CB20/Bot/26/890
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CBLU/BOT/26/330
07-01-2026

Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)

Department of Botany

Syllabus and Examination Scheme

M.Sc. Botany

In accordance with NEP-2020

w.e.f. 2025-2026

(2025-26)

07-01-2026

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ChaudharyBansiLalUniversity,Bhiwani

(AStateUniversityestablishedunderHaryanaActNo.25of 2014)

EvaluationScheme of M.Sc. Botany

Summary

Programme	**:M.Sc.Botany**
Duration	**:Twoyear(FourSemesters)**
Maximum Duration	**: Four Years**
Medium	**: English**
Minimum Attendance Required	**: 75%**
Total Credits	**:96**
Total Marks	**:2000(Option I in IV Sem.)**
	:2100(Option II in IV Sem.)

Assessment/Evaluationof Theory examination:

Internal Marks	MajorTest (End Semester Exam)Marks	TotalMarks
30	70	100
15	35	50

InternalEvaluation:

MinorTest Marks	Attendance Marks	Assignment/ Quiz Marks	TotalMarks
15	05	10	30
07	04	04	15

DurationofExamination:

MinorTest (Internal)	MajorTest
1 hr.	2 or 3 hrs.

There is 5% IKS in the syllabus of M.Sc. Botany including assignments.

Passing Criteria:

To qualify for the course, a student is required to secure a minimum of 40% marks in aggregate including the internal evaluation and Major Test (End Semester Examination).

*For other details please visit University Website on PG Ordinance

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PGBOS Meeting dt 02.8.2025 Faculty Meeting dt 07.11.2025

Chaudhary Bansi Lal University, Bhiwani

(A State University established under Haryana Act No. 25 of 2014)

Study & Evaluation Scheme of P.G. Diploma in Botany

Summary

Programme	**: M.Sc. Botany**
Duration	**: One year (Two Semesters)**
Maximum Duration	**: Two Years**
Medium	**: English**
Minimum Attendance Required	**: 75%**
Total Credits	**: 50**
Total Marks	**: 1050**

Assessment/Evaluation of Theory examination:

Internal Marks	Major Test (End Semester Exam) Marks	Total Marks
30	70	100
15	35	50

Internal Evaluation:

Minor Test Marks	Attendance Marks	Assignment/ Quiz Marks	Total Marks
15	05	10	30
07	04	04	15

Duration of Examination:

Minor Test (Internal)	Major Test
1 hr.	2 or 3 hrs.

There is 5% IKS in the syllabus of M.Sc. Botany including assignments.

Passing Criteria:

To qualify for the course, a student is required to secure a minimum of 40% marks in aggregate including the internal evaluation and Major Test (End Semester Examination).

**For other details please visit University Website on PG Ordinance*

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***Internship Program (For one-year Diploma in Botany):**

Students desire to exit the programme after second semester and securing 50 credits. For other details visit university website

To qualify the course, a student is required to secure a minimum of 40% marks in aggregate including the internal evaluation and Major Test (End Semester Examination). A candidate who secures less than40% of marks in a course shall be deemed to have failed in the course. The student should have obtained at least 40%marks in aggregate to qualify the semester.

Examination scheme (Question Paper Structure) *The question paper shall consist of 9 questions. Out of which, first question shall be of short answer type and will be compulsory. Question no. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer all parts. The remaining 8 questions shall have internal choice. The weightage for each question shall be 14 marks*

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SEMESTER-I **CREDTS: 24** **MARKS: 500**

Sr. No.	Paper Code	Subjects	Type of Course	Contact hours per week			Credits			Examination Scheme			
				Theory	Practical	Total	Theory	Practical	Total	Theory	Internal Assessments	Practical	**Total**
1.	25BOT 101	Cell Biology	CC-1	04	-	04	04	-	04	70	30	-	100
2.	25BOT102	Phycology, Mycology and Plant Pathology	CC-2	04	-	04	04	-	04	70	30	-	100
3.	25BOT 103	Bryophytes, Pteridophytes and Gymnosperms	CC-3	04	-	04	04	-	04	70	30	-	100
4.	25BOT 104	Plant Biochemistry	DEC-**1 /2** (Select any one)	04	-	04	04	-	04	70	30		100
5.	25BOT 105	Biodiversity and conservation											
6.	25BOT 106	**Lab course I**	P.C.1	-	08	08	-	04	04	-	-	50	50
7.	25BOT 107	**Lab course II**	P.C.2	-	08	08	-	04	04	-	-	50	50
TOTAL				16	16	32	16	**08**	**24**	**280**	**120**	**100**	**500**

C.C = Core Course **P.C. = Practical Course**

DEC= Discipline Elective Course # Select one out of two provided in Scheme.

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SEMESTER II **CREDITS: 26** **MARKS: 550**

Sr. No.	Paper Code	Subjects	Type of Course	Contact hours per week			Credits			Examination Scheme			
				Theory	Practical	Total	Theory	Practical	Total	Theory	Internal Assessments	Practical	Total
1.	25BOT 201	Molecular Biology	CC-4	04	-	04	04	-	04	70	30	-	100
2.	25BOT 202	Plant Systematics and Economic Botany	CC-5	04	-	04	04	-	04	70	30	-	100
3.	25BOT 203	Plant Biotechnology & Genetic Engineering	CC-6	04	-	04	04	-	04	70	30	-	100
4.	25BOT 204	**Lab course I**	P.C.3	-	08	08	-	04	04	-	-	50	50
5.	25BOT 205	**Lab course II**	P.C.4	-	08	08	-	04	04	-	-	50	50
6.	25BOT 206	Plant Genetics	**D.E.C.-3/4** (Select any one)	04	-	04	04	-	04	70	30	-	100
7.	25BOT 207	Biostatistics, IPR and Biosafety											
8.	25BOT- VAC-1-208	Environment Sciences (V.A.C)	V.A.C. or IKS	02		02	02		02	35	15	-	50
9.	25BOT-IKS-1-209	Indian Knowledge Systems in Biology (IKS)		02		02	02		02	35	15	-	50
TOTAL				**20**	**16**	**36**	**20**	08	**26**	**350**	**150**	**150**	**600**

C.C = Core Course EEC= Employability enhancement Course P.C. = Practical Course V.A.C.= Value Added Course IKS= Indian Knowledge System

DEC= Discipline Elective Course # Select one out of two or student can also take MOOCs course from SWAYAM portal of equal.
Note: Discipline Elective Course paper can be offered depending upon the availability of the Resources and faculties.

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Appendix-I

DISSERTATION/ PROJECT WORK EVALUATION REPORT

Name of Course :
Name of the Candidate :
Subject :
Title of the Dissertation/Project Report :
Academic Session :
Registration Number :

EVALUATION CRITERIA

Dissertation/Project Report will be evaluated under the following three evaluation heads:

Quality, Content, Presentation

The grade for each of them on a scale of 0 – 10 where:

"10" stands for "Excellent"	"4" stands for "Satisfactory"
"8" stands for "Very Good"	"2" stands for "Poor"
"6" stands for "Good"	"1" stands for "Inferior"

EVALUATION HEADS		SCORE
Quality		
1.	Introduction to the work	
2.	Review of literature	
3.	Scope of the work	
4.	Technical soundness (Research methodology/Experimental set up)	
5.	Problem statement	
6.	Originality of work	
7.	Timeliness of work	
8.	Contribution to the field	
9.	Conclusions drawn	
10.	Scope for further research in the field	
Content		
11.	Adequacy of data and information	
12.	Organization of the Dissertation/Project Report	
13.	Practical applications/utility	
14.	Adequacy of reference/Bibliography	
Presentation		
15.	Clear explanation of the work	
16.	Sufficient details of the methods/techniques adopted	
17.	Justification of the work done	
18.	Clarity and unambiguity of the language	
19.	Clarity of Objectives	
20.	Freedom from redundancy/Irrelevancy	
Total Score out of 200		

(in word .....**)**

Date

Signature of the Examiner

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PBOD Meeting dt 02-8-2025

Faculty Meeting dt 07-11-2025

Appendix-I

DISSERTATION/PROJECT WORK EVALUATION REPORT

Name of Course .....
Name of the Candidate .....
Subject .....
Title of the Dissertation/Project Report .....
Academic Session .....
Registration Number .....

EVALUATION CRITERIA

Dissertation/Project Report will be evaluated under the following three examination heads

Quality, Content, Presentation

The grade for each of them on a scale of 0 - 10 where

"10" stands for "Excellent"
"8" stands for "Very Good"
"6" stands for "Good"
"4" stands for "Satisfactory"
"2" stands for "Poor"
"1" stands for "Inferior"

EVALUATION HEADS

		SCORE
Quality		
1.	Introduction to the work	
2.	Review of literature	
3.	Scope of the work	
4.	Technical soundness (Research methodology/Experimental set-up)	
5.	Problem statement	
6.	Originality of work	
7.	Timeliness of work	
8.	Contribution to the field	
9.	Conclusions drawn	
10.	Scope for further research in the field	
Content		
11.	Adequacy of data and information	
12.	Organization of the Dissertation/Project Report	
13.	Practical applications/utility	
14.	Adequacy of reference/Bibliography	
Presentation		
15.	Clear explanation of the work	
16.	Sufficient details of the methods/techniques adopted	
17.	Systematic flow of the work done	
18.	Clarity and unambiguity of the language	
19.	Clarity of objectives	
20.	Freedom from redundancy/Irrelevancy	
Total Score out of 200		
(in word .....)		

Date

Signature of the Examiner

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21.4 A dissertation/project work will be of total 12 credits (300 marks). The evaluation of dissertation/project work will have two components. In the first part, dissertation/project report will be evaluated for 200 marks on the parameters laid down in the proforma for the evaluation of dissertation (*Appendix-I*) and the second part of the evaluation will comprise of 100 marks (Attendance + Presentation + Viva-Voce) in which the student will give a presentation on the dissertation and an open viva-voce examination will be conducted by the external examiner.

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21. **Assessment and Evaluation:**

21.1 **Student Progression and Mentoring:**
Each student shall be examined in the course(s) to help their progression through the programme as laid down in the scheme, syllabus and learning outcomes through a system of Continuous Comprehensive Assessment (CCA) using a mix of Mid-Term (Sessional) and End-Term Examinations.

21.1.1 Internal Assessment will be broadly 30% of the total marks and weightage of 70% shall be given to evaluation of End-Term examination(s).

21.1.2 Internal Assessment (30%) shall be broadly based on the following defined components:

a)	Class Participation.	
	Class Participation of 5 marks will be based on following criteria of attendance: Attendance	
	65% and above but less than 70%	1 marks*
	70% and above but less than 75%	2 marks*
	75% and above but less than 80%	3 marks
	80% and above but less than 90%	4 marks
	90% and above	5 marks
*For students engaged in co-curricular activities only as mentioned in 22.2.		
b)	Presentation/Assignment/Quiz/Class Test/Seminar, etc. in case of Theory examination and Case Study/Demonstration/Viva-Voce/Lab record/Field work/Survey, etc. in case of Practical examination	5 marks
c)	Mid - Term Examination.	20 marks

Internal Assessment Marks will further divided as per following tables:

Course Composition- Theory/(Theory +Tutorial)			
Course Credit	Internal Assessment Marks	End-Term Exam Marks	Total Marks
2	15	35	50
3	20	50	70
4	30	70	100

Course Composition - Theory + Practical						
Course Credit		Theory		Practical		Total Marks
Theory	Practical	Internal Assessment Marks	End- Term Exam Marks	Internal Assessment Marks	End- Term Exam Marks	
1	1	10	20	5	15	50
2	1	15	35	5	15	70
3	1	20	50	10	20	100

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Faculty meeting 02.11.2025

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22 **Eligibility for Examination:**

22.1 End-Term Examination shall be open to a regular student who:

a. has been on the rolls of the Department/College/Institute during the semester.
b. has passed the requisite qualifying examination, if s/he is a candidate for the first semester Examination.
c. has her/his examination form submitted on the University portal through the Chairperson/Principal/Director of the concerned Department/College/Institute.
d. has attended not less than 75% of the lectures in a course. This requirement shall be fulfilled separately for each course of the programme. A deficiency in the prescribed course (Lectures/Practicum, etc.) may be condoned by the Chairperson/Principal/ Director of the Department/College/Institute in deserving cases up to 15%.

22.2 The condonation up to 15% shall also include loss of attendance due to participation in the cultural and sports assignments, etc. organized by the concerned agencies/branches/offices such as DYW, NSS, NCC, YRC, Sports etc. Provided further that, a student who participates in the Inter-University Tournaments or Inter University Youth Festivals or Republic Day Parade and any event as deemed fit by the concerned office, may be allowed additional condonation on this ground up to 10% in each course on a certificate from the Director, Sports; Director, Youth Welfare; Programme Coordinator, NSS/NCC as the case may be, subject to the condition that such a student shall not be allowed to appear in the examination if his/her attendance, after condonation on all counts, falls below 50%. The concerned office shall issue such certificates.

22.3 A candidate, who has not attended the requisite percentage of lectures/practicum, shall not be eligible to take the End-Term Examinations in the concerned theory/practicum course unless s/he repeats the course and obtains the requisite attendance but will be eligible to take examination in the remaining paper(s).

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19. Dissertation/Project Work:

A student who opts for Dissertation/Project work of 12 credits in 4th / 2nd semester of 2-year / 1-year PG Programme will be required to do the research work based on systematic, scientific and rigorous investigations on the chosen and approved topic utilizing relevant research methods/techniques/innovations.

19.1 A student, who opts for Dissertation/Project work in 4th semester of 2 year PG Programme, shall submit a request for allotment of a supervisor mentioning her/his research areas of interest in order of preference to the Chairperson/Principal/Director during 3rd semester. The Department/College/Institute will allot a qualified supervisor to guide the student for doing research for Dissertation/Project work. A regular full-time teacher of that Department/College/Institute, who has been approved to supervise Ph.D. scholars by the University, will be eligible to guide the students for Dissertation/Project work.

19.2 The student will submit the synopsis to the supervisor. In case of University Teaching Department (UTD), the synopsis will be approved by the Departmental Committee after recommendation of the supervisor.

19.3 In case of affiliated Colleges/Institutes, the Principal/Director shall constitute a committee of at least three members of the concerned subject for this purpose at the College/Institute level. The committee will consist of at least one subject expert from Chaudhary Bansi Lal University, Bhiwani to be nominated by the Chairperson/Director on the request of College/Institute. The request for external expert should reach to the Chairperson/Director before 30th November of the concerned year. The list of students, their approved topics, and names of supervisors along with their synopsis will have to be submitted by the College/Institute to the respective Chairperson/Director latest by 31st January of the concerned year.

19.4 The student shall be required to submit three hard copies of her/his dissertation or project report along with soft copy as PDF file to the Department/College/Institute by 31st May of the concerned year which will be forwarded to the Controller of Examinations for evaluation within a week.

19.5 The anti-plagiarism policy of the University will have to be strictly followed by the candidate and the supervisor for dissertation/project report. Similarity report certificate issued by the Librarian as per anti-plagiarism policy of the university is to be annexed with the dissertation/project report.

19.6 Evaluation of the dissertation/project report shall be done by an external examiner. The panel of examiners for evaluation of dissertations/project reports will be approved by the respective Board of Studies.

19.7 The schedule as specified above is to be strictly followed by the student and Department/College/Institute and any relaxation will not be allowed. However, in exceptional circumstances, late submission may be allowed with a late fee, as decided by the University authorities from time to time.

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1. Program Learning outcomes (PLOs): The graduates after completion of their Masters in Botany, shall be able to learn:

PLOs	Outcomes
PLO1	Postgraduate students will be able to demonstrate and apply their knowledge to solve the real problems of the society.
PLO 2	Students will be able to develop hands on knowledge to execute their career in applied life sciences problems, which opens up the possibility of improved industry learning as well as career aspects in the future.
PLO 3	Helping the students to become a more experienced professional and building a network with other industry specialists and professionals.
PLO 4	Students will be able to comprehend three key features of biological phenomena: a) what to seek; b) how to search; and c) why to seek.
PLO 5	Viewing botany as a tool for growing the mind, critical attitude, and logical reasoning ability that is ready to assist in a variety of professions.
PLO 6	Have the capacity to develop and carry out experiments, as well as analyses and interpret data for any research project.
PLO 7	Understand the fundamental concepts of botany to grasp the variety of situations found in nature and in everyday life.

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Learning outcome index

Course code	PLO1		PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
25BOT 101	√		√	√	√	√	√	√
25BOT 102	√		√	√	√	√	√	√
25BOT 103	√		√	√	√	√	√	√
25BOT 104	√		√	√	√	√	√	√
25BOT 105	√		√	√	√	√	√	√
25BOT 106	√		√	√	√	√	√	√
25BOT 107	√		√	√	√	√	√	√
25BOT 201	√		√	√	√	√	√	√
25BOT 202	√		√	√	√	√	√	√
25BOT 203	√		√	√	√	√	√	√
25BOT 204	√		√	√	√	√	√	√
25BOT 205	√		√	√	√	√	√	√
25BOT 206	√		√	√	√	√	√	√
25BOT 207	√		√	√	√	√	√	√
25BOT 208	√		√	√	√	√	√	√
25BOT 209	√		√	√	√	√	√	√
25BOT 301	√		√	√	√	√	√	√
25BOT 302	√		√	√	√	√	√	√
25BOT 303	√		√	√	√	√	√	√
25BOT 304	√		√	√	X	√	√	√
25BOT 305	√		√	√	√	√	√	√
25BOT 306	X		√	√	√	√	√	√
25BOT 307	√		√	√	√	√	√	√
25BOT 308	√		√	√	√	√	√	√
25BOT 309	√		√	√	√	√	√	√
25BOT 401	√		√	√	√	√	√	√
25BOT 402	√		√	√	√	√	√	√
25BOT 403	√		√	√	√	√	√	√
25BOT 404	√		√	√	√	√	√	√
25BOT 405	X		√	√	√	√	√	√
25BOT 406	√		√	√	√	√	√	√
25BOT 407	√		√	√	√	√	√	√
25BOT 408	√		√	√	√	√	√	√

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M.Sc. Botany
Semester I

25BOT 101
Cell Biology

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objective: *This course is intended to provide the basic understanding of structures and purposes of basic components of cell especially membranes, organelles, cell division and it's regulation.*

Course Outcome:

CO1: Students will be able to understand cell ultrastructure and its relation to cell functions.
CO2: Students will learn about structure and function of various cellular organelles & cytoskeleton arrangement.
CO3: Students will learn about the mechanism of cellular communication and cell division pathway.
CO4: It will focus on the mechanism of protein localization and programmed cell death.

Unit-I

Introduction to Cell biology: Ultrastructure of prokaryotic & eukaryotic cells, Structural organization & function of plant cell wall. Membrane structure and function: Molecular composition of the cell membrane, Structural models of membrane, lipid bilayer and membrane proteins, diffusion, osmosis, ion channels, active transport, pumps, electrical properties of membranes.

Unit-II

Structural organization and function of intracellular organelles: Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, Nucleus; structure and organization, nuclear pores, nucleolus. Cell shape and motality: cytoskeleton, organization and role of microtubule and microfilaments, Motor movements; implications in flagella and other movements.

Unit-III

Cellular communication: Regulation of homeostasis, general principles of cell communication, cell adhesion and rolesof different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Cell cycle: Mitosis and meiosis; various stages in cell cycle, regulation and control of cell cycle, cyclin and cyclin dependent kinases.

Unit-IV

Protein Localization: Synthesis of secretory and membrane proteins, Protein sorting and targeting of proteins intonucleus, mitochondria, chloroplast, vacuoles and peroxisomes, Exocytosis, Endocytosis, Receptor mediated endocytosis.Apoptosis (Programmed cell death); its Mechanism and inducing factors, apoptosis triggered by internal and external pathway.

Suggested readings:

1. Essential Cell Biology by Bruce Albert, Garland Science (2nd Ed).
2. Cell and Molecular Biology by Phillip Sheeler and Donald E. Bianchi, John Wiley and Sons (3rd Ed.).
3. The World of Cell by W. Becker, L.J. Kleinsmith and J. Hardin. Pearson Education (5th Ed.).
4. Molecular Cell Biology by Harvey Lodish, W.H. Freeman & Co (8th Ed.).
5. Cell Biology by P.S. Vermaand, V.K. Agarwal, S. Chand Publishing (1st Ed.).
6. Lewin, B. 2000. Genes VII, Oxford University Press, U.S.A. (1st Ed.).

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M.Sc. Botany
Semester I

25BOT-102

Phycology, Mycology & Pathology

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objective: *To educate and train the students for professional and research career in the field of phycology, mycology and plant pathology.*

Course Outcome:

CO1: The students will be inspired to become aware and comprehend the broader aspects of algae.
CO2: The learning outcome will be aimed toward advanced academic education to broaden the knowledge of algae
CO3: The students will be inspired to become well versed with the fungal world and their economic importance.
CO4: Students will learn about disease cycle on plants and different plant disease caused by microbes.

Unit: I

Phycology: Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization, cell ultrastructure, reproduction (vegetative, asexual and sexual), Classification of algae, criteria for classification (pigments, reserve food and flagella).

Unit: II

Algal Classes: Overview and characteristics of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta. Economic importance of algae: as food, feed, in medicine and industry, Algal blooms, algal bio- fertilizers

Unit: III

Mycology: General characters, Organization of thallus, nutrition and reproduction; General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina; Heterokaryosis, Heterothallism, Parasexuality, Economic importance of fungi

Unit: IV

History of plant pathology, Various levels of parasitism, Classification of plant diseases, Pathogenesis.
Plant Diseases: Causal organisms, symptoms and management of –
A) Diseases caused by Bacteria – Bacterial blight of paddy, Crown gall of stone fruits
B) Diseases caused by Viruses - TMV, Tristza of Citrus, Yellow vein mosaic of Okra
C) Diseases caused by Mycoplasma - Sandal spike
D) Diseases caused by fungi - Wart of potato, Apple scab, karnal bunt of wheat, Black, yellow and brown rust of wheat, Tikka diseases of groundnut, Red rot of sugarcane, Late and early blight of potato, Downy mildew of grapes, Smut of Bajra

Suggested readings:

1. Ahluwalia, A.S. (Ed.). *Phycology: Principles, Processes and Applications.* Daya Publishing House, New Delhi. 2003.
2. Becker, E.W. 1994. Microalgae - Biotechnology & Microbiology, Cambridge University Press, Cambridge,U.K.
3. Carr, N.G. & Whitton, B.A. 1982. The biology of Cyanobacteria Blackwell Scientific Publ., Oxford, U.K.
4. Dubey, R.C. 2006. Introduction to Biotechnology, Delhi Book Trust, New Delhi.
5. Dubey, R.C. 2014. Advanced Biotechnology, S Chand & Company Pvt. Ltd., New Delhi.
6. Agrios, G.N. *Plant Pathology.* 5th Ed. Elsevier Acadmic Press, San Diego. 2005.

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M.Sc. Botany
Semester I

25BOT 103

Maximum Marks: 100

Bryophytes, Pteridophytes and Gymnosperms

Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objective: *This course is intended to provide the basic understanding of morphology and reproduction in Bryophytes, Pteridophytes, Gymnosperms and their Economic importance. .It also give details of the various fossil gymnosperms.*

Course Outcome:

CO1: Classify and distinguish bryophytes from other groups of plants and comparative account of morphology, anatomy and reproduction of different orders.
CO2: Learn about different orders of Pteridophytes and heterospory, origin of seed habit and evolutionary trends in stele.
CO3: Study life cycle and evolution of gymnosperms with detailed description of different gymnosperms orders.
CO4: To study fossil gymnosperms and methods of propagation of gymnosperms. It also describe the economic significance of bryophytes, pteridophytes and gymnosperms.

Unit: I

Introduction to Bryophyta: Morphology, structure, reproduction and life history , Evolution and distribution of sporophyte in Bryophytes. Comparative account of the morphology, anatomy and reproduction : Marchantiales, Jungermanniales, Anthoceratales, Sphagnales, Funariales and Polytrichales.

Unit: II

Introduction to Pteridophyta: General characteristics, morphology, anatomy, reproduction andclassification of Pteridophytes. Evolution of stele and stelar system, heterospory and origin of seed habit. Comparative account of the morphology, anatomy and reproduction: Psilopsida, Lycopsida,Sphenopsida and Pteropsida.

Unit-III

Introduction to gymnosperms: General characters, life cycle, diversity, origin andClassification, Apogamy, Apospory, Evolution of gymnosperms. Comparative account of the morphology, anatomy and reproduction: Cycadales (Cycas), Coniferales (Pinus), Ephedrales (Ephedra), Ginkgoales (Ginkgo), Welwitschiales (Welwitschia) and Gnetales (Gnetum).

Unit-IV

General account of few fossil members: (Orders); Cycadeoidales, Pentoxylales and Cordaitales.(Families); Lyginopteridaceae, Medullosaceae, Glossopteridaceae and Caytoniaceae. Modern methods of propagation of gymnosperms: somatic embryogenesis, haploids and protoplast culture. Economic and ecological importance: Bryophytes, Pteridophytes and Gymnosperms

Suggested Readings:

1. Rashid, A. 1998. An Introduction to Bryophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
2. Watson, E.V. 1967. The Structure and Life of Bryophytes. B.I. Publications, New Delhi.
3. Glime, J.M and Saxena D. 1991. Uses of Bryophytes. Today and Tomorrow's Printers and Publishers,New Delhi.
4. Sporne, K.R. 1985 (reprint) The Morphology of Pteridophytes. B.I. Publications Pvt. Ltd., Delhi.
5. Sambamurty,A.V.S.S. 2005,A Text book of bryophytes,Pteriophytes,Gymnosperms andPaleobotany I.K. Int. Pvt. Ltd.
6. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age International Pvt. Ltd., New Delhi.
7. Biswas, C. and Johri, B.M. 1999. The Gymnosperms. Narosa Publishing House, New Delhi.
8. Chamberlain, C.J. 2000. Gymnosperms. C B S Publishers and Distributors, New Delhi.
9. Sporne, K.R. 1986. Morphology of Gymnosperms. Hutchinson University Press.
10. Vashishta, P.C. 1999. Gymnosperms, S. Chand & Company Ltd. New Delhi.

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PG BOS Meeting dt. 02-8-25

Faculty Meeting dt. 07-11-25

M.Sc. Botany
Semester-I

25BOT 104
Plant Biochemistry

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives: *The course has been designed to train students with the knowledge of various biomolecules and their synthesis with metabolism. In addition the course also deals with different biochemical tests to identify various biomolecules.*

Course Outcome:

CO1: This course will impart the knowledge of principles of biochemistry and bioenergetics.
CO2: The students will be able to increase the understanding about enzymes, amino acids & proteins.
CO3: During the course students will learn about structure, classification and metabolism of carbohydrates and lipids.
CO4: The students will be able to increase the understanding about Nitrogen & sulphur metabolism and structure & functions of vitamins.

UNIT-I

Principles of Biochemistry: Structure of atom, molecules, forces stabilizing macromolecules, weak bonds and covalent bonds, buffers and pKa values. Bioenergetics: Principles of thermodynamics, free energy, chemical and redox potential, Structure and function of ATP, Exergonic and endergonic reaction, Entropy and energy.

UNIT-II

Fundamentals of enzymology: General aspects, nature of enzyme catalysis, enzyme kinetics, enzyme regulation and inhibition, isozymes, Allosteric enzyme and cofactors.Amino acids and Proteins: Structure types, properties and Metabolism of Amino acids; Primary, Secondary, Tertiary and Quaternary structure of proteins; Domains, motif and folds; Stability of protein structure; Classification of proteins based on composition, solubility function; Reverse turns and Ramachandran plot.

UNIT-III

Carbohydrates: Structure and classification. Metabolism of carbohydrates (polysaccharide, glycoprotein and peptidoglycan); Stereoisomerism, transformation of carbohydrates, synthesis and degeradation of sucrose, starch and cellulose Lipids: Composition, structure and classification, Biosynthesis and oxidation of structural and storage lipids.

UNIT-IV

Nitrogen fixation and N & S metabolism: Overview of biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation. Sulfate uptake, transport and assimilation. Vitamins: structure and function of Thiamine, Riboflavin, Nicotinic Acid, Pantothenic Acid,Pyridoxine, Biotin, Folic Acid, Vitamin B12 , Ascorbic Acid, Vitamin A , D , E and K.

Suggested Readings:

1. Lehninger, A. Principles of Biochemistry. Worth Publishers. 1011 pp. 1982.
2. Voet, D. and J.G. Voet. Biochemistry. 3 rd Ed. John Wiley & Sons Inc. 1264 pp. 2008.
3. Jain, J.L., N. Jain and S. Jain. Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi. 1264pp. 2007.
4. Nelson, D.L. & M.M. Cox. Lehninger's Principles of Biochemistry. 5th Ed. W.H. Freeman& Co., USA.1100 pp. 2008.
5. Palmer, T. Enzymes Biochemistry,Biotechnology,Clinical Chemistry. Affiliated East – West Press Pvt. Ltd. 2004.
6. Plummer, D.T. An Introduction to Practical Biochemistry.2nd Ed. T.M.H. Publishing Co., New Delhi.352pp.1979.
7. Prince, N.C and L. Stevens. Fundamental of Enzymology. Oxford University Press, Oxford. 1984.
8. Stumpf, P.K. and E.E. Conn. The Biochemistry of Plants-A Comprehensive Treatise. Academic Press,London. 1981.

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PGBOS Meeting dt 02-8-25

Faculty Meeting 07-11-25

M.Sc. Botany
Semester I

25BOT- 105
Biodiversity and Conservation

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objectives: *This paper is meant for students to gain in-depth knowledge of different levels, threats and distribution of Biodiversity and focus on the different approaches for biodiversity conservation.*

Course Outcomes:

CO1: Students will learn about the biodiversity and hotspots along with their importance.
CO2: Students will learn about the biodiversity Conservation status and strategies.
CO3: students will learn about concepts of plant exploration and phytogeography.
CO4: Learn about the various national and international efforts to conserve biodiversity.

UNIT-I

Biodiversity: Significance of biodiversity; levels of biodiversity- species, genetic and ecosystem diversity, threats tobiodiversity; habitat loss and fragmentation, exotic species, overexploitation, endemism and extinction. Biodiversity and ecosystem services, IUCN categories of threat, Red Data Book
Hotspots: Introduction, Terrestrial and marine hotspots of biodiversity; Hottest hotspots, Hotspots of biodiversity inIndia.

UNIT-II

Principles of conservation: Major approaches to biodiversity management, Biodiversity Conservation strategies; In-situ conservation; Wildlife sanctuaries, National parks, Biosphere reserves, Ex-situ conservation; Principles and practices, seed banks, field gene banks and cryobanks, Role of botanical gardens .Wetlands and Ramsar convention.

UNIT-III

Plant exploration: Basic Concept of plant introduction and invasion, National Bureau of Plant Genetic Resources (NBPGR), National Biodiversity Authority (NBA) ,
Phytogeography: Major terrestrial biomes, Theory of island biogeography, Biogeographical zones of India , Forest types of India, Ecological and economic importance of forests, Social forestry, Desertification and Wasteland reclamation .

UNIT-IV

International and National efforts to conserve biodiversity: Convention of Biological Diversity (CBD), Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES), Indian initiatives in biodiversity conservation.
United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol and Emission Trading, PostKyoto World: Problems and Prospects, Montreal protocol.

Suggested Readings:

1. Odum, E.P. and Barrett, G.W. 2005. Fundamentals of Ecology (5thIndiaPvt. Ltd., New Delhi.
2. Kormondy, E.J. 2008. Concepts of Ecology. Prentice Hall of India., New Delhi.
3. Subrahmanyam, N.S. and Sambamurty, A.V.S.S. 2008. Ecology (2ndsEd.) Narosa Publishing House, New Delhi
4. Singh, J.S., Singh, S.P. and Gupta, S.R. 2008. Ecology, Environment and Resource Conservation, AnamayaPublishers, New Delhi.
5. Stiling, P. 2009. Ecology: Theory and Applications (4Th Ed.). PHI Learning Pvt. $L_t t_h$d. New Delhi.
6. Rana,S.V.S. 2009. Essentials of Ecology and Environmental Sciences (4Ed.) PHI Learning Pvt. Ltd.New Delhi.
7. A. Rosencranz and S. Divan. 2004, Environmental Law and Policy in India: Cases, Materials and Statutes.Oxford University Press, New Delhi.
8. Sahasranaman, P. B. 2009. Handbook of Environmental Law. Oxford University Press, New Delhi, India.
9. Upadhyay, C. B.2001. Forest Laws: Central and States. Hind Publishing House, Allhabad, India.

PGBOS meeting dt 02-8-25

Faculty Meeting dt. 07-11-25

M.Sc. Botany
Semester I

25BOT 106
Lab course I

Time: 8 hours
Total Marks: 50

Evaluation scheme in examination:

Practical Performance & Evaluation	Viva-voce	Practical Record/File
35	10	05

Course outcome:

We seek to train the next generation of researchers in cell biology and Phycology, Mycology & Pathology with a deep understanding of core disciplines and the ability to plan important, incisive research and execute their plans with appropriate technology and methodology, from the classic to the cutting edge.

Practical:

1. Study of Ultrastructure of the cell.
2. Cell staining and visualization under microscope.
3. Mitotic division in onion root tip cells.
4. Slide preparation of chromosomes.
5. Effect of different factors on cell membrane permeability.
6. Effect of tonicity on plant cells.
7. Taxonomy/ morphological study of representative members of algae-
   Volvox, Cladophora, Coleochaete, Oedogonium , Zygonema, Spirogyra,Chara, Vaucheria,Ectocarpus,Fucus, Polysiphonia, Nostoc, Euglena
8. To study permanent slides of Algae and Fungi.
9. To study the symptoms and diagnostic features of causal organisms and their reproductive sporesby sectioncutting of diseased plant parts of the following plant diseases:
   - Downy mildew of grapes
   - Smut of bajra
   - Late and early blight of potato
   - Tikka disease of groundnut
   - Black rust of wheat
   - Bacterial blight of paddy
   - Red rot of sugarcane
10. Collection and submission of plant disease specimens.

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M.Sc. Botany
Semester I

25BOT 107
Lab course II

Time: 8 hours
Total Marks: 50

Evaluation scheme in examination:

Practical Performance & Evaluation	Viva-voce	Practical Record/File
35	10	05

Course outcome:
We seek to train the next generation of researchers in Bryophytes, Pteridophytes & Gymnosperms and Plant biochemistry and biodiversity and conservation with a deep understanding of core disciplines and the ability to plan important, incisive research and execute their plans with appropriate technology and methodology, from the classic to the cutting edge.

Practical:

1. Taxonomy/ morphological study of representative members of Bryophytes and Pteridophytes
- Bryophytes: *Marchantia, Anthoceros, Funaria, Polytrichum, Pellia, Porella, Sphagnum.*
- Pteridophytes: *Lycopodium, Selaginella, Psilotum, Equisetum, Adiantum, Marsilea,Azolla,Pteris, Ophioglossum, Dryopteris, Nephrolepis.*
2. Comparative study of anatomy of vegetative and reproductive parts of *Cycas, Pinus, Ginkgo,Cedrus ,Aurocaria , Ephedra, Gnetum and Taxus.*
3. To study permanent slides of Bryophytes and Pteridophytes (both vegetative and reproductivephases) and Gymnosperms.
4. Collection and submission of locally available plant species (Bryophytes, Pteridophytes, Gymnosperms)
5. Detection of reducing, non-reducing and total sugars: Molisch test, Fehling's test, Benedict's test, Barfoed's test, and Iodine test.
6. Quantitative estimation of total carbohydrates by Anthrone reagent. Preparation of potato starch,its microscopicstructure and solubility test.
7. Qualitative tests of protein like Biuret test, Xanthoproteic test, Ninhydrin test, Bradford's test.
8. Quantitative estimation of amino acid by using Spectrophotometer.
9. Isolation, assay and determination of specific activity of plant enzymes of germination, growth andfruitripening, viz amylase, lipase, protease, peroxidase, polyphenol oxidase
10. Extraction and estimation of total phenols.
11. Determination of antioxidants in plant tissues – ascorbic acid, tocopherol, β – carotene

OR

12. Understanding the concept of sampling: Random sampling, sample size, quadrat, transect and point method for the study of community structure.
13. Study the community structure using quadrate method by establishing minimum size and minimum number of quadrates.
14. Study of community structure and assessment of cover and basal area of species present and determine the IVI (Importance Value Index) of the species.
15. Study of community structure and assessing frequency of the species. Prepare a frequency diagram and divide the species into classes based on percentage frequency.
16. Study of community structure and assess the density and abundance of the species
17. Understand the concept of community coefficient by comparing the frequency of two communities.

- **Field visit to Botanical Gardens/various labs etc. and preparation of report.**

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M.Sc. Botany
Semester II

25BOT-201

Molecular Biology

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objective: *This course deals about how nucleic acids and proteins interact with in the cell to promote proper growth, division and development by the process of replication, transcription and translation. This course also emphasize on DNA damage and repair, gene regulation.*

Course Outcome:

CO1: The students will have enhanced understanding of genome structure, evolution and its replication along with DNArepair mechanisms.
CO2: The students will learn mechanism of transcription and post transcriptional changes.
CO3: The students will learn about translation and the methods of genetic recombination.
CO4: The students will gain insight into the principle mechanisms of genome expression and its regulation.

UNIT I

Replication: Evidences of DNA and RNA as the genetic material for bacteria, virus and eukaryotes, Mechanism of prokaryotic replication; Initiation, Elongation and Termination, Replicons; linear, circular and D-loops, enzymes and proteins involved in replication, Fidelity of replication and coordinating synthesis of leading and lagging strands, Okazaki fragments. DNA damage and repair: Causes of DNA damage and molecular mechanism of repair-excision repair system in bacteria and eukaryotes base excision, recombination repair systems

UNIT II

Transcription and post transcription changes: Types of RNA, mRNA structure, prokaryotic and eukaryotic RNA polymerase, Transcriptional factors, promoter sequences, binding sites for RNA polymerase, transcription initiaton, promoter clearance and elongation, termination, attenuation and anti-termination, Role of Enhancers, repressors, mediators, silencers and inhibition of transcription regulation. RNA splicing and processing: Capping, polyadenylation, splicing, spliciosome, mRNA stability, Group I introns and trans-esterification, ribozymes

UNIT III

Translation: Ribosome, Structure of tRNA, genetic code, Initiation; formation of initiation complex, initiation factors and their regulation, Elongation; elongation factors, amino acylation of tRNA, amino acyl tRNA synthatase, termination in prokaryotes and eukaryotes, translational inhibitors, Co -translational and Post- translational modification of proteins.Genetic Recombination: Recombination; Types, Molecular Mechanism of Recombination, Holliday junction, Role of RecA and RecBCD enzymes, Site-specific recombination, FLP/FRT and Cre/Lox recombination.

UNIT IV

Gene Regulation: Regulation of gene expression (in viruses); Lytic and lysogenic cycle. Regulation of gene expression (in prokaryotes); Lac and Trp operons, positive and negative controls. Regulation of gene expression (in eukaryotes); Differential gene expression, regulation of chromatin structure; Histone modification, DNA methylation, Epigenetic inheritance, Regulation of transcription Initiation; Role of transcription factors, enhancers, Post transcriptional regulation, gene silencing, RNA interference; effect of miRNA and siRNA

Suggested readings:

1. J D Watson et al,2013, Molecular Biology of Gene, 7th Edition, Benjamin Cummings publishers Inc.
2. Alberts et al.2014, Molecular Biology of the Cell, 6th Edition, Garland Science.
3. Karp G.2013. Cell and molecular Biology 7th edition Wiley publication.
4. Cooper GM, Hausmann, RE.2013. The Cell –A Molecular Approach.6th edition Sinaur Associates.
5. Lolish, H., Berk, A., Zipursky, S.L., Matsudaira, P.,Baltimore, D. Darnell. J 2000 Molecularcell biology(4th edition).

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PGBOS Meeting dt 02-8-25

Faculty Meeting dt 07-11-25

M.Sc. Botany
Semester II

25BOT- 202
Plant Systematics and Economic Botany

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3 hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objective: *The course would deal with the basic concepts of plant taxonomy and nomenclature. The course is also designed to provide the knowledge about economic importance of various plants.*

Course Outcome:

CO1: Understand the significance, basic concepts, tools of plant taxonomy.
CO2: Learn about the different systems of classification of angiosperms and detailed features of several angiospermic plant families.
CO3: Acquire knowledge about the plant sources of foods, fibers, medicine, oil and aroma. Along with involves innovationsin meeting food demand.
CO4: Gain knowledge about plants yielding timber, paper, NWFPs and their role in pollution control and energy source.

Unit: I

Principles of Plant Classification with emphasis modern tools of taxonomy: Taxonomy as a synthetic discipline, Modern tools of Taxonomy (Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy, Serology) Botanical Nomenclature and International Code of Botanical Nomenclature (ICBN) ImportantBotanical Gardens and Herbaria.

Unit: II

Systems of classification: Benthem & Hooker, Hutchinson, Cronquist, Takhtajan, Dahlgren and Thorne Salient features of following families: (Monocotyledons) Orchidaceae, Liliaceae, Palmae, Cyperaceae, Araceae, and Graminae. (Dicotyledon) Ranunculaceae, Magnoliaceae, Cruciferae, Papaveraceae, Malvaceae, Leguminosae,Solanaceae, Cucurbitaceae, Umbelliferae, Compositae, Asclepediaceae, Euphorbiaceae.

Unit: III

Cultivation and uses of Important Crops: Food (cereals, pulses), forage and fodder (sorghum,bajra),Fiber yielding plants (cotton,hemp,jute), Medicinal plants (poppy, tulsi, amla, sarpgandha, ashwgandha), Oil yielding plants (mustard,coconut,groundnut,sunflower). Innovations for meeting world food demands (Green revolution, Hybridization and GM crops)

Unit: IV

General account of Important Plants: Fire-wood & Timber-yielding plants (Acacia, Teak, Eucalyptus, Casurina), Raw materials & process of paper-making, Non-wood forest products (Gums, tannins, dyes, resins).
Plants used as pollution control, Plant as a source of renewable energy.

Suggested readings:

1. Kocchar, S.L. 1998. Economic Botany of Tropics.
2. Gupta, R.K. 1981.Systematic Botany. Atma Ram and Sons, New Delhi.
3. Hutchinson, J. 1950.The families of flowering plants.Vol.I , II. Clarendon Press, Oxford.
4. Naik, V.N. 1984. Taxonomy of Angiosperms.Tata McGraw Hill, New Delhi.
5. Pandey, S.N. and S.P. Misra. 2008. Taxonomy of Angiosperms. Ane Books, India.
6. Singh, G.Plant Systematic: 1999. Theory and Practice.Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi.
7. Sharma, O.P. 2002. Plant Taxonomy. Tata McGraw Hill Publishing Co. Pvt. Ltd., New Delhi.
8. Thakur, R.S. et al., Major Medicinal Plants.
9. Richard B. Primack. 1993. Essentials of Conservation Biology.
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment.

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PGBOS meeting dt. 02-8-25

Faculty Meeting dt. 07-11-25

M.Sc. Botany

Semester II

25BOT 203
Plant Biotechnology and Genetic Engineering

Maximum Marks: 100
Theory Examination: 70
Internal Assessment: 30
Time: 3 hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives: The main objective of this course is to familiarize students with techniques of plant tissue culture, genetic manipulations of plants and quality enhancement of plant products through the use of biotechnological tools. **Course Outcome:**
CO1 The students will have better understanding of basics of plant biotechnology with emphasis on plant tissueculture. CO2 The students will acquire understanding of micropropagation and distant hybridisation. CO3 During the course students will gain in depth knowledge about different tools and techniques of RDT CO4 The students will acquire understanding of production of transgenic plants for biotic and abiotic stress resistance and nutritional enrichment of crops.

Unit-I

Scope and basic concepts of plant biotechnology and tools. Relevance of plant biotechnology to sustainable agriculture and food security, Status of transgenic plant research in India; Terminator seed technology. Plant tissue culture: Tissue culture media preparation and sterilization techniques; Callus and suspension cultures, Concept of cellular differentiation and totipotency: Regeneration and somatic embryogenesis. Somaclonal and gametoclonal variations.

Unit-II

Micropropagation: Methods, Applications an limitations; Production of virus free plants; Germplasm conservation; haploid plant production through plant tissue culture (Androgenesis and Gynogenesis); Distant hybridization: Embryo rescue and *in vitro* pollination, Somatic hybridization.

Unit-III

Recombinant DNA technology, Tools of rDNA technology: Enzymes, Cloning vectors (Plasmids, Bacteriophages, Cosmids, Phagemids, Shuttle vectors, transposons vectors, artificial chromosomes as vector andeukaryotic vectors); Gene constructs: Promoters, Expression systems, Reporter genes. Constriction of genomic library and cDNA library, screening libraries; Polymerase Chain Reaction(PCR): Principles, technique and modifications

Unit-IV

Gene transfer methods in plants: Plasmid mediated, electroporation, cation precipitation, liposomes, microinjection and particle gun technology, *Agrobacterium* mediated gene transfer: Molecular genetics of T-DNA transfer from *Agrobacterium* to plants Production of transgenic plant with respect to: herbicide resistance, resistance against biotic (insect,fungal and viral) and abiotic (salinity, drought, chill) factors; Nutritional quality improvement in plants for: Starch, Oil and Protein content;Golden rice and other developments.

Suggested Readings:

1. Plant Biotechnology, B.D. Singh (2015) 3rd edition, Kalyani Publishers.
2. Plant Tissue culture: theory and practices (Vol. 5 of Studies in Plant Science) (1996)st Revised edition, S.S. Bhojwani and M.K. Razdan, Elsevier Publishing.
3. Plant Biotechnology: The Genetic Manipulation of Plants (2008) 2nd edition, AdrianSlater Oxford.
4. Principles of gene manipulation and Genomics (2010) 8th edition, S.B Primose and R.M Twyman, Blackwell publishing.
5. Gene cloning and DNA analysis – An Introduction (2016) 7th edition, T.A. Brown, Blackwell publisher.

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M.Sc. Botany
Semester II

25BOT204
LabcourseI

TotalMarks: 50
Time:8hours

Evaluationschemein examination:		
PracticalPerformance& Evaluation	Viva-voce	PracticalRecord/File
35	10	05

Courseoutcome;

. The course is aimed to promote the confluence of areas such as molecular biology, plant systematics & Economic botany It is also to promote and integrate research and development in the above-mentioned field. Also, to organize periodic experiments either exclusive to our lab or jointly with other organizations.

1. Isolation of GenomicDNA.
2. Isolation of plasmid DNA
3. Separation and visualization of DNA fragments by agarose gel electrophoresis.
4. Determination of size of DNA by comparison with DNA ladder
5. Quantitative analysis of DNA using spectrophotometer.
6. Restriction digestion of DNA and ligation of DNA fragments.
7. To study the separation of proteins with the help of electrophoresis (SDS-PAGE).
8. Study of basic structure of flower, variations, floral parts in details, floral symmetry, insertion of floral parts etc. of various angiospermic families.
9. Study of phyllotaxy in different plants
10. Morphologyandanatomyofvariousplants:*Papaversomniferum,Catharanthusroseus,Allium sativum, Rauwolfia serpentine, Withaniasomnifera, Phyllanthusniruri, Aloe barbadensis,Menthaarvensis, Ricinuscommunis, Abutilon indicum, Datura sp., Ocimum sanctum*

    FoodCrops: Wheat,Maize,Potato, Sugarcane.

    FodderCrops: Sorghum,Bajra, Oat.

    PlantFibres:Cotton,Jute, **Gums,Resins,Tannins**,Dyes
11. Study of angiosperm in various habitats and preparation of herbarium.
12. Prepare a list of important sources of fire wood and timber in your locality.

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PGBOS Meeting Dt 02-8-2025

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M.Sc.Botany
Semester II

25BOT205
Lab course II

Total Marks:50
Time:8 hours

Evaluationschemein examination:		
Practical Performance& Evaluation	Viva-voce	Practical Record/File
35	10	05

Course outcome: The course is aimed to promote the knowledge of areas such as Plant biotechnology & genetic engineering, plant genetics,Biostatistics, IPR and Biosafety.It is also to promote and integrate research and development in the above-mentioned field. Also, to organize periodic experiments either exclusive to our lab or jointly with other organizations.

Practical:

1. Preparation of plant tissue culture Media & Surface sterilization of explants
2. Organ culture. Induction of callus, callus propagation, Organogenesis.
3. DNA isolation from plant tissues and quantitation
4. Bacterial culture and antibiotic selection medias.
5. Preparation of competent cells.
6. Genetic problem on gene mapping in higher plants.
7. Study of problems on Mendelian Genetics, Multiple allele and multiple gene inheritance.
8. Preparation of Linkage Maps in Diploids using three points test cross method.
9. Tetrad analysis and Centromere mapping in ordered and unordered tetrads.
10. Pedigree analysis.
11. Basic Calculation based statistical analysis
12. Statistical Software (Origin, R, Sigma plot etc.) handling and basic knowledge
13. IPR/Patent /copyright filing, searching in international and domestic database
14. Patent drafting/writing basic knowledge based short report preparation

- Field Visit Various labs/Museum/Patent office etc. submission of report on such survey.

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M.Sc. Botany
Semester II

25BOT 206
Plant Genetics

Maximum Marks: 100

Theory Examination: 70
Internal Assessment: 30
Time: 3 hrs

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.*

Objective: This course is intended to provide the basic understanding of genetic, Inheritance, variation, mapping and mutation.

Course Outcomes:

CO1: The students will learn genome structure and Mendelian principles with their extensions.
CO2: The students will develop understanding of phenomenon of linkage and crossing over and its role in genomic imprinting.
CO3: The students will learn methods of gene mapping, qualitative genetics and genetic fine structures.
CO4: This course will impart the knowledge of basics of mutations and their importance.

UNIT-I

Gene and DNA: Genome, gene, Double helical structure of DNA, molecular organization of chromatin. Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Extensions of Mendelian principles: Co-dominance, incomplete dominance, gene interactions.

UNIT-II

Allelism and Linkage: Multiple Allele, Pseudo-alleles, Complementation tests, Pleiotropy, Penetrance and Expressivity, Phenocopy, Linkage and Crossing over, Sex Linkage, Sex limited and Sex influenced characters. Genomic equivalence and cytoplasmic determinants, genomic imprinting.

UNIT-III

Gene Mapping methods: Linkage maps, Tetrad analysis, Centromere mapping in linear tetrads and analysis of unordered tetrad, Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping Genetic fine structure: Cis-trans test; Dosage compensation and mechanism of sex determination in plants.

UNIT-IV

Mutations and mutagenesis: Types, causes and detection, mutant types-lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis, Mutagens and their molecular mechanisms of occurrence; directed mutagenesis; DNA methylation, chemical mutagens and their effect, ames test,
mutagenesis, inspectional mutagenesis by transposons, in-vitro mutagenesis.

Suggested readings:

1. Robert J Brooker(2009).Genetics:Analysis and principles (III Edition).McGraw Hill.
2. Hartl DL and Jones EW (2007). Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers.
3. Hartwell LH, Hood LGoldberg ML, Reynolds AE, Silver LM, Veres RC (2006). Genetics – From Genes to Genomes, 3rd edition, McGraw Hill.
4. Lewin B (2008). Genes IX, Jones and Barlerdtt Publishers.
5. Strickberger MW (2008). Genetics, 3rd Edition, Pearson (Prentice Hall).
6. Gardner E J,Simmons M J,Snustad D P (1991).Principles of genetics(III edition).John Wiley and Inc.
7. William S Klug, Michael R Cumming (1994). Concepts of Genetics, Prentice Hall.

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M.Sc. Botany
Semester II

25BOT 207
Biostatistics, IPR and Biosafety

Maximum Marks: 100
Theory Examination:70
Internal Assessment: 30
Time: 3 hrs

Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.

Objectives: The course is designed to train students in basic statistical applications in biology.

Course Outcome

CO1: Students will be able to locate, analyze, evaluate and generate meaningful information from the given data.

CO2: The students can find career opportunities as analysts in health sciences, academics, research and Industries.

CO3: Understand the basic concepts, significance and agencies of Intellectual property

CO4: Understanding about bioethics, social and ethical implications of bioweapons. Gain knowledge about biosafety levels

Unit I

Presentation of data: Types of graphs; modes of graphical representation of data; line graph; bar diagram; pie, circle and sector chart; histogram; frequency polygon; frequency curve; frequency distribution; relative and cumulative frequency distribution. Measures of central tendency: Mean; median; mode; empirical relationship between mean, median and mode; quartile and percentile.

Unit II

Measures of dispersion: Variability; range; mean deviation; coefficient of mean deviation; standard deviation; merits, demerits and uses of standard deviation; calculation of standard deviation. Regression analysis: Regression coefficients; properties of regression coefficients; student's t-test; chi- square test; f- test; one- and two-way ANOVA. Correlation analysis: Correlation; co-variance; calculation of co-variance; correlation analysis; correlation coefficient.

Unit III

Introduction to intellectual property: Types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge and geographical indications. Establishment and functions of GATT, WTO and WIPO; main features of TRIPS agreement; WIPO treaties and PCT. Concept of 'prior art': patent databases; basics of patents: types of patents, Indian Patent Act 1970 and recent amendments; types of patent applications: PCT and convention patent applications; patent application forms and guidelines, fee structure, time frames

Unit IV

Introduction to bioethics: Bioethical issues related to genetically-modified organisms and gene therapy/gene editing; international bioethics advisory committees and their tasks (IBC, IBA, IBS etc.); Introduction to biosafety; biological safety cabinets; primary containment for biohazards; biosafety levels for microorganisms, infectious agents and infected animals; biosafety guidelines of Government of India; GMOs & LMOs;

Suggested Readings:

1. Biostatistical Analysis, Zar, Pearson Education India
2. Gupta, S.P.,Statistical Methods., S. Chand & Sons, New Delhi.
3. Dhirendra Kumar et al. Emerging Trends in IPR :India and Globe, Elite publication, Delhi 2025
4. Biostatistics by P.N. Arora and P.K. Malhan, Himalayan publishing house.
5. Laws relating to Intellectual Property Rights by V K Ahuja, Lexis Nexis Publishers.
6. IPR, Biosafey and Bioethics by Deepa Goel and Somini Prashar, Pearson.

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M.Sc. Botany
Semester II

25BOT208
Environmental Science

Maximum Marks: 50
Theory Examination:35
Internal Assessment: 15
Time: 2 hrs

Note: The course will be evaluated based on the theory (35) and internal examination (15). In addition, students will also participate in environment related activities through debate, declamation, group discussions, poster competition, seminar/conference/paper/poster presentation, nukkad natak at university/local/state/national level. Paper/article publication in state/national/level journal, newspaper/conference/seminar proceeding remains as a mandatory part of curriculum.

Objectives*: This course will provide the fundamental knowledge about environment and related issues that have direct impact on human population.*

Course outcomes (CO): The students will understand the environmental challenges, realizing their role and motivated to protect the environment. These learning will prepare the students to develop their queries and ideas for a healthy environment.
CO1. Understanding the water resource management and the concept of green energy. CO2. Understanding the different types of wastes and their management.
CO3. To develop awareness with the environmental laws and policies.
CO4. Understanding the wildlife protection and environmental impact assessment.

Unit-I

Water Resources Management: coordinated development and management of water, land and related resources. Revival of Water Bodies: enumeration, protection and management of water bodies in their respective States. Energy & Green Technologies: Renewable and Alternative energies such as, Solar, Wind, Tidal etc. **Waste Management:** Solid/Liquid/Plastic/C&D/Electronic/Bio-medical/Hazardous wastes. Sanitation & Hygiene: Methods Garbage collection, industrial/ hazardous waste management, Methods of wastewater treatment and disposal.

Unit-II

Environmental Laws & Policies related to protecting the environment such as The National Green Tribunal Act, 2010, Government Acts & Missions for Environment Protection & Conservation
Wildlife Protection & Conservation: habitat conservation, endangered and keystone species protection, ex-situ efforts, and poaching prevention. Socio-economic and Health Environment. Environment Management Plan.

Suggestive Readings:

1. Fundamentals of Ecology: E. P. Odum, W.B. Saunders Co. USA
2. Concepts of Environmental Science (2017): Mishra & Kumar, Rajesh Publication, Delhi, India
3. Environmental Science (6th ed) (1997): Jr. G. T. Mille r, Wadsworth Pub. Co
4. Fundamentals of Environmental Science: G. S. Dhaliwal, G. S. Sangha and P. K. Raina, Kalyani Publication
5. Environment and Public Health Challenges: Gupta &Kumar, Genic books Publishers, Agra, UP, India

Please note: The latest edition of these books is proposed or as recommended by the concerned faculty.

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M.Sc. Botany
Semester II

25BOT209
Indian Knowledge Systems in Biology

Maximum Marks: 50
Theory Examination:35
Internal Assessment: 15
Time: 2 hrs

Note: The course will be evaluated based on the theory (35) and internal examination (15). In addition, students will also participate in environment related activities through debate, declamation, group discussions, poster competition, seminar/conference/paper/poster presentation, nukkad natak at university/local/state/national level. Paper/article publication in state/national/level journal, newspaper/conference/seminar proceeding remains as a mandatory part of curriculum.

Objectives: This course explores the ethical, philosophical, and interdisciplinary dimensions of Indian Knowledge Systems (IKS) in biology, emphasizing their relevance to sustainable development and modern challenges. It aims to foster a holistic approach to biological innovation.

Course Outcomes:
CO1: Understand the ethical frameworks of IKS with its influence on modern biological practices.
CO2: Explore philosophical concepts of IKS and their application.
CO3: Gain insights into sustainable biological solutions inspired by IKS for addressing climate change and health challenges.
CO4: Develop an interdisciplinary perspective, integrating IKS with fields like anthropology and agriculture for innovative research.

Unit I

Ethical Frameworks in IKS: Ethical principles in IKS: Ahimsa (non-violence) and its influence on genetic engineering, animal cell culture and GM crops. Ethical considerations in modern biology inspired by traditional practices. Case studies on ethical dilemmas in biological research. Concept of inter connected ness: Pancha-mahabhuta (five elements) and Tridosha (body balance) in understanding biological systems.

Unit II

Philosophy and Spirituality in Biology: Integration of philosophical concepts of Prana (life force) and spiritual symbolism of plants/animals in drug design and regenerative medicine. Role of IKS in shaping holistic approaches to biological research and innovation. bioenergy, and biodiversity for addressing climate change and health challenges. Interdisciplinary approaches: Integration of IKS with anthropology (ethno medicine), Agriculture for innovations and environmental solutions.

Suggested Readings:

1. Sushruta Samhita, translated by Kaviraj Kunjalal Bhishagratna, Chowkhamba Sanskrit Series.
2. Charaka Samhita, translated by P.V. Sharma, Chaukhambha Orientalia.
3. Indian Philosophy by S. Radhakrishnan, Oxford University Press.
4. Ethnomedicine and Pharmacognosy by V.K. Singh and J.N. Govil, Studium Press.
5. Biotechnology and Traditional Knowledge by S.K. Jain, Oxford & IBH Publishing.
6. Environmental Biotechnology by Bimal C. Bhattacharyya, Oxford University Press.
7. Bioethics and Biosafety by M.K. Sateesh, I.K. International Publishing House.

Please note: The latest edition of these books is proposed or as recommended by the concerned faculty.

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DECLARATION

It is certify that

a) The work contained in this research report is original and has been carried by me under the guidance of my supervisor.
b) The work has not been submitted to other University/Institute for any degree or diploma.
c) I have followed the University guidelines and ethics throughout the study.
d) Wherever I have used materials (data, theoretical analysis, figures, and text) from other sources, I have given due credit to them by citing them in the text of the dissertation and giving their details in the references. Further, I have taken permission from the copyright owners of the sources, wherever necessary.

Date:
Place:

Signature
(Name of the Student with Roll number)

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Chaudhary Bansi Lal University, Bhiwani
(A State University Established Under Haryana Act. 25 of 2014)

CERTIFICATE

This is to certify that the dissertation entitled ……., submitted by.....to Chaudhary Bansi Lal University, Bhiwani, for the partial fulfillment of award of..... M.Sc./PG Diploma in Botany, is a record of bonafide research work carriedout by him/her under my supervision and has not been submitted to other University/Institute for any degree or diploma..

Signature

Name: ……
(Supervisor)

Signature

Name: ……..

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