

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce, and Science College
Ahmednagar (Autonomous)
(Affiliated to Savitribai Phule Pune University, Pune)



National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Framework
B. Sc. - I (Biotechnology)

Implemented from
Academic Year 2024-25

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)

Board of Studies in Biotechnology

Sr. No.	Name	Designation
1.	Dr. Shubhangi S. Moharekar	Chairman
2.	Dr. Sanjay T. Moharekar	Member
3.	Dr. Sarika R. Deshmukh	Member
4.	Mr. Ashish S. Wani	Member
5.	Dr. Bimalendu B. Nath	Vice-Chancellor Nominee
6.	Prof. Dr. Nitin S. Desai	Academic Council Nominee
7.	Dr. Jyoti P. Jadhav	Academic Council Nominee
8.	Mr. Nitin Shirole	Industry Expert
9.	Mr. Sachin R. Adsare	Alumni
10.	Dr. Aparna A. Kulkarni	Member (co-opt)
11.	Mr. Girish P. Kukreja	Member (co-opt)

1. Prologue/ Introduction of the programme:

Biotechnology has expanded and established as an advanced interdisciplinary applied science. The study of Life itself is at the core of it and the interdisciplinary networking potential of biotechnology has given it a separate status in fundamental research as well as in modern industrial enterprise. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. In the milieu of research and industrialization for economic development and social change, biotechnology is an ideal platform to work. The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies

from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology to biodiversity, from microbiology to bioprocess engineering, from bioremediation to material transformation and so on. The use and application of these studies on living organisms and their bioprocesses is extensively covered in this field with the help of technology. Green revolution and white revolution was possible in India thanks to the deeper and intrinsic understanding of biotechnology.

The restructured syllabus is a choice based credit system with semester pattern. Biotechnology has grown extensively in last couple of decades. The syllabi till today had been sufficient to cater to the needs of students for building up their careers in industry and research. However, with the changing scenario at local and global level, we feel that the syllabus orientation should be altered to keep pace with developments in the education and industrial sector. The need of the hour is to design appropriate syllabi that emphasize on teaching of technological as well as the economical aspects of modern biology. The proposed credit based curriculum ensures the requirement of academia and industry. Theory supplemented with extensive practical skill sets will help a graduate student to avail the opportunities in the applied fields (research, industry or institutions) without any additional training. Thus, the university/college itself will be developing the trained and skilled man- power. Biotechnology being an interdisciplinary subject, this restructured syllabus will combine the principles of physical, chemical and biological sciences along with developing advanced technology.

Biotechnology curricula are operated at two levels viz. undergraduate and postgraduate. The undergraduate curricula are prepared to impart primarily basic knowledge of the respective subject from all possible angles while postgraduate syllabus emphasizes on more applied courses. In addition, students are to be trained to apply this knowledge particularly in day-to-day applications of biotechnology and to get a glimpse of research.

The basic aim of the revised course curriculum is to integrate various disciplines of life sciences which will cater the needs of human resources in academia and industry. The Overall objective of the Program is to promote education and research in biotechnology and provide academic and professional excellence for immediate productivity in academics, government organization, biomedical sectors, health and nutrition settings for ultimate benefit of society and sustainable development.

2. Programme Outcomes (POs)

1. To introduce the concepts in various allied subjects
2. To enrich students' knowledge in basic and applied aspects of life sciences.
3. To help the students to build interdisciplinary approach in teaching/ learning and in research.
4. To inculcate the sense of scientific responsibilities and social awareness.
5. To help students build-up a progressive and successful career in academia and industry.

B. Sc. Programme Framework: Credit Distribution

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		T		P				T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	02		02				02	02	02	02	-	02		02	02	02	02	22
	II	02		02				02	02	02	02	02	-	02	--	02	02	02	22
		Credits Related to Major						Selected as Minor											
		Core		Elective		VSC	FP / OJT / CEP/RP												
		T	P	T	P	P	P	T	P	-	P	T	P	-	-	-	-	-	
Diploma 5.0 / 200	III	04	02	--		02	02	02	02	-	02	02		-	02	-	02	22	
	IV	04	02	--		02	02	02	02	-	02		02	--	02	-	02	22	
Degree 5.5 / 300	V	06	04	02	02	2	2	02	-	-	-	-	-	02	-	-	-	22	
	VI	06	04	02	02	2	4	02	-	-	-	-	-	-	-	-	-	22	
Total		24	16	04	04	08	10	10	08	04	04	06	08	04	08	04	08	132	
6.0/400 Honours	VII	08	06	02	02	-	RM-04											22	
	VIII	08	06	02	02		OJT-04											22	
6.0/400 Honours with Research	VII	06	04	02	02		RM-04 RM-04											22	
	VIII	06	04	02	02		RM-08											22	
Total		40/36	28/24	08	08	08	18/26	10	08	04	04	06	04	04	04	08	04	08	176

B.Sc. Programme Framework: Course Distribution

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		T		P				T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	01		01				01	01	01	01	-	01		01	01	01	01	11
	II	01		01				01	01	01	01	01	-	01	--	01	01	01	11
		Credits Related to Major						Selected as Minor											
		Core		Elective		VSC	FP / OJT / CEP / RP												
		T	P	T	P	P	P	T	P	-	P	T	P	-	-	-	-	-	
Diploma 5.0 / 200	III	02	01	--		01	FP-01	01	01	-	01	01		-	01	-	01	11	
	IV	02	01	--		01	CEP-01	01	01	-	01		01	--	01	-	01	11	
Degree 5.5 / 300	V	03	02	01	01	01	FP-01	01	-	-	-	-		01	-	-	-	11	
	VI	03	02	01	01	01	OJT-01	01	-	-	-	-		-	-	-	-	10	
Total		12	08	02	02	04	04			02	02	03	04	02	04	02	04	65	
6.0/400 Honours	VII	03	03	01	01	-	RM-01											09	
	VIII	03	03	01	01		OJT-01											09	
6.0/400 Honours with Research	VII	02	02	01	01		RM-01 RM-01											08	
	VIII	02	02	01	01		RM-01											07	
Total		18/16	14/12	04	04	04	06/07	06	04	02	02	03	04	02	04	02	04	83/80	

B. Sc. - Biotechnology: Credit and Course Distribution in Brackets

Level / Difficulty	Sem	Subject-1							Total
		T		P					
4.5	I	02 (01)		02 (01)				04(02)	
	II	02 (01)		02 (01)				04(02)	
		Credits Related to Major							
		Core		Elective		VSC	FP / OJT/ CEP	IKS	
		T	P	T	P	P	P	T	
5.0	III	04(02)	02(01)	--		02(01)	FP-02(01)		10(05)
	IV	04(02)	02(01)	--		02(01)	CEP-02(01)		10(05)
5.5	V	06(03)	04(02)	02(01)	02(01)	02(01)	FP-02(01)	02(01)	20 (10)
	VI	06(03)	04(02)	02(01)	02(01)	02(01)	OJT-04(01)		20(09)
Total		12	08	(02)	(02)	04	04	(01)	33
6.0	VII	03	03	(01)	(01)	-	RM-04(01)		22(09)
	VIII	03	03	(01)	(01)		OJT-04(01)		22(09)
6.0	VII	(02)	(02)	(01)	(01)		RM-04(01) RP-04(01)		22(08)
	VIII	(02)	(02)	(01)	(01)		RM-08(01)		22(07)
		18/16	14/12	04	04	04	06/07	(01)	51/48

Programme Framework (Courses and Credits): B. Sc. Biotechnology

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-01	BS-BT 111T	Botanical Sciences	02
2.	I	I	4.5	DSC-02	BS-BT 112P	Practicals in Botanical Sciences	02
3.	I	II	4.5	DSC-03	BS-BT 121T	Genetics	02
4.	I	II	4.5	DSC-04	BS-BT 122T	Practicals in Genetics	02
5.	II	III	5.0	DSC-05	BS-BT 231T	Cell Biology	02
6.	II	III	5.0	DSC-06	BS-BT 232T	Immunology	02
7.	II	III	5.0	DSC-07	BS-BT 233P	Practicals in Cell Biology	02
8.	II	III	5.0	VSC-01	BS-BT 234P	Environmental Biotechnology	02
9.	II	III	5.0	FP-01	BS-BT 235T	Field Project on EBT	02
10.	II	IV	5.0	DSC-08	BS-BT 241T	Animal Development	02
11.	II	IV	5.0	DSC-09	BS-BT 242T	Plant Development	02
12.	II	IV	5.0	DSC-10	BS-BT 243P	Practicals in Animal and Plant Development	02
13.	II	IV	5.0	VSC-02	BS-BT 244T	Molecular Biology	02

14.	II	IV	5.0	CEP-01	BS-BT 245P	Community Engagement Project	02
15.	III	V	5.5	DSC-11	BS-BT 351T	Animal Tissue Culture	02
16.	III	V	5.5	DSC-12	BS-BT 352T	Plant Tissue Culture	02
17.	III	V	5.5	DSC-13	BS-BT 353T	Recombinant DNA Technology	02
18.	III	V	5.5	DSC-14	BS-BT 354P	Practicals in Tissue Culture Techniques	02
19.	III	V	5.5	DSC-15	BS-BT 355P	Practicals in Recombinant DNA Technology	02
20.	III	V	5.5	DSE-01	BS-BT 356T	Microbial Biotechnology	02
21.	III	V	5.5	DSE-02	BS-BT 357P	Practicals in Microbial Biotechnology	02
22.	III	V	5.5	VSC-03	BS-BT 358P	Scientific Communication	02
23.	III	V	5.5	FP-02	BS-BT 359P	Project	02
24.	III	V	5.5	IKS-02	BS-BT 360T	Biotechnology – Indian Perspective	02
25.	III	VI	5.5	DSC-16	BS-BT 361T	Biodiversity and Evolution	02
26.	III	VI	5.5	DSC-17	BS-BT 362T	Enzyme Technology	02
27.	III	VI	5.5	DSC-18	BS-BT 363T	Bioinformatics	02
28.	III	VI	5.5	DSC-19	BS-BT 364P	Practicals in Biodiversity, Evolution and Bioinformatics	02
29.	III	VI	5.5	DSC-20	BS-BT 365P	Practicals in Enzyme Technology	02
30.	III	VI	5.5	DSE-03	BS-BT 366T	Bioanalytical Techniques	02
31.	III	VI	5.5	DSE-04	BS-BT 367P	Practicals in Bioanalytical Techniques	02
32.	III	VI	5.5	VSC-04	BS-BT 368T	Food Biotechnology	02
33.	III	VI	5.5	OJT-01	BS-BT 369T	Internship	04

B. Sc. Biotechnology (Honours)

34.	IV	VII	6.0	DSC-21	BS-BT 471T	Plant Biotechnology	03
35.	IV	VII	6.0	DSC-22	BS-BT 472T	Advanced Biological Chemistry	03
36.	IV	VII	6.0	DSC-23	BS-BT 473T	Biostatistics	02
37.	IV	VII	6.0	DSC-24	BS-BT 474P	Practicals in Plant Biotechnology	02
38.	IV	VII	6.0	DSC-25	BS-BT 475P	Practicals in Advanced Biological Chemistry	02
39.	IV	VII	6.0	DSC-26	BS-BT 476TP	Practicals in Biostatistics	02
40.	IV	VII	6.0	DSE-05	BS-BT 477T	Nanobiotechnology	02
41.	IV	VII	6.0	DSE-06	BS-BT 478T	Pharmaceutical Biotechnology	02
42.	IV	VII	6.0	RM-01	BS-BT 479T	Research Methodology	04
43.	IV	VIII	6.0	DSC-27	BS-BT 481T	Animal Biotechnology	03
44.	IV	VIII	6.0	DSC-28	BS-BT 482T	Advanced Bioanalytical Techniques	03
45.	IV	VIII	6.0	DSC-29	BS-BT 483T	Large Scale Manufacturing Process	02
46.	IV	VIII	6.0	DSC-30	BS-BT 484P	Practicals in Animal Biotechnology	02

47.	IV	VIII	6.0	DSC-31	BS- BT 485P	Practicals in Advanced Bioanalytical Techniques	02
48.	IV	VIII	6.0	DSC-32	BS- BT 486P	Practicals in Large Scale Manufacturing Process	02
49.	IV	VIII	6.0	DSE-07	BS- BT 487T	Environmental Biotechnology	02
50.	IV	VIII	6.0	DSE-08	BS- BT 488T	Clinical Research	02
51.	IV	VIII	6.0	OJT-02	BS- BT 489T	--	04

B. Sc. Biotechnology (Honours with Research)

34.	IV	VII	6.0	DSC-21	BS-BT 471T	Plant Biotechnology	03
35.	IV	VII	6.0	DSC-22	BS- BT 472T	Advanced Biological Chemistry	03
36.	IV	VII	6.0	DSC-23	BS- BT 473P	Practicals in Plant Biotechnology	02
37.	IV	VII	6.0	DSC-24	BS- BT 474P	Practicals in Advanced Biological Chemistry	02
38.	IV	VII	6.0	DSE-05	BS- BT 475T	Biostatistics	02
39.	IV	VII	6.0	DSE-06	BS- BT 476P	Practicals in Biostatistics	02
40.	IV	VII	6.0	RM-01	BS- BT 476T	Research Methodology	04
41.	IV	VII	6.0	RP-01	BS- BT 477T	Project	04
42.	IV	VIII	6.0	DSC-19	BS-BT 481T	Animal Biotechnology	03
43.	IV	VIII	6.0	DSC-20	BS- BT 482T	Advanced Bioanalytical Techniques	03
44.	IV	VIII	6.0	DSC-21	BS- BT 483T	Practicals in Animal Biotechnology	02
45.	IV	VIII	6.0	DSE-04	BS- BT 484T	Practicals in Advanced Bioanalytical Techniques	02
46.	IV	VIII	6.0	DSE-07	BS- BT 485T	Environmental Biotechnology	02
47.	IV	VIII	6.0	DSE-08	BS- BT 486P	Pharmaceutical Biotechnology	02
48.	IV	VIII	6.0	PR-02	BS- BT 487T	Project	08

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B. Sc. -I (Biotechnology)

Title of the Course: Botanical Sciences								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-01	BS-BT 111T	02	00	02	30	15	35	50

Learning Objectives:

1. To explore the diversity and economic importance of plant kingdom
2. To explore plant cells and tissues types
3. To understand fundamentals of plant physiology
4. To explore plant nutrition, growth, and development

Course Outcomes (Cos)

1. Students will learn basic concepts, the diversity and economic importance of plant kingdom.
2. Students will know organization of plant body at cell and tissue level.
3. Students will understand the basic concepts of plant physiology: Plant water relations, Photosynthesis, Respiration.
4. Students will study role of mineral nutrients and plant growth regulators in plant growth and development.

Detailed Syllabus:**Unit I Introduction to Plant Biology:****10**

Importance of plants in ecosystems and human life, Basic plant structure and organization, A general account of different groups (Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and angiosperms), Overview of plant reproduction and their economic importance with example.

Plant Cells and Tissues system: Structure and functions of plant cells, Types and functions of plant tissues (Meristematic, Permanent-Simple and complex, epidermal), internal structures of roots, stems, and leaves.

Unit II Basics of Plant Physiology:**12**

Plant-water relations: Permeability, diffusion and osmosis, water uptake and transport in plants.

Photosynthesis: Light reactions and Calvin cycle, Factors affecting

photosynthesis, Photorespiration and C4 and CAM pathways

Respiration and Metabolism: Overview of cellular respiration and ATP production.

Secondary metabolites and stress: Plant response to stress (biotic and abiotic), Plant secondary metabolites and their roles.

Unit III Plant Nutrition, Growth and Development: 8

Essential elements and their role in plant growth.

Plant hormones and their functions.

Seed germination and metabolic changes during seed germination.

Plant propagation by vegetative and artificial methods.

Fruits and fruit ripening

Regulation of plant growth and development: Photo-biology (movement and photo-morphogenesis (vegetative), Photoperiodism and Vernalization

Unit IV Economic importance of plants: Cereals, Pulses, Oil seeds, Fiber plants, Medicinal Plants, Timber yielding plants, Plants used in beverages with examples 4

Suggested Readings/Material:

1. Biochemistry and Molecular Biology of Plants, 2nd (2015), Russell L. Jones (Editor), Wilhelm Gruissem (Editor), Bob B. Buchanan (Editor) ISBN: 978-0-470-71421-8
2. Lincoln Taiz, Ian Max Møller, Angus Murphy, and Eduardo Zeiger (2022) Plant Physiology and Development, 7th Edition ISBN: 9780197577240
3. Ganguli, Das Dutta (2011) – College Botany Vol I, II and III (New Central Book
4. Agency, Kolkata)
5. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley &
6. Sons, U.S.A. 4th Edition.
7. Nobel P. S. (1998), Physiochemical and Environmental Plant Physiology (Second
8. Edition), Academic Press, San Diego, USA.
9. Albert F Hill; O P Sharma (1996) Hills Economic Botany, New Delhi: Tata McGrawHill, ©1996.

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Syllabus
B. Sc. -I (Biotechnology)

Title of the Course: Practicals in Botanical Sciences								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-02	BS-BT 112P	00	02	02	60	15	35	50

Learning Objectives:

1. To study different plant groups and its economic importance.
2. To study different cell and tissue types of plants using various techniques.
3. To study the different physiological and biochemical processes.

Course Outcomes (Cos)

1. Students will acquire practical knowledge about different plant groups and its importance in ecosystem and they will be able to identify different plant groups.
2. Students will use different techniques (sectioning, squash, maceration) to know about internal structure as well as various cell and tissue types of plants
3. Students will learn about transport of water in plant body and role of transpiration, qualitative and quantitative estimation of various metabolites.

Detailed Syllabus: Example

Sr. No.	Title of the Experiment	No. of Practicals
1.	Study of collection and preservation of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.	1
2.	Study of typical plant/plant parts (Monocot and Dicot) and dissection of flower and study of parts of flower.	1
3.	Study of epidermal tissue system: stomata, trichome and root hairs.	1
4.	Study of plant cell/tissue types using squash and maceration techniques.	1
5.	Observation of internal structure of typical dicot and monocot stem.	1

6.	Observation of internal structure of typical dicot and monocot leaf.	1
7.	Study of plant propagation by using different propagation methods.	1
8.	Study of transpiration and translocation in plants	1
9.	Testing presence of primary (proteins, carbohydrates) and secondary (phenols) metabolites in the plant tissue.	1
10.	Estimation of chlorophyll content in photosynthesizing and non-photosynthesizing leaf	1
11.	Determination of rate of respiration in germinating seeds.	1
12.	Studies of economically important plants: Students should prepare herbarium specimens with their uses	1

Suggested Readings/Material:

1. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi. Co. Ltd.
2. Chmielewski, Jerry & Krayesky, David. (2013). General Botany Laboratory Manual. ISBN: 978-1-4772-9653-0.
3. Manju Bala , Sunita Gupta , N.K. Gupta & M.K. Sangha (2019) Practicals in Plant Physiology and Biochemistry. ISBN 9789386102638

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
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Syllabus
B. Sc. -I (Biotechnology)**

Title of the Course: Genetics								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-03	BS-BT 121T	02	00	02	30	15	35	50

Learning Objectives:

1. To understand basic principles of inheritance
2. To learn Mendelian and Non-Mendelian genetics
3. To understand chromosomal aberrations and mutation
4. To study concept of linkage and recombination

Course Outcomes (COs):

1. Students are able to understand the basic principles of inheritance biology.
2. They get in-depth knowledge about gene interaction, epistasis and pleiotropism.
3. Students will able to understand the chromosomal aberrations and mutation.
4. Students will study the mechanisms Linkage, recombination and genetic disorders.

Detailed Syllabus:**Unit I: Genetic basis of Inheritance:****03**

Concept of Genetics, Heredity and Variation, Pre- Mendelian genetics, Applications of genetics.

Unit II: Mendelian Genetics :**07**

Mendel's Experiments, Mendel's Laws, Monohybrid and Dihybrid cross, Deviation from Mendel's Law- Incomplete Dominance, Co Dominance, Gene Interaction- Epistasis, Multiple Allele

Unit III: Chromosomal aberrations - 05

Numerical aberrations - euploidy, aneuploidy, polyploidy, mosaics, trisomy and monosomy. Structural aberrations: translocation, inversion, duplication, deletion.

Unit IV: Mutations- 05

Concept of mutation, its classification and types, molecular basis of mutations, Mutagens and their action, hot spot mutations.

Unit V: Linkage and Recombination- 05

Discovery of Linkage, Complete and incomplete linkage, crossing over, two point cross, Recombination Frequency and Map Distance

Unit VI: Genetic Disorders - 05

Sickle Cell Anemia, Hemophilia, Colour Blindness, Albinism, Down's and Klinefelter's Syndrome, Genetic Counseling

Suggested Readings/Material:

1. Genetics: Strickberger M. W. (2015) 3rd edition, Prentice Hall, India.
2. Genetics: analysis of genes and genomes by Hartl DL, Jones EW (2017) – 9th edition Jones and Bartlett, Massachusetts.
3. Introduction to genetic analysis by Griffiths AJ, Wessler SR, Carroll SB, Doebley J (2015) eleventh edition, Freeman & Co, New York.
4. Molecular genetics of bacteria by Snyder L, Champness W (2013) ASM Press, Washington.
5. Textbook of Cell Biology, Genetics, molecular biology , Ecology and Evolution.: P.S. Verma and V.K.Agarwal (2022) S. Chand And Company Ltd.
6. Principals of Genetics: Robert H. Tamarin (2017) 7th Edition.
7. GENES IX (2007): Benjamin Lewin.
8. Concepts of genetics by Robert Brooker (2011) McGraw-Hill Education
9. Genetics: A Mendelian Approach by Peter J. Russell (2011) Benjamin Cummings.

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Syllabus
B. Sc. -I (Biotechnology)**

Title of the Course: Practicals in Genetics								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-04	BS-BT 122P	00	02	02	60	15	35	50

Learning Objectives:

1. Master Mendelian inheritance & explore non-Mendelian patterns.
2. Analyze genetic diversity through blood groups & multiple alleles.
3. Understand sex-linked inheritance and its unique patterns.
4. Gain practical skills in karyotyping & Drosophila experiments.
5. Apply genetic principles to solve problems and predict outcomes.

Course Outcomes (Cos)

1. Explain & differentiate Mendelian vs. non-Mendelian inheritance.
2. Analyze genetic data & predict offspring genotypes & phenotypes.
3. Describe how gene interactions influence trait expression.
4. Perform basic genetic techniques like karyotyping & Drosophila handling.
5. Appreciate real-world applications of genetics through field visits.

Detailed Syllabus:

Sr.No.	Title of practical	Number of Practicals (12)
1.	Study of monohybrid Cross and verifying Law of Dominance and Law of Segregation	1
2.	Study of dihybrid Cross and verifying Law of Independent Assortment	1

3.	Study of Non- Mendelian Inheritance- Co-dominance, Incomplete dominance	1
4.	Study of gene interaction -Epistasis	1
5.	Study of multiple alleles using blood group data	1
6.	Study of sex-linked inheritance	1
7.	Estimation of map distance between genes using two-point cross data	1
8.	Karyotype analysis for testing chromosomal abnormality	1
9.	Rearing and handling of <i>Drosophila</i> for laboratory experiments	1
10.	Familiarization with a few mutant phenotypes of <i>Drosophila melanogaster</i> using stereo zoom microscope	1
11.	Preparation of mitotic/polytene chromosomes of <i>Drosophila melanogaster</i>	1
12.	Visit to Cytogenetics laboratory /Agricultural university/ Seed company	1

Suggested Readings/Material:

1. **A Laboratory Manual for Genetics** by S.K. Verma & A.K. Srivastava (S. Chand Publishing, 2018)
2. **Laboratory Manual of Human Genetics** by R.C. Sohani (Affiliated East-West Press Pvt. Ltd., 1999)
3. **Drosophila Genetics: An Introduction** by M.R. Yadav (Springer Nature Singapore Pte Ltd., 2018)
4. **Elements of Biotechnology: Practical Manual** by P.C. Joshi (Publisher: PHI Learning Private Limited, 2017)