independent project.
PO 3	Practical Skills: Students learn following skills through field and laboratory work- <ol style="list-style-type: none">1. Interpreting plant morphology and anatomy.2. Identification of plants.3. Vegetation analysis techniques.4. A range of physiochemical analysis of plant materials.5. Analyze data using appropriate statistical methods and computer programs.6. Plant pathology to be added for sharing of fieldwork and lab analysis.
PO 4	Transferable Skills: <ol style="list-style-type: none">1. Use of IT (word-processing, use of internet, statistical packages and databases).2. Communication of scientific ideas in writing and orally.3. Ability to work as part of a team, function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.4. Ability to use library resources.5. Time management.6. Career planning.
PO 5	Scientific Knowledge:

	Apply the knowledge of life sciences and fundamental processes of plants.
PO 6	Problem Analysis: Identify the taxonomic position of plants and analyze non reported plants with substantiated conclusions
PO 7	Design/Development of Solutions: Design solutions from medicinal plants for health problems, disorders and diseases of human beings and estimate the phytochemical content which meet the specified need to public health.
PO 8	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.
PO 9	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, cellular and physiological activities of plants with an understanding of the applications and limitations.
PO 10	The Botanist and Society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, ethical principles, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice and need of sustainability.
PO 11	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

॥ आर्योह तमसो ज्योतिः ॥
Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)

Semester - I

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आर्योह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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 know the Origin, evolution, and genetic diversity of microbial life.
- LO-2 To study the linkage between microbial diversity.
- LO-3 To become familiar with Cryptogamic botany.
- LO-4 To give General account of stellar evolution.
- LO-5 To study different types of spore in Pteridophytes.
- LO-6 To develop the awareness about the importance of Cryptogams and Gymnosperms.
- LO-7 To learn the life cycles of Cryptogams and Gymnosperms.
- LO-8 To study different types of cell.

Course Outcomes:

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

- CO-1 Classify microorganisms on the basis of host.
- CO-2 Identify microorganisms and their role in various environments.
- CO-3 Distinguish between reproductive stages of cryptogams.
- CO-4 Examine the morphology and life cycles of certain genera of Cryptogams and Gymnosperms.
- CO-5 Analyze the economic importance of Cryptogams and Gymnosperms.
- CO-6 Correlate significance of bacteria, algae and fungi with human welfare.
- CO-7 Classify the microbes and understand the characteristics of Bacteria and viruses.
- CO-8 The range of plant diversity in terms of structure, function and environmental relationships.
- CO-9 The evaluation of plant diversity

Unit No.	Title of Unit & Contents	Hrs.
I	Bacteria and Viruses	12

Unit No.	Title of Unit & Contents	Hrs.
	<p>A) Bacteria:</p> <ol style="list-style-type: none"> 1. General characters. 2. Size, Shape and Ultra structure. 3. Mode of Nutrition 4. Reproduction: <ol style="list-style-type: none"> i. Asexual ii. Genetic Recombination: <ol style="list-style-type: none"> a. Conjugation b. Transformation c. Transduction 5. Economic importance. <p>B) Viruses:</p> <ol style="list-style-type: none"> 1. General characters. 2. Classification 3. Viroids and Prions 4. Transmission of plant viruses 5. Ultra-structure of TMV. 6. Economic importance. <p>Unit Outcomes:</p> <p>UO 1. Classify microorganisms on the basis of host.</p> <p>UO 2. Identify microorganisms and their role in various environments.</p> <p>UO 3. Correlate significance of bacteria, algae and fungi with human welfare.</p>	
II	Fungi	10
	<ol style="list-style-type: none"> 1. General characters 2. Classification (Alexopolous and Mims, 1979). 3. Asexual reproduction 4. Study of life cycle of <i>Agaricus</i> (Developmental stages not expected) 5. Study of life cycle of <i>Erysiphe</i> (Developmental stages not expected) 6. Economic importance. 7. Mycorrhiza: <ol style="list-style-type: none"> i General characters ii Types iii Economic importance 	

Unit No.	Title of Unit & Contents	Hrs.
	<p>8. Lichens:</p> <ul style="list-style-type: none"> i General characters ii Types iii Economic importance. <p>Unit Outcome:</p> <p>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. General characters. 2. Classification (F.E. Fritsch, 1935). 3. Pigmentation and Store food material 4. Thallus organization 5. Study of life cycle (Developmental stages not expected): <ul style="list-style-type: none"> i) <i>Nostoc</i> ii) <i>Chara</i> 6. Economic importance <p>B) Bryophytes:</p> <ol style="list-style-type: none"> 1. General characters 2. Classification (N.S. Parihar) 3. Asexual Reproduction 4. Study of life cycle (Developmental stages not expected): <ul style="list-style-type: none"> i) <i>Riccia</i> ii) <i>Funaria</i> 5. Economic importance <p>Unit Outcomes:</p> <p>UO 1. Correlate the economic importance of Algae, Bryophytes, Pteridophytes and Gymnosperm</p> <p>UO 2. Acquire practical skills to identify, classify and distinguish microbes and nonvascular cryptogams.</p>	
IV	Pteridophytes and Gymnosperms	13
	<p>A) Pteridophytes:</p> <ol style="list-style-type: none"> 1. General characters. 2. Classification (N.S. Parihar) 3. Stellar Evolution 	

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

Learning Resources:

1. Morphology of Vascular plants- Bierhorst, D.W. MacMillan Co.; First Edition (January 1, 1971)
2. Comparative morphology of vascular plants- Eames, A. J. and E. M. Giffard - Madroño; a West American Journal of Botany (1960)
3. An introduction to Pteridophytes. - Rashid, A. (1978) Vikas Publishing House (P) Ltd., 1999
4. Morphology of Pteridophytes- Sporne, K.R. (1966), Hutchinson University Library, 1962
5. The Phylogeny and Classification of ferns Jermy- A. G. (1973)- Academic Press Inc (1 December 1973)
6. Botany for Degree Students – Pteridophytes- Vashishta, B.R. (1996) S. Chand Publishing, 2006
7. An Introduction to Pteridophyta- Parihar, N.S. (1959) - Central Book Depot, 1962
8. An introduction to Paleobotany- Arnold, C.A. (1972) - McGraw Hill Book Company Inc.
9. Principles of Paleobotany- Darroh, W.C. (1968) - Chronica Botanica Company, 1939
10. Indian Fossil Pteridophytes- Surange, K.R. (1968)- Alexander Doweld, 1966
11. Pteridophytes and Gymnosperms-K.U.Kramer, P.S.Green, Springer Verlag, New York
12. The Gymnosperms- Biswas, C &Johri, B.N. (2004), Narosa Publishing House, New Delhi.Coulter
13. Morphology of Gymnosperms- J.M. & Chamberlain C.J. (1978): Central Book Depot, Allahabad.

14. The Gymnosperms (Fossils& Living)- Kakkar, R.K.andKakkar, B.R. (1995) Central Publishing House, Allahabad.
15. Gymnosperms- Vashishta P.C., A.R. Sinha, Anil Kumar, S.Chand-Publishing House-2006
16. Pteridophytes- Vashishta P.C, S. Chand- Publishing House-2006
17. Biology and Morphology of Pteridophytes- Parihar N.S. Central Book Depot, Allahabad.1996
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>



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

Department of Botany

Course Type: Lab Course

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

Course Code: 101BOT1103

Credits: 01

Max. Marks: 50

Hours: 30

Learning Objectives

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

Course outcomes

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

- CO-1 Identify the different microbes.
- CO-2 Identify the different types of algae, bryophytes, Pteridophytes, Gymnosperms etc.
- CO-3 Study the diversity of Microbes, Cryptogams and Gymnosperms.

Practical No.	Unit
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>Erysiphe</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 Practicals from above.



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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 study cell and cell organelles.
- LO-2 To study biomolecules.
- LO-3 To identify the different stages of cell division.
- LO-4 To study the cellular components underlying mitotic cell division.
- LO-5 To study cellular components are used to generate and utilize energy in cell.

Course outcomes

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

- CO-1 Identify organism using karyotype and ideograms.
- CO-2 Identify and differentiates various cell organelles.
- CO-3 Differentiate different stages of mitotic and meiosis.
- CO-4 Explain the process of cell division in both somatic and germ cells.
- CO-5 Examine Morphology, chemical composition, structure and function of typical chromosome
- CO-6 Correlate the structural aspect of DNA and RNA.

Unit No.	Title of Unit & Contents	Hrs.
I	Cell Biology	13
	<ol style="list-style-type: none">1. Ultra-structure of Prokaryotic cell2. Ultra-structure of Eukaryotic cell.3. Structure and functions of Cell wall4. Structure and functions of Plasma membrane5. Structure and functions of cell organelles:<ol style="list-style-type: none">i Nucleusii Golgi apparatusiii Endoplasmic reticulum	

Unit No.	Title of Unit & Contents	Hrs.
	iv Ribosome v Lysosome vi Mitochondria vii Chloroplast 6. Structure of Flagella. Unit Outcome: UO 1. Identify and differentiate various cell organelles.	
II	Chromosome	10
	1. 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 ii. Numerical Unit Outcome: UO 1. Examine Morphology, chemical composition, structure and function of typical chromosome	
III	Cell Division	10
	1. Cell Cycle: Inter phase G1 - S - G2 -M phase and G0 phase 2. Mitosis: Phases and significance 3. Meiosis: Phases and significance 4. Difference between Mitosis and Meiosis 5. Cell senescence and Cell death (Apoptosis): i. Programmed cell death, ii. Mechanism of cell death iii. Significance. Unit Outcomes: UO 1. Distinguish between mitotic and meiosis. UO 2. Explain the process of cell division in both somatic and germ cells. UO 3. Develop skills in study of mitosis and meiosis in plants.	
IV	Molecular Biology	12

Unit No.	Title of Unit & Contents	Hrs.
	1. Structure of DNA (Watson and Crick's model) 2. Types of DNA 3. Replication of DNA (Semi-conservative) 4. Structure, function and types of RNA. (r-RNA, t-RNA, m-RNA) 5. Genetic code: Properties and importance 6. Protein synthesis	
	Unit Outcome: UO 1. Correlate the structural aspect of DNA and RNA.	

Learning Resources:

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



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

Course Type: Lab Course

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

Course Code: 101BOT1104

Credits: 01

Max. Marks: 50

Hours: 30

Learning Objectives:

LO-1 To study cell and cell organelles.

LO-2 To study biomolecules.

LO-3 To identify the different stages of cell division.

LO-4 To study the cellular components underlying mitotic cell division

LO-5 To study cellular components are used to generate and utilize energy in cell.

Course outcomes:

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

CO-1 Identify the different Cell organelles.

CO-2 Identify the different stages of cell division etc.

CO-3 Prepare the ideogram on the basis of Karyotype.

Practical No.	Unit
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. Lambrush
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 Practicals from above.



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

Course Type: VSC-I

Course Title: Nursery, Lawn Management and Entrepreneurship Development

Course Code: 101BOT1501

Credits: 02

Max. Marks: 50

Lectures: 45 Hrs.

Learning Objectives:

- LO-1 To learn techniques of Nursery.
- LO-2 To learn the techniques of Lawn management.
- LO-3 To learn the methods of Poly House.
- LO-4 To know the protection of Ornamental plants.

Course Outcomes:

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

- CO-1 Students describe the techniques of Nursery.
- CO-2 Students describe the techniques of Lawn management.
- CO-3 Students explain the techniques of floral decoration and poly house.
- CO-4 Students explain the protection of Ornamental plant.
- CO-5 Students explain the Lawn development and farmhouse management.

Unit No.	Title of Unit & Contents	Hrs.
I	Nursery Management	08
	<ol style="list-style-type: none">1. Nursery Management.2. Production Nursery Management.3. Plant protection in Ornamental crops.4. Nutrient deficiency in plants	
	<p>Unit Outcomes:</p> <p>UO 1. Explain the protection of Ornamental plant.</p> <p>UO 2. Learn Nursery Management.</p>	
II	Lawn Development and Farmhouse Management	07
	<ol style="list-style-type: none">1. Lawn development2. Making of lawn3. Making of artificial lawn4. Farm house management	

	<p>Unit Outcomes:</p> <p>UO 1. Describe the techniques of Lawn management.</p> <p>UO 2. Explain the Lawn development and farmhouse management.</p>	
III	Grafting Technique	07
	<ol style="list-style-type: none"> Grafting Types Grafting Methods Technique of sampling from mother plant <p>Unit Outcome:</p> <p>UO 1. Learn the techniques of Grafting.</p>	
IV	Entrepreneurship Development	08
	<ol style="list-style-type: none"> Entrepreneurship Development Poly House Technology Bonsai and its types <p>Unit Outcomes:</p> <p>UO 1. Explain the techniques of poly house.</p> <p>UO 2. Learn the techniques of Bonsai preparation.</p>	
V	Practicals (Included in above 04 units)	
	<ol style="list-style-type: none"> Seed Germination techniques for tree species Tools, implements and containers used for propagation and nursery techniques. Seed propagation- preparation of portable trays, seed treatments, sowing and seedling Planning and designing of gardens, functional uses of plants in the landscape Preparation of land for lawn and planting. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Grading, packing and marketing of cut flowers. Identification of common garden weeds and their control methods Identification of insect, fungal, bacterial and viral pest of ornamental plants and their control methods Determination of Soil texture properties (temp, pH and texture) Technique of potting and repotting Preparation of Hanging basket Propagation of plants by cutting: Soft stem, semi hard and hard wood, Layering, Grafting and Budding Demonstration of Verme-composting and Bio-composting 	

14. Flower arrangement and Ikebana	
15. Types of Bonsai and technique	

Learning Resources:

1. A handbook of Landscape: CPWD Directorate general, New Delhi Feb. 2013
2. Horticulture in India: P. C. Bansil CBS Publishers & Distributors
3. Complete gardening in India- Gopaldaswamiengar K.S. (1935) Revised edition. Hosali Press, Bangalore.
4. Floriculture in India-G. S. Randhawa, Allied Publishers, 1986
5. Handbook of Agriculture-ICAR, New Delhi, 1 January 2006
6. Ornamental gardening in India: Mishra K. K. Biotech Books
7. Home gardening: P. P. Trivedi, Indian Council of Agricultural Research
8. Horticulture Nursery Management: Dr. Surya Gunjal, Director, School of Agricultural Sciences, YCMOU, Nashik
9. Plant Propagation: Principles and practices (8th Edition) Hartmann, H.T., Kester D.E., Davis, F.T and R.L Geneve (2010)
10. Plant Nursery Development and Management-PriyaLokare, Dr. Keshamma E. 18 December 2021 Kindle Edition
11. Plant Nursery Management –P.K. Ray 2012 Scientific Publisher India New Delhi
12. Management-John Mason Landlinks Press, 2004
13. Ralph Snodsmiths Fundamentals of Gardening: Questions and Answers from the Garden Hotline – Ralph Snodsmith. Morrow 1993. The University of Virginia 15 Apr 2010

Suggested Activities:

Raising a nursery, managing it, studying and drawing various land scaping designs, practicing layering methods, using shade nets to protect horticultural crops, practicing indoor gardening, techniques, visiting florists and recording their methods of prolonging vase life of commercial cut flowers.

॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)

Semester - II

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आर्योह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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 understand the relationships between epistatic and non-epistatic genes.
- LO-4 To develop the awareness about genetic disorders
- LO-5 Describe mechanisms that generate variation in traits.

Course outcomes:

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

- CO-1 Justify about Syndromes.
- CO-2 Explain the process of inheritance.
- CO-3 Solve problems related to Genetics.
- CO-4 Explain sex determination and extranuclear inheritance
- CO-5 Evaluate Pedigree analysis and its control.

Unit No.	Title of Unit & Contents	Hrs.
I	Mendelism	13
	<ol style="list-style-type: none">1. Introduction of Genetics2. Mendel's experiments (biography of Mendel).3. Rediscovery of Mendel's Work4. Genetic terminologies5. Monohybrid crosses with examples.6. Dihybrid cross with examples7. Back cross and Test cross with examples.8. Mendel's Laws of Inheritance.	
	Unit Outcome: UO-1. Explain the process of inheritance.	
II	Gene Interactions	10

Unit No.	Title of Unit & Contents	Hrs.
	<p>1. Introduction</p> <p>A. Allelic interactions:</p> <ol style="list-style-type: none"> Incomplete dominance with examples of 4 'o'clock plant. Co- dominance with examples of coat color in cattle <p>B. Non-Allelic interactions</p> <p>I. Epistatic: Explanation and examples of</p> <ol style="list-style-type: none"> Dominant epistasis - 12:3:1 (Fruit colour in summer squash) Recessive epistasis - 9:3:4 (Supplementary genes) (Grain colour in maize/coat colour in mice) Duplicate dominant epistasis - 15:1 (Seed capsule of Shepherds purse) Duplicate recessive epistasis (Complementary genes) - 9:7 (Sweet pea flower color) <p>II. Non-epistatic: Explanation and examples of Collaborator gene - 9:3:3:1 (Comb shape in fowl)</p>	
	<p>Unit Outcome:</p> <p>UO-1. Solve problems related to Genetics.</p>	
III	Sex Determination	10
	<ol style="list-style-type: none"> Introduction Sex determination: Discovery of sex chromosomes, Chromosomal theory of sex determination. Sex determination in Animals/ Drosophila (XX, XY method) Sex determination in insects (XO-XX method), Sex determination in Birds (ZW-ZZ method), Sex determination in Plants (<i>Asparagus</i>). Linkage: Definitions, significance, Coupling and repulsion hypothesis. 	
	<p>Unit Outcomes:</p> <p>UO-1. Explain sex determination and extranuclear inheritance.</p> <p>UO-2. Evaluate Pedigree analysis and its control.</p>	
IV	Sex Linked Inheritance	12
	<ol style="list-style-type: none"> Introduction: Definition Types of Sex linked inheritance: <ol style="list-style-type: none"> X-linked with example 	

Unit No.	Title of Unit & Contents	Hrs.
	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: Hypertrochosis 7. Inheritance of bobbed bristles in Drosophila 8. Gene related diseases: i. Phenylketonuria (PKU) ii. Alkaptonuria (AKU) iii. Albinism. 9. Syndromes in Man: i) Autosomal: Down's syndrome ii) Chromosomal: Klinefelter's Syndrome.	
	Unit Outcome: UO-1. Justify about Syndromes.	

Learning Resources:

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



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

Department of Botany

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 Students are able to stand in clinic as genetics services.
LO-2 Students identify the different types of genetic disorder.
LO-3 To differentiate syndrome on the basis of physical characteristics.

Course outcomes:

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

- CO-1 Identify the different types of Linkage.
CO-2 Know the genetic diseases
CO-3 Solve the problems of Genetics very easily

Practical No.	Name of the Experiment
1	Problems based on Monohybrid ratio
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 Hypertrochosis (Man).
11	Study of Karyotype
12	Study of Syndromes (according to syllabus).
13	Study of genetic diseases- i. Phenylketonuria (PKU) ii. Alkaptonuria (AKU)

	iii. 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.



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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 awaken the students about Tissue system of plants.
- LO-2 To learn the process and concepts in plant Embryology.
- LO-3 To interpret fertilization and development of embryo.
- LO-4 To become familiar with histology and anatomy of plants
- LO-5 To analyse the internal structures of leaf and stem.

Course outcomes:

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

- CO-1 Interpret the different tissues and their function.
- CO-2 Perform sectioning of various anatomical structure.
- CO-3 Developed approach for embryology study.
- CO-4 Analyse the post fertilization changes during fruit development.

Unit No.	Title of Unit & Contents	Hrs.
I	Histology	12
	Plant Tissues A. Meristematic tissues and their classification based on position B. Permanent Tissues I Simple Tissues: 1. Parenchyma 2. Collenchyma 3. Sclerenchyma II Complex Tissues 1. Xylem 2. Phloem III Secretary Tissues 1. Laticiferous Tissues	

Unit No.	Title of Unit & Contents	Hrs.
	Ex. Latex cells 2. Glandular Tissues a. External glands Ex. Digestive glands b. Internal glands Ex. Oil glands	
	Unit Outcome: UO-1. Interpret the different tissues and their function.	

Unit No.	Title of Unit & Contents	Hrs.
II	Anatomy	12
	1. Anatomy of dicot Stem (Sunflower). 2. Anatomy of monocot Stem (Maize). 3. Secondary growth in dicot stem. 4. Leaf anatomy of dicotyledons (Sunflower) and monocotyledons (Maize). 5. Anomalous secondary growth in <i>Dracaena</i> stem.	
	Unit Outcome: UO-1. Perform sectioning of various anatomical structure	
III	Embryology -I	11
	1 Structure of a Microsporangium (T.S. of anther). 2. Structure of a Microspore. 3. Development of male gametophyte (Microgametogenesis). 4. Structure of a Megasporangium. 5. Anatroous ovule 6. Types of ovule. 7. Development of female gametophyte (Monosporic).	
	Unit Outcome: UO-1. Developed approach for embryology study.	
IV	Embryology -II	10
	1. Fertilization. 2. Post fertilization changes. 3. Endosperm and its types. 4. Development of dicot embryo (Crucifer type). 5. Structure of Dicot seed.	

	6. Structure of Monocot seed.	
	Unit Outcome:	
	UO-1. Analyse the post fertilization changes during fruit development.	

Learning Resources:

1. **Briggs David 2009.** *Plant microevolution and Conservation in Human-influenced Ecosystems.* Cambridge University Press.
2. **Cronquist, A. 1981.** *An Integrated System of Classification of Flowering Plants* Columbia University Press, New York.
3. **Cronquist, A. 1988.** *The Evolution and Classification of Flowering Plants (2nded.)* Allen Press, U.S.A.
4. **Davis, P. H. and V. H. Heywood 1991.** *Principles of Angiosperm Taxonomy.* Today and Tomorrow Publications, New Delhi.
5. **Hutchinson, J. 1959.** *Families of Flowering plants.* **Judd W. S., Campbell, C. S., Kellogg, E. A., Stevens P. F. and M. J. Donoghue 2008.**
6. *Plant Systematics: A phylogenetic Approach.* Sunderland, Massachusetts, USA.
7. **Lawrence George H. M. 195.1** *Taxonomy of Vascular Plants.* Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi.
8. **Leadlay E. and S. Jury (ed.) 2006.** *Taxonomy and Plant conservation.* Cambridge University Press.
9. **Manilal, K. S. and M. S. Muktesh Kumar [ed.] 1998.** *A Handbook of Taxonomic Training.* DST, New Delhi.
10. **Naik, V. N. 1984.** *Taxonomy of Angiosperms.* Tata McGraw-Hill Publication Com. Ltd. New Delhi
11. **Quicke, Donald, L. J. 1993.** *Principles and Techniques of Contemporary Taxonomy.* Blakie Academic & Professional, London
12. **Takhtajan, A. 1962.** *Flowering plants- Origin and Dispersal.*
13. **Taylor, D. V. and L. J. Hickey 1997.** *Flowering Plants: Origin, Evolution and*
14. *Phylogeny.* CBS Publishers & Distributers, New Delhi.

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

Course Type: Lab Course

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

Course Code:

Credits: 01

Max. Marks: 50

Hours: 30

Learning Objectives:

- LO-1 To interpret the role of meristematic tissue.
- LO-2 To learn the types of tissue.
- LO-3 To study the internal structure of leaf and stem.
- LO-4 To know the embryological structures.

Course outcomes:

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

- CO-1 Evaluate the internal structure of stem and leaf.
- CO-2 Analyse the types of tissue.
- CO-3 Identify the abnormal growth.
- CO-4 Prepare the double stained permanent slides of stem

Practical No.	Name of the Experiment
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 Dracaena 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.



॥ आरोह तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Botany

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 quality food.

LO-2 To maintain and increase long term fertility of soil.

LO-3 To allow agricultural producers an adequate returns and satisfaction.

LO-4 To avoid all forms of pollution that may result from agricultural techniques.

LO-5 To work as much as possible, within a closed system, with regard to organic matter and nutrient elements

Course Outcomes:

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

CO-1 Students learned the benefits of organic Farming.

CO-2 To gain knowledge about the staple food crops and their cultivation practices.

CO-3 Students award about importance Nutrient uptake and Utilization by plant

CO-4 Students award about importance of organic fertilizers.

CO-5 Students learned about composition of organic manure

Unit No.	Title of Unit & Contents	Hrs.
I	Organic Farming	08
	i. Introduction ii. Need of Organic Farming iii. Benefits of Organic Farming iv. Social aspects of Organic Farming v. Market aspects of Organic Farming	
	Unit Outcome: UO-1. Students learned the benefits of organic Farming	
II	Organic Fertilizers	07
	i. Introduction ii. Need of Organic Fertilizer	

	<ul style="list-style-type: none"> iii. Benefits of Organic Fertilizer iv. Preparation of Organic Fertilizer v. Demonstration & land preparation 	
	Unit Outcome: UO-1 Students award about importance of organic fertilizers.	
III	Plant Nutrients	07
	<ul style="list-style-type: none"> i. Introduction ii. Name of plant Nutrients iii. Functions of Nutrients in plant growth and Development iv. Nutrient uptake and Utilization by plant: (From Organics) From Inorganic v. Sources of nutrients for Organic Agriculture 	
	Unit Outcome: UO-1 Students award about importance Nutrient uptake and Utilization by plant.	
IV	Organic Manure	08
	<ul style="list-style-type: none"> i. Farmyard manures ii. Compost manures iii. Vermicompost iv. Green Manure with Leguminous crop 	
	Unit Outcome: UO-1 Students learned about composition of organic manure	
V	Practicals (Included in above 04 units)	
	<ul style="list-style-type: none"> 1. Preparation of compost 2-4. Indigenous technology knowledge (ITK) for nutrient arrangement 1. Preparation of vermicompost 2. Quality analysis of compost (Grading) 3. Packaging of compost 8. Estimation of total nitrogen from plants 9. Estimation of crude protein from plants 10. Visit to organic farms to study the various components and their utilization 	

Learning Recourses:

1. Principles of Organic Farming (With Theory and Practicals)_by E Somasundaram, D Udhaya Nandhini, et al. New India Publishing Agency- Nipa.
2. Arts & Science of Organic Farming by [Sujit Chakrabarty](#) , [Sumati Narayan](#) , [Farooq Ahmad Khan](#) ,Notion Press
3. The Complete Book on Organic Farming and Production of Organic Compost by [NPCS Board of Consultants & Engineers](#), Asia Pacific Business Press Inc.
4. Principles Of Organic Farming by [P.L.Maliwal](#), Scientific Publishers Indian Organic Business Today: Global And Local Hardcover – by [Manoj Kumar Menon Tej Partap](#)
5. Organic Farming Manual: A Comprehensive Guide To Starting And Running A Certified Organic Farm by [Ann Larkin Hansen](#), Storey Publishing LLC
6. ABC of Organic Farming (PB) Unknown Binding – Student Calendar, 1 by [Amitava Rakshit and H B Singh](#)
7. Sustainable Development of Organic Agriculture by [Kimberly Etingoff](#)
8. The Complete Technology Book on Biofertilizer and Organic Farming by [Dr. Himadri Panda](#)



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Basket IV: Generic/Open Elective (GE/OE)

(GEs offered to the Science & Technology students in Sem.-I / II)

Sr. No.	BoS Proposing GE/OE	Code	Course Title	Credits	Hrs.
1	Commerce	101AAF1401	Mutual Fund Management	04	60
2	Commerce	101MAE1401	Fundamentals of Statistics	04	60
3	English	101ENG1402	English for Science and Technology	04	60
4	Geography	101GEO1401	General Geography	04	60
5	Commerce	101BAI1401	Personal Financial Management	04	60
6	Marathi	101MAR1401	स्पर्धा परीक्षा आणि मराठी भाषा	04	60
7	Political Science	101POL1401	Human Rights	04	60
8	Biotechnology	101BIO1401	Nutrition, Health and Hygiene	04	60
9	Music	101MUS1401	Indian Vocal Classical & Light Music	04	60
10	NCC Studies	101NCC1401	Introduction to NCC	04	60
11	Sports	101SPO1401	Counseling and Psychotherapy	04	60

Note: Student can choose any one GE from the basket.

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year

Basket V: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem.-I / II)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Chemistry	101CHE1601	Pesticides and Green Chemistry	02	30-45
2	Information Technology	101COM1601	Basics of Python Programming	02	30-45
3	Physics	101PHY1601	Physics Workshop Skills	02	30-45
4	Biotechnology	101BIO1601	Food Processing Technology	02	30-45
5	Botany	101BOT1601	Mushroom Cultivation Technology	02	30-45
6	English	101ENG1601	Proof Reading and Editing	02	30
7	Information Technology	101COA1601	PC Assemble and Installation	02	30-45
8	Marathi	101MAR1601	कथा/पटकथालेखन	02	30
9	Zoology	101ZOO1601	Bee Keeping	02	30-45

Note: Student can choose any one SEC from the basket.

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

UG First Year Sem II

Basket VI: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-I / II)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR1701	ललित वाङ्मय	02	30
2	Hindi	101HIN1701	हिंदी भाषा शिक्षण एवं अनुवाद	02	30
3	Sanskrit	101SAN1701	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL1701	निबडक गद्य व पद्य	02	30



॥ आरोह तमसो ज्योतिः॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

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 Tutorial 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.
6. 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.

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

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	Mid Term	CAT II	Att.	CAT			
1	2	3				4		5	6	5 + 6
DSC/DSE/ GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	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. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam 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.