Institute of Science, Nagpur

(An Autonomous Institute of Govt. of Maharashtra)

Department of Botany

B. Sc. Semester I and II Syllabus as per NEP 2020

To be implemented from 2023-2024

INSTITUTE OF SCIENCE, NAGPUR.
(An Autonomous Institute of Government of Maharashtra)
Department of BOTANY
Teaching and Examination scheme
Bachelor of Science (Honors/Research)
Four-Year (Eight Semester Degree Course)
B.Sc. Sem- I (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical					
					Th	Tu	P		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Paper 1:- **Microbes And Fungi**	B-BO111T	4.5	2	--	--	2	2	40	10	20
		Paper 2:- **Algae Lichens And Bryophytes**	B-BO112T		2	--	--	2	2	40	10	20
		DSC Lab (Based on Paper 1 + Paper 2)	B-BO113P		--	--	4	2	4 – 6	40	10	25
2	GE	Refer to GE Basket **Mushroom cultivation and fungal biotechnology**	**B-BO114T**		2	--	--	2	2	40	10	20
		Refer to GE Basket **Floriculture**	**B-BO115T**		2	--	--	2	2	40	10	20
3	VSEC	Refer VSC Basket **Mushroom Cultivation and fungal Biotechnology**	**B-BO116P**		--	--	4	2	4 - 6	40	10	25
		Refer SEC Basket **Floriculture**	**B-BO117P**		--	--	4	2	4 - 6	40	10	25
4	AEC	English Compulsory			2	--	--	2	2	40	10	20
5	VEC	Environmental Studies			2	--	--	2	2	40	10	20
6	IKS	Indian Knowledge System	**B-BO118T**		2	--	--	2	2	40	10	20
7	CC	NSS /NCC / Sports / Cultural			--	--	4	2	--	25	25	25
Total					14	--	16	22	--	425	125	--

B.Sc. Sem-II (BOTANY-Major, Minor from Basket)

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical					
					Th	Tu	P		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Paper 1:- **Pteridophytes And Palaeobotany**	B-BO121T	4.5	2	--	--	2	2	40	10	20
		Paper 2:- **Gymnosperms And Palaeobotany**	B-BO122T		2	--	--	2	2	40	10	20
		DSC Lab (Based On Paper 1 + Paper 2)	B-BO123P		--	--	4	2	4 – 6	40	10	25
2	GE	Refer to GE Basket **Identification of Angiospermic Plant**	B-BO124T		2	--	--	2	2	40	10	20
		Refer To GE Basket **Plant Tissue Culture**	B-BO125T		2	--	--	2	2	40	10	20
3	VSEC	Refer VSC Basket **Identification of Angiospermic Plant**	B-BO126P		--	--	4	2	4 - 6	40	10	25
		Refer SEC Basket **Plant Tissue Culture**	B-BO127P		--	--	4	2	4 - 6	40	10	25
4	AEC	English Compulsory			2	--	--	2	2	40	10	20
5	VEC	Constitution of India			2	--	--	2	2	40	10	20
6	IKS	Indian Knowledge System	B-BO128T		2	--	--	2	2	40	10	20
7	CC	NSS /NCC / Sports / Cultural			--	--	4	2	--	25	25	25
Total					14	--	16	22	--	425	125	--

B.Sc. Sem-III (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical					
					Th	Tu	P		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Paper 1:- Morphology of **Angiosperms & PlantAnatomy**	B-BO231T	5.0	2	--	--	2	2	40	10	20
		Paper 2:- **Plant Taxonomy**	B-BO232T		2	--	--	2	2	40	10	20
		DSC Lab (Based on Paper 1 + Paper 2)	B-BO233P		--	--	4	2	4 – 6	40	10	25
2	Minor	Paper 1:-Refer Minor Basket **Microbes and Fungi**	B-BO234T		2	--	--	2	2	40	10	20
		Paper 2:-Refer Minor Basket **Algae, lichens and bryophytes**	B-BO235T		2	--	--	2	2	40	10	20
		Minor Lab (Based on Paper 1 + Paper 2)	B-BO236P		--	--	4	2	4 - 6	40	10	25
3	GE	Refer to GE Basket **Ecology and Environment**	B-BO237T		2	--	--	2	2	40	10	20
4	VSEC	Refer VSC Basket **Ecology and Environment.**	B-BO238P		--	--	4	2	4 - 6	40	10	25
5	AEC	Second Language			2	--	--	2	2	40	10	20
6	FP	Field Project	B-BO239FP		--	--	4	2	4 - 6	25	25	25
7	CC	NSS/NCC / Sports / Cultural			--	--	4	2	--	25	25	25
Total					12	--	20	22	--	410	140	--

B.Sc. Sem-IV (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
					Th	Tu	P					
1	DSC	Paper 1:- **Angiosperm Systematics & Embryology**	B-BO241T	5.0	2	--	--	2	2	40	10	20
		Paper 2:- **Cell Biology**	B-BO242T		2	--	--	2	2	40	10	20
		DSC Lab (Based on Paper 1 + Paper 2)	B-BO243P		--	--	4	2	4 – 6	40	10	25
2	Minor	Paper 1:-Refer Minor Basket **Pteridophytes andPaleobotany**	B-BO244T		2	--	--	2	2	40	10	20
		Paper 2:-Refer Minor Basket **Gymnosperms and Palaeobotany**	B-BO245T		2	--	--	2	2	40	10	20
		Minor Lab (Based on Paper 1 + Paper 2)	B-BO246P		--	--	4	2	4 - 6	40	10	25
3	GE	Refer to GE Basket **Traditional Knowledge of Plants**	B-BO247T		2	--	--	2	2	40	10	20
4	VSEC	Refer SEC Basket **Traditional knowledge of Plants.**	B-BO248P		--	--	4	2	4 - 6	40	10	25
5	AEC	Second Language			2	--	--	2	2	40	10	20
6	CEP	Community Service			--	--	4	2	--	25	25	25
7	CC	NSS/NCC / Sports / Cultural			--	--	4	2	--	25	25	25
Total					12	--	20	22	--	410	140	--

B.Sc. Sem-V (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
					Th	Tu	P					
1	DSC	Paper 1:- **Genetics**	B-BO351T	5.5	3	--	--	3	3	60	15	30
		Paper 2:- **Plant physiology**	B-BO352T		3	--	--	3	3	60	15	30
		DSC Lab (Based on Paper 1 + Paper 2)	B-BO353P		--	--	6	3	6	60	15	38
2	DSE	Elective 1:- **Mycology and Industrial Microbiology**	B-BO354T		2	--	--	2	3	40	10	20
		DSE Lab (Based on Elective 1)	B-BO355P		--	--	4	2	4-6	40	10	25
3	Minor	Paper 1:-Refer Minor Basket **Morphology of Angiosperms & Plant Anatomy**	B-BO356T		2	--	--	2	2	40	10	20
		Paper 2:-Refer Minor Basket **Plant Taxonomy**	B-BO357T		2	--	--	2	2	40	10	20
		Minor Lab (Based on Paper 1 + Paper 2)	B-BO358P		--	--	4	2	4 - 6	40	10	25
4	VSEC	Refer VSC Basket **Instrumentation for BotanyLaboratory**.	B-BO359P		--	--	4	2	4 - 6	40	10	25
5	CEP	Community Service			--	--	2	1	--		25	25
					12	--	20	22		420	130	--

B.Sc. Sem-VI (BOTANY-Major, Minor from Basket)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical					
					Th	Tu	P		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Paper 1:- Plant Ecology **Phytogeography & Plant Utilization**	B-BO361T	5.5	3	--	--	3	3	60	15	30
		Paper 2:- **Plant Biotechnology, genetic Engineering**	B-BO362T		3	--	--	3	3	60	15	30
		DSC Lab (Based on Paper 1 + Paper2)	B-BO363P		--	--	6	3	6	60	15	38
2	DSE	Elective 2:- **Conservationand management of Natural resources**	B-BO364T		2	--	--	2	2	40	10	20
		DSE Lab (Based on Elective 2)	B-BO365P		--	--	4	2	4-6	40	10	25
3	Minor	Paper 1:-Refer Minor Basket**Angiosperm Systematics & Embryology**	B-BO366T		2	--	--	2	2	40	10	20
		Minor Lab (Based on Paper 1 + Paper 2)	B-BO367P		--	--	2	1	2	20	5	13
4	VSEC	Refer VSC Basket **Biodiversity and Conservation**	B-BO368P		--	--	4	2	4 - 6	40	10	25
5	OJT	Internship / Apprenticeship (Related to DSC)	B-BO369OJT		--	--	8	4	4 – 6	80	20	50
					10	--	24	22		440	110	--

B.Sc. Sem-VII (Honors) (BOTANY-Major, Minor from Basket)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
					Th	Tu	P					
1	DSC	Paper 1:- **Cell & Molecular Biology**	B-BOH471T	6.0	4	--	--	4	3	80	20	40
		Paper 2:- **Ethnobotany & MedicinalPlants**	B-BOH472T		4	--	--	4	3	80	20	40
		DSC Lab (Based on Paper 2)	B-BOH473P		--	--	12	6	4 – 6	100	50	75
2	DSE	Elective 3:- **Forestry**	B-BOH474T		2	--	--	2	2	40	10	20
		DSE Lab (Based on Elective)	B-BOH475P		--	--	4	2	4-6	40	10	25
3	RM	Research Methodology	B-BOH476T		4	--	--	4	3	80	20	40
					14	--	16	22		420	130	--

B.Sc. Sem-VIII (Honors) (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical					
					Th	Tu	P		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Paper 1:- **Plant Metabolism**	B-BOH481T	6.0	4	--	--	4	3	80	20	40
		Paper 2:- **Plant biodiversity &Conservation**	B-BOH482T		4	--	--	4	3	80	20	40
		DSC Lab (Based on Paper 2)	B-BOH483P		--	--	12	6	4 – 6	100	50	75
2	DSE	Elective 4:- **Seed Technology**	B-BOH484T		2	--	--	2	2	40	10	20
		DSE Lab (Based on Elective)	B-BOH485P		--	--	4	2	4-6	40	10	25
3	OJT	Internship / Apprenticeship (Related to DSC)	B-BOH486OJT		--	--	8	4	4 – 6	80	20	50
					10	--	24	22		420	130	--

B.Sc. Sem-VII (Honors with Research) (BOTANY -Major, Minor from Basket)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
					Th	Tu	P					
1	DSC	Paper 1:- **Molecular Biology**	B-BOR471T	6.0	4	--	--	4	3	80	20	40
		Paper 2:- **Ethnobotany**	B-BOR472T		4	--	--	4	3	80	20	40
		DSC Lab (Based on Paper 1 + Paper2)	B-BOR473P		--	--	4	2	4-6	40	10	25
2	DSE	Elective **Pharmacognosy and Phytochemistry**	B-BOR474T		2	--	--	2	2	40	10	20
		DSE Lab (Based on Elective)	B-BOR475P		--	--	4	2	4-6	40	10	25
3	RM	Research Methodology	B-BOR476T		4	--	--	4	3	80	20	40
4	RP	Research Project / Dissertation (Core)	B-BOR477P		--	--	8	4	--	50	50	50
					14	--	16	22		410	140	--

B Sc Sem VIII (Honors with Research)

Sr No	Course Category	Name of the course(Title of the Paper)	Course code	Level	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
					Theory	Tutorial	Practical		Duration of Examination(Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
					Th	Tu	P					
1	DSC	Paper 1:- **Plant Metabolism**	B-BOR481T	6.0	4	--	--	4	3	80	20	40
		Paper 2:- **Plant biodiversity & Conservation**	B-BOR482T		4	--	--	4	3	80	20	40
		DSC Lab (Based on Paper 1 + Paper2)	B-BOR483P		--	--	4	2	4-6	40	10	25
2	DSE	Elective 1 **Plant Growth Regulators**	B-BOR484T		2	--	--	2	2	40	10	20
		DSE Lab (Based on DSE 10)	B-BOR485P		--	--	4	2	4-6	40	10	25
3	RP-1	Research Project / Dissertation (Core)	B-BOR486P		--	--	8	4	--	50	50	50
4	RP-2	Research Project / Dissertation (Core)	B-BOR487P		--	--	8	4	--	50	50	50
					10	--	24	22		380	170	--

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Total Credits:

1. Three year UG Degree Program: 132

2. Four year UG Degree Program: 176

Table 16: Table showing course category wise credit distribution semester wise

Exit Point /Course Category	**Certificatein Science**	**Diploma inScience**	**Three YearBachelor ofScience**	**Bachelor ofScience (Honors) Degree**	**Bachelor of Science (Honors withResearch) Degree**
Major Credits	12	12	26	36	28
Minor Credits	--	12	9	--	--
GE	8	4	--	--	--
VSEC	8	4	4	--	--
AEC	4	4	--	--	--
VEC	4	--	--	--	--
IKS	4	--	--	--	--
CC	4	4	--	--	--
FP	--	2	--	--	--
CEP	--	2	1	--	--
OJT	--	--	4	4	--
RP	--	--	--	--	12
RM	--	--	--	4	4
Total Credits	44	44	44	44	44

Table 16: Table showing total marks in theory and Practical semester wise

Semester	Theory	Practical	Total Marks
I	350	200	550
II	350	200	550
III	300	250	550
IV	300	250	550
V	300	250	550
VI	250	300	550
VII (Honors)	350	200	550
VIII (Honors)	250	300	550
VII (**Honors with Research**)	350	200	550
VIII (**Honors with Research**)	250	300	550
For Honors	**2450**	**1950**	**4400**
For Research	**2450**	**1950**	**4400**

Institute of Science, Nagpur.
Department of Botany
B. Sc. Sem. I Syllabus as per NEP 2020
To be implemented from 2023-24

Semester	Course Code	Title of Paper
I	B-BO111T	Microbes and Fungi
	B-BO112T	Algae Lichens and Bryophytes
	B-BO113P	Discipline Specific Core Course Laboratory Exercise
	B-BO114T	Mushroom cultivation and fungal biotechnology
	B-BO115T	Floriculture
	B-BO116P	Mushroom Cultivation and fungal biotechnology
	B-BO117P	Floriculture
	B-BO118T	IndianKnowledgeSystem
II	B-BO121T	Pteridophytes and Palaeobotany
	B-BO122T	Gymnosperms and Palaeobotany
	B-BO123P	Discipline Specific Core Course Laboratory Exercise
	B-BO124T	Identification of Angiospermic Plant
	B-BO125T	Plant Tissue Culture
	B-BO126P	Identification of Angiospermic Plant
	B-BO127P	Plant Tissue Culture
	B-BO128T	IndianKnowledgeSystem

B. Sc. Semester-I
Discipline Specific Core Course (DSC-I)- (B-BO111T)
MICROBES AND FUNGI

Course objectives: -

1. To acquainted students about the morphology, characters and importance of different microorganisms.

Course outcome :-

1. The course, will enable students to know about different types of microorganisms: virus, bacteria, Cyanobacteria, mycoplasma and fungi.

DSC-I Theory	Hours: 2Hours/Week	Marks: 40+10=50	Credit: 2

Unit-I

1. Viruses: General characteristic and nature of viruses, Classification of viruses based on host. 2. Ultrastructure of TMV, structure and multiplication and economic importance of T4 – bacteriophage. 3. Mycoplasma: morphology, properties and pathogenicity.	7.5 Hrs

Unit-II

1. Bacteria: cell structure, cilia, flagella, reproduction: Vegetative, Asexual and Sexual methods. Economic importance. *2.* Cyanobacteria: Cell ultrastructure, Structure of heterocyst, structure and reproduction in *Nostoc* 3. Economic importance of Cyanobacteria	7.5 Hrs

Unit-III

1. Fungi: Classification (Alexopoulos 1979), 2. Economic importance's of Fungi. 3. Life history of – 4. *Albugo*(Oomycetes) 5. *Mucor*(Zygomycetes)	7.5 Hrs

Unit-IV

1. Fungi: life history of – • *Aspergillus*(Ascomycetes) • *Puccinia*(Basidiomycetes) • *Cercospora*(Deuteromycteres)	7.5 Hrs

List of Books

1. Singh V., Pande, P. C., and Jain D.K. (2005): A Text book of Botany, Rastogi Publications, Meerut.
2. Alexopoulos, C. J. (1962): C.J.: Introductory Mycology, Wiley International Edition.
3. Gangulee. H. C. and Kar, A. K. (1989): College Botany, Vol. l New Central Book Agency, (P) Ltd. London.
4. Dubey R. C., Maheshwari D.K. (1999): Text Book of Microbiology (S. Chand and Co.)
5. Prescott *et. al.*, (1999): Microbiology 3RDedn. (WmC. Brown Pub)
6. Vasishta, B. R. (1990): Fungi (S. Chand and Co. New Delhi)
7. Dutta A. C. (1963), Botany for degree students, (Revised edition) Oxford University Press, New Delhi 110002, India.

B. Sc. Semester-I
Discipline Specific Core Course (DSC-II)- (B-BO112T)
ALGAE LICHENS AND BRYOPHYTES

Course objectives: -

1. To acquainted students about the morphology, characters and importance of different algae and bryophytes.

Course outcome :-

1. The course, will enable students to know about different types of algae, lichen and bryophytes.

DSC-II Theory	Hours: 2Hours/Week	Marks: 40+10=50	Credit:2

Unit-I

1. Algae –Classification (Fritsch 1945), 2. Economic importance of Algae 3. Life history of • *Oedogonium*(Chlorophyceae) • *Chara* (Chlorophyceae)	7.5 Hrs

Unit-II

Algae – life history of 1. *Vaucheria*(Xanthphyceae) 2. *Ectocarpus*(Phaeophyceae) 3. *Batrachospermum*(Rhodophyceae)	7.5 Hrs

Unit-III

1. Lichens: Types, Reproduction and Economic importance. 2. Bryophyta: Classification (Proskauer 1957). 3. General characters of various classes of Brypophyta (Hepaticopsida, Anthocerotopsida and Bryopsida), 4. Economic importance and Alternation of Generation.	7.5 Hrs

Unit-IV	
Life history of – 1. *Riccia*(Haepaticopsida) 2. *Anthoceros* (Anthoceratopsida) 3. *Funaria*(Bryopsida) (Note: Development stages not expected)	7.5 Hrs

List of Books

1. Bold H.C. and M. J. Wynne (1978): Introduction of Algae: structure and reproduction (Prentices Hall of India, Pvt. Ltd.)
2. Morris (1986): Introduction to the Algae. Cambridge University press, UK
3. Chopra, G. I. and D. I. Yadav (1980): A text Book of Bryophyta (Arihant Press)
4. Kumar H. D. (1988): Introductory Phycology, Affiliate East- West Press. Pvt. Ltd. (New Delhi)
5. Casselman. (1993). Craft of the Dyer-colour from plants and Lichens. Dover publications, Inc., N. Y.
6. Singh K. P. and Sinha G. P. (2010) Indian Lichens an annotated checklist, M/s Bishen Singh Mahendra pal Singh
7. Smith G. M. (1971) Cryptogamic Botany, Vol. II Bryophyta and Pteridohyta (THM)
8. Sporne, K.R.11: The Morphology of Bryophyta (Hutchinson University, London)
9. Vasistha B. R. (1992): Bryophyta (S. Chand and co. New Delhi)
10. Ram Udar (1970): An introduction to Bryophyta (ShashidharMalviyaPrakashan, Lucknow)
11. Parihar, N. S. (1997): The Biology and morphology of Bryophytes (Central Book Depot. Allahabad)

B. Sc. Semester-I

Discipline Specific Core Course Laboratory Exercise (B-BO113P)

Based on Paper I and Paper II	Hours: 2 Hours/Week	Marks: 40+10(Internal)=50	Credit: 2

1. Study of ultrastructure of TMV and T4 Bacteriophages.
2. Study of various types of Bacteria.
3. Study of Mycoplasma structure
4. Study of Algal genera :
    - *Oedogonium,*
    - *Chara,*
    - *Vaucheria,*
    - *Ectocarpus*
    - *Batrachospermum*
5. Study of Lichens : Thallus structure, Types
6. Study of Bryophytes :
    - *Riccia*
    - *Anthoceros*
    - *Funaria*

Suggested activity:

Seminar, Quiz, debate, Assignments, collection and study of Algae and Bryophytes available in local area, Field work, Study Projects, Models etc. are Part of Curriculum. Botanical Excursion (one short excursion is compulsory)

B. Sc. - SEMESTER –I BOTANY PRACTICAL

Based on Paper I and Paper II B-BO113P

Time: 4-6hrs. **Max. Marks: 40**

1. Gram stain the given Bacterial strain/stain the given **Cyanobacterial**material **(A)** identify giving reasons. **6 Marks**
2. Identify the given **Fungal** material **(B)** prepare temporary mount and write identifying characters. **6 Marks**
3. Identify the given **Algal** material **(C)**prepare a temporary mount and write identifying characters. **6 Marks**
4. Identify the given **Bryophytic** material **(D)** prepare temporary mount and write identifying characters. **6 Marks**
5. **Spotting:** **6 Marks**

   E. Virus

   F. Bacteria

   G. Fungi

   H.Lichen

   I. Algae.

   J. Bryophyte
6. Viva-voce **5 Marks**
7. Record and excursion report (submission is compulsory) **5 Marks**

B. Sc. Semester-I

MUSHROOM CULTIVATION AND FUNGAL BIOTECHNOLOGY (B-BO114T)

Course objectives: -

1. To raise curiosity in students for cultivation of mushrooms.
2. Students will be acquainted to various aspects of mushroom cultivation.

Course outcome :-

1. By the end of this course, the students will be able to:
2. Describe morphology of mushrooms. Learn the process of Compost preparation.
3. Learn importance of mushrooms in human welfare.
4. Learn the process of cultivation of various mushrooms.
5. Discuss application of fungi in biotechnology.
6. Describe the role of fungi in production of metabolites.

GE-I Theory	**Hours: 2Hours/Week**	**Marks: 40+10=50**	**Credit: 2**

Unit-I

1. Mushroom Cultivation: Mushrooms and Mycophagy. 2. Food and Biological Value of Mushrooms 3. Edible and Poisonous Mushrooms. 4. Tools used for mushroom cultivation. 5. Commercially Cultivated Mushrooms. 6. Cultivation of White Button Mushroom on Commercial scale	7.5 Hrs

Unit-II

1. Growing Mushrooms in Laboratory 2. Cultivation of Shiitake mushroom (*Lentinusedodes*) 3. Cultivation of Paddy Straw Mushroom. 4. Cultivation of Oyster Mushroom. 5. Commercial Production of Some other Macrofungi	7.5 Hrs

Unit-III

1. Mushroom Parasites 2. Mushroom Dishes	7.5 Hrs

3. Role of Fungi in Biotechnology, 4. Fermentation Technology 5. Fungal enzyme Technology 6. Production Technology of Alcoholic Beverages.	
Unit-IV	
1. Mycoproteins 2. Single-Cell Protein, Advantages and disadvantages 3. Fungi in Food Processing Industry. 4. Production of Primary Metabolites from Fungi 5. Production of Secondary Metabolites from Fungi	7.5 Hrs

List of Books / Online Resources

1. Chang, Shu-Ting and Philip G. Miles. 2004. Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact. CRC Press. 480 P
2. Beyer,D. M. 2003. Basic Procedures for Agaricus Mushroom Growing. http://pubs.cas.psu.edu/PubTitle.asp?varTitle=mushroom.
3. Coles, P. S., et al. 2002. Pennsylvania Mushroom Integrated Pest Management Handbook. http://pubs.cas.psu.edu/PubTitle.asp?varTitle=mushroom
4. Harris, R. 1994. Growing Shiitake Commercially. 2nd Ed. Second Foundation Publications, Summertown, TN. 72 P.
5. Krieger, L. C. 2010. The Mushroom Handbook. Sufi Press. 578 P. ISBN 486-21861-9
6. ATTRA Mushroom Publications -- http://www.attra.org/attra-pub/mushroom.html
7. Fungi Perfecti -- http://www.fungi.com
8. Gourmet Mushrooms http:// www.gmushrooms.com/ or www.arrowweb.com/MUSHROOM/
9. Mushroom Business -- http://www.mushroombusiness.com
10. Mushroom Council -- http://www.mushroomcouncil.org/index.htm
11. Mushroom World-- http://www.mushworld.com/home/
12. Mushroom News - Published monthly by the American Mushroom Institute -- http://www.americanmushroom.org/news.htm.

13. Mushroom Growers' Handbook 1(Oyster Mushroom) -- http://forums.mycotopia.net/faq-frequently-asked-questions/5594-mushroom-growers-handbook-1-mushworld-com.html
14. Mushroom Growers' Handbook 2 (Shiitake) -- http://forums.mycotopia.net/faq-frequently-asked-questions/6556-mushroom-growers-handbook-2-mushworld-com.html
15. NASS Mushroom Statistics -- http://usda.mannlib.cornell.edu/reports/nassr/other/zmu-bb/
16. NAMMEX North American Mushroom Extracts - http://www.nammex.com/MedicinalMushroomBooks.html
17. Nova Scotia Department of Agriculture and Fisheries www.gov.ns.ca/nsaf/elibrary/archive/hort/organic/990015.htm
18. Penn State University Mushroom Science and Technology http://mushroomspawn.cas.psu.edu/mushroom.shtml
19. Purdue Publication on Specialty Mushrooms -- http://www.hort.purdue.edu/newcrop/proceedings1996/V3-464.html
20. Shiitake Mushroom Production Economics -- http://ohioline.osu.edu/for-fact/0043.html

B. Sc. Semester-I

FLORICULTURE (B-O115T)

Course objectives :-

1) To provide judicious mixture of skills relating to a profession and appropriate content.
2) Familiarize students with the flowering plants and their utilization.
3) Develop skills in various technologies for production of flowers.
4) Study techniques of using fertilizers and irrigation for increasing productivity of floricultural plants.

Course outcome :-

After the satisfactory completion of course, the student will be able to;

1) List and describe procedural steps necessary during floriculture crop production from propagation to marketing.
2) Identify and define environmental factors that regulate growth and flowering of floriculture crop.
3) Develop production schedules for floriculture crops.

GE-II Theory	**Hours:** **2Hours/Week**	**Marks: 40+10=50**	**Credit: 2**

Unit-I

1. Floriculture: Definition and commercial aspect. 2. Common garden operation using different implements. 3. Commercial floriculture, soil selection. 4. Preparation of soil nursery beds. 5. System of planting. 6. Propagation by cutting, budding and grafting.	7.5 Hrs

Unit-II

1. Methods of cultivation with reference to soil type, sowing pattern, weather condition, irrigation regime, fertilizers and harvesting of especially cut flowers such as • *Carnation* • *Asters* • *Gerbera* • *Dahlia* • Marigold	7.5 Hrs

Unit-III	
1. Harvesting and processing of flowers: • Harvesting technique. • Postharvest handling and grading. • Packing and storage. • Transportation and marketing.	7.5 Hrs
Unit-IV	
1. Identification of various annual, biannual, perennial and bulbous floricultural plants and their uses. 2. Nurseries establishment, care and management of nursery, selection of site and layout, propagation of ornamental plants. 3. Principles and styles of flower arrangement, production of flowers for exhibition.	7.5 Hrs

List of Books / Online Resources

1. Bhargav V., Rajababu K., Sumalatha, Nihzesa floriculture, Newvishal publication.
2. Kulkarni Balaji S. (2016), Floriculture and landscaping, Agro India publication
3. Desh Raj (2020), Floriculture at a glance, (kalyani publisher) (Latest edition)
4. Kumar Ashok, Kumar Abhinav (2019) Text book on commercial floriculture and ornamental horticulture with landscape architecture, Kalyani publishers
5. Hartman, H. T., Kester D. E., Davis, F. T. and R. L. Geneve (2010), Plant propagation: principles and practices (8th Edition).
6. Website URL:http//www.wikipedia.org/wiki/plant propagation

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
1	GE	Refer to GE Basket	----------	2	--	--	2	2	40	10	20

B. Sc. Semester-I

Mushroom Cultivationand Fungal Biotechnology (B-BO115T)

Objective: To raise curiosity in students for cultivation of mushrooms.

Course Outcomes: By the end of this course, the students will be able to:

1. Describe morphology of mushrooms.
2. Learn the process of Compost preparation.
3. Learn importance of mushrooms in human welfare.
4. Learn the process of cultivation of various mushrooms.
5. Discuss application of fungi in biotechnology.
6. Describe the role of fungi in production of metabolites.

Laboratory Exercise	**Hours: 4 Hours/Week**	**Marks: 40+10(Internal)=50**	**Credit: 2**

1. To study morphology of commonly available mushrooms.
2. To perform test for presence of carbohydrate, protein and lipids in mushrooms.
3. Study of tools required for mushroom cultivation.
4. Preparation of culture tubes for mushroom cultivation.
5. Preparation of compost for mushroom cultivation.
6. Preparation of spawn for mushroom cultivation.
7. Cultivation of Oyster Mushroom in laboratory.
8. Cultivation of Oyster Mushroom in laboratory.
9. Cultivation of Paddy straw Mushroom in laboratory.
10. Cultivation of Shitake Mushroom in laboratory.
11. Preparation of mushroom dishes.
12. Visit to a commercial mushroom growing facility.

Suggested activity:

Seminar, Quiz, debate, Assignments, collection of mushroomfrom local area, Field work, Study Projects, Models etc. are Part of Curriculum.

B.Sc. - SEMESTER –I BOTANY PRACTICAL

VSEC Course Laboratory Exercise (B-BO116P)

Time: 4 ~~-6~~hrs. **Max. Marks: 40**

1. Inoculate the given fungal culture **(A)** on slant. **10 Marks**
2. Perform casing on mycelial mat **(B)** under aseptic condition. **5 Marks**
3. Demonstrate inoculation of spawn **(C)**for cultivation of Oyster /paddy straw mushroom under aseptic condition. **8 Marks**
4. Demonstrate harvesting of mushrooms from given material **(D)**. **5 Marks**
5. **Spotting:** **4 Marks**
   E.Tools used for mushroom cultivation
   F.Mushroom dishes.
6. Viva-voce **3 Marks**
7. Practical Record and report of visit to mushroom growing facility.(submission is compulsory) **5 Marks**

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
4	VSEC	Refer VSC Basket ----------	----------	--	--	4	2	4 - 6	40	10	25

B. Sc. Semester-I
Floriculture (B-BO117P)

Course objectives :-

1) To provide judicious mix of skills relating to a profession and appropriate content of Floriculture.
2) Familiarize students with the cultivation practices of floriculture plants.
3) Develop skills in production of various types of flowers.
4) Study techniques of using fertilizers and irrigation for increasing productivity.

Course outcome :-

1) List and describe procedural steps necessary during floriculture crop production from propagation to marketing.
2) Identify and define environmental factors that regulate growth and flowering of floriculture plant.
3) Skill development of floricultural plants.

Laboratory Exercise	**Hours: 4 Hours/Week**	**Marks: 40+10(Internal)=50**	**Credit: 2**

1) Identification of various flowers.
2) Harvesting technique, post-harvest handling.
3) Methods of cultivation of flowers mention in theory.
4) Selection of ornamental plants.
5) Study of various protected structure.
6) Weed management, rationing, training, and pruning.
7) Draw and practices in preparing design to home gardens.
8) Visit to commercial cut flowers unit and case study.
9) Drying and preservation of cut flower.
10) Study of treatments of seed, bulbs and cut flowers.
11) Practice in manuringand pinching.
12) Packing method of flower.

Suggested activity:

Seminar, Quiz, debate, Assignments, Visit to Garden from local area, Field work, Study Projects, Models etc. are Part of Curriculum. One short/long excursion compulsory

B.Sc. - SEMESTER –I BOTANY PRACTICAL

VSEC Course Laboratory Exercise (B-BO117P)

Time: 4-6hrs. **Max. Marks: 40**

1. Identification of Various flowers. **8 Marks**
2. To perform methods of cultivation of flowers. **8 Marks**
3. To draw and Practices in preparing design to home gardens. **8 Marks**
4. **Spotting:** **6 Marks**

   a) Identification of various Garden tools

   b) Cut flowers

5. Viva-voce **5 Marks**
6. Practical Record and tour report (submission is compulsory) **5 Marks**

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
4	VSEC	Refer VSC Basket ----------	----------	--	--	4	2	4 - 6	40	10	25

B. Sc. Semester-I

(B-BO118T)

Indian knowledge system

IKS- Theory	Hours: 2 Hours/Week	Marks: 40+10=50	Credits: 2

Module I

Course Objective:

Establish, guide and monitor subject-wise interdisciplinary research groups comprising of researchers from institutes, centers and individuals. Create and promote popularization schemes. Facilitate funding of various projects and develop mechanisms to undertake research**Course outcome:**

These guidelines, drafted in line with the National Education Policy (NEP) 2020 mandate to promote research and instruction in Indian Knowledge Systems (IKS), at all levels of education, by preparing and teaching new courses/programmes at the undergraduate and postgraduate levels.

Module I

Bhāratīya Civilization and Development of Knowledge System Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy (6+3), Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.	7.5 Hrs

Module II

Basicsofhypothesisandresearchmethods Art, Music, and Dance, Naṭarāja– A Masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭīlya, Pāṇini, Thiruvalluvar, Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya. .	7.5 Hrs

Module III

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bhāratīya Kāla-gaṇanā, Kerala School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth,	7.5 Hrs

Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeostronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.	
Module IV	
Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet–Dwārkā	7.5 Hrs

References/Books:

Text books:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,

2. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).

2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).

3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

B. Sc. Semester-II
Discipline Specific Core Course (DSC-III)- (B-BO121T)
PTERIDOPHYTES AND PALAEOBOTANY

Course objectives: -

1. To raise curiosity in students for study of Pteridophytes and Fossils. .

Course outcome :-

By the end of this course, the students will be able to:

1. Describe morphology of Pteridophytes.
2. Learn the process of fossilisation.
3. Learn importance of fossils in human welfare.
4. Describe the reproduction of Pteridophytes.

DSC-III Theory	Hours: 2Hours/Week	Marks: 40+10=50	Credit: 2

Unit-I	
1. Pteridophytes: General characteristics and classification (Smith 1952), alternation of generations. 2. Eusporangiate and leptosporangiate ferns. 3. Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction, and lifecycles of *Psilotum*, *Selaginella*.	7.5 Hrs
Unit-II	
1. Structure of sporophytes and lifecycle. Distribution, morphology, anatomy, reproduction and lifecycle of Equisetum, *Marsilea* 2. Apospory, Apogamy, Heterospory and seed habit. 3. Stelar evolution in Pteridophytes. 4. Ecological and economic importance of pteridophytes.	7.5 Hrs
Unit-III	
1. Geological Time scale: Outline of Eras, periods and epochs; Major events in the Geological time scale. 2. Palaeobotany- definition, fossils, Preservation of plant fossils, 3. Types of fossils- impressions, compressions, petrification, mould, cast and coal balls.	7.5 Hrs
Unit-IV	
Fossil Pteridophytes- 1. *Rhynia*: External morphology anatomy and reproduction.	7.5 Hrs

2. *Lepidodendron*: Habit, Habitat and structure 3. *Lepidocarpon*: morphology and anatomy 4. *Calamites*: External morphology, anatomy and reproduction.	

List of Books / Online Resources

1. Sharma, O P; 2012; Pteridophyta, McGrow Hill Education New Delhi.
2. Vashishta, P C, Sinha, A K; Kumar, A; 2010; Pteridophyta, S. Chand& company New Delhi.
3. V. Singh, P.C. Pande and D.K. Jain 2008. A Text Book of Botany, Rastogi Publications Meerut
4. H.C. Ganguly and A.K. Kar 1999, College Botany. Vol. 2, NCBA
5. Rashid, A, 1999, Pteridophyta, Vikas publishing house
6. S. N. Pandey, S. P. Misra, P. C. Trivedi (2016), A text book of botany, Vol. II (thirteenth Edition), Vikas Publishing House Pvt. Ltd., E-28, Sector- 8, Noida-201301 (U. P.) India.
7. A. C. Dutta, (1963), Botany for degree students (Revised edition) Oxford University Press, New Delhi 110002, India.
8. http://www.biologydiscussion.com/pteridophytes
9. https://species.wikimedia.org/wiki/Pteridophyta assessed in 2018

B. Sc. Semester-II
Discipline Specific Core Course (DSC-IV)- (B-BO122T)
GYMNOSPERMS AND PALAEOBOTANY

Course objectives: -

1. To raise curiosity in students for study of Gymnosperms and Fossils.

Course outcome :-

By the end of this course, the students will be able to:

1. Describe morphology of Gymnosperms.
2. Learn the process of fossilisation.
3. Learn importance of fossils in human welfare.
4. Describe the reproduction of Gymnosperms.

DSC-IV Theory	**Hours: 2Hours/Week**	**Marks: 40+10=50**	**Credit: 2**

Unit-I

1. Radiocarbon dating. 7.5 Hrs
2. Importance of fossils.
3. Exploration of fossil fuels.
4. Pseudofossil, Living fossil
5. BirbalSahni Institute of Paleosciences.

Unit-II

Fossil Gymnosperms- 7.5 Hrs

5. *Lyginopteris*: External morphology, anatomy and reproduction.
6. *Glossopteris*: External morphology, anatomy and reproduction.
7. *Cycadeoidea*: External morphology, anatomy and reproduction.

Unit-III

1. Gymnosperms- General characteristics. Distribution and classification of Gymnosperms (Stewart 1982), alternation of generations. 7.5 Hrs
2. Study of the habit, habitat, distribution, anatomy, reproduction, and life-cycles of
   - *Cycas*
   - *Pinus*

Unit-IV

1. Study of the habitat, distribution, habit, anatomy, reproduction, and life-cycles in 7.5 Hrs
   - *Ginkgo*
   - *Gnetum*.
2. Economic importance of Gymnosperms - food, timber, industrial uses, and medicines.

List of Books / Online Resources

1. H.C. Ganguly and A.K. Kar 1999, College Botany. Vol. 2, NCBA
2. Rashid, A, 1999, Pteridophyta, Vikas publishing house
3. S. N. Pandey, S. P. Misra, P. C. Trivedi (2016), A text book of botany, Vol. II (thirteenth Edition), Vikas Publishing House Pvt. Ltd., E-28, Sector- 8, Noida-201301 (U. P.) India.
4. A. C. Dutta, (1963), Botany for degree students (Revised edition) Oxford University Press, New Delhi 110002, India.
5. P. C. Vashishta, (1990), Botany for degree students, gymnosperms, Vol. V, S. Chand and Company Ltd., Ram Nagar, New Delhi- 110 055.
6. S. N. Pandey, S. P. Misra, P. C. Trivedi (2016), A text book of botany, Vol. II (thirteenth Edition), Vikas Publishing House Pvt. Ltd., Noida-201301 (U. P.) India.
7. V. Singh, P. C. Pandey D. K. Jain, 2016 Text Book of Botany, Rastogi Publications, GangotriShivaji Road, Meerut, 250002.
8. Biswas C, Johri B.M (1997). Pentoxylales. In: The Gymnosperms. Springer, Berilin, Heidelberg. • Osborn J M, Taylor T N, Crane P R (1991).
9. Singh V P. (2006). Gymnosperm (naked seeds plant): structure and development. Sarup& sons.
10. S.P Bhatnagar and AlokMoita, 1996, Gymnosperms. New age international publications, New Delhi.
11. Vashishta PC, 1996, Gymnosperms. S. Chand & Company Ltd. New Delhi.
12. Kumar A. 2006, Botany for Degree Students Gymnosperm. S. Chand Company Ltd. New Delhi.
13. https://en.wikipedia.org/wiki/Ginkgo_biloba
14. https://www.britannica.com/plant/Gnetum

B. Sc. Semester-II

Discipline Specific Core Course Laboratory Exercise (B-BO123P)

Based on Paper III and Paper IV	Hours: 2 Hours/Week	Marks: 40+10(Internal)=50	Credit: 2

1. To study types of fossils: impressions, compressions, petrification, mold, cast and coal balls
2. To study fossil plants:
    - *Rhynia*
    - *Lepidodendron,*
    - *Lepidocarpon,*
    - *Lyginopteris,*
    - *Calamites,*
    - *Glossopteris*
    - *Cycadeoidea.*
3. Study of Pteridophytes:
    - *Psilotum*
    - *Selaginella*
    - *Marsilea*
    - *Equisetum*
4. Study of Gymnosperms:
    - *Cycas,*
    - *Pinus,*
    - *Ginkgo*
    - *Gnetum*.

Suggested activity:

Seminar, Quiz, debate, Assignments, collection of Pteridophytes and Gymnosperms available in local area, Field work, Study Projects, Models etc. are Part of Curriculum.

B. Sc. - SEMESTER –II BOTANY PRACTICAL

Based on Paper III and Paper IV(B-BO123P)

Time: 4-6hrs. **Max. Marks: 40**

1. Identify and classify the given Pteridophyte material[**A**],&prepare a temporary mount. **8 Marks**
2. Identify and classify thegivenGymnosperm material[**B**],&prepare a temporary mount. **8 Marks**
3. Identify and classify thegivenPteridophyte fossil[**C**],&comment on it. **6 Marks**
4. Identify and classify the given Gymnosperm fossil [**D**], & comment on it. **6 Marks**
5. **Spotting:** **6 Marks**
   E.Pteridophyte
   F.Gymnosperm
   G. Types of fossils
6. Viva-voce, Record and excursion report (submission is compulsory) **6 Marks**

B. Sc. Semester-II

IDENTIFICATION OF ANGIOSPERMIC PLANT

(B-BO124T)

Objective:

1. To raise curiosity in students for identification of flowering plants.
2. To know the local flora of higher plants Scientifically

Course Outcomes: By the end of this course, the students will be able to:

1. Describe morphology of flowering plants.
2. Learn the technique of Herbarium.
3. Learn to use flora for Identification of flowering plants.
4. Learn the technique of Identification of flowering plants.
5. Understand identification of plant families

GEOE-III Theory	Hours: 2Hours/Week	Marks: 40+10=50	Credit: 2

Unit-I

1. Root Morphology: Tap root & adventitious roots, Modifications for storage, Respiration & reproduction. 2. Stem Morphology: Shape, surface, and nature Branching (Monopodial, Sympodial), modification of stem (Runner, Rhizome, Tuber and Bulb). 3. Leaf morphology: Typical Leaf, Types (Simple and Compound), Types of Phyllotaxy, Venation, and modifications of leaf (Tendril, Phyllode)	7.5 Hrs

Unit-II

1. Inflorescence: Definition, Racemose and Cymose type, and Special types 2. Flower: Definition, structure of typical flower, variation in thalamus (Androphore, Gynophore & Gynandrophore) 3. Calyx & Corolla: Forms of corolla, Cohesion, Aestivation. 4. Androecium: Parts, Cohesion, Adhesion and Fixation 5. Gynoecium: Parts, cohesion, Adhesion and Placentation.	7.5 Hrs

Unit-III

1. Fruit: Definition, pericarp. Types of fruits simple (Dehiscent, Schizocarpic, Dry indehiscent) Aggregate (Etaerio) fruits, Composite fruits (Sorosis and syconous). 2. Plant families: Dicot families: • Brassicaceae, • Caesalpiniaceae, • Fabaceae • Solanaceae. • Convolvulaceae	7.5 Hrs

Unit-IV	
1. Study of monocot family: • Liliaceae • Orchidacea • Arecaceae 2. Taxonomic aids: Botanical gardens, manual, Flora, keys, museum, monograph and herbarium.	7.5 Hrs

List of Books / References / Online Resources

1. Flora of British India by T. Cooke
2. Flora of Nagpur District by Dr. N. R. Ugemuge
3. Flora of Marathwada by V. N. Naik
4. Flora of Kolhapur by M. M. Sardesai and S. R. Yadav
5. Taxonomy of Angiosperms by V. N. Naik

Suggested activity:

Seminar, Quiz, debate, Assignments, local visit to different area, Field work, Study Projects, Models etc. are Part of Curriculum and considered along with presenty for Continuous Internal Evaluation (CIE)

B. Sc. Semester-II

PLANT TISSUE CULTURE(B-BO125T)

Objective:

1. To make students aware of tools and technique of plat tissue culture.
2. To acquaint with new technology, this will be useful as better carrier option.

Course Outcomes:

By the end of this course, the students will be able to:

1. Understand the requirements of Plant tissue culture.
2. Understand Preparation of M. S. Medium.
3. Get the hands-on skills of sterilization.
4. Discuss the inoculation and incubation technique.
5. Understand the technique of plant tissue culture.

GEOE-IV Theory	**Hours: 2Hours/Week**	**Marks: 40+10=50**	**Credit: 2**

Unit-I

1. Definition, history, principle and significance. 2. Totipotency. 3. Design and layout for wash area, medium preparation, sterilization and storage room, transfer area for aseptic manipulations, 4. Culture rooms and observation/data collection areas. 5. Labware, Good safety practices.	7.5 Hrs

Unit-II

1. **INSTRUMENTATION**: Working principle, maintenance and management of following instruments: Laminar air flow, autoclave, distillation unit, pH meter, orbital shaker, microscope, deep freezer, growth chamber 2. **CULTURE MEDIUM**: Introduction, Types of Media and its importance; Preparation of stocks, pH and Buffers and their significance in media. Media Constituents (Vitamins, Unidentified supplements, carbohydrate for energy source, Nitrogen source)	7.5 Hrs

3. **PLANT HORMONES**: Role of Plant hormones (auxins, Gibberellins, cytokinins, abscisic acid, ethylene and) in plant development.	
Unit-III	
1. Washing and preparation of glassware and other required containers. 2. Methods of sterilization of tools and required useful things, culture media and explants, 3. packing and sterilization, media sterilization, surface sterilization, 4. Aseptic workstation, precautions to maintain aseptic conditions.	7.5 Hrs
Unit-IV	
1. Callus culture, Plant regeneration, 2. Micropropagation, 3. Anther culture, 4. Embryo and Endosperm culture. 5. Somatic embryogenesis, 6. Protoplast isolation and culture.	7.5 Hrs

Suggested activity:

Seminar, quiz, debate, assignments, collection of required explants and other biological material from local area, field work, study projects, models etc. are part of Curriculum and considered along with presenty for Continuous Internal Evaluation (CIE)

List of Books / Online Resources

1. MK Razdan, 2019, Introduction to Plant tissue culture
2. SP Mishra, 2020, Plant tissue culture
3. TB Jha and B Ghosh, 2016, Plant tissue culture, PLATINUM PUBLISHERS
4. Plant Cell and Tissue culture: A laboratory Manual, SPRINGER PUBLICATION

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
3	GE	Refer to GE Basket		2	--	--	2	2	40	10	20

B. Sc. Semester-II

Identification of Angiospermic Plant (B-BO126P)

Course Outcomes:

By the end of this course, the students will be able to:

1. Describe morphology of flowering plants.
2. Learn the technique of Herbarium.
3. Learn to use flora for Identification of flowering plants.
4. Learn the technique of Identification of flowering plants.
5. Understand identification of plant families

Laboratory Exercise	Hours: 4 Hours/Week	Marks: 40+10(Internal)=50	Credit: 2

1. To study morphology of different types of Roots and its Modifications with examples
2. To study morphology of different types of Stem and its Modifications with Examples.
3. To study morphology of different types of Leaf and its Modifications with
4. To study phyllotaxy and venation pattern of different leaves with locally available suitable examples.
5. To study of Morphological features of reproductive parts of plant.
6. Study of different types of Inflorescence- i) Racemose, 2) Cymose, 3) Special types
7. To study structure of typical flower.
8. To study accessory whorls of flower-Calyx and Corolla with modifications
9. To study essential whorls of flower Androecium and Gynoecium with Modifications.
10. To study types of fruits-Simple, aggregate and composite with suitable examples.
11. Describing commonly available flowering plant in technical language (*Hibiscus rosa-sinensis*, and *Brassica compestris*).
12. Study of dicot families: Brassicaceae, Caesalpiniaceae and Fabaceae.
13. Study of dicot families: Solanaceae, and Convolvulaceae.
14. Study of monocot family: Liliaceae.
15. Identification of plant by-a) Flora (Minimum 4 Plants).
16. Herbarium technique

Suggested activity:

Seminar, Quiz, debate, Assignments, collection of Angiospermic plant and study of higher plants preparation of herbarium and visit to local area, Field work, Study Projects, Models etc. are Part of Curriculum and considered along with attendance for Continuous Internal Evaluation (CIE)

B. Sc. - SEMESTER –II BOTANY PRACTICAL

VSEC Course Laboratory Exercise (B-BO126P)

Time: ~~4~~ ~~6~~hrs. **Max. Marks: 40**

1.	Describe the given plant material **(A)**in technical language and identify the family.	**10 Marks**
2.	Describe the modifications of leaf/stem material **(B)**.	**8 Marks**
3.	Prepare a family key of given plant material**(C)**	**6 Marks**
4.	Identify the given plant species **(D)**using flora	**5 Marks**
5.	**Spotting:** **E.** Vegetative Morphology **F.** Floral morphology **G.** Types of Inflorescences **H.** Type of fruit.	**4 Marks**
6.	Viva-voce	**3 Marks**
7.	Practical Record and tour report (submission is compulsory)	**4 Marks**

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
4	VSEC	Refer VSC Basket	-------	--	--	4	2	4 - 6	40	10	25

B. Sc. Semester-II

Plant Tissue Culture (B-BO127P)

Objective: to make students aware of tools and technique of plat tissue culture

Course Outcomes: By the end of this course, the students will be able to:

1. Understand the requirements of Plant tissue culture.
2. Understand Preparation of M. S. Medium.
3. Get the hands-on skills of sterilization.
4. Discuss the inoculation and incubation technique.
5. Understand the technique of plant tissue culture.

Laboratory Exercise	**Hours: 4 Hours/Week**	**Marks: 40+10(Internal)=50**	**Credit: 2**

1. Preparation of laboratory for Plant Tissue Culture.
2. Preparation of M. S. Medium.
3. Sterilization of M. S. Medium and apparatus for plant tissue culture technique.
4. Pouring of sterilized medium into test tubes and culture tubes under aseptic condition.
5. Sterilization of various explants.
6. Inoculation of various explants.
7. Incubation of various explants to induce Callus formation.
8. Callus to Plant Regeneration.
9. Micropropagation of important crop plants.
10. Hardening / acclimatization of regenerated plants.
11. Anther culture technique.
12. Embryo culture technique.
13. Endosperm culture technique.
14. Somatic embryogenesis technique.
15. Isolation of protoplast form suitable method.

Suggested activity:

Seminar, Quiz, debate, Assignments, Field work, Study Projects, Models etc. are Part of Curriculum for all units.

B. Sc. - SEMESTER –II BOTANY PRACTICAL

VSEC Course Laboratory Exercise (B-BO127P)

Time: 4 ~~-6~~hrs. **Max. Marks: 40**

1. Sterilize the given plant material **(A)**and inoculate on culture medium. **10 Marks**
2. Demonstrate pouring of M. S. medium **(B)** under aseptic condition. **5 Marks**
3. Demonstrate Anther culture from given material**(C)**under aseptic condition. **8 Marks**
4. Isolate protoplast from given material **(D)**. **5 Marks**
5. **Spotting:** **4 Marks**
   E. sterilization Instrument
   F.Callus induction/Micropropagation
6. Viva-voce **3 Marks**
7. Practical Record and tour report (submission is compulsory) **5 Marks**

B. Sc. Semester-II

(B-BO128T)

Indian knowledge system

IKS- Theory	**Hours: 2 Hours/Week**	**Marks: 40+10=50**	**Credits: 2**

Module I

Course Objective:

1) To promote interdisciplinary research on all aspects of IKS,
2) Preserve and disseminate IKS for further research and societal applications,
3) Actively engage for spreading the rich heritage of our country and traditional knowledge in the field of Arts and literature, Agriculture, Basic Sciences, Engineering & Technology, Architecture, Management, Economics, etc.

Course outcome:

1) Establish, guide and monitor subject-wise interdisciplinary research groups comprising of researchers from institutes, centers and individuals.
2) Create and promote popularization schemes.
3) Create and promote popularization schemes.

Module I

History of Science in India: In this lecture, we will discuss India's contributions to the world of science are generally either under-represented or misrepresented. In this lecture, we will offer an introduction to the field, starting with a general historical context to developments in astronomy, mathematics and chemistry. **History of Technology in India:** India's technological achievements are generally better known, yet remain underrepresented. In this lecture, we will deal with agriculture, urbanism, early craft techniques and metallurgy. We will also cover topics such as constructions, transport, textiles, paper and writing, along with some miscellaneous technologies. Water management was given special importance and produced a variety of systems and devices.	7.5 Hrs

Module II

India and the World – I: In this lecture, we will discuss how India has shaped the world, and how the world has shaped India. We will examine how India richly	7.5 Hrs

interacted with other cultures and civilization. We will explore exchanges, channels and methods of influence with Mesopotamia, Egypt and Greece.	
Module III	
India and the World – II: In this lecture, we will discuss how India has shaped the world, and how the world has shaped India. We will examine how India richly interacted with other cultures and civilization. We will discuss the exchanges with central Asia and China and with South East and Far-East Asia	7.5 Hrs
Module IV	
Ayurveda – In this lecture, we will discuss the chief characteristics of Indian medical and health tradition. We will discuss how Ayurveda is perhaps the earliest form of Integrative Medicine practiced by humanity. **Historical Evolution of Medical Tradition in India:** In this lecture, we will cover many health-related topics, including plural medical systems, Ayurveda and other forms of traditional Indian medicine, health and environment, religion and healing. We will trace the evolution of Indian medical tradition by discussing the prominent Ayurvedic *acharyas* and texts of the ancient period.	7.5 Hrs

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