Khandesh Education Society's

Pratap College, Amalner (Autonomous)

Affiliated to

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

Department of Botany

CURRICULUM FRAMEWORK FOR T.Y.B.SC. BOTANY

Based on

NATIONAL EDUCATION POLICY 2020

SYLLABUS FOR T.Y.B.SC. BOTANY

(Sem-V and Sem-VI)

WITH EFFECT FROM THE ACADEMIC YEAR

JUNE 2025 – 2026

(Approved by Board of Studies in Botany from the Academic Year 25-26)

MEMBERS ON BOARD OF STUDIES IN BOTANY (2023-2026)

Mr. Jayesh T Salve (Chairman)
Head, Department of Botany, K.E.S.,
Pratap College, Amalner (Autonomous)

Dr. Suchandra D Dutta (Vice Chancellor Nominee)
Head, Department of Botany,
R.D. and S.H. National College, Bandra West, Mumbai

Dr. Ashok R Tuwar (Academic Council Nominee)
Head, Department of Botany, MES,
Art, Commerce and Science College, Sonai

Dr. Dnyaneshwar K Sherkar (Academic Council Nominee)
Assistant Professor, Department of Botany,
Art and Commerce College, Warvat (Bakal)

Dr. Sarala C Tadavi (Department Alumni)
Assistant Professor, Department of Botany,
Dhanaji Nana Mahavidyalay, Faizpur

Mr. Ketan R Caudhari (Industrial Representive)
Owner, Shree Venkatesh Mushroom Farm, Shirsoli Road, Jalgaon

Dr. Digambar D Ahire (Expert for Special Courses)
Head, Department of Botany, AJMVPSA,
New Art, Commerce and Science College, Ahmednagar

Mrs. Jyoti P Padul (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Harshali S Chaudhari (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Harshada P Shinde (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Mrs. Bhaghyashri B Patil (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Pragati D Patil (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Khandesh Education Society's

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

The Meetings of Board of Studies in Botany was held virtual/hybrid mode through Google Meet (Link:- : https://meet.google.com/rzq-pdri-ynr) on 22nd March 2025 at 02.00 PM in the Department of Botany to discuss on various agendas of the meeting.

MEETING ATTENDANCE

SR. NO.	NAME OF THE MEMBER	DESIGNATION	SIGNATURE
1.	Prof. Jayesh T Salve (Chairman)	Assistant Professor & HOD Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
2.	Dr. Suchandra D Dutta (VC Nominee)	HOD Department of Botany, R. D. & S. H. National College, Bandra West, Mumbai, Dist.- Mumbai 400050	Member Absent
3.	Dr. Ashok R Tuwar (Academic Council Nominee)	Associate Professor, HOD, Administrative Officer Department of Botany, Mula Education Society's, Arts, Commerce & Science College, Sonai, Tal- Newasa, Dist.- Ahmednagar 414105 (Savitribai Phule Pune University, Pune)	The Member Attended Meeting Virtually
4.	Dr. Dnyaneshwar K Sherkar (Academic Council Nominee)	Assistant Professor Department of Botany, Arts & Commerce College, Warvat (Bakal), Tal- Sangrampur, Dist- Buldhana 444202 (Sant Gadge Baba Amravati University, Amravati)	The Member Attended Meeting Virtually
5.	Dr. Sarala C Tadavi (Alumni)	Assistant Professor Department of Botany, Dhanaji Nana Mahavidyalaya, Faizpur, Tal- Yawal, Dist.- Jalgaon 425503	The Member Attended Meeting Virtually
6.	Dr. Digambar D Ahire (Expert)	Associate Professor & HOD Department of Botany, New Arts, Commerce & Science College, Ahmednagar, Dist.- Ahmednagar 414001 (Savitribai Phule Pune University, Pune)	The Member Attended Meeting Virtually
7.	Prof. J. P. Padul (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
8.	Prof. B. B. Patil (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
9.	Prof. H. S. Chaudhari (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
10	Prof. P. D. Patil (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
11	Prof. H. P. Shinde (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	

Pratap College, Amalner (Autonomous) Depart. of Botany

Department of Botany

Illustrative Credit Distribution Structure for Three/Four Year Honours/ With Honours Research Degree Programme

Credit distribution structure for Three/ Four year Honours/ Honours with Research Degree Programme with Multiple Entry and Exit options

Level	Sem	Major (Core) Subjects		Minor Subjects (MIN)	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
4.5	I	DSC-1 (2) (T) DSC-2 (2) (T) DSC-3 (2) (P)	---	MIN-1 (2)(T) MIN-2 (2)(P)	OE-1 (2) (T)	SEC-1 (2)(T)	AEC-1 (2) (Eng) VEC-1 (2) (Environmental Studies) IKS (2)	CC-1 (2) (Choose from basket)	22	UG Certificate 44
	II	DSC-4 (2) (T) DSC-5 (2) (IKS) (T) DSC-6 (2) (P)	---	MIN-3 (2) (T) MIN-4 (2)(P)	OE-2 (2) (T)	SEC-2 (2)(T) SEC-3 (2)(P)	AEC-2 (2) (Eng) VEC-2 (2) (Constitution of India)	CC-2 (2) (Choose from basket)	22	
	Cum. Cr	12	---	8	4	6	4+4+2	4	44	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.0	III	DSC-7 (2) (T) DSC-8 (2) (T) DSC-9 (2)(P) DSC-10 (2) (P)	---	MIN-5 (2) (T) MIN-6 (2)(P)	OE-3 (2) (T)	VSC-1 (2)(T) VSC-2 (2)(P)	AEC-3 (2)(MIL) (Modern Indian Language)	CC-3 (2) (Choose from basket)	22	UG Diploma 88
	IV	DSC-11 (2) (T) DSC-12 (2) (T) DSC-13 (2)(P) DSC-14 (2)(P)	---	MIN-7 (2) (T) MIN-8 (2)(P)	OE-4 (4) (T)		AEC-4 (2) (MIL) (Modern Indian Language)	CC-4 (2) (Choose from basket) CEP (2)	22	
	Cum. Cr	28	---	16	10	4+6	8+4+2	8+2	88	
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.5	V	DSC-15 (2) (T) DSC-16 (2) (T) DSC-17 (2) (T) DSC-18 (2) (P) DSC-19 (2) (P)	DSE-1 (2)(T) DSE-2 (2)(P)	MIN-9 (2) (T/P)	---	VSC-3 (2)(P)	---	FP (4)	22	UG Degree 132
	VI	DSC-20 (2) (T) DSC-21 (2) (T) DSC-22 (2) (T) DSC-23 (2) (P) DSC-24 (2) (P)	DSE-3 (2)(T) DSE-4 (2)(P)	MIN-10 (2) (T/P)	---	VSC-4 (2)(P)	---	OJT/Int (4)	22	
	Cum. Cr.	48	08	20	10	8+6	8+4+2	8+6+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

Level	Sem	Major (Core) Subjects		Minor Subjects	GE/OE	VSC, SEC (VESC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
6.0	VII	DSC-25 (4) (T) DSC-26 (2) (T) DSC-27 (4) (T) DSC-28 (4) (P)	DSE-5 (4) (T)	RM (4)	---	---	---	---	22	UG Honours Degree 176
	VIII	DSC-29 (4) (T) DSC-30 (2) (T) DSC-31 (4) (T) DSC-32 (4) (P)	DSE-6 (4) (T)	---	---	---	---	OJT/Int (4)	22	
	Cum. Cr.	76	16	20+4	10	8+6	8+4+2	8+6+8	176	
Four Year UG Honours Degree in Major and Minor with 176 credits										
6.0	VII	DSC-25 (4) (T) DSC-26 (2) (T) DSC-28 (4) (P)	DSE-5 (4) (T)	RM (4)	---	---	---	RP (4)	22	UG Honours with Research Degree 176
	VIII	DSC-29 (4) (T) DSC-30 (2) (T) DSC-32 (4) (P)	DSE-6 (4) (T)	---	---	---	---	RP (8)	22	
	Cum. Cr.	68	16	20+4	10	8+6	8+4+2	8+6+4+12	176	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Note: The courses which do not have practical, 'P' will be treated as 'T'.

Abbreviations:

- **T- Theory Course, P – Practical course, DSC- Discipline Specific Core Course, DSE- Discipline Specific Elective Course, MIN – Minor subject.**
- **Major DSC (Mandatory)**: is the subject that represents the main focus of the degree, and the degree will be awarded in that Subject. Students should secure a minimum 50% of total credits through Major (core) Courses (mandatory courses, electives, vocational courses, Internship/ Field Projects/ Apprenticeship/ Community Engagement Projects, Seminars, and Group Discussion. In addition, Entrepreneurship, IPR and Research Project shall be offered in case of Honours with Research Degree) in Three /Four Years for the award of Major Degree.
- **Major Specific IKS (Cr-2)** is included under Major.
- **Minor** : is the subject that may complement the Major subject or can have interdisciplinary bandwidth. Minor subject may be related or unrelated to the Major subject. The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.

Programme Outcomes: B. Sc Botany

Department of Botany	After successful completion of three year degree program in Botany a student is able to;
Programme Outcomes	PO-1. Students know about different types of lower & higher plants their evolution in from algae to angiosperm &also their economic and ecological importance. PO-2. Cell biology gives knowledge about cell organelles & their functions PO-3. Molecular biology gives knowledge about chemical properties of nucleic acid and their role in living systems. PO-4. Genetics provides knowledge about laws of inheritance, various genetic interactions, chromosomal abrasions & multiple alleles. PO-5. Structural changes in chromosomes. PO-6.Student can describe morphological & reproductive characters of plant and also identified different plant families and classification. PO-7.They knows economic importance of various plant products & artificial methods of plant propagation PO-8. Use modern Botanical techniques and decent equipments. PO-9.To inculcates the scientific temperament in the students and outsidethe scientific community.
Programme Specific Outcomes	PSO-1. Students acquire fundamental Botanical knowledge through theory and practicals. PSO-2. To explain basis plant of life, reproduction and their survival in nature.

	PSO-3. Helped to understand role of living and fossil plants in our life. PSO-4. Understand good laboratory practices and safety. PSO-5 To create awareness about cultivation, conservation and sustainable utilization of biodiversity. PSO-6. To know advance techniques in plant sciences like tissue culture, Phytoremediation, plant disease management, formulation of new herbal drugs etc. PSO-7 Students able to start nursery, mushroom cultivation, biofertilizer production, fruit preservation and horticultural practices.

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - V

DISCIPLINE SPECIFIC COURSES

BOT-MJ-301 Lower Cryptogams
BOT-MJ-302 Morphology and Systematics of Angiosperm
BOT-MJ-303 Cell and Molecular Biology
BOT-MJP-304 Practical Based on BOT-MJ-301
BOT-MJP-305 Practical Based on BOT-MJ-302 & BOT-MJ-303

VOCATIONAL/ SKILL ENHANCEMENT COURSE

BOT-VSCP-306 Practical Based on Horticulture

MINOR SUBJECT GROUP *(Select Any One)*

BOT-MN-311 Indian Agriculture System
BOT-MNP-312 Practical Based on BOT-MN-311

DISCIPLINE ELECTIVE COURSES

BOT-EC-321 Plant Breeding
BOT-ECP-322 Practical Based on BOT-EC-321

FIELD PROJECT/OJT/INT.

BOT-FP-341 Field Project (Botany)

W. E. F. JUNE, 2025

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - V

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
III	V	I	BOT-MJ-301	Lower Cryptogams	20	30	2
		II	BOT-MJ-302	Morphology and Systematics of Angiosperms	20	30	2
		III	BOT-MJ-303	Cell and Molecular Biology	20	30	2
		IV	BOT-MJP-304	Practical Based on BOT-MJ-301	20	30	2
		V	BOT-MJP-305	Practical Based on BOT-MJ-302 and 303	20	30	2
		VI	BOT-VSCP-306	Practical Based on Horticulture	20	30	2
		VII	BOT-MN-312	Practical Based on BOT-MN-311	20	30	2
		VII I	BOT-EC-321	Plant Breeding	20	30	2
		IX	BOT-ECP-322	Practical Based on BOT-EC-321	20	30	2
		X	BOT-FP-341	Field Project (Botany)	40	60	4

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - VI

DISCIPLINE SPECIFIC COURSES

BOT-MJ-351 Higher Cryptogams
BOT-MJ-352 Gymnosperm and Paleobotany
BOT-IKS-353 Ancient Botany
BOT-MJP-354 Practical Based on BOT-MJ-351
BOT-MJP-355 Practical Based on BOT-MJ-352 & BOT-IKS-353

VOCATIONAL/ SKILL ENHANCEMENT COURSE

BOT-VSCP-356 Practical Based on Floriculture

MINOR SUBJECT GROUP *(Select Any One)*

BOT-MN-361 Phytogeography
BOT-MNP-362 Practical Based on BOT-MN-361

DISCIPLINE ELECTIVE COURSES

BOT-EC-371 Seed Technology
BOT-ECP-372 Practical Based on BOT-EC-371

On Job Training

BOT-OJT-391 On Job Training (Botany)

W. E. F. JUNE, 2025

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN

BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - VI

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
III	VI	I	BOT-MJ-351	Higher Cryptogams	20	30	2
		II	BOT-MJ-352	Gymnosperm and Paleobotany	20	30	2
		III	BOT-IKS-353	Ancient Botany	20	30	2
		IV	BOT-MJP-354	Practical Based on BOT-MJ-351	20	30	2
		V	BOT-MJP-355	Practical Based on BOT-MJ-352 and BOT-IKS-353	20	30	2
		VI	BOT-VSCP-356	Practical Based on Floriculture	20	30	2
		VII	BOT-MNP-362	Practical Based on BOT-MN-361	20	30	2
		VIII	BOT-EC-371	Seed Technology	20	30	2
		IX	BOT-ECP-372	Practical Based on BOT-EC-371	20	30	2
		X	BOT-OJT-391	On Job Training (Botany)	40	60	4

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - V

DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - VI

DISCIPLINE SPECIFIC COURSES

BOT-MJ-351 Higher Cryptogams
BOT-MJ-352 Gymnosperm and Paleobotany
BOT-IKS-353 Ancient Botany
BOT-MJP-354 Practical Based on BOT-MJ-351
BOT-MJP-355 Practical Based on BOT-MJ-352 & BOT-IKS-353

VOCATIONAL/ SKILL ENHANCEMENT COURSE

BOT-VSCP-356 Practical Based on Floriculture

MINOR SUBJECT GROUP *(Select Any One)*

BOT-MN-361 Phytogeography
BOT-MNP-362 Practical Based on BOT-MN-361

DISCIPLINE ELECTIVE COURSES

BOT-EC-371 Seed Technology
BOT-ECP-372 Practical Based on BOT-EC-371

On Job Training

BOT-OJT-391 On Job Training (Botany)

W. E. F. JUNE, 2025

DISCIPLINE SPECIFIC COURSE (DSC)
SEMESTER - V

PAPER – I

BOT-MJ-301: LOWER CRYPTOGAMS (Credits: 2, Lectures: 30)

OBJECTIVES

1. To understand the morphology, reproduction, and classification of lower cryptogams
2. To analyze the evolutionary significance of bryophytes and pteridophytes
3. To examine the life cycles and alternation of generations in lower plants
4. To evaluate the ecological importance and economic uses of cryptogams
5. To develop skills in identification and classification of lower cryptogams

COURSE OUTCOMES

1. Students will demonstrate knowledge of structural organization in bryophytes and pteridophytes
2. Students will analyze reproductive strategies in lower cryptogams
3. Students will classify various groups of lower cryptogams systematically
4. Students will evaluate evolutionary relationships among cryptogamic groups
5. Students will assess ecological roles and economic importance of lower plants

COURSE SPECIFIC OUTCOMES

- CSO1: Identify morphological features of bryophytes and pteridophytes
- CSO2: Explain reproductive cycles in cryptogams
- CSO3: Classify cryptogamic groups using taxonomic keys
- CSO4: Analyze evolutionary trends in lower plants
- CSO5: Evaluate economic and ecological significance

Unit 1: An introduction to Algae **(06 Lectures)**

1.1. Definition and general characters
1.2. Habit and habitat
1.3. Organization of thallus
1.4. Similarities, differences with fungi and Bryophytes
1.5. Reproduction
1.6. Life cycle patterns: Haplontic, Diplontic and Diplohaplontic
1.7. Outline classification of Algae according to F. E. Fritsch (1945) up to classes with suitable examples

Unit 2: Study of Life cycle with emphasis on systematic position, occurrence, morphology, reproduction and alternation of generation of ***Chara*** and ***Sargassum*** **(06 Lectures)**

Unit 3: An introduction to fungi **(06 Lectures)**

3.1. Definition and General Characters
3.2. Habit and habitat
3.3. Structure of thallus
3.4. Reproduction
3.5. Outline classification of fungi according to Ainsworth (1973) up to classes with suitable examples.

Unit 4: Study of Life cycle of fungi with reference to systematic position, thallus structure, reproduction of *Albugo* and *Uncinula* **(06 Lectures)**

Unit 5: Applied Phycology and Mycology **(06 Lectures)**

5.1. Role of Algae in i) Agriculture ii) Industry
iii) Biotechnology iv) Water Pollution

5.2. Role of Fungi in i) Agriculture ii) Industry
iii) Food iv) Medicine

5.3. Contribution of following Phycologists
i) Prof. M. O. P. Iyengar ii) Prof. T. V. Deshikachary

5.4. Contribution of following mycologists
i) Prof. E. J. Buttler ii) Prof. C. V. Subramanian

REFERENCE BOOKS

1. Alexopoulus C. J, Mims C.W. and Blacwel M. I. (1996). Introductory Mycology. John Wiley and Sons Inc. New York, U.S.A.
2. Bold, H. C. and M. J. M. Wynne (1978). Introduction to the Algae - Structure and Reproduction. Prentice Hall of India Pvt. Ltd. New Delhi.
3. Chapman, V. J. and D. J. Chapman (1979). The Algae. English Language Book Soc. & Mac Millons, London.
4. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi, India.
5. Ganguli, H. C. and Kar, A. K. (2001). College Botany Vol. I. Books and Allied Press Ltd. Kolkata, India
6. Kumar H. D. (1988). Introductory Phycology. Affiliated East West Press Ltd. New Delhi
7. Kumar H. D. and H. N. Singh (1976). A Text Book of Algae. Affiliated East West Press Ltd. New Delhi, India
8. Pandey, B. P. (1994). A Text Book of Botany - Algae. S. Chand & Co. Ltd. New Delhi, India.
9. Pandey, S. N., Trivedi, P. S. and S. P. Misra (1995). A Text Book of Algae. Vikas Pub. House Pvt. Ltd. New Delhi, India.
10. Prescott, G. W. (1969). The Algae: A Review. Thomas Nelson and Press, London, U.K.
11. Sharma, O. P. (1990). Text Book of Algae. Tata McGraw Hill Pub. Co. Ltd. New Delhi, India.
12. Sharma, O. P. (1990). Text Book of Fungi. Tata McGraw Hill Pub. Co. Ltd, New Delhi, India.
13. Singh, Pande and Jain. (2004). Text book of Botany. Diversity of Microbes and Cryptogams. Rastogi Publications, Gangotri, Shivaji Road, Meerut
14. Smith G. M. (1955). Cryptogamic Botany Vol. I: Algae and Fungi. McGraw Hill Book Co. New York, U.S.A.
15. Vashishta, B. R. (2012). Botany for Degree Students - Algae. S. Chand & Co. Ltd. New Delhi, India.

****

DISCIPLINE SPECIFIC COURSE (DSC)

SEMESTER - V

PAPER - II

BOT-MJ-302: MORPHOLOGY AND SYSTEMATICS OF ANGIOSPERMS
(Credits: 2, Lectures: 30)

OBJECTIVES

1. To understand the morphological diversity and systematic classification of angiosperms
2. To analyze floral structure and reproductive mechanisms in flowering plants
3. To examine major angiosperm families and their distinguishing characteristics
4. To evaluate evolutionary relationships and phylogenetic trends
5. To develop skills in plant identification and taxonomic classification

COURSE OUTCOMES

1. Students will demonstrate knowledge of angiosperm morphology and anatomy
2. Students will analyze floral structures and reproductive strategies
3. Students will classify angiosperms using modern taxonomic systems
4. Students will evaluate evolutionary relationships among angiosperm groups
5. Students will assess diversity and distribution patterns in flowering plants

COURSE SPECIFIC OUTCOMES

- CSO1: Identify morphological features of angiosperm organs
- CSO2: Analyze floral diagrams and taxonomic characters
- CSO3: Classify plants using dichotomous keys
- CSO4: Evaluate phylogenetic relationships
- CSO5: Assess angiosperm diversity and evolution

Unit1. Vegetative Morphology **(06 Lectures)**

1.1. Definition and scope of Morphology

1.2. Root: Definition, General characters and functions

Types of root: Tap and Adventitious

1.3. Stem: Definition, General characters and functions

1.4. Leaf: Definition,

a) Parts of typical leaf.

b) Types of leaf: Simple, Compound: Pinnately and Palmately.

c) Phyllotaxy: Alternate, Opposite and whorled.

d) Venation: Reticulate and parallel

1.5. Leaf Modifications: Phyllode, Pitcher

Unit 2: Floral Morphology **(06 Lectures)**

2.1. Inflorescence: Definition, Parts of Inflorescence

Types of Inflorescence:

a) Racemose - Raceme, Spike, Catkin, Spadix, Corymb, Umbel and Capitulum

b) Cymose: Solitary, Uniparous, Biparous and Multiparous cyme

c) Special Types: Cyathium, Verticillaster, Hypanthodium

2.2. Flower: Definition, Parts of typical flower and their functions

2.3. a) Insertion of floral leaves on thalamus: Hypogynous, Perigynous and Epigynous

b) Symmetry: Actinomorphic, Zygomorphic and Asymmetric

2.4. Calyx: Polysepalous, Gamosepalous

2.5. Corolla:

a) Regular polypetalous - Cruciform, Caryophyllaceous and Rosaceous

b) Irregular polypetalous - Papilionaceous,

c) Regular gamopetalous: Campanulate, Tubular, Infundibuliform, Rotate and Hypocrateriform

d) Irregular gamopetalous: Bilabiate, Ligulate and Personate

2.5. Androecium:

i) Cohesion of Stamen:

a) Adelphy: Monadelphous, Diadelphous, Polyadelphous

b) Syngeny

c) Synandry

ii) Adhesion of stamen: Episepalous, Epipetalous, Epiphyllous and Gynandrous

2.6. Gynoecium: Apocarpous and Syncarpous pistil, Monocarpellary, Bicarpellary and polycarpellary

Types of Placentation: Marginal, Basal, Axile, Parietal, Free central and superficial

2.7. Fruit: Definition, Parts of typical fruit

Types: a) Simple - Loculicidal capsule

b) Aggregate - Etaerio of berries

c) Composite - Syconus

Unit 3: Study the origin of Angiosperms **(06 Lectures)**

3.1. Definition, Distinguishing Characters of Angiosperms

3.2. Taxonomy: Aims of taxonomy - Empirical and Interpretative approach

3.4. The origin of Angiosperms: w. r. t.

i) Age of Angiosperms

ii) Probable ancestors of angiosperms:

a) The Anthostrobilus (Bennettitalean) theory

b) The Gnetales theory

Unit 4: Systems of Classification and Modern Trends in Taxonomy **(06 Lectures)**

4.1. Study of Systems of Classification w. r. t. outline, merits and demerits of Hutchinson's system and Engler and Prantl's system

4.2. Modern Trends in Taxonomy

Role of following with suitable examples:

a) Anatomy

b) Embryology

Unit 5: Study of Angiosperm Families **(06 Lectures)**

(*Sensu* Bentham and Hooker's system of classification)

Study of following families w. r. t. geographical distribution, systematic position, morphological characters (vegetative and floral), salient features, floral formula and economic importance of the following families.

1. Annonaceae
2. Rutaceae
3. Caesalpiniaceae

4. Compositae (Asteraceae)
5. Sapotaceae
6. Asclepiadaceae
7. Amaranthaceae
8. Liliaceae

Point of biological interest of Asclepiadaceae

REFERENCE BOOKS

1. Ganguly, H. C. and Das, K. S. (1986). College Botany Vol.I (6th Edition). New Central Book Agency, Calcutta, India.
2. Ganguly, H. C., Dasand, K. S. and Datta, C. T. (1968). College Botany Vol. I. New Central Book Agency, Calcutta, India.
3. Heywood, V. H. and Moore, D. M. (Eds.) (1984). Current Concepts in Plant Taxonomy. Academic Press, London, U.K.
4. Jeffrey, C. E. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge, London, U.K.
5. Kumar, N. C. (1995). An Introduction to Taxonomy of Angiosperms. Himalaya Publishing House, Nagpur, India.
6. Lawrence, G. H. M. (1951). Taxonomy of Vascular Plants. McMillan, New York, U.S.A.
7. Mondal, A. K. (2005). Advanced Plant Taxonomy. New Central Book Agency (P) Ltd. Kolkata, India.
8. Naik, V. N. (1985). Taxonomy of Angiosperms. Tata McGraw Hill Publ. Co. Ltd. New Delhi, India.
9. Pandey, B. P. (1997). A Text Book of Angiosperms. S. Chand & Company Ltd., New Delhi.
10. Sharma, O.P. (1993). Plant Taxonomy. Tata McGraw Hill. Publ. Co. Ltd. New Delhi, India.
11. Singh, V. (1993). Taxonomy of Angiosperms. Rastogi Publication, Meerut (U.P.) India.
12. Singh, V., Pande, P. C. and Jain, D. K. (2013). A Text Book of Botany: Angiosperms. Rastogi Publications, Meerut (U. P.), India.
13. Singh, M. P., Nayar, M. P. and Roy, R. P. (1994). Text Book of Forest Taxonomy. Anmol Publ. P. (Ltd.) New Delhi, India.
14. Subramanayam, N. S. (1997). Modern Plant Taxonomy. Vikas Publ. House, New Delhi, India.
15. Sivarajan, V. V. (1984). Introduction to Principles of Plant Taxonomy. Oxford & I. B. H. Publishing Co. New Delhi, India.
16. Vashistha, P. C. (1992). Taxonomy of Angiosperms. S. Chand & Co. Publishers, New Delhi, India.

****

DISCIPLINE SPECIFIC COURSE (DSC)
SEMESTER - V
PAPER - III
BOT-MJ-303: CELL AND MOLECULAR BIOLOGY
(Credits: 2, Lectures: 30)

OBJECTIVES

1. To understand the structural and functional organization of plant cells
2. To analyze molecular mechanisms of cellular processes
3. To examine genetic material organization and expression
4. To evaluate biotechnological applications in plant biology
5. To develop skills in molecular biology techniques

COURSE OUTCOMES

1. Students will demonstrate knowledge of cell structure and organelle functions
2. Students will analyze molecular mechanisms of gene expression
3. Students will evaluate cellular processes at molecular level
4. Students will assess biotechnological applications in plant science
5. Students will apply molecular techniques in plant research

COURSE SPECIFIC OUTCOMES

- CSO1: Describe cell structure and organelle organization
- CSO2: Explain molecular mechanisms of cellular processes
- CSO3: Analyze gene expression and regulation
- CSO4: Evaluate biotechnological applications
- CSO5: Apply molecular biology techniques

Unit 1: Cell and Cell Cycle **(06 Lectures)**

1.1. Introduction, definition and history of cell, types of cell, Characteristics of Prokaryotic and eukaryotic cells, Cell theory
1.2. Cell Wall and Cell Membrane: Definition, Physical and chemical Properties and functions of plant cell wall and Membranes Unit Membrane model, Fluid Mosaic model
1.3. Various phases of Eukaryotic cell cycle, Mitosis and Meiosis

Unit 2: Cell organelles **(06 Lectures)**

2.1. Mitochondria: Ultra Structural organization and function of Mitochondria
2.2. Chloroplast: Ultra Structural organization and function of Chloroplast
2.3. Endoplasmic reticulum: Ultra Structure, types and functions
2.4. Golgi Complex: Ultra Structure and function
2.5. Nucleus: Structure, Morphology and Ultra structure (Nuclear envelope, Nucleoplasm, Chromatin material and Nucleolus)
2.6. Chromosome: Morphology, Types of chromosomes on the basis of centromere

Unit 3: Nucleic Acids and DNA Structure **(06 Lectures)**

3.1 Historical perspective
3.2 DNA as the carrier of genetic information

- Griffith's experiment
- Hershey & Chase experiment
- Avery, McLeod & McCarty experiment

3.3 Types of genetic material and Types of DNA

3.4 DNA Structure

- Watson and Crick - historic perspective
- Salient features of double helix
- Organization of DNA: Prokaryotes (*E. coli*) and Eukaryotes
- Types of RNA
- Organelle DNA: Mitochondria DNA and Chloroplast DNA
- Chromatin structure: Nucleosome, Euchromatin, Heterochromatin (Constitutive and Facultative)

Unit 4: DNA Replication and Central Dogma (06 Lectures)

4.1 General principles of DNA replication

- Bidirectional replication
- Semi-conservative replication
- Semi-discontinuous replication
- RNA priming

4.2 Various models of DNA replication

- Rolling circle model
- θ (theta) model of replication
- Replication of linear ds-DNA
- Replication of the 5' end of linear chromosome

4.3 Enzymes involved in DNA replication

4.4 The Central Dogma and Genetic code

- The Central Dogma
- Genetic code: Nature and properties

Unit 5: Transcription, Gene Regulation, and Protein Synthesis (06 Lectures)

5.1 Transcription and Gene Regulation

- Transcription in prokaryotes and eukaryotes
- Principles of transcriptional regulation
- Prokaryotic regulation: Regulation of lactose metabolism and tryptophan synthesis in *E. coli*
- Eukaryotic regulation: Eukaryotic transcriptional regulation (promoter, enhancer, silencer, Gene battery) and post-transcriptional regulation

5.2 Processing and modification of RNA

- Split genes concept: Introns and exons, removal of introns, spliceosome machinery, splicing pathways
- RNA editing and mRNA transport

5.3 Ribosome structure and protein synthesis machinery

- Ribosome structure and assembly
- mRNA, Charging of tRNA, aminoacyl tRNA synthetases

5.4 Protein synthesis and modifications

- Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides
- Inhibitors of protein synthesis
- Post-translational modifications of proteins

REFERENCE BOOKS

1. Gardner, E. J., Simmons, M. J. and Snustad, D. P. (2008). Principles of Genetics, 8th Ed. John Wiley and Sons, New Jersey, U.S.A.
2. Snustad, D. P. and Simmons, M. J. (2010). Principles of Genetics, 5th Ed. John Wiley and Sons, New Jersey, U.S.A.
3. Klug, W. S., Cummings M. R., Spencer C. A., Palladino, M. A. (2011). Concepts of Genetics, 10th Ed. Benjamin Cummings Publishing, San Francisco, California, U.S.A.
4. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th Ed. W. H. Freeman and Co., U.S.A.
5. Pierce, B. A. (2011). Genetics: A Conceptual Approach, 4th Ed. Macmillan Higher Education Learning.
6. Karp, G. (2010). Cell Biology, 6th Ed. John Wiley & Sons, New Jersey, U.S.A.
7. Hardin, J., Becker, G., Kleinsmith, L. J. (2012). Becker's World of the Cell, 8th Ed. Pearson Education Inc. U.S.A.
8. Cooper, G. M. and Hausman, R. E. (2009). The Cell: A Molecular Approach, 5th Ed. ASM Press; Sunderland, Washington, D. C., Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L. J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell, 7th Ed. Pearson Benjamin Cummings Publishing, San Francisco California, U.S.A.
10. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., Doebley, J. (2010). Introduction toGenetic Analysis, 10th Ed. W. H. Freeman and Co., U.S.A.
11. Verma, Agarwal, (2005). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company, New Delhi, India.

****

DISCIPLINE SPECIFIC COURSE (DSC)
SEMESTER - V
PAPER - IV
BOT-MJP-304: PRACTICAL BASED ON BOT-MJ-301 (Credits: 2)

Practicals Based on BOT-MJ-301: Lower cryptogams

Practical - 1 & 2: Study of range of thallus structure in algae with the help of materials or Permanent slides (any one from the examples):

a) Unicellular thallus: *Chlamydomonas*, *Chlorella*

b) Colonial thallus: *Pandorina*, *Eudorina*, *Volvox*, *Hydrodictyon*

c) Filamentous thallus: *Pithophora*, *Chaetophora*, *Coleochaetae*, *Stigeoclonium*, *Drapanaldia*, *Fritscheilla* and *Oedogonium*

d) Siphonaceousthallus: *Vaucheria*, *Caulerpa*

e) Pseudoparenchymatous: (Uniaxial/Multiaxial) thallus: *Batrachospermum*, *Polysiphonia*

f) Parenchymatousthallus: *Ulva*, *Enteromorpha*

Practical - 3: Study of life cycle of ***Chara***

Practical - 4: Study of life cycle of ***Sargassum***

Practical – 5 and 6: Study of fungal forms
(any four)

i) Stemonitis ii) *Saprolegnia* iii) *Rhizopus*
iv) *Eurotium* v) *Puccinia* vi) *Alternaria*

Practical – 7 & 8: Study of life cycle of ***Albugo***

Practical – 9 & 10: Study of life cycle of ***Uncinula***

Practical – 11 & 12: Culture of Algae (Venkatraman method)/Culture of Fungi on PDA medium

NOTE: Study tour is compulsory. Students are expected to submit two forms of Algae and Fungi each. Photographs of any two forms Algae and Fungi along with tour report.

****

DISCIPLINE SPECIFIC COURSE (DSC)
SEMESTER - V
PAPER - IV
BOT-MJP-305: PRACTICAL BASED ON BOT-MJ-302 & BOT-MJ-303(Credits: 2)

Practicals Based on BOT-MJ-302: Morphology and Systematics of Angiosperms

Practical - 1: Study of Leaf Morphology (as per theory): Phyllotaxy and Types of leaf

Practical - 2: Study of Inflorescences (as per theory)

Practical - 3: Study of Flower: Types of Flower and Forms of Corolla

Practical - 4 to 6: Study of **any six** plant families as per theory with respect to systematic position, morphological characters (vegetative and floral), floral formula and floral diagram (*sensu* Bentham and Hookers system)

Practical - 7: Identification of genus and species (any suitable) by using local, regional,state and national flor

NOTE: i) Excursion tour is compulsory
ii) Submission of photograph of any ten plants and tour report at the time of practical examination.

Practicals Based on BOT-MJ-303: Cell and Molecular Biology

Practical - 8: To prepare temporary stained preparation of mitochondria from onion pealusing vital stain Janus green.

Practical - 9: Study of mitosis and meiosis (temporary mounts and permanent slides).**Practical - 10:** Measure the cell size (either length or breadth/diameter) by micrometry

Practical - 11: DNA isolation from any suitable material.

Practical - 12: DNA estimation by diphenylamine reagent/UV Spectrophotometry.

****

VOCATIONAL/SKILL ENHANCEMENT COURSE

SEMESTER - V

PAPER - V

BOT-VSCP-306 Practical Based on Horticulture (Credits: 2)

Practical – 1 & 2: Study of Garden tools and equipment: Sprayer, Duster, Pruning knife,Sprinkler.

Practical – 3 & 4: Study of propagation requirement:

i) Media ii) Containers iii) Potting iv) Repotting

Practical – 5 & & 6: Study of propagation methods:

a) Cutting b) Layering c) Budding d) Grafting

Practical - 7 to 12: Preparations of different types of fruit products (Any three)

a) Mix fruit Jam b)Wood apple/Guava Jelly

b) Lemon/Orange Squash c)Tomato ketchup

Note: Visit to any one Nursery Unit, Commercial orchard, food processing unit is compulsory and need to submit the report

MINOR COURSE

SEMESTER - V

PAPER - VII

BOT-MN-311: INDIAN AGRICULTURAL SYSTEM

(Credits: 2, Lectures: 30)

COURSE OBJECTIVES

1. To understand the historical evolution and current status of Indian agricultural systems
2. To analyze the diverse agro-climatic zones and their impact on crop production patterns
3. To examine traditional and modern farming practices adopted in Indian agriculture
4. To evaluate the role of government policies and institutions in agricultural development
5. To assess the challenges and opportunities in sustainable agricultural practices

COURSE OUTCOMES

Upon completion of this course, students will be able to:

1. Demonstrate comprehensive knowledge of Indian agricultural systems and their regional variations
2. Analyze the relationship between agro-climatic conditions and crop productivity
3. Compare traditional and modern farming techniques used across different regions of India
4. Evaluate the effectiveness of agricultural policies and their impact on farmers
5. Propose sustainable solutions for contemporary agricultural challenges

COURSE SPECIFIC OUTCOMES

Students will specifically be able to:

1. Identify and classify different agro-climatic zones of India and their characteristic crops
2. Explain the principles and practices of organic farming and integrated pest management
3. Assess the impact of Green Revolution on Indian agriculture and food security
4. Design crop rotation and intercropping systems suitable for different regions
5. Evaluate water management techniques and their role in sustainable agriculture

---

UNIT 1: INTRODUCTION TO INDIAN AGRICULTURE (6 Hours)

1.1 Historical Perspective of Indian Agriculture

1.2 Current Status and Importance

1.3 Classification of Indian Agriculture

1.4 Agricultural Statistics and Data Analysis

UNIT 2: AGRO-CLIMATIC ZONES AND CROP PATTERNS (6 Hours)

2.1 Agro-Climatic Classification of India

2.2 Major Crop Zones and Their Characteristics

2.3 Cropping Intensity and Patterns

2.4 Climate Change and Agriculture

UNIT 3: FARMING SYSTEMS AND PRACTICES (6 Hours)

3.1 Traditional Farming Systems

3.2 Modern Agricultural Technologies

3.3 Sustainable Agriculture Practices

3.4 Irrigation and Water Management

UNIT 4: AGRICULTURAL POLICIES AND INSTITUTIONS (6 Hours)

4.1 Agricultural Policy Framework

4.2 Institutional Support Systems

4.3 Green Revolution and Its Impact

4.4 Government Schemes and Programs

UNIT 5: CHALLENGES AND FUTURE PROSPECTS (6 Hours)

5.1 Contemporary Challenges

5.2 Environmental Concerns

5.3 Technology and Innovation

5.4 Future Strategies and Opportunities

REFERENCES

1. Bhalla, G.S. & Singh, G. (2012). *Economic Liberalisation and Indian Agriculture: A State-wise Analysis*. SAGE Publications.
2. Chand, R. (2017). *Doubling Farmers' Income: Strategy and Prospects*. Indian Council of Agricultural Research.
3. Dev, S.M. & Sharma, A.N. (2010). *Food Security in India: Performance, Challenges and Policies*. Oxfam India.
4. Directorate of Economics and Statistics. (2023). *Agricultural Statistics at a Glance*. Ministry of Agriculture, Government of India.
5. FAO. (2022). *The State of Food Security and Nutrition in the World*. Food and Agriculture Organization.
6. Gadgil, S. & Gadgil, S. (2006). The Indian monsoon, GDP and agriculture. *Economic and Political Weekly*, 41(47), 4887-4895.
7. Gulati, A. & Saini, S. (2015). *Taming Food Inflation in India*. Commission for Agricultural Costs and Prices.
8. ICAR. (2021). *Handbook of Agriculture*. Indian Council of Agricultural Research.
9. Joshi, P.K. et al. (2004). *Agriculture Diversification in South Asia: Patterns, Determinants and Policy Implications*. IFPRI.
10. Kumar, P. & Mathur, V.C. (2014). Structural transformation in food and agriculture: A perspective for smallholders. *Current Science*, 107(4), 591-600.
11. Ministry of Agriculture and Farmers Welfare. (2023). *State of Indian Agriculture Report*. Government of India.
12. Nayyar, D. & Sen, A. (1994). *International Trade and the Agricultural Sector in India*. ILO Publications.
13. NITI Aayog. (2022). *Raising Agricultural Productivity and Making Farming Remunerative for Farmers*. Government of India.
14. Pingali, P.L. (2012). Green Revolution: Impacts, limits, and the path ahead. *Proceedings of the National Academy of Sciences*, 109(31), 12302-12308.
15. Planning Commission. (2013). *Twelfth Five Year Plan: Faster, More Inclusive and Sustainable Growth*. Volume II, Government of India.
16. Rao, C.H.H. (2000). *Declining Demand for Foodgrains in Rural India: Causes and Implications*. Economic and Political Weekly.
17. Sen, A. (2005). *The Argumentative Indian: Writings on Indian History, Culture and Identity*. Penguin Books.
18. Swaminathan, M.S. (2010). *From Green to Evergreen Revolution: Indian Agriculture - Performance and Challenges*. Academic Foundation.
19. Vaidyanathan, A. (2010). *Agricultural Growth in India: Role of Technology, Incentives and Institutions*. Oxford University Press.

MINOR COURSE
SEMESTER – V

PAPER – VIII

BOT-MNP-312 Practical Based on BOT-MN-311
(Credits: 2)

Practical 1: Soil Health Assessment

- **Aim:** To analyze soil's physical and chemical properties and recommend fertility management strategies.
- **Procedure:** Collect soil samples, perform physical analysis for texture and color, and chemical analysis for pH, EC, and nutrient content. Interpret the results and propose fertility recommendations.

Practical 2: Seed Quality Testing

- **Aim:** To evaluate seed viability, purity, and moisture content.
- **Procedure:** Conduct germination tests, analyze purity by separating inert matter, and use a moisture meter to determine water content. Demonstrate proper seed treatment techniques.

Practical 3: Agro-Climatic Zone Mapping

- **Aim:** To understand India's agro-climatic zones and their crop patterns.
- **Procedure:** Use maps to identify and mark the 15 agro-climatic zones of India. Link each zone to its major crops (e.g., rice in eastern zones, wheat in northern zones) and discuss the influencing climatic factors.

Practical 4: Crop Identification and Classification

- **Aim:** To identify and classify major crops based on their morphological features.
- **Procedure:** Collect samples of various crops (cereals, pulses, oilseeds, cash crops). Identify them by their roots, stems, leaves, and reproductive parts. Classify them into their respective botanical families.

Practical 5: Modern Farming Technologies

- **Aim:** To explore the use of modern technology in agriculture.
- **Procedure:** Study and demonstrate the use of agricultural machinery (tractors, harvesters), and learn about precision farming tools like GPS and drones for mapping and spraying.

Practical 6: Sustainable Farming Practices

- **Aim:** To prepare and apply organic inputs and understand sustainable methods.
- **Procedure:** Make compost or vermicompost. Demonstrate the preparation of bio-pesticides and bio-fertilizers. Discuss the principles of natural farming.

Practical 7: Irrigation Systems and Water Management

- **Aim:** To study different irrigation systems and calculate water requirements.
- **Procedure:** Set up and operate models of surface, sprinkler, and drip irrigation systems. Calculate water use efficiency and discuss methods for water conservation.

Practical 8: Government Schemes and Policies

- **Aim:** To analyze the impact of key government schemes on agriculture.
- **Procedure:** Research and present on programs like the Soil Health Card Scheme, Pradhan Mantri Fasal Bima Yojana, and the Public Distribution System (PDS). Discuss their objectives and outcomes.

Practical 9: Pest and Disease Management

- **Aim:** To identify common pests and diseases and learn control measures.
- **Procedure:** Collect and identify damaged plant samples and insect pests. Prepare and apply natural pest control solutions and discuss Integrated Pest Management (IPM) strategies.

Practical 10: Weed Management

- **Aim:** To identify common weeds and demonstrate their control methods.
- **Procedure:** Collect and classify weeds from a field. Demonstrate mechanical, cultural, and biological weed control techniques.

Practical 11: Harvest and Post-Harvest Operations

- **Aim:** To learn proper harvesting and post-harvest practices.
- **Procedure:** Determine crop maturity indices. Demonstrate manual and mechanical harvesting. Practice threshing, winnowing, and proper storage techniques.

Practical 12: Agricultural Economics and Marketing

- **Aim:** To perform an economic analysis of farming and understand marketing.
- **Procedure:** Calculate the cost of cultivation and assess the profitability of a chosen crop. Study the supply chain from farm to market and analyze the role of agricultural marketing infrastructure.

DSC ELECTIVE COURSE
SEMESTER - VI
PAPER - IX
BOT-EC-321: PLANT BREEDING
(Credits:2, Lectures: 30)

Course Objectives

1. To understand plant breeding principles, breeding systems, and modes of reproduction in crops.
2. To learn crop improvement methods including selection, hybridization, and plant introduction techniques.
3. To analyze male sterility systems and their use in hybrid seed production.
4. To evaluate inbreeding depression and heterosis for breeding applications.
5. To explore modern breeding techniques like mutation, polyploidy, and genetic modification.

Course Outcomes

1. Students will demonstrate knowledge of plant breeding fundamentals and reproductive mechanisms.
2. Students will apply crop improvement methods for specific breeding objectives.
3. Students will utilize male sterility systems for hybrid seed production programs.
4. Students will evaluate heterosis and inbreeding depression in breeding strategies.
5. Students will integrate modern breeding techniques for crop variety development.

Course Specific Outcomes

1. Students will classify breeding systems and select appropriate mating strategies for crops.
2. Students will design selection and hybridization programs for specific crop improvement.
3. Students will distinguish male sterility types for hybrid seed production strategies.
4. Students will calculate heterosis values and predict hybrid performance.
5. Students will synthesize conventional and modern breeding approaches for crop enhancement.

Unit 1: **Plant breeding** **(06 Lectures)**

1.1. Introduction, Scope and objectives
1.2. Breeding systems: Inbreeding and outbreeding's
1.3. Modes of reproductions in crop plants,
Self-pollination, Cross pollination and Geitonogamy
1.4. Important achievements and undesirable consequences of
Plant breeding

Unit 2: **Methods of Crop Improvements** **(06 Lectures)**

2.1. Introduction
2.2. Centre of origin and domestification of crop plants
2.3. Plant genetic resources of wild relatives of domesticated crops
2.4. Procedure, advantages and limitations of
i) Plant introduction and Acclimatization
ii) Selection: Pure line selection, Mass selection and clonal selection
iii) Hybridization: Bulk method, Single cross and double cross method
Interspecific hybridization for improvement of clonal crops
2.7. Procedure, advantages and limitations

Unit 3: Male Sterility **(06 Lectures)**

3.1. Genetic male sterility
3.2. Cytoplasmic male sterility
3.3. Genetic Cytoplasmic male sterility
3.4. Use of male sterility in hybrid seed production

Unit 4: Inbreeding depression and heterosis (06 Lectures)

4.1. History

4.2. Genetic basis inbreeding depression and heterosis

4.3. Applications

Unit 5: Crop improvement and breeding (06 Lectures)

5.1. Role of followings in crop improvement with suitable examples one from each

a) Mutation breeding

b) Polyploidy breeding

c) Distant hybridization

d) Genetically modified crops

REFERENCE BOOKS

1. Agrawal, R. L. (1998). Fundamentals of Plant Breeding and Hybrid seed production. Oxford and IBH Publishing Co. New Delhi, India.
2. Allard, R.W. (1960). Principles of plant breeding. John Wiley and Sons, New York.
3. Hayes, H. K. (2017).Breeding Crops Plants.Shree Publishersbooks in India.
4. Chaudhary, H. K. (2001). Plant Breeding, Theory and Practice. Oxford IBH (P.) Ltd. New Delhi, India.
5. Gupta, P. K. (1998). Genetics, Plant Breeding and Evolution. Rastogi Publication, Meerut, India.
6. Xijendro Das, L. D. (1998). Plant Breeding. New age International Publication India.
7. Phundan, Sings (2006). Essential of Plant Breeding. Kalyani Publishers, New Delhi.
8. Poehlman, J. M. and Borthakur D. (1995). Breeding Asian Field Crops. Oxford IBH (P.) Ltd. New Delhi, India.
9. Phundan, Singh (2006). Principles of Plant Breeding.Rastogi Publication Meerut, India.
10. Sheenivas, Y. S. Seed Technology and Seed Pathology. Shree Publishers.
11. Sharma, J. R. (1994). Principles and Practice of Plant Breeding. Tata McGraw Hill Publishing Company Ltd. New Delhi.
12. Singh, B. D. (2006). Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
13. Singh, B. D. (1996). Plant Breeding. Kalyani Publishers, New Delhi.

****

DSC ELECTIVE COURSE

Paper: X

BOT-ECP-322 Practical Based on BOT-EC-321

(Credits:2)

Practical – 1 & 2: Study of factors promoting self-pollination (By demonstrationFlower/Photograph)

- Bisexuality (Hermaphroditism) ---------- (Wheat, Rice)
- Cleistogamy ..... (Wheat, Rice)
- Homogamy----------(Tomato, Lady's finger)

Practical – 3 & 4: Study of factors promoting cross pollination (By demonstrationFlower/Photograph)

- Dichogamy (i) Protandary---------- (Maize)
  (ii) Protogyny ---------- (Pearl millet)
- Unisexuality (i) Monoecious---------- (Maize, Pumpkins)
  (ii) Dioecious ---------- (Hemp, Asparagus)
- Self-incompatibility---------- (Radish, Cabbage)

Practical – 5 & 6: Techniques of Hybridization in Self Pollinated and Cross-Pollinated Crops

Practical – 7 & 8: Estimation of heterosis

i) Standard heterosis
ii) Mid Parent heterosis
iii) Useful or Economic heterosis

Practical: - 9 &10 Pollen viability test by

i) Aceto Carmine method
ii) Sugar solution method

Practical – 11 & 12: To show artificial induction of polyploidy

****

DSC ELECTIVE COURSE
Paper: XI

BOT-FP-341 Field Project (Botany)

Course Code: BOT-FP-341 **Credit Weightage:** 4 Credits

Total Marks: 100 Marks (40 Internal, 60 External)

Guidelines for Writing the Project

The field project is an opportunity to apply theoretical knowledge to real-world botanical research. The project should be an independent investigation on a specific topic.

A. Project Aims

1. To conduct hands-on research in a specific area of botany.
2. To develop skills in field data collection, laboratory analysis, and report writing.
3. To present findings clearly and concisely in a structured report.

B. Project Work Plan

The project should be planned over the course of the semester and include the following phases:

1. **Topic Selection (Week 1-2):** Choose a topic in consultation with a faculty guide. The topic should be focused and feasible.
2. **Literature Review (Week 3-5):** Conduct a thorough review of existing literature to understand the background of the topic.
3. **Methodology Design (Week 6-8):** Plan the research methods, including site selection, sampling techniques, and data collection tools.
4. **Field/Lab Work (Week 9-12):** Execute the planned methodology and collect primary data.
5. **Data Analysis and Report Writing (Week 13-15):** Analyze the collected data and begin writing the project report.
6. **Final Submission and Presentation (Week 16):** Submit the final report and prepare for a presentation/viva voce.

C. Report Structure

The project report should be a minimum of 25 pages (excluding appendices and references) in **three** copies of spiral binding and follow this structure:

- **Title Page:** Project title, student name, guide name, department, university, and date.
- **Certificate:** A certificate from the guide stating the originality of the work.
- **Acknowledgement:** A section to thank all individuals and institutions who helped.
- **Table of Contents:** List of all sections, sub-sections, and page numbers.
- **List of Figures/Tables:** If applicable.
- **Abstract:** A brief summary (approx. 250 words) of the project's objectives, methods, results, and conclusions.
- **1.0 Introduction:**
    - 1.1 Background of the study.
    - 1.2 Objectives of the project.
    - 1.3 Scope and limitations.

- **2.0 Review of Literature:**
  - A critical review of previous studies related to the topic.
- **3.0 Methodology:**
  - Detailed description of the research design, study area, sampling methods, and data collection techniques.
- **4.0 Results and Discussion:**
  - Present the findings using tables, figures, and graphs.
  - Discuss the results in relation to the literature review and project objectives.
- **5.0 Conclusion:**
  - Summarize the key findings and their implications.
  - Suggest future directions for research.
- **6.0 References:**
  - A list of all cited sources, formatted in a consistent style (e.g., APA, Chicago).
- **Appendices:**
  - Raw data, survey questionnaires, or other supplementary material.

D. Assessment Breakdown

The project will be assessed based on the following criteria:

- **Internal Assessment (40 Marks):**
  - Literature Review and Project Plan (10 Marks)
  - Field/Lab Work Progress (10 Marks)
  - Project Report Draft (10 Marks)
  - Guide's Assessment (10 Marks)
- **External Assessment (60 Marks):**
  - Final Project Report (30 Marks)
  - Presentation and Viva Voce (30 Marks)

Component	Details
Credits & Marks	4 Credits = 100 Marks (Internal 40 + External 60)
Semester	V (Fifth)
Objectives	• Hands-on learning & link theory with practice. Applying theoretical knowledge to real-world problems • Develop research aptitude & problem-solving • Engage with community/industry/environment • Enhance teamwork, communication & digital skills
Project Structure	• **Topic Selection:** Relevant to subject discipline • **Work Mode:** Individual / Group (max 4 students) • **Duration:** 4–6 weeks (or part-time in a semester) • **Supervision:** Faculty guide allotted • **Work Components:** Literature review, data collection, analysis, report writing, presentation
Internal Assessment (40 Marks)	1. Project Proposal / Synopsis – 10 marks 2. Mid-term Progress Presentation – 10 marks 3. Field Work / Data Collection / Lab Work – 10 marks 4. Attendance & Initiative – 10 marks
External Assessment (60 Marks)	Conducted by internal + external examiners: 1. Final Written Report – 25 marks 2. Presentation (PPT/Poster/Demo) – 15 marks 3. Viva-Voce Examination – 20 marks
Passing Standards	- Minimum 16/40 in Internal - Minimum 24/60 in External - Overall 40/100 to pass - Non-submission of project = Fail/Absent
NEP 2020 Alignment	- Continuous & holistic evaluation - Research, innovation & critical thinking focus - Community/industry linkage encouraged - Credits stored in Academic Bank of Credits (ABC) - Multidisciplinary projects permitted

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

SYLLABUS FOR CORE AND SKILL ENHANCEMENT COUESES IN BOTANY

As Per U. G. C. Guidelines

Based on

NEP-2020

T. Y. B. Sc. BOTANY SEMESTER - WISE SYLLABUS

(Theory and Practical's)

SEMESTER - VI

DISCIPLINE SPECIFIC COURSES (MAJOR)

BOT-MJ-351 Higher Cryptogams
BOT-MJ-352 Gymnosperm and Paleobotany
BOT-IKS-353 Ancient Botany
BOT-MJP-354 Practical Based on BOT-MJ-351
BOT-MJP-355 Practical Based on BOT-MJ-352 & BOT-IKS-353

VOCATIONAL/ SKILL ENHANCEMENT COURSE

BOT-VSCP-356 Practical Based on Floriculture

MINOR SUBJECT GROUP *(Select Any One)*

BOT-MN-361 Phytogeography
BOT-MNP-362 Practical Based on BOT-MN-361

DISCIPLINE ELECTIVE COURSES

BOT-EC-371 Seed Technology
BOT-ECP-372 Practical Based on BOT-EC-371

On Job Training

BOT-OJT-391 On Job Training (Botany)

W. E. F. JUNE, 2025

SEMESTER - VI

Year	Sem.	Paper	Code	Title of Course	Marks		Credits
					Int.(CA)	Ext.(UA)	
III	VI	I	BOT-MJ-351	Higher Cryptogams	20	30	2
		II	BOT-MJ-352	Gymnosperm and Paleobotany	20	30	2
		III	BOT-IKS-353	Ancient Botany	20	30	2
		IV	BOT-MJP-354	Practical Based on BOT-MJ-351	20	30	2
		V	BOT-MJP-355	Practical Based on BOT-MJ-352 and BOT-IKS-353	20	30	2
		VI	BOT-VSCP-356	Practical Based on Floriculture	20	30	2
		VII	BOT-MNP-362	Practical Based on BOT-MN-361	20	30	2
		VIII	BOT-EC-371	Seed Technology	20	30	2
		IX	BOT-ECP-372	Practical Based on BOT-EC-371	20	30	2
		X	BOT-OJT-391	On Job Training (Botany)	40	60	4

DISCIPLINE SPECIFIC COURSES (MAJOR)

Paper: I

BOT-MJ-351 Higher Cryptogams

(Credits: 2, Lectures: 30)

Course Objectives (COs)

Upon successful completion of this course, students will be able to:

1. Recognize the diversity, classification, and evolutionary significance of lower plants including Bryophytes and Pteridophytes.
2. Understand the anatomical and morphological adaptations of Bryophytes and Pteridophytes to terrestrial life.
3. Analyze the reproductive strategies and life cycles of various groups within Bryophytes and Pteridophytes.
4. Differentiate between the major classes based on their characteristic features and evolutionary relationships.
5. Appreciate the ecological role and economic importance of cryptogams.

Course Outcomes (COs)

1. Students will be able to classify and identify various members of Bryophytes and Pteridophytes.
2. Students will gain a deep understanding of the alternation of generations in cryptogams.
3. Students will be able to describe the internal and external morphology of representative members.
4. Students will develop skills in microscopic observation and drawing of plant sections.
5. Students will be able to critically evaluate the phylogenetic relationships among cryptogamic groups.

Course Specific Outcomes (CSOs)

1. Analyze morphological diversity in Bryophytes.
2. Differentiate major Pteridophyte classes.
3. Explain life cycle patterns of cryptogams.
4. Identify key anatomical features of lower plants.
5. Relate cryptogam evolution to plant kingdom.

Unit I: Bryophytes - General Characteristics and Classification (6 Hours)

- 1.1 General characters and classification of Bryophytes (up to orders)
- 1.2 Study of representative members of Hepaticopsida (e.g., *Marchantia*)
- 1.3 Study of representative members of Anthocerotopsida (e.g., *Anthoceros*)
- 1.4 Study of representative members of Bryopsida (e.g., *Funaria*)

Unit II: Bryophytes - Anatomy and Reproduction (6 Hours)

- 2.1 Thallus and internal anatomy of Bryophytes
- 2.2 Vegetative reproduction and asexual reproduction methods
- 2.3 Sexual reproduction, fertilization, and spore dispersal
- 2.4 Alternation of generations and evolutionary significance

Unit III: Pteridophytes - General Characters and Classification (6 Hours)

- 3.1 General characters and classification of Pteridophytes (up to families)
- 3.2 Study of representative members of Psilophyta (e.g., *Psilotum*)
- 3.3 Study of representative members of Lycophyta (e.g., *Lycopodium*, *Selaginella*)
- 3.4 Study of representative members of Sphenophyta (e.g., *Equisetum*)

Unit IV: Pteridophytes - Anatomy and Reproduction (6 Hours)

- 4.1 Anatomy of stem and root, and stele evolution in Pteridophytes
- 4.2 Heterospory and seed habit evolution
- 4.3 Study of representative members of Pterophyta (e.g., *Pteris*, *Marsilea*)
- 4.4 Fossil Pteridophytes: an overview

Unit V: Economic and Ecological Importance (6 Hours)

- 5.1 Ecological roles of Bryophytes and Pteridophytes
- 5.2 Bryophytes as pollution indicators and biofertilizers
- 5.3 Economic importance of Pteridophytes as ornamentals and in traditional medicine
- 5.4 Conservation of cryptogams and their role in biodiversity

References

1. Rashid, A. (2013). *An Introduction to Cryptogamic Botany*. Vikas Publishing House.
2. Vashishta, P. C., Sinha, A. K., & Kumar, A. (2014). *Botany for Degree Students: Bryophyta*. S. Chand & Co.
3. Parihar, N. S. (2011). *An Introduction to Embryophyta: Vol. I Bryophyta*. Central Book Depot.
4. Sinha, B. M., & Verma, S. (2015). *Pteridophytes: Diversity, Classification and Evolution*. Scientific Publishers.
5. Puri, P. (2014). *Bryophytes*. Atharva Publishing House.
6. Gifford, E. M., & Foster, A. S. (1989). *Morphology and Evolution of Vascular Plants*. W. H. Freeman and Company.
7. Bold, H. C., Alexopoulos, C. J., & Delevoryas, T. (1987). *Morphology of Plants and Fungi*. Harper & Row Publishers.
8. Watson, E. V. (1981). *The Structure and Life of Bryophytes*. Hutchinson & Co.
9. Smith, G. M. (1955). *Cryptogamic Botany, Vol. II: Bryophytes and Pteridophytes*. McGraw-Hill Book Co.
10. Dube, H. C. (2011). *Textbook of Fungi, Bacteria and Viruses*. S. Chand & Co.
11. Sporne, K. R. (1965). *The Morphology of Pteridophytes*. Hutchinson & Co.
12. Sharma, O. P. (2015). *Pteridophyta*. Tata McGraw-Hill Publishing Company.
13. Singh, R. S. (2012). *Bryophyta, Pteridophyta and Gymnosperms*. Scientific Publishers.
14. Mauseth, J. D. (2012). *Botany: An Introduction to Plant Biology*. Jones & Bartlett Learning.
15. Raven, P. H., Evert, R. F., & Eichhorn, S. E. (2013). *Biology of Plants*. W. H. Freeman and Company.
16. Ray, J. (2010). *Bryophytes and Pteridophytes*. New Central Book Agency.
17. Bell, P. R., & Hemsley, A. R. (2000). *Green Plants: Their Origin and Diversity*. Cambridge University Press.
18. Kumar, A. (2016). *Pteridophytes*. Kedar Nath Ram Nath.
19. Chopra, R. S. (1975). *Taxonomy of Indian Bryophytes*. CSIR, New Delhi.
20. Wherry, E. T. (1961). *The Fern Guide*. Doubleday & Co.

DISCIPLINE SPECIFIC COURSES (MAJOR)

Paper II

BOT-MJ-352 Gymnosperm and Paleobotany

(Credits: 2, Lectures: 30)

Course Objectives (COs)

Upon successful completion of this course, students will be able to:

1. Understand the evolutionary position of gymnosperms between Pteridophytes and Angiosperms.
2. Examine the diversity and key morphological features of different gymnosperm classes.
3. Analyze the reproductive biology and life cycles of representative gymnosperm genera.
4. Grasp the principles of fossilization and the significance of paleobotany in understanding plant evolution.
5. Correlate the morphology of extant plants with their fossil ancestors.

Course Outcomes (COs)

1. Students will be able to classify and identify major gymnosperm groups.
2. Students will gain knowledge of the economic importance of gymnosperms.
3. Students will understand the process of fossilization and types of plant fossils.
4. Students will be able to describe the salient features of major fossil gymnosperm groups.
5. Students will develop an appreciation for the evolutionary history of the plant kingdom.

Course Specific Outcomes (CSOs)

1. Classify extant and extinct gymnosperm groups.
2. Explain reproduction in Pinus and Cycas.
3. Describe the process of fossilization.
4. Identify key fossil forms like *Glossopteris*.
5. Relate plant evolution through fossil records.

Unit I: General Characteristics and Classification (6 Hours)

- 1.1 General characters and classification of Gymnosperms (up to orders)
- 1.2 Study of representative members of Cycadales (e.g., *Cycas*)
- 1.3 Study of representative members of Ginkgoales (e.g., *Ginkgo*)
- 1.4 Study of representative members of Coniferales (e.g., *Pinus*)

Unit II: Anatomy and Reproduction (6 Hours)

- 2.1 Stem and leaf anatomy of selected gymnosperms
- 2.2 Male and female gametophyte development and pollination mechanisms
- 2.3 Fertilization and embryo development in *Pinus* and *Cycas*
- 2.4 Economic importance of gymnosperms

Unit III: Paleobotany - Introduction (6 Hours)

- 3.1 Introduction to Paleobotany and its significance
- 3.2 Geological time scale and the distribution of plant groups
- 3.3 Principles of fossilization, types of fossils (compression, impression, petrifaction)

- 3.4 Techniques for studying plant fossils

Unit IV: Fossil Gymnosperms (6 Hours)

- 4.1 Salient features of Pteridospermales (e.g., *Glossopteris*)
- 4.2 Salient features of Bennettitales (e.g., *Cycadeoidea*)
- 4.3 Salient features of Cordaitales
- 4.4 Salient features of a few other fossil groups

Unit V: Indian Paleobotany (6 Hours)

- 5.1 A brief history of Paleobotany in India
- 5.2 Contribution of Birbal Sahni
- 5.3 Fossil flora of the Gondwana period
- 5.4 Importance of paleobotanical studies in understanding ancient climate and geography

References

1. Chamberlain, C. J. (1935). *Gymnosperms: Structure and Evolution*. University of Chicago Press.
2. Vashishta, P. C., Sinha, A. K., & Kumar, A. (2014). *Botany for Degree Students: Gymnosperms*. S. Chand & Co.
3. Sporne, K. R. (1965). *The Morphology of Gymnosperms*. Hutchinson & Co.
4. Bhatnagar, S. P., & Moitra, A. (1996). *Gymnosperms*. New Age International Publishers.
5. Sharma, O. P. (2015). *Gymnosperms*. Tata McGraw-Hill Publishing Company.
6. Singh, V., Pandey, P. C., & Jain, D. K. (2013). *A Text Book of Botany*. Rastogi Publications.
7. Arnold, C. A. (1947). *An Introduction to Paleobotany*. McGraw-Hill Book Company.
8. Stewart, W. N., & Rothwell, G. W. (1993). *Paleobotany and the Evolution of Plants*. Cambridge University Press.
9. Taylor, T. N., Taylor, E. L., & Krings, M. (2009). *Paleobotany: The Biology and Evolution of Fossil Plants*. Academic Press.
10. Sahni, B. (1938). *Recent Advances in Indian Paleobotany*. Botanical Survey of India.
11. Maheshwari, P., & Konar, R. N. (1971). *The Cycads*. Botanical Monograph, CSIR.
12. Foster, A. S., & Gifford, E. M. (1959). *Comparative Morphology of Vascular Plants*. W. H. Freeman and Company.
13. Krassilov, V. A. (2015). *The Origin of Gymnosperms*. Cambridge University Press.
14. Scott, A. C., & Glasspool, I. J. (2006). *The Paleobotanical Record of the Carboniferous Period*. Journal of the Geological Society.
15. Willis, K. J., & McElwain, J. C. (2002). *The Evolution of Plants*. Oxford University Press.
16. Masamune, G. (1954). *Taxonomy of Indian Gymnosperms*. Scientific Publishers.
17. Biswal, A. K. (2011). *Plant Fossils*. Scientific Publishers.
18. Sharma, H. S. (2018). *Fossil Botany*. Scientific Publishers.
19. Trivedi, M. L. (2006). *An Introduction to Gymnosperms*. Pragati Prakashan.
20. Dilcher, D. L. (2000). *Plant Paleontology*. John Wiley & Sons.

DISCIPLINE SPECIFIC COURSES (MAJOR)

Paper III

BOT-IKS-353 Ancient Botany

(Credits: 2, Lectures: 30)

Course Code: BOT-P3 **Credit Weightage:** 2 Credits **Lecture Hours:** 30 Hours

Course Objectives (COs)

Upon successful completion of this course, students will be able to:

1. Trace the history of botanical knowledge from ancient civilizations to modern times.
2. Analyze the role of plants in ancient cultures, economies, and societies.
3. Understand the concepts of ancient ethnobotany and traditional plant uses.
4. Examine ancient botanical texts and their significance in the history of science.
5. Appreciate the contribution of ancient civilizations to the foundation of modern botany.

Course Outcomes (COs)

1. Students will be able to describe plant-related knowledge in ancient cultures.
2. Students will identify key ancient plants and their uses for food, medicine, and textiles.
3. Students will understand the development of agricultural practices in the ancient world.
4. Students will gain knowledge of ancient botanical classification systems.
5. Students will be able to evaluate the ethical and cultural dimensions of traditional plant knowledge.

Course Specific Outcomes (CSOs)

1. Identify key ancient botanical figures.
2. Explain plant domestication in ancient civilizations.
3. Describe medicinal plant use in ancient cultures.
4. Analyze ancient botanical illustrations.
5. Appreciate plants' cultural and historical role.

Unit I: Foundations of Ancient Botany (6 Hours)

- 1.1 Introduction to Ancient Botany and its scope
- 1.2 Prehistoric evidence of plant use: Paleolithic and Neolithic periods
- 1.3 Plant domestication and the dawn of agriculture
- 1.4 Development of early botanical knowledge in different cultures

Unit II: Botany in Mesopotamia and Egypt (6 Hours)

- 2.1 Plants in Mesopotamian civilization (e.g., Sumerian and Babylonian)
- 2.2 The Hanging Gardens of Babylon and other ancient horticulture
- 2.3 Plants in Ancient Egyptian civilization: food, medicine, and burial practices
- 2.4 Ancient botanical records: the Ebers Papyrus and other texts

Unit III: Botany in India (6 Hours)

- 3.1 Botanical knowledge in the Indus Valley Civilization
- 3.2 Plants in Vedic literature and ancient Indian texts (e.g., *Ayurveda*)
- 3.3 Contribution of Sushruta and Charaka to medicinal botany

- 3.4 Ethnobotanical traditions and their significance in modern India

Unit IV: Botany in Greek and Roman Civilizations (6 Hours)

- 4.1 Theophrastus as the "Father of Botany": *Enquiry into Plants* and *On the Causes of Plants*
- 4.2 Pedanius Dioscorides: *De Materia Medica* and its influence
- 4.3 Plants in Roman agriculture, horticulture, and medicine
- 4.4 The role of plants in classical mythology and art

Unit V: Ancient Botany to Modern Botany (6 Hours)

- 5.1 Legacy of ancient botanical knowledge
- 5.2 The transition to the medieval and Renaissance periods
- 5.3 The evolution of botanical illustration from ancient to modern times
- 5.4 Relevance of ancient botanical knowledge in contemporary research and conservation

References

1. Leigh, D. A. (2012). *Botany: An Introduction to Plant Biology*. Jones & Bartlett Learning.
2. Gifford, E. M., & Foster, A. S. (1989). *Morphology and Evolution of Vascular Plants*. W. H. Freeman and Company.
3. Morton, A. G. (1981). *History of Botanical Science*. Academic Press.
4. Rau, B. K. (2015). *History of Botany in India*. Scientific Publishers.
5. Singer, C. (1927). *The Herbal in Antiquity and its Transmission to the Sixteenth Century*. Journal of Hellenic Studies.
6. Dioscorides, P. (1933). *The Greek Herbal of Dioscorides*. The Hafner Publishing Co.
7. Gunther, R. T. (1934). *The Greek Herbal of Dioscorides*. Oxford University Press.
8. Dalby, A. (2000). *Dangerous Tastes: The Story of Spices*. University of California Press.
9. Chopra, R. N., Nayar, S. L., & Chopra, I. C. (1956). *Glossary of Indian Medicinal Plants*. CSIR, New Delhi.
10. Theophrastus (1916). *Enquiry into Plants*. Heinemann.
11. Stannard, J. (1999). *Ancient and Medieval Botany*. Taylor & Francis.
12. Janick, J., & Paull, R. E. (2008). *The Encyclopedia of Fruit and Nuts*. CABI.
13. Wickens, G. E. (2013). *The Plant Kingdoms*. Springer.
14. Schultes, R. E., & Hofmann, A. (1979). *The Plants of the Gods*. McGraw-Hill Book Co.
15. Heiser, C. B. (1985). *Of Plants and People*. University of Oklahoma Press.
16. Preece, L. (2009). *Herbalism in Ancient Egypt*. The Pomegranate.
17. Dube, R. S. (2012). *Ancient Indian Botany*. Scientific Publishers.
18. Singh, V. P., & Shrivastava, S. (2011). *Ethnobotany of India*. Scientific Publishers.
19. Janick, J. (2015). *Plant Domestication*. In *The Oxford Handbook of the History of Science*.
20. Olah, A., & Cserhati, A. (2014). *The History of Plant Taxonomy*. International Journal of Plant Biology.

DISCIPLINE SPECIFIC COURSES (MAJOR)
Paper IV

BOT-MJP-354 Practical Based on BOT-MJ-351

(Credit Weightage: 2 Credits)

Practicals (List)

1. Study of external morphology of *Marchantia* and its sporophyte.
2. Study of the anatomy of *Marchantia* thallus (V.S.) and antheridiophore/archegoniophore.
3. Study of external morphology of *Anthoceros* and its sporophyte.
4. Study of the anatomy of *Anthoceros* thallus (V.S.).
5. Study of external morphology of *Funaria* and its sporophyte.
6. Study of the anatomy of *Funaria* capsule (L.S.).
7. Study of external morphology of *Psilotum* and *Lycopodium*.
8. Study of the anatomy of *Lycopodium* stem (T.S.).
9. Study of external morphology and strobili of *Selaginella* and *Equisetum*.
10. Study of the anatomy of *Equisetum* stem (T.S.).
11. Study of the external morphology and sporangia of *Marsilea*.
12. Study of the anatomy of *Pteris* rhizome (T.S.) and leaf (T.S. of pinna).

DISCIPLINE SPECIFIC COURSES (MAJOR)

Paper V

BOT-MJP-355 Practical Based on BOT-MJ-352 & 353

(Credit Weightage: 2 Credits)

Practicals (List)

1. Study of external morphology of *Cycas* and its reproductive structures.
2. Study of the anatomy of *Cycas* root (T.S.) and stem (T.S.).
3. Study of external morphology of *Pinus* and its male and female cones.
4. Study of the anatomy of *Pinus* stem (T.S.) and needle (T.S.).
5. Study of the external morphology and foliage of *Ginkgo*.
6. Study of the anatomical features of *Pinus* wood (T.L.S. & R.L.S.).
7. Study of plant fossils and preparation of diagrams (e.g., *Rhynia*, *Lepidodendron*).
8. Study of the anatomy of fossil stem (e.g., *Cycadeoidea*).
9. Study of different types of fossils (impression, petrifaction, etc).
10. Study and identification of ancient botanical illustrations and scripts.
11. Study of the external morphology and medicinal uses of 5 ancient plants (e.g., *Tulsi*, *Ashwagandha*).

VOCATIONAL/SKILL ENHANCEMENT COURSES (MAJOR)

Paper VI

BOT-MJP-356 Practical Based on Floriculture

(Credit Weightage: 2 Credits)

Practicals:

1. Study of commercial flower crops: rose, chrysanthemum, marigold, jasmine, and tuberose.
2. Vegetative propagation methods: cutting, layering, and budding.
3. Seed sowing techniques and preparation of nursery beds.
4. Preparation of potting media and potting of ornamental plants.
5. Fertilizer application methods and nutrient management for floricultural crops.
6. Identification of common pests and diseases of flowers and their management.
7. Preparation and use of bio-pesticides.
8. Post-harvest handling of cut flowers: grading, pulsing, and packaging.
9. Preparation of floral arrangements, bouquets, and garlands.
10. Drying and preservation of flowers for commercial use.
11. Study of micro-propagation techniques in floriculture.
12. Visit to a commercial floricultural farm and preparation of a detailed report.

References:

1. Bose, T.K., & Yadav, L.P. (1989). *Commercial Flowers*. Naya Prokash.
2. Chaturvedi, A. & Kumar, R. (2018). *Floriculture: A Contemporary Approach*. Agrotech Publishing Academy.
3. Dhiman, A.K. (2009). *Practical Floriculture*. Agrobios India.
4. Jain, A. & Choudhary, A. (2019). *Floriculture and Landscaping*. Kalyani Publishers.
5. Kauthale, D. & Wani, M. (2020). *Floriculture: A Practical Manual*. Scientific Publishers.
6. Kumar, K. & Singh, R. (2017). *Advances in Floriculture*. Daya Publishing House.
7. Khandelwal, A. (2018). *Floriculture: An Overview*. New India Publishing.
8. Reddy, T.V. & Singh, R.S. (2017). *Commercial Floriculture*. New India Publishing.
9. Ramesh, K. & Rajani, K. (2020). *Modern Floriculture*. Scientific Publishers.
10. Yadav, R.K. & Sharma, A. (2019). *Practical Floriculture*. Kalyani Publishers.
11. Dole, J.M. & Wilkins, H.F. (2005). *Floriculture: Principles and Species*. Prentice Hall.
12. Hartmann, H.T., & Kester, D.E. (1990). *Plant Propagation: Principles and Practices*. Prentice Hall.
13. Larson, R.A. (1992). *Introduction to Floriculture*. Academic Press.
14. Laurie, A., & Ries, V.H. (1958). *Floriculture: A Guide to Commercial Flower Production*. McGraw-Hill.

MINOR
Paper VII

BOT-MN-361 Phytogeography

(Credit Weightage: 2 Credits)

Course Objectives:

1. To understand the fundamental principles and concepts of plant distribution.
2. To study the factors that influence the distribution of plants across the globe.
3. To analyze the floristic regions of the world and India.
4. To learn about the origin and evolution of floras.
5. To understand the role of endemism and plant migration in shaping plant communities.

Course Outcomes:

1. Students will explain the principles and concepts governing plant distribution.
2. Students will identify the key factors that influence plant distribution patterns.
3. Students will be able to describe the major floristic regions of the world and India.
4. Students will analyze the role of historical events in shaping current flora.
5. Students will understand the importance of phytogeography in plant conservation.

Course Specific Outcomes:

- Explains the principles of plant distribution.
- Analyzes factors affecting plant geography.
- Describes world and Indian floristic regions.
- Assesses the role of endemism in flora.
- Applies phytogeographical knowledge to conservation.

Unit 1: Introduction to Phytogeography (6 Hours)

1.1 Definition, scope, and significance of phytogeography.

1.2 History of phytogeographical studies and early explorers.

1.3 Major concepts: Disjunct distribution, continuous distribution, and endemism.

1.4 Relationship with other disciplines: Ecology, evolution, and climatology.

Unit 2: Factors Affecting Plant Distribution (6 Hours)

2.1 Climatic factors: Temperature, rainfall, light, and wind.

2.2 Edaphic (soil) factors: Soil type, pH, and nutrient availability.

2.3 Biotic factors: Competition, predation, and human influence.

2.4 Historical factors: Continental drift, glaciation, and land bridges.

Unit 3: Floristic Regions of the World (6 Hours)

3.1 Major floristic kingdoms of the world (e.g., Holarctic, Paleotropical).

3.2 Characteristics and representative flora of each kingdom.

3.3 Classification of vegetation types (e.g., forests, grasslands, deserts).

3.4 Vegetation zones and their relationship with climatic zones.

Unit 4: Phytogeography of India (6 Hours)

4.1 The major botanical regions of India: their boundaries and unique flora.

4.2 Floristic elements of India and their origin.

4.3 Endemism in the Indian flora, with examples of endemic species.

4.4 Plant migration routes and the Himalayan influence.

Unit 5: Applied Phytogeography and Conservation (6 Hours)

5.1 Role of phytogeography in conservation biology.

5.2 Threats to plant diversity: habitat loss, climate change, and invasive species.

5.3 Phytogeographical basis for designating biodiversity hotspots.

5.4 Conservation strategies: in situ and ex situ conservation.

References:

1. Sharma, P.D. (2009). *Ecology and Environment*. Rastogi Publications.
2. Ode, A. & Kumar, R. (2015). *Phytogeography of India*. Scientific Publishers.
3. Singh, J.S., Singh, S.P., & Gupta, S.R. (2016). *Ecology, Environmental Science and Conservation*. S. Chand Publishing.
4. Rajput, S.S. & Verma, V. (2018). *Phytogeography: A Concise Guide*. New India Publishing.
5. Tripathi, S.N. & Tiwari, A.K. (2019). *Principles of Phytogeography*. Agrobios India.
6. Kumar, H. & Singh, R.K. (2020). *Phytogeography and Plant Ecology*. Scientific Publishers.
7. Singh, R.S. (2017). *Phytogeography and Flora of India*. Daya Publishing House.
8. Yadav, A. & Kumar, A. (2018). *The Textbook of Phytogeography*. Kalyani Publishers.
9. Joshi, M. & Sharma, K. (2019). *Plant Geography*. New India Publishing.
10. Yadav, B. & Sharma, D. (2020). *Phytogeography: Concepts and Applications*. Agrotech Publishing Academy.
11. Good, R. (1964). *The Geography of the Flowering Plants*. Longman.
12. Gentry, A.H. (1988). *Endemism in Tropical Plant Communities*. Springer.
13. MacArthur, R.H., & Wilson, E.O. (1967). *The Theory of Island Biogeography*. Princeton University Press.

14. Cox, C.B., & Moore, P.D. (1985). *Biogeography: An Ecological and Evolutionary Approach*. Blackwell Science.
15. Walter, H. (1973). *Vegetation of the Earth in Relation to Climate and the Eco-physiological Conditions*. Springer-Verlag.
16. Brown, J.H., & Lomolino, M.V. (1998). *Biogeography*. Sinauer Associates.
17. Takhtajan, A. (1986). *Floristic Regions of the World*. University of California Press.
18. Polunin, N. (1960). *Introduction to Plant Geography*. Longmans.
19. Wulff, E.V. (1943). *An Introduction to Historical Plant Geography*. Chronica Botanica.
20. Zohary, M. (1973). *Geobotanical Foundations of the Middle East*. Gustav Fischer Verlag.

MINOR

Paper VIII

BOT-MNP-362 Practical Based on BOT-MN-361

(Credit Weightage: 2 Credits)

Course Objectives:

1. To practically understand the concepts of plant distribution and vegetation analysis.
2. To develop skills in plotting distribution maps of selected plant species.
3. To learn techniques for vegetation sampling and analysis.
4. To analyze the relationship between flora and geographical features.
5. To gain experience in field-based plant identification and data collection.

Course Outcomes:

1. Students will be able to prepare and interpret plant distribution maps.
2. Students will gain practical experience in vegetation sampling techniques.
3. Students will understand the relationship between climate and vegetation.
4. Students will be able to identify local plants and their habitat.
5. Students will demonstrate skills in field-based data collection and analysis.

Practicals:

1. Preparation of a world vegetation map showing major biome types.
2. Preparation of a map of India showing its major botanical regions.
3. Plotting distribution maps of five selected endemic plant species of India.
4. Study of herbarium specimens of plants from different floristic regions.
5. Field study of a local vegetation type (e.g., forest, grassland) and its classification.
6. Use of quadrat method for quantitative vegetation analysis.
7. Calculation of species density, frequency, and abundance of a plant community.
8. Preparation of a climate diagram (Climatograph) for two different regions of India.
9. Study of plant adaptations to different environmental conditions (e.g., xerophytes, hydrophytes).
10. Study of flora of two different habitats and their comparison.
11. Visit to a botanical garden to study plants from different geographical regions.
12. Preparation of a detailed project report on the phytogeography of a specific area.

DISCIPLINE ELECTIVE COURSE

Paper IX

BOT-EC-371 Seed Technology

(Credit Weightage: 2 Credits)

Course Objectives:

1. To understand the basic principles of seed science and technology.
2. To study the methods of seed production, processing, and certification.
3. To learn techniques for evaluating seed quality and viability.
4. To identify common seed-borne diseases and their management.
5. To understand the role of seed technology in crop improvement and food security.

Course Outcomes:

1. Students will explain the principles of seed production and handling.
2. Students will be able to perform standard seed quality tests.
3. Students will understand the process of seed certification and its importance.
4. Students will recognize and manage seed-borne diseases.
5. Students will evaluate the role of seed technology in food security.

Course Specific Outcomes

- Explains seed production and processing methods.
- Performs seed quality and viability tests.
- Understands the seed certification process.
- Identifies and manages seed-borne diseases.
- Assesses the role of biotechnology in seed improvement.

Unit 1: Introduction to Seed Technology (6 Hours)

1.1 Definition, scope, and importance of seed technology.

1.2 History and development of the seed industry in India.

1.3 Structure and morphology of seeds of major crop plants.

1.4 Seed development and maturation stages.

Unit 2: Seed Production and Handling (6 Hours)

2.1 Principles of seed production for different crops.

2.2 Seed processing: cleaning, grading, and drying.

2.3 Seed storage: principles and factors affecting seed longevity.

2.4 Seed dormancy: types and methods of breaking it.

Unit 3: Seed Quality and Certification (6 Hours)

3.1 Seed quality parameters: germination, vigor, purity, and moisture content.

3.2 Principles of seed testing and sampling.

3.3 Seed certification: purpose, process, and standards.

3.4 Role of national and international seed organizations (e.g., ISTA, NSSB).

Unit 4: Seed Pathology and Health (6 Hours)

4.1 Definition and types of seed-borne diseases.

4.2 Identification of common seed-borne pathogens.

4.3 Seed treatment methods: physical and chemical.

4.4 Seed health testing methods.

Unit 5: Biotechnology and Seed Technology (6 Hours)

5.1 Role of biotechnology in improving seed quality.

5.2 Genetically Modified (GM) crops and their implications.

5.3 Seed banks and gene conservation.

5.4 Intellectual Property Rights (IPRs) in the seed industry.

References:

1. Aggarwal, P.K. & Sharma, H.K. (2018). *Seed Science and Technology*. Agrotech Publishing Academy.
2. Jain, N. & Singh, R.P. (2019). *Principles of Seed Technology*. Scientific Publishers.
3. Joshi, M.C. (2020). *Seed Technology*. New India Publishing.
4. Kumar, K. & Singh, S. (2017). *Seed Production and Technology*. Daya Publishing House.
5. Lal, S. & Gupta, P.K. (2018). *Textbook of Seed Science and Technology*. Kalyani Publishers.
6. Ram, R.B. & Verma, P. (2020). *Fundamentals of Seed Technology*. Agrobios India.
7. Sharma, R.K. & Singh, R.S. (2019). *Seed Science and Technology*. New India Publishing.
8. Singh, H. & Kumar, A. (2017). *Seed Technology in India*. Daya Publishing House.
9. Yadav, A. & Sharma, D. (2018). *Seed Technology: An Applied Approach*. Scientific Publishers.
10. Yadav, B. & Khandelwal, S. (2020). *Seed Production and Certification*. Agrotech Publishing Academy.
11. Agrawal, P.K. (1993). *Principles of Seed Technology*. Oxford & IBH Publishing.
12. Copeland, L.O., & McDonald, M.B. (1995). *Principles of Seed Science and Technology*. Chapman & Hall.
13. Bewley, J.D., & Black, M. (1994). *Seeds: Physiology of Development and Germination*. Plenum Press.
14. Bradford, K.J. (2002). *Seed Technology*. The Haworth Press.
15. Ellis, R.H., Hong, T.D., & Roberts, E.H. (1985). *Handbook of Seed Technology*. FAO.
16. ISTA. (2017). *International Rules for Seed Testing*. ISTA.
17. Khare, D., & Singh, J. (2015). *Seed Science and Technology*. Springer.
18. Kumar, K. & Singh, R. (2017). *Advances in Seed Technology*. Daya Publishing House.
19. Nanda, S., & Singh, S. (2018). *Seed Science and Technology*. Scientific Publishers.
20. Siddiqui, Z.A., & Maqbool, M.A. (2005). *Seed Borne Diseases and Their Management*. Springer.

DISCIPLINE ELECTIVE COURSE

Paper X

BOT-EC-372 Practical Based on BOT-EC-371

(Credit Weightage: 2 Credits)

Course Objectives:

1. To provide hands-on experience in seed sampling and testing.
2. To teach students how to determine seed viability, purity, and moisture content.
3. To enable students to identify seed-borne pathogens.
4. To learn techniques for seed treatment and storage.
5. To understand the process of seed certification through practical work.

Course Outcomes:

1. Students will be able to perform standard seed quality tests.
2. Students will determine germination and viability of seeds.
3. Students will identify seed-borne diseases in a lab setting.
4. Students will gain practical knowledge of seed treatment and storage.
5. Students will understand the practical aspects of seed certification.

Practicals:

1. Collection and preparation of seed samples for testing.
2. Determination of seed moisture content using a moisture meter.
3. Determination of seed germination percentage using a germination chamber.
4. Evaluation of seed vigor using the tetrazolium (TZ) test.
5. Purity analysis of a given seed sample.
6. Germination test for different seed types (e.g., cereals, legumes).
7. Identification of seed-borne fungi using the blotter method.
8. Demonstration of different seed treatment methods.
9. Preparation of herbarium of weed seeds commonly found in crop seed samples.
10. Study of seed certification tags and their information.
11. Visit to a seed processing unit and preparation of a report.
12. Demonstration of different seed storage containers and methods.

References:

1. Aggarwal, P.K. & Sharma, H.K. (2018). *Seed Science and Technology*. Agrotech Publishing Academy.
2. Jain, N. & Singh, R.P. (2019). *Principles of Seed Technology*. Scientific Publishers.
3. Joshi, M.C. (2020). *Seed Technology*. New India Publishing.
4. Kumar, K. & Singh, S. (2017). *Seed Production and Technology*. Daya Publishing House.
5. Lal, S. & Gupta, P.K. (2018). *Textbook of Seed Science and Technology*. Kalyani Publishers.
6. Ram, R.B. & Verma, P. (2020). *Fundamentals of Seed Technology*. Agrobios India.
7. Sharma, R.K. & Singh, R.S. (2019). *Seed Science and Technology*. New India Publishing.
8. Singh, H. & Kumar, A. (2017). *Seed Technology in India*. Daya Publishing House.
9. Yadav, A. & Sharma, D. (2018). *Seed Technology: An Applied Approach*. Scientific Publishers.
10. Yadav, B. & Khandelwal, S. (2020). *Seed Production and Certification*. Agrotech Publishing Academy.
11. Agrawal, P.K. (1993). *Principles of Seed Technology*. Oxford & IBH Publishing.
12. Copeland, L.O., & McDonald, M.B. (1995). *Principles of Seed Science and Technology*. Chapman & Hall.
13. Bewley, J.D., & Black, M. (1994). *Seeds: Physiology of Development and Germination*. Plenum Press.
14. Bradford, K.J. (2002). *Seed Technology*. The Haworth Press.
15. Ellis, R.H., Hong, T.D., & Roberts, E.H. (1985). *Handbook of Seed Technology*. FAO.
16. ISTA. (2017). *International Rules for Seed Testing*. ISTA.
17. Khare, D., & Singh, J. (2015). *Seed Science and Technology*. Springer.
18. Kumar, K. & Singh, R. (2017). *Advances in Seed Technology*. Daya Publishing House.
19. Nanda, S., & Singh, S. (2018). *Seed Science and Technology*. Scientific Publishers.
20. Siddiqui, Z.A., & Maqbool, M.A. (2005). *Seed Borne Diseases and Their Management*. Springer.

DISCIPLINE ELECTIVE COURSE

Paper XI

BOT-OJT-391 On Job Training (Botany)

(Credit Weightage: 4 Credits)

Credit Structure: 4 Credits (100 Marks)

- **Internal Assessment:** 40 Marks (based on regular progress reports, attendance, and viva).
- **External Assessment:** 60 Marks (based on the final project report and external viva-voce).

BOT-OJT-391 On-Job Training (Botany): Guidelines

The On-Job Training (OJT) program is designed to give you **practical and professional experience** in the field of Botany, helping you to develop skills crucial for your career. This 4-credit, 100-mark program (40 internal, 60 external) is a mandatory component of your curriculum and must be completed during the summer break.

---

1. Goal and Purpose

The primary **goal** of this training is to bridge the gap between theoretical knowledge and practical application. It aims to expose you to real-world work environments and provide hands-on experience that will enhance your professional and personal development. The **purpose** is to give you a head start in your career by building a portfolio of practical skills. The hosting organization also benefits from your innovative ideas and contributions.

---

2. Training Components

You must choose a suitable institution, company, organization, or work with an academician whose work is relevant to Botany. The training should involve practical, hands-on tasks that allow you to apply your academic learning. This can include research assistance, lab work, fieldwork, or working in a botanical garden, nursery, or a related industry.

---

3. Evaluation and Marks Distribution

The program is evaluated out of **100 marks**.

- **Internal Assessment (40 Marks):** This is based on your day-to-day performance, punctuality, and a mid-term progress report submitted to your academic supervisor. Your attendance and active participation will also be considered.
- **External Assessment (60 Marks):** This is based on the quality of your final project report and a viva-voce examination conducted by an external examiner. The report is a crucial part of this assessment.

---

4. Project Report Guidelines

The project report is the main deliverable of your training. It should be a comprehensive document detailing your work. Here is a recommended structure:

- **Title Page:** Your name, roll number, project title, and details of both your institution and the host organization.
- **Certificate:** A formal letter from your host supervisor certifying your completion of the training.
- **Acknowledgments:** Thank everyone who supported you.
- **Introduction:** Briefly introduce your host organization and outline your specific project goals and objectives.
- **Methodology:** Detail the methods, tools, and techniques you used. Be specific about your day-to-day tasks.
- **Results & Discussion:** Present your findings using charts, tables, and figures. Discuss what the results mean and how they relate to your initial objectives.
- **Conclusion:** Summarize your key findings and reflect on what you learned during the training.
- **References & Appendices:** List all sources and include any supporting documents.

The report must be a minimum of 30 pages. It is your responsibility to maintain a daily log of your activities to make writing the report easier.

Component	Details
Credits & Marks	4 Credits = 100 Marks (Internal 40 + External 60)
Objectives	• Provide exposure to industry/real work settings alongside academics • Apply classroom knowledge in practical environments - Develop employability & professional skills • Maintain balance between academic learning & vocational training
Structure of OJT	• **Duration:** Minimum 4-6 weeks (part-time / parallel with semester • **Mode:** Students attend college regularly + OJT hours (evenings/holidays/weekly slots) • **Placement:** Industry/Research Lab/Organization approved by college • **Supervision:** Faculty Mentor (college) + Industry Supervisor (organization) • **Documentation:** OJT Logbook, Mid-term Progress, Final Report
Internal Assessment (40 Marks)	1. **OJT Proposal & Objectives** – 10 marks 2. **Mid-term Progress Presentation in college** – 10 marks 3. **Industry Supervisor's Evaluation (discipline, performance, attendance)** – 10 marks 4. Logbook/Diary Maintenance (weekly submission to faculty) – 10 marks
External Assessment (60 Marks)	Conducted jointly by internal + external examiner at semester-end: 1. **Final OJT Report (signed by industry supervisor)** – 25 marks 2. **Presentation / Demonstration in college** – 15 marks 3. **Viva-Voce Examination (linking theory with practice)** – 20 marks
Attendance Rules	• Students must maintain **minimum 75% attendance in regular college classes**. • OJT hours will be scheduled so they **do not clash with lectures/ practicals**. • Both **college attendance** and **OJT completion certificate** are mandatory to pass.
Passing Standards	• Minimum 16/40 in Internal • Minimum 24/60 in External • Overall 40/100 to pass - Completion Certificate from Industry is compulsory
NEP 2020 Alignment	• Encourages **experiential learning & skill development** without disturbing academic schedule • Strengthens **industry–academia–community linkages** • Credits recorded in **Academic Bank of Credits (ABC)** - Supports **multidisciplinary and flexible learning**

Internal Assessment Sheet Annexure B

Learning Outcome Assessment of Students by Mentor from HEI/On Campus School

Section-I (Basic Details): To be filled in by the Student			
Name of Organization for Internship/OJT/Project Work			
Name of the Student			
Uni.PRN Number			
Name of Course		**Semester No:**	
College Roll No		**Exam Seat No:**	
Date of Commencement of Training			
Date of Completion of Training			

Section-II : Internal Assessment Sheet (Learning Outcome Assessment) To be filled in by 'The Mentor' from HEI/On Campus School					
Attributes & Scoring (Please tick)	**Un-Satisfactory**	**Satisfactory**	**Good**	**Very Good**	**Excellent**
	"0"Marks	**"3"Marks**	**"5"Marks**	**"7" Marks**	**"8"Marks**
1) Quality and effectiveness of presentation: The presentation made by the students, the clarity of thoughts and learning expressed.					
2) Depth of knowledge and demonstrated skills: Evaluate the extent of learning, Depth of Knowledge Skillsdemonstrated by the student during the internship period.					
3) Variety and relevance of learning experience: Evaluate the student's understanding of theoretical concepts and practical applications and relationships with concepts taught.					
4) Quality of Report Writing: Assess the student's ability to document the details of the assigned tasks, deliverables, and project report in a qualitative way.					
5) Attendance Record and Supervisor Feedback: Student attendance records and overall feedback on same fromthe Internship Supervisor.					
TOTAL					
			Total Marks out of 40		

Mentor Sign & Dat

External Assessment Sheet Annexure C

Internship Supervisor Feedback on the "Conduct" and "Overall Project Work Done" by the Student

Section-I (Basic Details): To be filled in by the Student			
Name of Organization for Internship/OJT/Project Work			
Name of the Student			
Uni.PRN Number			
Name of Course		**Semester No:**	
College Roll No		**Exam Seat No:**	
Date of Commencement of Training			
Date of Completion of Training			

Section-II: External Assessment (Feedback on Conduct)To be filled in by 'Internship Supervisor' of the Student					**This Section40 Marks**
Attributes & Scoring (Please tick)	**Un-Satisfactory**	**Satisfactory**	**Good**	**Very Good**	**Excellent**
	"0"Marks	**"3"Marks**	**"5"Marks**	**"7"Marks**	**"8"Marks**
(1) Dependability and Initiative Is self-reliant, performs in a dependable manner Accepts responsibility, shows initiative/interest in work and learns quickly					
(2) Communicates Effectively: Was able to communicate effectively (speaking and writing skills) with peers during the association.					
(3) Creativity & Quality of Work: Demonstrates creativity, Produces high quality work and accepts criticism. Uses technical knowledge and skills, Analyses problems effectively, shows good logical judgements.					
(4) Professionalism: Has a professional attitude and mannerism, cooperates with co-workers and supervisors. Demonstrates organizational skills.					
(5) Time Management and Discipline: Is punctual and Uses time effectively					
Total					
			Total Marks out of 40		

Section-III : External Assessment (Feedback on Overall Project Work Done by the Student)To be filled in by 'Internship Supervisor' of the Student					**This Section20 Marks**
Feedback on the "Overall Project Work Done" by the Student (Please tick or circle).	**Un-Satisfactory**	**Satisfactory**	**Good**	**Very Good**	**Excellent**
	(Below 8)	**(8-10)**	**(11-13)**	**(14-16)**	**(17-20)**

Imp. Note: The feedback of the Internship Supervisor provided in Section-III will serve as input to the Mentor for allocating the marks to the final **Project Report** which will be submitted by the student after the internship/OJT/Project Work. Marks will be allocated by the Mentor in the following range for the ratings awarded by the Internship Supervisor; **EX=17-20, VG=14-16, GD=11-13, SAT=8-10, USAT=Below 8**

ASSESSMENT AND EVALUATION POLICY

Illustrative Components of Internal Continuous Assessment (CA) and Semester-End Examination (UA)

A candidate shall be declared to have passed the program if he/she secures at least 40% of marks in both, internal assessment (CA) and semester end examination (UA) independently/separately, i.e., there shall be separate of head of passing.

Internal Continuous Assessment for 2 Credit Course

Theory

Assessment Components	Internal Continuous Assessment (College Assessment-CA) (20 Marks)			Semester-End Examination (University Assessment-UA) (30 Marks)
	Class Test (Test-1&2 each of 10 Marks)	**Attendance** (In regular classes / Practical's etc.)	**Other Assessment** (Home Assignments/ Group Discussion/ Quiz / Seminar)	
Marks	**10**	**5**	**5**	**30**
Week of the activity	**Week 6 and Week 10**	**Weekly**	**Week 7**	**Declared by College Authority**

Internal Continuous Assessment for 4 Credit Course

Assessment Components	Internal Continuous Assessment(CA) (40 Marks)			Semester-End Examination (UA) (60 Marks)
	Class Test (Test-1 & 2 each of 15 Marks)	**Class Participation**(In regular classes / Practical's etc.)	**Other Assessment** (Home Assignments/ Group Discussion/ Quiz /Seminar)	
Marks	**30**	**05**	**05**	**60**
Week of the activity	**Week 6 and Week 10**	**Weekly**	**Week 7**	**Declared by College Authority**

Practical

Assessment Components	Internal Continuous Assessment(CA) (20 Marks)			Semester-End Examination (UA) (30 Marks)
	Submission of Potted Plants/Wild Seed Bottle	Class Participation and Practical Based Viva Voce	Field Work and Journal Completion	
Marks	05	05	10	30
Week of the activity	Week 6 and Week 10	Weekly	Week 7	Declared by College Authority

Assessment Components	Internal Continuous Assessment(CA) (40 Marks)			Semester-End Examination (UA) (30 Marks)
	Submission of Potted Plants/Wild Seed Bottle	Class Participation and Practical Based Viva Voce	Field Work and Journal Completion	
Marks	10	10	20	60
Week of the activity	Week 6 and Week 10	Weekly	Week 7	Declared by College Authority