I B.Sc BOTANY

GOVERNMENTARTSCOLLEGE FOR WOMEN (Autonomous)

Accredited with B^{++} by NAAC

PUDUKKOTTAI – 622 001

DEPARTMENT OF BOTANY

UNDER – GRADUATE PROGRAMME IN BOTANY

Courses of Study & Syllabus (Choice Based Credit System)

2021– 2022

GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PUDUKKOTTAI

DEPARTMENT OF BOTANY

Board Meeting : 27.03.2021 **Time : 10.00 A.M.**

MEMBER OF THE BOARD OF STUDIES

1. EXTERNAL MEMBERS :

S.No.	Experts	Name of the Board member	Official Address
1	University Nominee	Dr. C.Chandran Associate Professor Department of Botany	AVVM Sri Pusham College, Poondi– 613503 Thanjavur
2	Subject experts	1. Dr. D.Amish Abragam Associate professor, Dept. of Botany,	St.John's College, ManonmaniamSundaranar University, Palayamkottai-627002
3.	Industrialist	Dr. M. Marimuthu, Associate Professor. ADAC & RD	NavalurKuthapattu Trichy-27
4	Allumini	D.Pandimeenal	Teacher, Govt.Higher secondary school Karaikudi.

GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PUDUKKOTTAI

DEPARTMENT OF BOTANY

Board Meeting: 27.03.2021 Time: 10.00 A.M.

MEMBER OF THE BOARD OF STUDIES

1. **INTERNAL MEMBERS** :

Principal : Dr. B.Buvaneswari.

S.No.	Experts	Name of the Board member	Official Address
1.	Chairman	Dr.A.Nural Shiefa Assistant Professor and Head, Dept. of Botany,	Govt.Arts College for Women (Autonomous) Pudukkottai – 622 001
2.	Faculty Members	Dr. M.Ezhilvani Guest Lecturer in Botany Mrs.D.Sasikala Guest Lecturer in Botany Mrs.G.Gayathri Guest Lecturer in Botany	Govt.Arts College for Women (Autonomous) Pudukkottai – 622 001

GOVERNMENT ARTS COLLEGE FOR WOMEN (Autonomous)

PUDUKKOTTAI – 622 001

UG COURSE PATTERN – CBCS

PART	COURSE	NO. OF PAPERS	INST. / HRS	CREDIT	TOTAL MARKS
I	Language - Tamil	4	24	12	400
II	Language - English	4	24	12	400
III	CORE COURSE	Hours		Credits	Total Marks
	CORE COURSE	15	73	69	1500
	Allied Course	6	29	18	600
	Major Based Elective	3	14	12	300
IV	Non- Major Elective	2	4	4	200
IV	Skilled Enhancement course				
	VB	1	2	2	100
	ES	1	2	2	100
	YOGA	1	1	1	100
	GS	1	1	1	100
	EXA	-	-	1	-
TOTAL		41	180	140	4100

Course pattern for UG Botany programme

Sem	S.no	Part	Code	Course Code	Course title	Inst Hrs	Credit	CIA + SE	Marks
I	1	I	LC-1	21UT1	Language	6	3	25+75	100
	2	II	ELC-1	21UE1	English	6	3	25+75	100
	3	III	CC-1	21UBO01	Plant Diversity I	6	5	25+75	100
	4	III	CC/Lab	21UBO2P	Core practical I – Plant Diversity I	4	4	25+75	100
	5	III	FAC-1	21UACB1	First allied – Chemistry I	6	3	25+75	100
	6	IV	AEC-VB	21UVB	Value Education	2	2	25+75	100
					Total	**30**	**20**		**600**
II	7	I	LC-2	21UT2	Language	6	3	25+75	100
	8	II	ELC-2	21UE2	English	6	3	25+75	100
	9	III	CC-III	21UBO03	Plant diversity II	5	5	25+75	100
	10	III	CP-1I	21UBO4P	Core practical –II - Plant diversity II	4	4	25+75	100
	11	III	FAC-II	21UACB2	First allied – Chemistry II	5	3	25+75	100
	12	III	FAC-III	21UACB3P	First allied – Chemistry I & II Practical	4	3	75+25	100
					Total	**30**	**21**		**600**
III	13	I	LC-3	21UT3	Language	6	3	25+75	100
	14	II	ELC-3	21UE3	English	6	3	25+75	100
	15	III	CC-5	21UBO05	Anatomy and Embryology	6	5	25+75	100
	16	III	CC-6	21UBO6P	Core practical III - Anatomy and Embryology	5	5	25+75	100
	17	III	SAC-1	21UAZ1	Second allied – Zoology I	5	3	25+75	100
	18	IV	AEC-ES	21UES	Environmental Science	2	2	25+75	100
					Total	**30**	**21**		**600**
			SS1	**21USS1**	**Floriculture**	-	**2**	**25+75**	**100**
IV	19	I	LC-4	21UT4	Language	6	3	25+75	100
	20	II	ELC-4	21UE4	English	6	3	25+75	100
	21	III	CC-7	21UBO07	Horticulture and Plant Breeding	4	4	25+75	100
	22	III	CP-8	21UBO08P	Core Practical – Horticulture and Plant Breeding	3	3	25+75	100

	23	III	SAC-2	21UAZ2	Second allied – Zoology II	5	3	25+75	100
	24	III	SAC-3	21UAZ3P	Second allied – Zoology Lab	4	3	25+75	100
	25	IV	SEC-1	21UBOSE1	Mushroom Culture	2	2	25+75	100
					Total	**30**	**21**		**700**
			SS2	21UBOSS2	**Forestry**		**2**	**75+25**	**100**
V	26	III	CC-9	21UBO09	Morphology and Taxonomy of Angiosperms	5	5	25+75	100
	27	III	CC-10	21UBO10	Genetics and Evolution	5	5	25+75	100
	28	III	CC-11	21UBO11	Plant ecology and Phytogeography	4	4	25+75	100
	29	III	CP-12	21UBO12P	Core Practical –Morphology and Taxonomy of Angiosperms, Genetics and Evolution, Plant ecology and Phytogeography	5	5	25+75	100
	30	III	ME-I	21UBOME1	Major Elective course I – Medicinal Botany	4	4	25+75	100
	31	IV	SEC-2	21UBOSE2	Plant Wealth for Human Life	2	2	25+75	100
	32	IV	SEC-3	21USS1	Soft Skill	2	2	25+75	100
	33	IV	NME-1	21UB0NME1	Botanical Garden and Land Scaping	2	2	25+75	100
	34	IV		21USB1	YOGA	1	1	25+75	100
					Total	**30**	**30**		**900**
VI	35	III	CC-13	21UBO13	Cell and Molecular Biology.	5	5	25+75	100
	36	III	CC-14	21UBO14	Plant Physiology and Biochemistry.	6	5	25+75	100
	37	III	CP-15	21UBO15P	Core Practical -Cell and Molecular Biology, Plant Physiology and Biochemistry,	6	5	25+75	100
	38	III	ME-2	21UBOME2	Elective course 2 - Biostatistics and Computer application in Botany	5	4	25+75	100
	39	III	ME-3	21UBOME3	Elective course 3 –Plant Biotechnology and Genetic Engineering	5	4	25+75	100
	40	IV	NME-2	21UBONME2	Preservation of Fruits and Vegetables	2	2	25+75	100
	41	V	GS	21UGS	Gender Studies	1	1	25+75	100
	42	V	EXA	21UEXA	Extension Activities	-	1	-	-
					Total	**30**	**27**		**700**
					Gross total	**180**	**140**		**4100**

Self Study Course : 2 Self Study Course Total : 200 Total credits : 4

Programme Outcomes – UG Science

Upon completion of B.Sc degree programme, the graduate will be able to

PO1	Acquire fundamental knowledge of Mathematics, Physical, Chemical, Life Sciences and Computing to identify, formulate and obtain solutions for the Scientific problems.
PO2	Relate scientific ideas with practical experience in various fields and develop skills to implement new scientific techniques.
PO3	Apply analytical, creative and problem solving skills to plan, execute and report the results of theoretical and experimental investigations.
PO4	Explore technical knowledge and improve communicative skills to pursue higher education and excel as entrepreneurs.
PO5	Integrate professional, ethical and social issues and interpret the benefits, limitations of science and its application in technological developments.

Programme Specific Outcomes (PSOs)

The student graduating with the Degree B.Sc. Botany should be able to acquire		
PSO 1	**Core competency**	The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants. The students will also be able to explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level.
PSO 2	**Practical skills**	Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany like Interpreting plant morphology and anatomy, Plant identification and range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry.
PSO 3	**Scientific Knowledge**	Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.
PSO 4	**Environment and sustainability**	Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO 5	**Ethics**	Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

KALAIGNAR KARUNANIDHI GOVERNMENT ARTS COLLEGE FOR WOMEN
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III	CORE COURSE	Hours		Credits	Total Marks
	CORE COURSE	15	73	68	1500
	Allied Course	6	29	18	600
	Major Based Elective	3	14	12	300
IV	Non- Major Elective	2	4	4	200
IV	Skilled Enhancement course VB ES YOGA	1 1 1	2 2 1	2 2 2	100 100 100
	GS EXA	1 -	1 -	1 1	100 -
TOTAL		41	180	140	4100

Course Pattern for Allied Botany Programme

Semester	Part	Course Code	Course title	Instrn. Hrs	Credit	Exam Hrs	SE + CIA
I	III	21UAB1	Allied Botany course I – Plant diversity			3	75+25
		21UAB2P	Allied Botany course II Practical – Plant Diversity, Anatomy, Embryology, Cytology, Genetics, Ecology, Evolution, Plant Physiology and Plant Biotechnology	3	-	-	-
II	III	21UAB4P	Allied Botany course II Practical – Plant Diversity, Anatomy, Embryology, Cytology, Genetics, Ecology, Evolution, Plant Physiology and Plant Biotechnology	3	4	3	75+25
		21UAB3	Allied Botany course III - Anatomy, Embryology, Cytology, Genetics, Ecology, Evolution, Plant Physiology and Plant Biotechnology	4	3	3	75+25
			Total				

COURSES OFFERED BY THE DEPARTMENT

Core Courses

1. Plant diversity I
2. Core practical I – Plant Diversity I
3. Plant Diversity II
4. Core Practical – II Plant Diversity II
5. Anatomy and Embryology
6. Core Practical III –Anatomy and Embryology.
7. Horticulture and Plant Breeding
8. Core Practical IV – Horticulture and Plant Breeding
9. Morphology and Taxonomy of Angiosperms
10. Genetics and Evolution.
11. Plant Ecology and Phytogeography.
12. Core Practical V – Morphology and Taxonomy of Angiosperms, Genetics and Evolution, Plant Ecology and Phytogeography.
13. Cell and Molecular Biology
14. Plant Physiology and Biochemistry
15. Core Practical VI – Cell and Molecular Biology, Plant Physiology and Biochemistry.
16. Bionanotechnology
17. Biopesticides.
18. Seed Technology.

Elective Courses

1. Medicinal Botany
2. Biostatics and Computer Application in Botany
3. Plant Biotechnology and Genetic Engineering
4. General Microbiology

Non Major Elective Courses

1. Botanical Garden and Land Scaping
2. Preservation of Fruits and Vegetables
3. Nursery Technology

Skill Enhancement Course

1. Mushroom Culture
2. Plant Wealth for Human Life
3. Organic Farming

Self Study course

1. Floriculture
2. Forestry

Course pattern for UG Botany programme

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	42	V	EXA	21UEXA	Extension Activities	-	1	-	-
					Total	**30**	**27**		**700**
					Gross total	**180**	**140**		**4100**

Self StudyCourse : 2 Self Study Course Total : 200 Total credits : 4

CORE COURSE I

PLANT DIVERSITY - I: ALGAE, FUNGI, LICHENS AND PLANT PATHOLOGY

SEMESTER - I **HOURS / WEEK 6**

CODE 21UBO01 **CREDIT 5**

Course Objectives

1. To study the structure and reproduction of certain selected algae.
2. To acquire knowledge about general characters and classification of fungi and structure of genera mentioned in the syllabus.
3. To acquire knowledge on the structure and reproduction of genera mentioned in syllabus
4. To understand the types, distribution, structure and reproduction of Lichens.
5. To learn the different pathogenic organisms of plants causing various diseases.

UNIT I: ALGAE

1.1 General Characters

1.2 F.E. Fritsch's Classification

1.3 Life Cycles: (a) Haplontic (b) Diplontic (c) Diplohaplontic (e) Hablobiontic (f) Diplobiotic

1.4 Economic Importance: (a) Food (b) Agriculture (c) Industry (e) Medicine (f) Sewage Treatment-Harmful effects

Unit II: ALGAE - TYPE STUDY

2.1 Thallus organization: 2.1.1 Unicellular –Chlorella, Diatoms., 2.1.2 Colonial – Volvox., 2.1.3. Filamentous – Anabaena, Nostoc, Oedogonium., 2.1.4. Siphonous-*Caulerpa*, 2.1.5.Parenchymatous-*Sargassum, Gracilaria*.

2.2 Asexual and sexual reproduction

2.4 Life cycles: haplontic-, *Oedogonium*, diplontic-Diatoms, diplohaplontic-*Ulva* and diplobiontic-*Gracilaria*

Unit III: FUNGI

3.1 Fungi - General Characters

3.1.1. Alexopolus Classification

3.1.2. Mycelium: (a) Aseptate Mycelium (b) Septate Mycelium (c) Septal pore

3.1.3. Reproduction: (a) Asexual (b) Sexual

3.1.4 Economic Importance

3.2 Lichens - General characters

3.2.1. Thallus Structure:(a) Crustose (b) Foliose (c) Fruticose

3.2.2. Structure and reproduction of Usnea

UNIT : IV FUNGI - TYPE STUDY

4.1 Characteristic features, thallus organization, structure, reproduction and life-history of following species

4.2 Zygomycotina (*Mucor, Rhizopus*),

4.3 Ascomycotina (*Aspergillus, Saccharomyces)*,

4.4 Basidiomycotina (*Agaricus, Pleurotus,*)

4.5 Deuteromycotina (*Cercospora, Alternaria*).

UNIT : V PLANT PATHOLOGY

5.1. Definition

5.2. Classification of Plant diseases

5.3. Study of the following diseases with reference to casual agents, symptoms, and preventions and control methods.

5.3.1. Tikka Disease of Groundnut

5.3.2. Tobacco Mosaic virus

5.3.3. Citrus Canker

5.3.4. Red rot of Sugarcane

Course Outcomes

On completion of the course, students are able to:

1. Understand the diversity among Algae.
2. Identify the internal and external structure of Algae
3. To explain about structure, reproduction, life cycle and economic importance of Algae and Fungi.
4. To impart knowledge about the general Characteristics and economic importance of Algae and fungi.
5. To classify different plant diseases and their symptoms and its effect on economy of crops.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**		**Title of the Course**			**Hours**			**Credit**	
I	**21UBO01**		**PLANT DIVERSITY - I**			**6**			**5**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 49						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

REFERENCES:

TEXT BOOKS

Algae

1. Sharma. O.P (1990) - Text Book of Algae, Tata Mc Graw Hill Publishing Co, Ltd., New Delhi.
2. Pandey, B.B(1993) - A Text Book of Botany - Algae, S. Chand & Co. (P) Ltd, New Delhi.

Fungi

1. Vashista, B.R. (1969) Botany for Degree students. Part II. Fungi. S. Chand and Co.
2. Sharma, O.P. Text Book of Fungi. Tata McGraw Hill Publishing Co.,New Delhi.

Plant Pathology

1. Sharma, D. (1996) : Plant Pathology Rastogi Publications, Meerut, India-188pp.,
2. Pandey, B.P. (1997) : College Botany Vol.I. Including Algae, Fungi,Lichens,Bacteria, Viruses, Plant Pathology, Industrial Microbiology & Bryophyta S. Chand & Co., New Delhi, India.

REFERENCES BOOKS

1. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
2. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
3. Smith, G.M (1955) - Cryptogamic Botany (Vol. I - Algae, Fungi & Lichens), Mc Graw Hill Book Co, New York.
4. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
5. Trainor, F.A (1978) - Introductory Phycology, John Wiley.
6. Rangaswami, G. &A. Mahadevan (1998) : Diseases of Crop Plants In India (4th Edition) Prentice Hall of India (P)Ltd., New Delhi.

Related Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382
2. https://swayam.gov.in/nd2_cec20_bt11/preview 2 https://www.mooc-list.com/course/introduction-algae-coursera
3. htpps://diatom.ansp.org
4. http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html

CORE COURSE II **CORE PRACTICAL - I**

PLANT DIVERSITY I

SEMESTER - I **HOURS / WEEK 4**

CODE : 21UBO2P **CREDIT 4**

Course Outcomes

1. To develop skills to identify algae based on habitat, thallus structure and the internal organization..
2. To enable students to identify microscopic and macroscopic fungi.
3. To prepare microslides of algae, fungi and lichens.
4. To learn symptoms of various plant diseases

Detailed study of the following genera:

Algae:

(a)Nostoc (b) Volvox(c) Diatoms (d) Dictyota(e) Polysiphonia

Fungi:

(a) Saccharomyces (b)Mucor (c) Penicillium (d) Agaricus (e) Polyporus

Lichen:

(a) Crustose (b) Foliose (c) Frutiose

Plant Pathology:

(a) Tobacco Mosaic Virus, Citrus canker, Red rot of Sugarcane, Little leaf of Brinjal,

CORE COURSE III

PLANT DIVERSITY- II

BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERM and PALEOBOTANY

SEMESTRER II **HOURS/WEEK 5**

CODE: 21UBO03 **CREDIT 5**

General Objectives

1. To understand the salient features of Bryophytes

2. To Study of Stellar types, Heterospory and seed habit and members of Pteropsida.

3. To learn about the classification of Pteridophytes, evolution of stele and life cycle of Selaginella, Psilotum and Equisetum.

4. To gain knowledge about of classification of Gymnosperm and general characters of Cycas, Pinus and Gnetum.

5. To Explore Paleobotany, Geological time scale, fossil studies, techniques of carbon dating and few types

UNIT – I : BRYOPHYTE

1.1 General Characters

1.2 Rothmaler's Classification

1.3 Study of Selected Bryophyte species in the following aspects without Reproduction and Lifecycle (a)Riccia (b)Anthoceros (c)Funaria

1.4 Habit and habitat,

1.5 External and internal structure

1.6 Reproduction and life cycle (Development not required)

Unit II : PTERIDOPHYTES

2.1 General characters

2.2 Sporne's Classification

2.3 Stelar Types

2.3.1. Haplostele and Actinostele

2.3.2. Plectostele and mixed stele

2.3.3. Siphnostele: (a) Ectophloicsiphnostele (b) Ambphiphloicsiphnostele

2.3.4. Solenostele: (a) Ectophloicsolenostele (b) Ambphiphloicsolenostele

2.3.5. Distele and Polystele

2.4 Apospory - Apogamy

2.5 Heterospory

2.6 Seed habit

Unit III- PTERIDOPHYTES- TYPE STUDY

3.1 Habit and habitat,

3.2 External and internal morphology Structure,

3.3 Asexual and sexual reproduction

3.4 Life cycles (Development not required): (a) Psiltoum (b) Selaginella(c)Equisetum (d)Azolla

UNIT IV : GYMNOSPERMS

4.1 General characters

4.2 Sporne's Classification

4.3 Economic Importance: (a) Food (b) Medicine (c) Timber

4.4 Habit and habitat

4.5 External and internal structure,

4.6 Reproduction - asexual and sexual

4.7 Life Cycles (Development not required).: (a) Cycas (b) Pinus (c)Gnetum

Unit V: PALEOBOTANY

5.1 Fossils - Definition

5.2 Methods of fossilization

5.2.1. Petrifactions

5.2.2. Compressions

5.2.3. Impressions

5.3 Geological time scale

5.4 Radio carbon dating

5.5 A study on fossil forms: (a) Rhynia(b)Lepidodendron (c) Lyginopteris

Course Outcomes

On completion of the course, students are able to:

1. To understand the morphological diversity of Bryophytes.

2. To describe the Heterospory and seed habit and life cycle of Pteridophytes.

3 Gain in depth knowledge about Pteridophytes classification, evolution of stele and life cycle of Psilotum, Selaginella, Lycopodium and Equisetum..

4. To interpret the evolutionary trends and affinities of living gymnosperms with respect to external and internal features

5. To impart knowledge about the fossil, fossilization and geological time scale.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course	Hours	Credit
I	21UBO03	PLANT DIVERSITY - II	5	5

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 47						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

Bryophytes

1. Gupta, S.K. (1978) - Introductory Botany Vol II - Bryophyta and Gymnospems. KedarNath Ram Nath Publisher, Meerut.
2. Vashishta, B.R. (1983) - Botany for degree student -Bryophyta, S.Chand& Co, New Delhi.

Pteridophytes

1. SundaraRajan, S. (1994) : Introduction to Pteridophyta New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi, Bangalore, Bombay, Calcutta,Guwahati, Hyderabad, Lucknow, Madras, Pune, London
2. Vashista, P.C. (1997) : Botany for Degree Students-Pteridophyta. S. Chand & Co., New Delhi.

Gymnosperms

1. Sharma, O.P. (1997) : Gymnosperms, Pragati Prakashan, Meerut, India
2. Bhatnagar, S.P. &Alok Moitra (1997) : Gymnosperms New Age International (P)Ltd., Publisher, New Delhi, Bangalore, Calcutta, Chennai, Guwahati, Hyderabad, Lucknow, Mumbai, Pune.

Paleobotany

1. Shukla, A.C. and Misra, S.P. (1975). *Essentials of Paleobotany*. Vikas Publishing House (P) Ltd., New Delhi.
2. Stewart, W.N. (1983). *Paleobotany and the Evolution of Plants*. Cambridge University Press, Cambridge, London.

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1. Chopra, G.L (1968) - A Class Book of Bryophyta Hari Singh &Bros.Jnlunder.
2. Prem Puri. M(1981) - Bryophytes-morphology, growth and differentiation.Atma Ram & Sons, New Delhi.
3. Rashid, A (1998) - An Introduction to Bryophyta Vikas Publishin (P) Ltd., New Delhi.
4. Sporne, K.R. 1991.The Morphology of Gymnosperms. B.I. Publications Pvt. Mumbai.
5. Venkatachala, B.S., Shukla, M. and Sharma, M. (1992). *Plant Fossils-a Link with the Past* (*A Birbal Sahni Birth Centenary Tribute*). Birbal Sahni Institute of Paleobotany, Lucknow.

Related Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://courses.lumenlearning.com/boundless-biology/chapter/bryophytes/
2. http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ces_tr/TR129/life_cycle.htm
3. https://www.youtube.com/watch?v=avK7hGnaRAY
4. https://www.youtube.com/watch?v=zZ6XPDDeVwk

CORE COURSE – IV **CORE PRACTICAL - II**

PLANT DIVERSITY II

SEMESTER II **HOURS / WEEK 4**

CODE 21UBO4P **CREDIT 4**

Course Objectives

1. To enable students gain expertise in hand sectioning technique.
2. To study diversity of Bryophytes and Pteridophytes.
3. To learn morphological and anatomical features of Gymnosperms.
4. Develop comprehensive skills in sectioning and micro preparation.
5. Describe the structure of fossil forms prescribed in the syllabus.

Detailed study of the following genera:

Bryophytes:

(a)Riccia(b)Anthoceros(c)Funaria

Pteridophytes

(a) Psiltoum (b) Selaginella(c)Equisetum (d)Azolla

Gymnosperms:

(a) Cycas (b) Pinus (c)Gnetum

Paleobotany

Fossils: Rhynia, Lepidodendron, and Lyginopteris.

Course Outcomes

On successful completion of this course the student will be able to:

1. Recognize the major groups of Non-vascular and Vascular cryptogams
2. Describe the structure of Bryophytes and Pteridophytes forms prescribed in the syllabus.
3. Identify and illustrate the morphological and anatomical features of bryophytes and Pteridophytes.

CORE COURSE V

PLANT ANATOMY AND EMBRYOLOGY

SEMESTER III **HOURS/WEEK 6**

CODE 21UBO05 **CREDIT 5**

General Objectives:

1. To understand various types of tissues present in stem, root and leaves

2. To understand the primary and secondary structure of dicots and monocots with reference to root, stem and leaves

3. To acquire basic knowledge of the structure and development of male and female gametophytes in plants

4. To acquire knowledge on the structure and development of dicot and monocot embryos

5. To study apomixis and polyembryony and their significances

UNIT- I: ANATOMY

TISSUE SYSTEM

1.1 Plant Tissues- Definition

1.1.1. Plant Anatomy - History

1.1.2. Tissue – definition, Characteristics and Classification

1.2. Meristematic Tissue – Definition and Types.

1.2.1. Characteristics, Classification of meristem based on stage of development.

1.2.2. Origin of initiating cells, Position in plant body and function

1.2.3. Organisation – Shoot Apex and Root Apex

1.3. Simple Tissues- Origin

1.3.1. Structure and Function of the following tissues – Parenchyma, Collenchyma, Sclerenchyma.

1.4. Complex Tissues

1.4.1. Xylem and its Components, 1.4.2. Phloem and its Components

UNIT II

EPIDERMAL AND VASCULAR TISSUE SYSTEM, NODAL ANATOMY

2.1 Epidermal Tissue System

2.1.1. Occurrence, Structure, Types and Functions of the following tissues - Epidermis, Stomata and Trichomes.

2.2 Fundamental or Ground Tissue System

2.2.1. Structure and Functions of the following tissues- Cortex, Endodermis, Pericycle and Pith.

2.3. Vascular Tissue System - Primary Vascular Tissues – Structure and Functions of the following tissues-Procambium, Xylem, Phloem and cambium.

2.3.1. Types of Vascular Bundles – Radial, Conjoint-Collateral, Bicollateral, Concentric

2.4. Nodal Anatomy – Definition

2.4.1 Leaf Trace, Leaf Gap,

2.4.2 Types of Nodes- Unilacunar, Trilacunar and Multilacunar

UNIT III:

PRIMARY AND SECONDARY GROWTH, ANOMALOUS SECONDARY GROWTH

3.1. Primary Growth - Definition

3.1.1. Structure of Monocot and Dicot Root, Stem and leaf

3.2. Secondary Growth - Definition

3.2.1. Secondary growth in dicotyledonous stem and root

3.2.2 Annual Rings - Heart Wood and Sap Wood

3.3. Anomalous secondary thickening – Definition

3.3.1. Anomalous secondary growth of the following Genus – Dracaena, Aristolochia & Boerhaavia.

UNIT – IV

EMBRYOLOGY

4.1. Embryology - Definition

4.2. Types of ovules - Orthotropous, Anatropous, Campylotropous, Hemianatropous and Amphitropous.

4.3. Microsporangium – Structure and Development

4.4. Megasporangium – Structure and Development

4.5. Types of Embryo sac –Monosporic, Bisporic and Tetrasporic

UNIT V: POLLINATION, FERTILIZATION, APOMIXIS AND POLYEMBRYONY

5.1. Pollination- Definition

5.1.1. Characteristics, Dehiscence of anther, Pollen transfer

5.1.2. Types of Pollination – Self Pollination, Cross Pollination

5.2 Double Fertilization and Triple Fusion.

5.3 Endosperm- Definition, Characteristics

5.3.1 Types – Nuclear, Cellular, Helobial and Cereal

5.4 Types of Embryo in Dicots (a) Crucifer type (b) Asterad Type (c) Solanad type (d) Caryophyllad type (e) Chenopodial type.

Course Outcome

On completion of the course,students are able to:

1. Understand the organization of cell and tissue system in higher plants.

2. Learn the Epidermal & vascular tissue system, nodal anatomy

3. Acquire knowledge on Anomalous secondary growth in higher plants.

4. Figure out embryology, structure and development of male and female sporangium, micro and mega gametophyte.

5. Solve Self-incompatibility in Pollination and fertilization & relate between Embryo, Endosperm and Seed.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course					Hours		Credit
I	21UBO05	PLANT ANATOMY AND EMBRYOLOGY					6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓		✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches : 45						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

1. Vasishta, P.C. (1977). *A Text Book of Plant Anatomy*. S. Nagin and Co., New Delhi.

2. Annie Ragland (2001). Plant anatomy and Microtechniques. Saras Publication, Nagercoil

Embryology

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). *The Embryology of Angiosperms* (4th Edition). Vikas Publishing House (P) Ltd., UBS Publisher's Distributors, New Delhi.

2. Rogland, A. (2000). *Developmental Botany* (*Embrylogy of Angiosperms*). Saras Publications, Nagercoil.

REFERENCES

1. Krishnamurthy K.V(1980)Wood. Tetrahedron Publications, Trichy.
2. Ray F Evert (1989) Esaus's Plant Anatomy, A John Wiley & Sons., Inc., Publication.

3 . Govindarajalu A (1980) Marangal (Trees). Tamil Nadu Text book Society, Chennai.

4. Fahn A (1997) Plant Anatomy. Pergoman Press, Oxford.

5. Swamy B.G.L & Krishnamurthy K V (1980) from flower to fruit. Tata McGraw Hill publishing Co,. Ltd., New Delhi.

6. Maheswari P (1985) An introduction to the Embryology of Angiosperms. Tata McGraw Hill Publishing Co,. Ltd., New Delhi.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.htm
2. https://www.youtube.com/watch?v=Q1VosdthSLM
3. https://www.youtube.com/watch?v=WfURKyslthI
4. https://www.youtube.com/watch?v=2_Kj_GtWBdU
5. https://www.biologydiscussion.com/stems-2/dicot-stem/secondary-growth-in-dicot-stem-with-diagram/70397
6. https://www.google.com/search?q=neela+bakore+reproduction+in+flowering+plants

CORE COURSE – VI **CORE PRACTICAL - IV**

PLANT ANATOMY& EMBRYOLOGY

SEMESTER III **HOURS/WEEK 5**

CODE 21UBO6P **CREDITS 5**

ANATOMY:

Preparation of transverse section of the following plant parts to observe and record the internal structure.

1. Primary structure of Monocot Leaves, Stems & Roots.
2. Primary structure of Dicot Leaves, Stems & Roots.
3. Secondary structure of Dicot stems & roots.
4. Anomalous secondary thickening in *Nyctanthus*,*Boerhaavia*,*Aristolochia.*
5. Nodal anatomy – Uni & Tri lacunar types.
6. Stomatal structure.

WOOD SCIENCE

1. Microscopic observation of slides of wood components.
2. Photographs of wood types and reaction wood.

EMBRYOLOGY:

1. T.S. of anther at various stages of developments.
2. Study of development stages of Female gametophyte, Monocot & Dicot embryos.
3. Embryo mounting (Dicot embryo only).
4. Photographs of endosperm types.

CORE COURSE VII

HORTICULTURE AND PLANT BREEDING

SEMESTER IV **HOURS/WEEK 4**

CODE 21UBO07 **CREDIT 4**

Course Objectives

1. To understand the aim and objectives of Horticulture

2. To acquire knowledge on various techniques of Horticulture

3. To acquire knowledge on methods of breeding economically important crops

4. To learn hybridization and its applications

5. To understand the importance of floriculture.

UNIT – I

Introduction and Principles of Horticulture:

1.1 Definition of Horticulture.

1.2 Importance of horticulture in terms of economy, production, environmental protection and human resource development.

1.3 Scope for horticulture in India. Nutritive value of horticultural crops.

1.4 Divisions of horticulture with suitable examples and their importance.

UNIT -II

2.1 Propagation: Definition

2.1.1 Methods- Sexual and asexual, advantages and disadvantages of each method.

2.2 Propagation by cuttings:

2.2.1 Definition of cutting,

2.2.2 Different methods of cuttings-semi hard wood, soft wood and herbaceous stem cuttings.

2.3 Plant propagation by layering:

2.3.1 Definition of layering and layer; Types of layering : Ground layering – Tip layering, Simple layering, Trench layering, Mound or Stool layering and Compound or Serpentine layering.

2.4 Plant propagation by grafting: Definition

2.5 Methods of grafting: Side grafting methods- Veneer grafting, Apical grafting methods- Epicotyls grafting- Soft wood grafting.

2.6 Plant propagation by budding: Definition

2.6.1 Methods of budding- budding and Inverted T- budding, patch budding and ring budding.

UNIT – III

3.1 Olericulture : Definition.

3.3.1 Importance of vegetables in human nutrition and national economy.

3.2. Physiological and Biochemical changes during maturation and Ripening

3.3 Methods of storage of fruits and vegetables

3.4 Preservation and value addition of fruits and vegetables

Unit IV : PLANT BREEDING

4.1. Introduction to Plant breeding: 4.1.1. History, 4.1.2. Objective 4.1.3. Importance

4.2. Basic principles of selection methods:

4.2.1. Mass Selection,

4.2.2. Pureline Selection

4.2.3. Clonal selection

4.4. Hybridization - Objectives

4.4.1. Hybridization techniques (a) Choice of parents(b) Emasculation(c) Bagging and Labelling (d) Harvesting and Raising F1 generation

4.5. Heterosis: Definition,

4.5.1. Genetic causes of heterosis (a) Dominance theory (b) Over dominance theory

4.5.2. Physiological causes of heterosis - Effects of heterosis

Unit V- BREEDING METHODS

5.1. Mutation Breeding: Definition – Mutation and Mutagenesis

5.1.1 Types of mutation: (a) Spontaneous(b) Induction -Physical and Chemical

5.1.2. Application and limitation,

5.1.3. Achievements

5.2. Polyploidy in breeding

5.2.1. Types of Polyploidy: (a) Aneuploidy(b) Euploidy(c) Autopolyploidy (d) Allopolyploidy

5.2.2. Application,

5.2.3. Achievements

5.3. Breeding for disease resistance

5.3.1. Disease escape

5.3.2. Disease resistance - Vertical and Horizontal

5.3.3. Mechanisms of Disease resistance: (a) Mechanical(b) Hypersensitivity (c) Antibiosis (d) Nutritional

5.3.4. Achievements

5.4. Breeding for drought tolerance

5.4.1. Mechanisms of Drought Resistance: (a) Drought escapes (b) Drought avoidance

(c) Drought tolerance (d) Drought resistance

5.4.2. Achievements in Drought tolerance

5.5. Plant breeding achievements in India with reference to Rice, Wheat

Course outcomes

On completion of the course, students are able to:

1. Know importance and scope of Horticulture and Plant breeding.

2. Understand the science of plant breeding.

3. To introduce the student with branch of plant breeding for the survival of human being from starvation.

4. To study the techniques of production of new superior crop varieties.

5. Understand the modern strategies applied in Horticulture for crop improvement and the utility of plant resources.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**	**Credit**			
I	**21UBO07**	**HORTICULTURE AND PLANT BREEDING**				**4**	**4**			
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓		✓		✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓		✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 46						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

REFERENCES

TEXT BOOKS

1. George Acquaah (2004). Horticulture Principles and practices. Prentice hall of India Pvt. Ltd., New Delhi.
2. Chowdry R.C. (1991) Introduction to plant breeding. Oxford and IBH publishing house, New Delhi.

REFERENCES

1. Randhawa (1997) Ornamental Horticulture in India. Today and Tomorrow Publishers, New Delhi.
2. Kumar N (1977). Introduction to Horticulture. Rajalakshmi Publications. Nagercoil, India.
3. Sing B.D (1999) Plant Breeding : Principles and Methods. Kalyani Publishers, Nagercoil, India.
4. Vijendra Das L.D (1998) Plant Breeding : Theory and Practice, Oxford & IBH Publishing house, New Delhi.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd2_cec20_bt06/preview
2. https://www.youtube.com/watch?v=8ATRfaiaOLg
3. https://www.google.com/search?q=genetics+princ
4. https://swayam.gov.in/nd2_cec20_ag11/preview
5. https://swayam.gov.in/nd2_cec20_bt13/preview
6. https://swayam.gov.in/nd1_noc20_ce11/preview
7. https://swayam.gov.in/nd1_noc19_ag04/preview

CORE COURSE VIII **CORE PRACTICAL : IV**

HORTICULTURE AND PLANT BREEDING

SEMESTER IV **HOURS/WEEK 3**

CODE 21UBO8P **CREDIT 3**

Course outcome

1. To understand the techniques involved in Horticulture and Plant Breeding

2. To import knowledge in some basic techniques necessary to handle the above objective.

HORTICULTURE

Vegetative propagation techniques

1. Graftings,
2. Budding,
3. Layering

Tools and Implements used in Horticulture.

Bonsai.

PLANT BREEDING

Hybridization Techniques :

1. Emasculations

2. Bagging

Selection procedures through charts from standard text book

1. Mass,
2. Pedigree,
3. Back cross

CORE COURSE IX

MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS

SEMESTER: V **HOURS/WEEK 5**

CODE 21UBO09 **CREDIT 5**

General objectives

1. To study and understand various Angiosperm plant habits.
2. To learn about vegetative and reproductive structural features of Angiosperms.
3. To understand various modifications and its purpose in plant parts.
4. To comprehend the concepts of Plant taxonomy and classification of Angiosperms.
5. To study various Angiosperm families and its economic value.

MORPHOLOGY

Unit I: Vegetative Morphology

1.1. Plant Habits

1.2. Root, Stem, Leaf and its modification

1.3. Leaf structure and its modifications,

1.3.1 Phyllotaxy

1.4. Inflorescence and types

1.4.1 Racemose and Cymose

1.4.2 Special types of Inflorescence.

Unit II: Floral Morphology

2.1 Floral morphology

2.1.1 Types of flowers

2.2 Aestivation

2.3 Types of anthers and arrangement

2.4 Gynoecium – types

2.4.1 Placentation.

2.5 Classification of fruits

2.5.1 Description of simple, aggregate and multiple fruits and examples.

TAXONOMY

Unit III: Taxonomy

3.1 Importance of Taxonomy

3.2 Binomial nomenclature

3.3 Bentham and Hooker's classification, merits and demerits,

3.4 Herbarium - importance and techniques.

UNIT – IV: Angiosperm Families

4.1 A detailed study of Angiosperm families with their economic importance.

4.2 Polypetalae: Annonaceae, Capparidaceae, Sterculiaceae, Rutaceae, Fabaceae, vi) Caesalpineaceae, vii) Cucurbitacea ix) Apiaceae.

UNIT V:

Angiosperm families with their economic importance

5.1 Gamopetalae: Rubiaceae, Asteraceae, Apocynaceae , Asclepiadaceae, Sapotaceae, Lamiaceae, Verbinaceae

5.2 Monochlamideae: Euphorbiaceae, Amaranthaceae,

5.3 Monocotyledon: Liliaceae, Poaceae.

Course outcomes

On completion of this course, the students will be able to:

1. Get a thorough knowledge of descriptive term used in taxonomy and its classification

2. Understand the descriptive characters of floral morphology and fruits type.

3. Know about herbarium techniques, nomenclature, typification, author citation and modern trends in taxonomy

4. To study the salient features of various families mentioned in the syllabus

5. Understand the descriptive characters of families/their pollination methods of Monochlamydeae and Monocot families and their economic importance

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**		**Title of the Course**						**Hours**	**Credit**
V	**21UBO09**		**MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS**						**5**	**5**
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓
Number of Matches : 47						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

TEXT BOOKS

1.Pandey B.P. (1999). Taxonomy of Angiosperms. S. Chand & Co., New Delhi.

2.Sambamoorthy A.V.V.S. & Subramanian N.S. (1989). A Text Book of Economic Botany Wiley astern Ltd., New Delhi.

REFERENCES

1. Krishnamurthy K.V. and Rao K.N.(1976) Angiosperms. Viswanathan publications.
2. Randle A.B. (1979). The classification of flowering plants. Vikas publishing house (P) Ltd., U.P.
3. Lawrence G.H. (1995). Taxonomy of vascular plants. Macmillan Co., USA.
4. Vashista P.C. (1997). Taxonomy of Angiosperms. S. Chand & Co. (P) Ltd., New Delhi.

Sporne, K.R. 1977. The Morphology of Angiosperms. B.I. Publications Pvt., Mumbai.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd2_cec19_bt10/preview
2. https://nptel.ac.in/courses/102/107/102107075/
3. https://www.swayamprabha.gov.in/index.php/program/archive/9
4. https://www.youtube.com/watch?v=qIAoMgHtyOc
5. https://www.youtube.com/watch?v=vMs16X1H4tk

CORE COURSE X

GENETICS AND EVOLUTION

SEMESTER V **HOURS/WEEK 5**

CODE 21UBO10 **CREDIT 5**

General Objectives

1. To understand the basic concepts of mendelian genetics, its variations and applications

2. To understand the types and significance of Linkage and crossing over.

3. To study the basic concept of chromosome morphology and its mutations.

4. To understand the evolution of gene concept.

3. To have a clear knowledge on the various concepts of evolution

UNIT – I

Genetics

1.1 Definition of Genetics,

1.1.1 Scope and importance of genetics, Heredity and Variation.

1.2 Mendel's Laws of inheritance. - Law of segregation, Law of dominance and Law of independent assortment

1.3 Monohybrid cross, dihybrid cross, Back cross and Test cross

1.4 Variation in Dominance- Incomplete dominance, Co-dominance, Lethal factor,

1.4.1 Complementary gene 9:7

1.4.2 Epistasis-Definition and types- Dominant Epistasis (12:3:1), Recessive Epistasis (9:3:4)

1.5 Multiple alleles- Polygenic inheritance- Definition, Kernal Colour in wheat, Skin colour in human 1:8

1.5.1 Blood Group in human, Rh factor.

UNIT – II

2.1 Linkage Definition

2.1.1 Types- complete and incomplete linkage and its Significance of linkage

2.2 Crossing over- Definition

2.2.1 Types –Single, double and Mutiple crossing over and its significance

2.3 Crossing over - Theories about the mechanisms of crossing over- Stern's experiment, Tetrad analysis and Crighton and McClintocks experiment

2.4 Linkage Mapping

2.5 Cytoplasmic inheritance– Kappa particle (Paramaceium)

2.6 Sex linkage – Definition and Drosophilla (Bar eye) and human (colour blindness)

2.7 Sex determination -Definition and Drosophila and human

2.8 Neurospora Genetics

UNIT - III

3.1 Chromosome morphology and Karyotype concept,

3.2 Deletion, Duplication, Inversion, Translocation,

3.3 Position effect; Euploidy, Aneuploidy and Amphiploidy and their implications.

3.4 Types of mutations

3.4.1 Molecular basis of Mutations; Induction of mutations and Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents)

3.4.2 Detection of mutations: ClB method.

3.4.3 Role of Transposons in mutation.

3.5 DNA repair mechanisms.

UNIT – IV

4.1 Evolution of Gene Concept - Classical vs Molecular concepts of gene

4.2 One gene-one enzyme, one gene-one polypeptide hypothesis and beyond

4.3 Cistrons complementation test for functional allelism and gene as unit of function, mutation and recombination, non-coding RNA.

4.4 Allele frequencies, Genotype frequencies,

4.5 Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

Evolution

UNIT – V

5.1 Definition of Evolution - Inorganic, Organic Evolution

5.2 Theories of Evolution of organic forms- Theory of Eternity, Theory of Special creation, Cosmologic theory, Catastrophism and Modern theory

5.3. Theories of Evolution- inheritance of acquired characters (Lamarckism) and natural selection (Darwinism)

5.4 Modern Synthetic Theory

5.5 Isolation - Types of Isolation and Role

5.6 Speciation–Definition, Gradual Speciation - Allopatric Speciation and Sympatric Speciation.

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand the laws of inheritance, genetic basis of loci and allelic and non-allelic interaction.

2. Explain the significance of linkage crossing over and cytoplasmic inheritance.
3. Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
4. Develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.
5. Interpret the concept of Lamarckism, Neo Lamarckism, Darwinism and also understand the concept of natural selection.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**					**Hours**		**Credit**	
V	**21UBO10**	**GENETICS AND EVOLUTION**					**5**		**5**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓		✓	✓	✓	✓	✓	✓
Number of Matches : 48						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

TEXT BOOKS

1. Gupta, P.K. 2100 – Genetics – Rastogi Publication Meerut.
2. Meyyan, R.P. 2100 – Genetics – Saras Publication, Nagercoil.
3. Shukla R.S &Chandal P.S (1996) Cytogenetics, Evolution & Plant breeding. S.Chand& Co., New Delhi.

REFERENCES:

1. Winchester A.M (1958) Genetics. Oxford & IBH publishing house, New Delhi.
2. Jain H.K (1999) Genetics - Principles, concepts & implications. Oxford & IBH publishing house, New Delhi.

3. Gupta P.K (2100) Genetics. Rastogi publications, Meerut, India.
4. Savage J.M (1969) Evolution. Amarimd publishing Co (P) Ltd., New Delhi.
5. Gottlieb L.D & Jain S.K (1988) Plant Evolutionary Biology. Chapman & Hall, London.
6. John Jothi Prakash.E., Principles of Genetics and Genetic Engineering., Emkay Publication.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. 1 https://swayam.gov.in/nd2_cec20_bt03/preview
2. https://swayam.gov.in/nd2_cec20_bt07/preview
3. https://swayam.gov.in/nd2_cec20_bt06/preview
4. https://www.google.com/search?q=genetics+principles+of+inheritance+and+variation+neel a+ bakore

CORE COURSE XI

PLANT ECOLOGY AND PHYTOGEOGRAPHY

SEMESTER V **HOURS / WEEK 4**

CODE 21UBO11 **CREDIT 4**

General Objectives

1. To understand the basic concepts of general Geology, Ecology and Phytogeography

2. To know the basic principles of Geology

3. To understand the importance of Ecology

4. To realize the values of plants and animals of the ecosystem and biodiversity.

5. To Highlight plant geography vegetational types of India and phytogeographical regions of India

UNIT I:

1.1 Basic concepts; Levels of organization. Abiotic and biotic Components and their interrelationships and dynamism, homeostasis.

1.2 Soil: Origin; Types and Formation; Composition; Physical, Chemical and Biological components; Soil profile. Types of soils in India.

1.3 Water: States of water in the environment; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Atmospheric moisture; Water in soil; Ground water table.

1.4 Water resources of India

UNIT II:

2.1 Variations in adaptation of plants in relation to light, temperature, water, wind and fire.

2.2 Biotic interactions: Competition: Inter- and intraspecific competition; Ammensalism, heterotrophy; mutualism, commensalism, parasitism; herbivory, carnivory, protocooperation,

2.3 Population ecology: Characteristics and population growth, population regulation, life history strategies.

2.4 Ecological Speciation.

UNIT III:

3.1 Community characteristics: analytical and synthetic; Concept of ecological amplitude; Habitat and niche; Ecotone and edge effect;

3.2 Succession: processes, types; climax concept. Primary vs Secondary succession.

3.3 Ecosystem: Structure; Processes; Trophic organization; Food chains and Food webs; Ecological pyramids.

3.4 Ecosystems of India.

UNIT IV:

4.1 Applied ecology – population and its control

4.2 Atmospheric pollution – particulate matter

4.3 Air pollution - acid rain- radiation pollution- Noise pollution

4.4 Thermal pollution – soil pollution – industrial effects – pesticides

4.5 Water pollution – industrial effects (liquid effluents).

Unit V:

5.1 Principles and models of energy flow; Production and productivity; Ecological efficiencies;

5.2 Biogeochemical cycles of carbon, nitrogen and phosphorus.

5.3 Phytogeography: Principles; Continental drift; Theory of tolerance;

5.4 Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra);

5.5 Phyto-geographical division of India; Local Vegetation.

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand core concepts of biotic and abiotic factors
2. Classify the soils on the basis of physical, chemical and biological components
3. Analysis the phytogeography or phytogeographical division of India
4. Evaluate energy sources of ecological system
5. Assess the adaptation of plants in relation to light, temperature, water, wind and fire.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**						**Hours**		**Credit**
V	**21UBO11**	**PLANT ECOLOGY AND PHYTOGEOGRAPHY**						**4**		**4**
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO5	✓	✓	✓		✓	✓	✓	✓	✓	✓
Number of Matches : 47						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

TEXT BOOKS

1. Sharma P.D (2105) Ecology and Environment. Rastogi Publications. Meerut, India.
2. Mani, M.S. (1974). *Ecology & Biogeography of India*. Dr. W. Junk Publishers, The Haque.

REFERENCES

1. Odum E.P (1970) Fundamentals of Ecology. W.B. Saunders Ltd., UK.
2. Krishnamoorthy K.V. (2104) Advanced text book of biodiversity. Oxford IBH Publishers, New Delhi.
3. Kumar, H.D. (1992). *Modern Concepts of Ecology* (7th Edn.). Vikas Publishing Co., New Delhi.
4. Cain, S.A. (1944). *Foudations of Plant Geography*. Harper & Brothers, N.Y.
5. Good, R. (1997). *The Geography of flowering Plants* (2nd Edn.). Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd2_cec19_hs10/preview
2. https://swayam.gov.in/nd1_noc20_ge16/preview
3. https://swayam.gov.in/nd1_noc20_hs77/preview
4. https://www.youtube.com/watch?v=yXgUn794TVo
5. https://www.youtube.com/watch?v=0zctBpOxRi4

COURE COURSE – XII **CORE PRACTICAL – V**

MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS, GENETICS AND EVOLUTION, PLANT ECOLOGY AND PHYTOGEOGRAPHY

SEMESTER V **HOURS/WEEK 5**

CODE 21UBO12P **CREDIT 4**

MORPHOLOGY:

1. Study of Phyllotaxy and Inflorescence, Flowers (Dicot and Monocot) and Fruit type included in the theory syllabus.

TAXONOMY:

Dissection, Observation, Identification, floral parts, floral formula and floral diagram of families mentioned in the theory syllabus.

Field study of flora – Submission of 20 Herbarium specimens belonging to the families included in the theory syllabus.

Field trip must be done and Herbarium, Field trip and Field note should be submitted.

GENETICS AND EVOLUTION

1. Simple genetic problems in monohybrid crosses, incomplete dominance and lethal genes.
2. Simple problems on dihybrid ratio and interaction of factors.
3. Spotters: Linkage and Crossing over DNA model/ Photograph Evolution (Origin of life, Speciation).

PLANT ECOLOGY, PHYTOGEOGRAPHY

1. Study of morphological and anatomical features of the Hydrophytes, Xerophytes.
2. Study of Pond Ecosystem
3. Study of photographs of food chain, food web and different types of ecological pyramids.
4. Analysis of herbaceous vegetation - by using quadrate and line transect method to find out frequency, density, abundance and interpret the vegetations in terms of Raunkaier‟s frequency formula.

CORE COURSE XIII

CELL AND MOLECULAR BIOLOGY

SEMESTER VI **HOURS/WEEK 5**

CODE 21UBO13 **CREDIT 5**

General Objectives

1. To study the basics of cell and its inclusions

2. To understand the basic concepts of Chromosome morphology and DNA,RNA structure.

3. To have a clear knowledge on the various concepts of molecular biology

4. To study the basic principles of gene regulation in prokaryotes and eukaryotes.

5.To understand gene regulation and chloroplast and mitochondria genome organization.

UNIT – I

1.1 Cell- Definition and types- Prokaryotic cell and Eukaryotic cells

1.2 Plant cell wall – Ultra structure and functions

1.3 Cytoplasm- physical, chemical and biological properties

1.4 Plasma membrane – Ultrastructure, Models (Sand wich and Fluid mosaic model) functions

1.5 Endoplasmic Reticulum – Ultrastructure, types and functions

1.6 Mitochondria- ultrastructure and functions

1.7 Plastids- Types and functions

1.8 Chloroplasts – distribution, Ultrastructure and functions

1.9 Golgi Apparatus – Ultrastructure and functions

2.0 Ribosomes- Ultrasturcture and functions- (a) Prokaryotic Ribosomes (70S) (b) Eukaryotic Ribosomes (80S)

UNIT – II: NUCLEUS

2.1 Nucleus – Ultrastructure and functions

2.2 Chromosomes- types - Euchromatin and Heterochromatin (a) Facultative and (b) Constitutive heterochromatin

2.3 Special types of Chromosomes- (a) Lampbrush chromosomes (b) Polytene chromosomes

2.4 Components and Organization of Nucleic acid– DNA structure and Watson and crick's double helical DNA model and types- DNA -A, B and Z form of DNA

2.5. Ribonucleic acid -mRNA, rRNA, tRNA – Clover leaf model

2.6 Cell division- Amitosis, Mitosis and Meiosis- Occurrence, Processes and Significances

Unit III: Basic Concept of Molecular Biology

3.1. DNA replication Denaturation and Renaturation

3.2.1. Semi-conservative method- Proof for semi-conservative - Meselson and Stahl's Experiment

3.2.3. Rolling circle mechanism 3.2.4. Theta replication

3.3. Semi-discontinuous replications

3.3.1. Unwinding of double helix, RNA primer formation- DNA polymerase in prokaryotes and eukaryotes DNA polymerase I,II,III, Topoisomerase, SSB Protein - Leading strand synthesis, Lagging strand synthesis, Okazaki fragments - Origin of replication - replication fork

Unit IV: Gene Expression

4.1 Central dogma of molecular biology

4.2. Prokaryotic transcription a) RNA Polymerase in prokaryotes (b) Transcription unit (c) recognition of promoter region (d) Initiation of polynucleotide chain (e) Elongation of RNA polynucleotide (f) Termination of transcription

4.3. Eukaryotic transcription - Eukaryotic RNA Polymerases - RNA Polymerase I, II and III - Transcription factors and Promoters, Post Transcription modifications - RNA capping, Poly A tailing, Intron splicing.

4.4. Translation in Prokaryotes - Initiation, Elongation, Termination

4.5. Translation in Eukaryotes – Initiation, Elongation, Termination -. Post Translation modifications - Protein folding, Biochemical modification.

Unit V APPLICATIONS OF MOLECULAR BIOLOGY

5.1 Nucleic acid hybridization

5.1 Blotting techniques 5.1.1 Southern, Northern, Western blotting

5.2 PCR – Principle, Techniques and Applications.

5.3 RFLP - Principle, Techniques, Applications, Advantages and Disadvantages

5.4 RAPD – Principle, Techniques, Applications, Advantages and Disadvantages

5.5 DNA Finger Printing

Course outcomes

On completion of this course, the students will be able to:

1. Understand the basic structure and function of cells and cell organelles.
2. Analyse the structures and chemical properties of DNA and RNA through various historic experiments.
3. Evaluate the experiments establishing central dogma and genetic code
4. Differentiate the regulation of gene expression between prokaryote and eukaryote
5. To apply the techniques involved in molecular biology in research.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course					Hours		Credit
VI	21UBO13	CELL AND MOLECULAR BIOLOGY					5		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches : 48						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

1. Sharma N.S. 2105, Molecular Cell Biology, International Book distributors, Dehradun

2. Verma P.S. and Agarwal V.K. 1986, Cell Biology and Molecular Biology (Cytology) S.Chand and Company, New Delhi

REFERENCES:

1. Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation Blackwell Science, London

2. Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, NewYork

3. Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John wiley and sons, London

4. Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai

5. De. Robertis and De Robertis, 1998, Cell and Moleceular Biology, K.M. Verghese and Company

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd2_cec19_bt12/preview
2. https://nptel.ac.in/courses/102/103/102103012/
3. https://www.youtube.com/watch?v=zufaN_aetZI

CORE COURSE XIV

PLANT PHYSIOLOGY AND BIOCHEMISTRY

SEMESTER VI **HOURS/WEEK 6**

CODE 21UBO14 **CREDIT 5**

General Objectives

1. To overview Plant Physiology concepts, water relation, transpiration in detail

2. To understand the mechanism of photosynthesis and respiration.

3. To have clear knowledge on the role of plant growth regulators and its function

4. To understand the structure and properties of biomolecules

5. To understand the structure of enzymes and significance of secondary metabolites

PLANT PHYSIOLOGY:

UNIT - 1:

1.1.1 Water – properties & role

1.1.1. Structure, Physical and chemical properties

1.1.2. Importance of Water.

1.2 Diffusion – Role in Plants

1.2.1. Kinds of Solution – Hypotonic, Hypertonic and Isotonic

1.2.2. Osmosis – role in plants, Diffusion Pressure Deficit, Turgor Pressure, Osmotic Pressure and Significance.

1.2.3. Plasmolysis – definition, Incipient, Deplasmolysis, Advantages

1.2.4. Imbibition

1.2.5. Mechanism of Absorption of water (i) Types – Active – Osmotic and Non-Osmotic absorption, Passive, Symplastic and Apoplastic absorption.

1.2.5. Factors affecting absorption of water.

1.2.6. Ascent of sap (a) Path of ascent of sap – Ringing Experiment

1.3 Stomatal transpiration : Structure - Mechanism of Stomatal Transpiration (i) Osmotic Diffusion of water in the leaf from xylem to intercellular spaces (ii) Opening & Closing of Stomata

1.3.1. Advantages, factors affecting stomatal movements

1.3.2 Transpiration as a Necessary evil.

1.4 Mineral nutrition of plants : Essential and Non-essential elements, Types- Essential – Major and Minor Elements and its function.

1.4.1. Specific roles & deficiency symptoms of Major and Minor elements.

UNIT - II:

2.1 Radiant energy & its role in photosynthesis

2.1.1. Photosynthesis – definition, significance, Photosynthetic Apparatus

2.1.2. Photosynthetic Pigments, Location, Absorption and utilisation of light energy

2.2. Absorption Spectrum - Absorption Spectra of Chlorophylls, Carotenoids and Phycobilins

2.3 Red drop & Emerson's Enhancement effect

2.4 Photosystems - Types – Photosystem I, Photosystem II

2.5. Mechanism of Photosynthesis - Parts – Light / Hill's Reaction, Dark Reaction - Electron Transport - Photophosphorylation Types – Non-cyclic Photophosphorylation, Cyclic Photophosphorylation - Products of light reaction & their utilization - Dark Reaction - Pathway of C3 Cycle.

2.6 Hatch and Slack Pathway - C4 –Dicarboxylic Acid Pathway and its Significance. -CAM pathway - Crassulacean Acid Metabolism (CAM) -Photorespiration - Glycolate Pathway, Factors affecting photorespiration and Significance.

2.7 Respiration. Definition,

2.7.1 Aerobic and Anaerobic. -Glycolysis - Glycolysis / EMP Pathway -.Krebs cycle -. Krebs / TCA Cycle – pathway

2.8 Electron Transport System & Oxidative Phosphorylation.

UNIT III

3.1 Plant Growth - Growth-Definition, Growth curve, Natural Growth Hormones, GrowthPromoting substances – Auxin, Gibberellins and Cytokinins.

3.2 Auxins – Discovery, Chemical Nature, Physiological effects

3.3 Gibberellins - Discovery, Chemical Nature, Physiological effects

3.4 Kinetin - Discovery, Chemical Nature, Physiological effects 3.4.1 Abscission of leaves - Definition and Mechanism

3.5 Photoperiodism 3.5.1. Definition, Duration of Photoperiod – Short Day, Long Day, Day Neutral, Long Short Day, Short-Long Day Plants. 4.5.2. Photoperiodic Induction- definition, Continuous Inductive Cycle, Dis-Continuous Inductive Cycle 3.5.3. Importance of Photoperiodism

3.6 Phytochrome 3.6.1. Definition, Types- Red light absorbing form(PR), Far-red light absorbing Form(PFR)

3.7 Vernalization 3.7.1. Definition, Perception of the cold stimulus and other conditions. 3.7.2. Mechanism of Vernalization- Phasic development theory, Harmonaltheory.

3.8 Seed dormancy 3.8.1. Definition, factors causing dormancy 3.8.2. Artificial methods of breaking the seed dormancy.

BIOCHEMISTRY:

UNIT - IV;

4.1 Carbohydrates: Nomenclature and classification and isomeric form;

4.1.1 Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.

4.1.2 Lipids: Definition and major classes of storage and structural lipids;

4.1.3. Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties; Phosphoglycerides.

4.2 Proteins: Structure of amino acids;

4.2.1 Levels of protein structure-primary, secondary, tertiary and quaternary;

4.2.3. Protein denaturation and biological roles of proteins.

4.3 Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides;

4.3.1. Types of nucleic acids

4.4 Lipids – Classification, Saturated & Unsaturated fatty acids.

UNIT V

5.6 Enzymes – Structure,

5.7 Mechanism of action,

5.8 Factors affecting Enzyme activity,

5.9 Enzyme inhibitors (Competitive, non- competitive and feedback inhibitors).

5.5 Elementary study of secondary plant metabolites (Phenols, Terpenoids & Alkaloids).

Course Outcomes

On completion of this course, the students will be able to:

1. Understand Water relation of plants with respect to various physiological processes.
2. Explain the significance of Photosynthesis and respiration
3. Assess the role of growth regulators in plants
4. Describe the relationship between the structure and function of biomolecules.
5. Classify the enzymes and explain mechanism of action and structure.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course					Hours		Credit
VI	21UBO14	PLANT PHYSIOLOGY AND BIOCHEMISTRY					6		5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓
Number of Matches : 48						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

Plant Physiology

1. Jain V.K (1990) Fundamentals of Plant Physiology. S.Chand& Co., (P) Ltd., New Delhi.
2. Pandey, S.N. (1991). *Plant Physiology*. Vikas Publishing House (P) Ltd., New Delhi.

Biochemistry

2. Dulsy Fatima, R.P. et. al., (1994). *Elements of Biochemistry*. Saras Publications, Nagercoil, Tamilnadu.
3. Jain J.L (1998) Fundamentals of Biochemistry S.Chand& Co., (P) Ltd., New Delhi.

REFERENCES:

1. Salisbury, F.B. and Ross, C.W. (1999). *Plant Physiology*. CBS Publishers and Printers, New Delhi.
2. Gill, D.S 2100 –Plant Physiology, S.Chand and co., New Delhi.
3. Devlin, R.M. (1969). Plant Physiology. Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.

4. Lehninger, A.L. (1984). *Biochemistry* (2nd Edition). Kalyani Publishers, Ludhiana, New Delhi.

Stryer, L. (1989). *Biochemistrty*. W.H. Freeman & Co., New York, San Francisco.

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3. https://www.austincc.edu/sziser/Biol%201409/1409lecnotes/LNExamIII/Plant%20Physiology-General.pdf
4. https://www.uou.ac.in/sites/default/files/slm/BSCBO-303.pdf
5. http://www.esalq.usp.br/lepse/imgs/conteudo_thumb/Plant-Biochemistry-by-Heldt--2005-.pdf

COURE COURSE – XV **CORE PRACTICAL – VI**

CELL AND MOLECULAR BIOLOGY, PLANT PHYSIOLOGY, BIOCHEMISTRY

SEMESTER VI **HOURS/WEEK 6**

CODE 21UBO12P **CREDIT 5**

PLANT PHYSIOLOGY

1. Determination of water potential by plasmolytic method using salt and sugar in onion and Rheo leaf.
2. Determination of stomatal frequency and index in two different plants.
3. Determination of photosynthetic rate in water plants (*Hydrilla)* under different CO_2 concentrations.
4. Determination of photosynthetic rate in water plants (*Hydrilla*) under different colour lights using WilImot's bubbler.
5. Extraction and separation of leaf pigments.
6. Effect of light and CO2 on photosynthesis.
7. Demonstration experiments:

i. Phototropism,

ii. Geotropism,

iii Ganong's respiroscope

iv Balsam plant experiment

BIOCHEMISTRY

1. Separation of pigments using paper chromatography.
2. Colorimetric estimation of sugars
3. Colorimetric estimation of Starch.
4. Colorimetric estimation of chlorophyll pigments
5. Quantitative estimation of protein
6. Quantitative estimation of aminoacid

Cell and Molecular Biology

Detailed Study:

1. Ultra structure of cell organelles.

2. Study of mitosis in Onion root tip by squash technique

3. Study of meiosis in anthers

4. Isolation and display of polytene chromosomes.

CORE COURSE XVI

BIONANOTECHNOLOGY

SEMESTER	**VI**	**HOURS/WEEK**	**5**
CODE	**21UBO16**	**CREDIT**	**5**

General Objectives

1. To learn the basic knowledge of nanoscience

2. To learn the properties and dimensions of nanoparticles

3. To synthesis green nanoparticles

4. To understand the mechanism of action of nanoparticles

5. To characterize nanoparticles using various techniques

Unit I : Introduction to Nanotechnology

1.1. Nanotechnology - origin, scope and importance.

1.2 Nanoparticles – definition

1.3 Principles: quantization effects - inverse relationship between size and reactive surface area.

1.4 Properties: surface effects, the effects of size, shape, surface and bulk composition, and solubility and persistence.

Unit II :

2.1 Physical, chemical and biogenic synthesis of nanomaterials – biomimetics, green plants, and microorganisms.

2.2 Role of bio molecules - reducing and/or capping agents: proteins, viruses and carbohydrates.

Unit III :

3.1. Detection and measurement of nanoparticles – physical characterization by UV, FTIR, SEM, FESEM, DLS, X-ray diffraction and Zeta potential..

Unit IV:

4.1 Targeted nanoparticles: active & passive targeting.

4.2 Application: medicine, manufacturing & materials, delivery vehicles, cancer therapy, tissue engineering, fluorescent biological labels, biological assays, imaging agents, biosensors, manipulation of cells and biomolecules.

Unit V:

6.1 Interactions between nanoparticles and living systems, interaction with cells, exposure of living systems to nanomaterials - toxicity effects.

6.2 Mediators of the toxicity of particles. Factors influencing the interaction of nanomaterials over mammalian cells: uptake, transport and biodistribution of nanoparticles in living system, toxicity on cellular processes.

6.3 Overview of EU regulatory aspects.

Course Outcomes

On completion of this course, the students will be able to:

1. Understand origin, scope and importance of nanotechnology.
2. Explain the synthesis and properties of nanoparticles.
3. Assess the detection of nanoparticles by using various techniques.
4. Describe the application of nanoparticles in various fields..
5. Interpret the impact of nanoparticle in living system..

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**						**Hours**	**Credit**
VI	**21UBO16**	**BIONANOTECHNOLOGY**							
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓			✓	✓	✓		✓	✓
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓	✓		✓		✓
CO5	✓	✓	✓	✓		✓		✓	✓	
Number of Matches : 40						Relationship : High				

6.

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

References

Text Book

1. Sharon, M. & Sharon, M 2012. Bio-Nanotechnology- Concepts and Applications, CRC Press.

2. Jain, K. K. 2012. Handbook of Nanomedicine, Springer.

References

1. Barbara Panessa-Warren, 2006 Understanding cell nanoparticle interactions making nanoparticles more biocompatible. Brookhaven National Laboratory

2. Bhushan Bharat (Ed.) 2012. Encyclopedia of Nanotechnology, Springer. Chand A, Mirkin, Christof Niemeyer 2007. Nanobiotechnology II: more concept and applications 1st edition Wiley-VCH Publisher.

3. European Commission, SCENIHR, 2006. Modified opinion on the appropriateness of existing methodologies to assess the potential risks associated with engineered and adventitious products of nano technologies, European Union

4. Gysell Mortimer, 2011. The interaction of synthetic nanoparticles with biological systems PhD Thesis, School of Biomedical Sciences, Univ. of Queensland.

5. Iseult Lynch, Anna Salvati & Kenneth A. Dawson, 2009 Protein nanoparticle interactions: What does the cell see? Nature Nano technology 4, 546 - 547 doi:10.1038/nnano.2009.248

6. Jain K.K. Nanobiotechnology molecular diagnostics: Current techniques and application (Horizon Bioscience) 2006 Taylor & Francis 1st edition.

7. Johan Ach, Ludwig Siep 2007. Nano–Bio–Ethics: Ethical dimension of nanobiotechnology by 1st edition lit ver leg publication.

8. Kelsall Robert W, Ian Hamley, Mark Geoghegan, 2004 Nanoscale Science and Technology, Wiley Eastern.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://www.researchgate.net/publication/290714091_Bionanotechnology/link/58c85e9faca2723ab170d244/download
2. https://www.nano.gov/sites/default/files/pub_resource/nni_nanobiotechnology_rpt.pdf

CORE COURSE XVII

BIOPESTICIDES

SEMESTER	**VI**	**HOURS/WEEK**	**5**
CODE	**21UBO17**	**CREDIT**	**5**

Course Objectives

1. To understand the types and mode of action of biopesticides
2. To understand plants as source of natural pesticides
3. To learn moss production techniques of microbial biopesticides
4. To learn insects as biopesticides
5. To learn virus as biopesticide

Unit I

1.1 Biological control of insect pests: scope and principles, factors affecting biological control.

1.2 Biopesticides: introduction, importance and classification – living creatures to control pests – weeds for controlling pest.

Unit II

2.1 Botanical pesticides: present status and future prospects;

2.2 Opportunities for botanical pesticides in crop rotation; multiple cropping for controlling pests.

2.3 Plants as a source of natural pesticides: neem, chrysanthemum, aristolochia, garlic, turmeric and citronella.

Unit III

3.1 Bio control agents: Isolation, identification, mode of action and mass production of Pseudomonas fluorescens (bacterial agent), Trichoderma viride (fungal agent).

Unit IV

4.1 Biological pesticides: isolation, identification.

4.2 Bacterium as bio pesticide (Bacillus thuringiensis).

4.3 Fungus as bio pesticide (Entomophagous - Beauveria bassiana).

4.4 Insect as bio pesticide (Reduviid predators - Rhynocoris kumarii, R. fussipus R. marginatus). Trichogramma.

4.5 Virus as bio pesticide (Baculovirus - NPV).

Unit V

5.1 Production methods of bio pesticides: liquid culture fermentation and solid state fermentation –

5.2 Types of bio pesticide formulations: dry inoculums, granules, pellets, capsules, wettable powder and liquid formulations.

On completion of this course, the students will be able to:

1. Understand the principles and factors of biological control agent..
2. Analyse the status and future prospects of Botanical pesticides.
3. Evaluate the experiments in isolation and identification of biocontrol agent.
4. Differentiate the production methods of bio pesticides.
5. To develop different formulation of bio pesticides in agriculture .

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**					**Hours**		**Credit**
VI	**21UBO17**	**BIOPESTICIDES**							
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓	✓		✓	✓	
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓		✓	✓		✓	✓	✓	✓	✓
CO5	✓	✓		✓	✓	✓	✓		✓	✓
Number of Matches : 43						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

Books

1. Ghosh G K, 2000, Biopesticide and Integrated pest Management, A P H Publishing Corporation, New Delhi.

2. Subba Rao N S, 1982, Advances in Agricultural Microbiology, Oxford &IBH Publishing Company, Chennai.

References

1. Krishna Chandra, Greep and Srivathsa, 2005, Bio Control Agents & Biopesticides,

2. Ministry of Agriculture, New Delhi and Regional Centre of Organic Farming, Bangalore.

3. Franklin R. Hell and Julius J. Menn, 1999, Biopesticides – Use and delivery, Humene Press, New Jersey.

4. D. Dent, 2000, Insect Pest Management 2nd Ed, ABI Publishers, UK

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://www.researchgate.net/publication/277017477_A_Review_of_Biopesticides_and_Their_Mode_of_Action_Against_Insect_Pests
2. https://www.fehd.gov.hk/english/pestcontrol/images/Pestnews_45e(text).pdf

CORE COURSE XVIII

SEED TECHNOLOGY

SEMESTER	**VI**	**HOURS/WEEK**	**5**
CODE	**21UBO18**	**CREDIT**	**5**

General Objectives

1. To learn the basic knowledge of floral biology
2. To learn the methods of seed sampling
3. To analyse the seed purity of various plants.
4. To understand the mechanism of seed viability.
5. To characterize seed certification using various techniques

UNIT - I

1.1 Floral biology. Seed formation.

1.2 Seed morphology and structural details of Dicot (Castor) and Monocot (Paddy) seeds.

1.3 Roles and goals of seed technology, importance of quality seeds in agriculture, characteristics of quality seed.

UNIT - II

2.1 Seed sampling – Method of sampling

2.2 Seed Purity – Seed Germination

2.3 Methods of Seed Germination using paper, Sand or soil

2.4 Standard Germination Test.

2.5 Seed dormancy.

UNIT – III

3.1 Seed viability – Topographical tetrazolium or T2 test embryo excision method.

3.2 Seed moisture Importance – methods of moisture determination basic methods.

UNIT - IV

4.1 Certified seed production of the following Paddy, groundnut, and cotton.

UNIT - V

5.1 Seed certification – objectives

5.2 Fundamental concepts of seed certification

5.3 Sources and classes of seed: Breeder's seed, certified seed.

5.4 Seed analysis – Tagging of seedlings – field standards.

REFERENCES:

1. Agarwal, R.L. Seed Technology Oxford and IBH Publishing Co. Pvt. Ltd.,

2. Bewley J.D. and Black M (Edn) 1985 – Seed Physiology of development and germination, Plenum Press, New York.

Kowslowsky. Seed Biology, Vol. I, Vol. II and Vol. III. Academic Press, New York.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBO18**	**SEED TECHNOLOGY**								
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓		✓	✓		✓	
CO4	✓	✓		✓		✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	
Number of Matches : 40						Relationship : High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

CORE ELECTIVE COURSE I

MEDICINAL BOTANY

SEMESTER	**V**	**HOURS/WEEK**	**4**
CODE	**21UBOME1**	**CREDIT**	**4**

Course Objectives

1. To understand the different Indian systems of medicine
2. To learn classifications of natural drugs
3. To study collection, cultivation and preparation of natural drugs
4. To understand drugs obtained from various parts of the plants
5. To study the process of drug adulteration

Unit I

1.1 History of medicinal plants.
1.2 Traditional medicinal systems: ayurvedha, siddha, unani and aturopathy.
1.3 Definition of drug classification of natural drugs – alphabetical, morphological, taxonomical, chemical and pharmacological.

Unit II

2.1 Ethnobotany – definition major tribes of South India and their ethno botanical and ethnobiological heritage.
2.2 Ethnobotany and conservation of plants with special reference to India.
2.3 Mythology and conservation of ecosystems (sacred groves).

Unit III

3.1 Cultivation, collection and preparation of natural drugs macroscopic (physical and organoleptic characters),

3.2 Therapeutic and pharmaceutical characterization of the following medicinal plants: Adathoda vasica, Aloe vera, Centella asiatica, Piper nigrum, Allium sativum, Curcuma longa,

Ocimum sanctum and Catharanthes roseus.

Unit IV

4.1 Drugs from leaves (Eucalyptus), flower (Eugenia), fruits and seeds (Coriander), roots (Withania), underground stem (Ginger), bark (Cinchona) and wood (Ephedra).
4.2 Cultivation and utilization of selected medicinal plants Bacopa monnieri, Cassia senna, Gloriosa superba, Phyllanthus amarus and Rauvolfia serpentina.

Unit V

5.1 Drug adulteration and types. Drug evaluation: physical, chemical and biological.
5.2 Quality control of herbal drugs. Role of AYUSH and CDRI.

Outcomes

On completion of this course, the students will be able to:

1. Understand Pharmacognosy, different systems of Indian medicines, classification of drugs and chemistry of drugs.
2. Learn about Morphological and Histological studies along with Chemical constituents and uses of few medicinal plants
3. Know about the Drug research, Identification, adulteration and drug evaluation.

4. Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBOME1**	**MEDICINAL BOTANY**				**4**			**4**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓		✓	✓		✓	✓
CO4	✓	✓	✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 45						Relationship : Very High				

5.

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://medicinalplants.insightconferences.com
2. https://en.m.wikipedia.org
3. https://researchguides.uic.edu>c.php

REFERENCES

Text Books

1. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. (2003). Pharmacognosy.Nirali Prakashan, Pune.

References

1. Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. Pointer

Publishers, Jaipur.

2. Harbourne, J. B. (1998). Phytochemical methods: A Guide to ModernTechniques of Plant Analysis (3rd edition). Chapman and Hill Co.,New York.

3. Jain, (2001). Medicinal plants. National Book Trust, New Delhi.

4. John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy.JPR Publication, Vallioor, Tirunelveli.

5. Joshi, S.G. (2001). Medicinal plants. Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.

6. Prajapathi, Purohit, Sharma and Kumar. (2003). A Hand book of Medicinalplants. Agrobios Publications, Jodhpur.

7. Purohit and Vyas, (2004). Medicinal Plants Cultivation. AgrobiosPublications, Jodhpur.

CORE ELECTIVE COURSE II

BIOSTATISTICS, COMPUTER APPLICATION AND BIOINFORMATICS

Semester: VI **HOURS: 5**

Code: 21UBOME2 **CREDITS: 4**

General objectives

1. To Study about Bioinformatics and its role in Biology and sequences used in Bioinformatics.

2. To Impart knowledge on Biological Database and its types.

3. To learn to use computers for biological data management and graphical presentation.

4. To comprehend the need for computer applications, programs and techniques for biology.

UNIT I: BASIC CONCEPT OF BIOSTATISTICS

1.1 Biostatistics 1.1.1. Definition 1.1.2 Scope

1.2. Data 1.2.1. Definition 1.2.2. Types- (a) Primary(b) Secondary 1.2.3. Collection of data

1.3 Population 1.3.1 Definition 1.3.2. Types of population - (a) Finite population (b) Infinite population

1.4 Sample 1.4.1. Definition

1.5 Sampling techniques 1.5.1. Random sampling techniques

1.6 Frequency distribution 1.6.1. Definition 1.6.2. Discrete method & Continuous method 1.6.3. Frequency graphs

1.7. Statistical table 1.7.1. Rules, Organization and types of table

1.8. Graphical Representation of Data 1.8.1. Importance and general guidelines 1.8.3. Types of graphs - (a) Bar (b) Simple(c) Multiple(d) Percentage (e) Subdivided (f) Pie diagram (g) Pictogram (h) Cartogram

1.9. Central Tendency 1.9.1. Mean (a) Definition (b) Merits and demerits (c) Problems 1.9.2. Median (a) Definition (b) Merits and demerits (c) Problems 1.9.3. Mode (a) Definition (b) Merits and demerits (c) Problems

UNIT II: DESCRIPTIVE AND INFERENTIAL STATISTICS

2.1. Measure of dispersion 2.1.1. Definition 2.1.2. Types of dispersion (a) Absolute measure of dispersion (b) Relative measure of dispersion

2.2. Probability 2.2.1. Probability scale, Definition, Types and application of biological problems

2.3. Binomial distribution 2.3.1. Introduction, Definition and Properties of binomial distribution

2.4. Poisson Distribution 2.4.1. Introduction, Definition and Properties of Poisson distribution

2.5. Normal distribution 2.5.1. Introduction, Definition and Properties

2.6. Test of Significance 2.6.1. Introduction, Definition, Procedure and application of chi-square test

UNITIII: FUNDAMENTALS OF COMPUTER

3.1. Computer application in biology 3.1.1. Introduction, Advantages, Evolution and Generations of Computer

3.2. Organization of a computer 3.2.1. Input devices- (a) Keyboard (b) Mouse 3.2.2. Output devices - (a) Monitors (b) Printers

3.3. Computer Memory - RAM and ROM

3.4. Storage devices – Floppy, Compact and Hard Disc

3.5. Central Processing Unit

3.6. Software

3.7. Hardware

UNIT IV: COMPUTER APPLICATIONS

4.1. Computer Network - LAN and WAN

4.2. Data – Representation

4.3. Number Systems- Binary and Arithmetic

4.4. Operating System -Windows

4.5. Word Processing Software - (a) MS Office (b) Word (c) Excel (d) Power point

UNIT V: BIOINFORMATICS

5.1. Bioinformatics 5.1.1. Definition and scope. 5.1.2. Role of Internet in Bioinformatics

5.2. Biological database 5.2.1. Nucleotide sequence database (a) National Centre for Biotechnology Information (NCBI)

5.3. Protein sequence database - (a) Protein Information resources (PIR) (b) Swiss-Plot

5.4. Role of Bioinformatics - Human genome project and *Arabidopsis thaliana*

Learning outcomes:

On completion of this course the students will be able to:

1. Comprehend the fundamental concepts related to descriptive and inferential biostatistics.
2. Know about basics of Bioinformatics and Information technology and their relationship with biology.
3. Gain knowledge about nucleotide sequence database.
4. Understand the usage of various biological Databases.

5. Correlate the gene prediction, , Biomolecular visualization, phylogenetic analysis and drug designing in future studies.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course	Hours	Credit
VI	21UBOME2	BIOSTATISTICS, COMPUTER APPLICATION AND BIOINFORMATICS	5	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO2	✓	✓		✓	✓	✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓	✓	✓		✓	
CO5	✓	✓		✓		✓	✓		✓	✓
Number of Matches : 40						Relationship : High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

References

1. Arora, P.N and P.K. Mahan.Biostatistics, Mumbai,Himalaya, 1998.

2. Gurumani. N. An introduction to biostatistics. 2nd Edition, MJP Publishers, Chennai, India, 2115.

3. PranabkumarBanerjee.Introduction to biostatistics. S. Chand And Company pvt ltd. New Delhi, India, 2114.

4. Rastogi, V.B. Fundamentals of biostatistics. 2nd Edition, Anne Books Pvt Ltd, New Delhi, India, 2109.

5. Manoharan, M. Statistical Methods, theory and Practice, Palani paramount, Palani, 1992.

6. Misra, B.N. and M.K. Misra. Introductory Practical Bio Statistics. DarbariUdyogGananganagar, N-24 Parganas, West Bengal, India, 1989.

7. Palanichamy. S., M. Manoharanand Ramakrishnan P.Statistical methods for Biologists Palani Paramount Publications, Palani, Tamil Nadu, 1995.

8. Ramakrishnan, P. Biostatistics, Saras Publication, Nagarcoil, Tamil Nadu, 2101.

9. Bly, R.W. The Puffin Dictionary of Computer Words. Puffin Books, United Kingdom, 1984.

10. Bryant, T.N. and J.W.T.Computers in Microbiology. Practical Approach Series. (Published in the Practical Approach Series. Editors, D. Rickwood and B.D. Hames.) Oxford University Press. Oxford, New York, 1989.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd2_cec20_bt03/preview
2. https://swayam.gov.in/nd2_cec20_bt07/preview
3. https://swayam.gov.in/nd2_cec20_bt06/preview
4. https://www.classcentral.com/institution/nptel 8 https://nptel.ac.in

CORE ELECTIVE COURSE III

PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

SEMESTER VI **HOURS / WEEK 5**

CODE 21UBOME3 **CREDIT 4**

Objectives:

1. To acquire knowledge on the principles and applications of plant tissue culture
2. To understand the basic concepts of genetic engineering and its applications.
3. To learn the types and application of cloning vectors
4. To study the different types of gene transfer methods
5. To understand the techniques involved in biotechnology and to know about IPR and GM crops.

UNIT – I:

1.1 Laboratory requirements of plant tissue culture

1.2 Preparation of Culture media –(a) Natural medium - Coconut milk (b) Synthetic medium - White medium and MS medium

1.3 Sterilization– Techniques.

1.4 Plant tissue culture techniques- Direct and Indirect.

1.5 Somatic embryogenesis

1.6 Production of synthetic seeds

1.7 Somoclonal variations

1.8 Protoplast isolation – Mechanical, Enzymatic

1.9 Protoplast fusion – Physical, Chemical and Advantages

2.0. GM foods - Varieties of GM foods, Advantages, Disadvantages

UNIT – II

2.1 Restriction Endonucleases (History, Mechanism, and usages in cloning);

2.2 Restriction Mapping (Linear and Circular);

2.3 Ligases enzymes, Cloning Vectors: History, basic sequences of any vector, types of bacterial vectors (pUC18 and pUC19, pBR322, Ti plasmid, BAC);

2.4 Viral vectors including Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors -Yeast vector, (YAC).

UNIT – III

3.1. Genomic and c-DNA libraries

3.2. Gene cloning strategies - Screening of recombinants, Expression of cloned genes

3.3. Methods of Gene transfer - Agrobacterium mediated,

3.4 Direct DNA transfer (I)Micro injection (II) Electroporation (III) Biolistics

UNIT – IV

4.1 Basic concept of Gene cloning, advantages of gene cloning,

4.2 Bacterial Transformation methods and selection of recombinant clones using various strategies, PCR- mediated gene cloning;

4.3 Gene Construct; Plant transformation vector.3.2.1 T-DNA and viral vector.

4.4 Selection of transgenic– selectable marker and reporter genes (Luciferase, GUS, GFP), chloroplast transformation,

4.5 Mutant formation, Maker-free and novel selection strategies.

UNIT – V

5.1 Biosafety concerns with transgenic technology,

5.2 History of transgenic development across the world,

5.3 Major concerns with implementation of transgenic technology in India.

5.4 Applications as Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean);

5.5 Transgenic crops with improved quality traits in major crops - Golden rice. - Improved horticultural varieties (Moondust carnations).- Role of transgenics in bioremediation (Superbug)

Learning outcomes

On the completion of the course the students will be able to

1. Understand the core concepts and fundamentals of plant biotechnology and genetic engineering
2. Develop their competency on different types of plant tissue culture
3. Analyze the enzymes and vectors for genetic manipulations
4. Examine gene cloning and evaluate different methods of gene transfer
5. Critically analyze the major concerns and applications of transgenic technology

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course	Hours	Credit
I	21UBO01	PLANT BIOTECHNOLOGY & GENETIC ENGINEERING	5	4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓		✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches : 46						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

1. Kumaresan V (2107) Biotechnology, Saras Publications, Nagercoil.
2. Kalyan kumar De (1997) Plant tissue culture. New central book agency, (P) Ltd.

REFERENCES

1. Edwin F. George and Paul Sherington D (1984) Plant propogation by tissue culture, Exegetics Ltd., Edington, Westburg, England.
2. Chawla, H.S. (2100) Introduction to Plant Biotechnology. Oxford & IBH Publishing Co., New Delhi.
3. Freifelder D (1989) Molecular Biology. Jones and Barlett, Boston.
4. Ramawat K.G (2100) Plant Biotechnology.S. Chand & Company Ltd., Ram Nagar, New Delhi.
5. Old and Primrose (1990) Principles of gene manipulation. B.S. Publishers, London.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://swayam.gov.in/nd1_noc19_bt20/preview
2. https://nptel.ac.in/AICTE_FDP/ 5 https://www.classcentral.com/report/swayam-moocs-course-list/
3. https://iubmb.onlinelibrary.wiley.com/journal/14708744
4. https://www.classcentral.com/course/swayam-principles-of-biotechnology-17738 3 https://swayam.gov.in/nc_details/NPTEL
5. https://www.classcentral.com/course/swayam.

CORE ELECTIVE COURSE IV

GENERAL MICROBIOLOGY

SEMESTER **HOURS / WEEK** **5**

CODE **21UBOME4**

General Objective

1. To know the basic concepts, methods, scopes, classifications, characterization, Diseases and economic importance of microorganisms

Unit I : Introduction to Microbiology

1.1. Microbiology- Definition of Microbes, History and concepts

1.2 Scope of microbiology

1.3 Classification of Microorganisms: Bacteria –Morphology,Cell Structure, Growth, Nutrition, Reproduction – Asexual and sexual methods

1.4 Economic Importance of Bacteria,

1.5 Virus - Morphology, Cell Structure, Nutrition, Reproduction -Lytic and Lysogenic cycle

1.6 Yeast – Morphology, Cell Structure, Nutrition, Reproduction –Vegetative, Asexual and Sexual methods

1.7 Economic importance of Yeast.

1.8 Cyanobacteria –Morphology,Cell Structure, Nutrition, Reproduction, Vegetative and Asexual methods

1.9. Economic Importance of cyanobacteria.

Unit II : METHODS IN MICROBIOLOGY

2.1 Microscope- Basic Principles of microscopy

2.2 Light Microscopes: Types – Principle, Structure and applications Simple, Compound and , Fluorescence microscopes

2.3 Electron microscopes -Principle, Structure and applications: SEM and TEM

2.4 Micrometer- Definition and types (Ocular and Stage micrometer)

2.5 Staining- Definition, procedure and Types- Simple, Gram's Negative and Acid fast staining.

2.6 Sterilization- Definition, Methods of sterilization-Heat, Chemical sterilization, Filtration, UV radiations, Aldehydes and Gases

2.7 Culture media- Definition and types- Batch culture, Plate culture and Differential culture

2.8 Pure culture- Definition and Methods - Serial dilution technique, Streak plate cultures Pour plate culture,Spread plate techniques, Enrichment culture, Selective medium culture, Differential medium culture and Single isolation culture

Unit III :FOOD AND DAIRY MICROBIOLOGY

3.1. Milk -Microorganisms in milk,Preservation of milk, Pasteurization, Sterilization and

Dehydration.

3.2. Bacteriological standard - Grading of milk and Methylene Blue reduction test

3.3. Dairy Products – definition and Microorganisms, Fermented milk, Curd, Butter, Ghee and

Cheese.

3.4. Food spoilage- Definition, Causes of food spoilage and Biochemical changes of food spoilage -

Putrefaction, Rancidity, Fermentation and Autolysis

3.5. Food poisoning – definition and Types - Food intoxication (Botulism, Staphylococcal food poisoning, Infantile gastroenteritis,Travelers diarrhea andMycotoxicosis) and Food infection

3.6. Methods of Food preservation-Pickling, Salting, Smoking, Aseptic processing, Canning,

Bottling, Pasteurization, Refrigeration, Sterilization, Dehydration, Lyophilization, High osmotic pressure, Chemical additives and Radiation

Unit IV: MEDICAL MICROBIOLOGY

4.1.1 Disease, Disease causing organism,

4.1.2 Symptoms and Prevention

4.1.3 Control measure- Typhoid, Cholera, Hepatitis -B, Common cold, Mycosis –superficial, Amoebiasis and Malaria

Unit V: ENVIRONMENTAL MICROBIOLOGY

5.1 Biogeochemical cycle: Definition and Role of microorganisms in biogeochemical cycle and Types - Nitrogen cycle andCarbon cycle

5.2. Biofertilizers- definition and Importance of Biofertilizers

5.3 Common Microorganisms used as biofertilizers-Identification, Isolation, Mass culture and

Commercial production-Rhizobium,Azospirillum and Mycorrhiza,

5.4 Biodegradation- Definition, Biodegrading agents, Degradation of Xenobiotics, Degradation of hydrocarbons and Degradation of Polychlorinated Biphenyl compounds

5.5 Bioremediation – definition andAdvantages of biodegradation

5.6 Bioleaching-Definition andTypes - Direct bioleaching, Indirect bioleaching, Heaps or dumos method, In situ bioleaching, Bioreactor and Advantages of bioleaching

Learning outcomes

On the completion of the course the students will be able to

1. Understand the core concepts and fundamentals of General microbiology
2. Analyse the methods involved in food and dairy microbiology
3. Analyze the techniques involved in medical microbiology
4. Examine the importance of microbes in environmental sustainability
5. Critically analyze the major concerns and applications of microbiology in various fields

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBOME4**	**GENERAL MICROBIOLOGY**				**5**			**4**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓		✓		✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓		✓		✓	✓	✓	✓	
Number of Matches : 45						Relationship :Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

References

1. Michael. J. Pelczar, J.R., E.C.S. Chan and Noel R. Krieg, Microbiology, Mc Grew Hill Education Private Limited, New Delhi, India, 2013.

2. Lansing M. Prescott, John P. Harley, Donald A. Klein, Microbiology 6 th Edition, Mc Grew Hill Companies, New York, 2005.

3. Moshrafuddin Ahmed and S.K. Basumatary, Applied Microbiology, MJP Publishers, Chennai, 2006.

4. Ananthanarayan and Panikers, Text book ofMicrobiology 9 th Edition. Editor – ArtiKapil,

Published by Universities press private limited, Hyderabad, 2013.

5. Dubey, R. C. and D.K. Maheshwari, A Text book of Microbiology. S.Chand& Company Ltd, New Delhi, 2004.

6. Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton, Prescott's Microbiology. McGrew Hill companies, New York, 2011.

7. Arumugam, M., A. Mani, A.M. Selvaraj and L.M Narayanan, Microbiology.Saras publication, Kanyakumari, Tamil Nadu, 2014.

8. Rajan, S., and R. Selvi Christy., Essential of Microbiology. Anjanaa Book House, Chennai.

2015.

NME - I

BOTANICAL GARDEN AND LAND SCAPING

SUB. CODE:21UBONME1 **CREDITS: 2**

SEMESTER: VI **HOURS: 2**

Learning outcomes:

After the completion of this course the learner will be able to:

1. Apply the basic principles and components of gardening
2. Conceptualize flower arrangement and bio-aesthetic planning
3. Design various types of gardens according to the culture and art of bonsai
4. Distinguish between formal, informal and free style gardens
5. Establish and maintain special types of gardens for outdoor and indoor landscaping

UNIT I

1.1 Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc.
1.2 Special types of gardens, their walk-paths, bridges, constructed features.
1.3 Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials.

UNIT II

2.1 Flower arrangement: importance, production details and cultural operations, constraints, postharvest practices.
2.2 Bio aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, and villages.

UNIT III

3.1 Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens.

3.2 Landscape designs, Styles of garden, formal, informal and free style gardens, types of gardens, Urban landscaping.

UNIT IV

4.1 Establishment and maintenance, special types of gardens,
4.2 Bio-aesthetic planning, ecotourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

UNIT V

5.1 Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities –
5.2 Planting - direct seeding and transplants.

On completion of this course the students will be able to:

1. Comprehend the fundamental concepts related to botanical garden
2. Know about basics of land scaping and its importance in gardening
3. Gain knowledge about roof garden.
4. Understand the importance of bio aesthetic planning, ecotourism.
5. Apply the knowledge of different types of gardening in day to day life.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBONME1**	**BOTANICAL GARDEN AND LAND SCAPING**				**2**			**2**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓		✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓
Number of Matches : 44						Relationship :Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

Suggested Readings

1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide . Smithsonian Books.

2. Butts, E. and Stensson, K. (2112). Sheridan Nurseries: One hundred years of People,Plans, and Plants. Dundurn Group Ltd.

3. Russell, T. (2112). Nature Guide: Trees: The world in your hands (Nature Guides).

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. http://www.jnkvv.org/PDF/05042020173542ornamental.pdf
2. https://agritech.tnau.ac.in/horticulture/horti_Landscaping_types%20of%20garden.html
3. https://edis.ifas.ufl.edu/pdf%5CMG%5CMG08600.pdf
4. https://cpwd.gov.in/Publication/LandscapeBook.pdf

NME – II

PRESERVATION OF FRUITS AND VEGETABLES

SUB. CODE: 21UBONME2 **CREDITS: 2**

SEMESTER: VI **HOURS: 2**

Learning Objectives:

1. To understand the principles of preservation of fruits and vegetables.
2. To know the nutritive values, importance, factors affecting storage
3. To know the methods of preservation of fruits and vegetables and preservation recipes.

Unit-I

1.1 Fruits and Vegetables:

1.2 Nutritive values, factors affecting storage, spoilage - microbial, enzymatic and insects.

Unit-II

2.1 Principles of Preservation:

2.2 Importance and Methods of Preservation - Refrigeration, Freezing, Canning, Drying and Dehydration, Chemical preservatives.

Unit-III

3.1 Preparation of Products:

3.2 Methods of preparation of Fruit Juice- Orange, Squashes- grape and Pine apple; Jam - Tomato and Mixed Fruit , Jellies- Guava.

Unit- IV

4.1 Preparation of Chutney, Sauce, Pickles & Ketchup:

4.2 Preparation of Chutney- Mango, Sauce –Tomato,Pickles- Lime, Mango and Garlic, Ketchup1Tomato. Drying of fruits: Banana, Mango, Grapes and Fig.

Unit- V

5.1 Canning of Fruits& Vegetables:

5.2 Mango and Banana; Tomato, Carrot, Bean and Mushrooms.

On completion of this course, the students will be able to:

1. Understand the importance of preservation of fruits and vegetables..
2. Analyse the methods of preservation of various food stuffs.
3. Apply the knowledge of preservation in healthy cooking.
4. Differentiate the production methods of various foods.

5. To develop different formulation of healthy food varieties .

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course	Hours	Credit
I	21UBONME2	PRESERVATION OF FRUITS AND VEGETABLES	2	2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓		✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓
Number of Matches : 44						Relationship :Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

REFERENCES:

1. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

2. C.K. Usha Rani and R. Mary Christi. 2010. Preservation of Fruits and Vegetables,SheenGrafix, Nagercoil.

3. GirdhariLal, G.S. Siddappa and G.L.Tandon, 1986, Preservation of Fruits and Vegetables,Indian Council of Aricultural Research, New Delhi.

4. Cruess W.V.1948. Commercial Fruits and Vegetables Products, McGraw Hill Book Company Inc, New York.

5. Alex.V and Ramani.2009. Food Chemistry, MPJ Publishers, Chennai.

V.Kumaresan. 2009.Horticulture, Saras Publication, Nagercoil.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. http://www.journeytoforever.org/farm_library/AD3.pdf
2. https://www.researchgate.net/publication/273270715_Preservation_technologies_for_fresh_fruits_and_vegetables

NME III

NURSERY TECHNOLOGY

SUB. CODE : 21UBONME3 **CREDITS: 2**

SEMESTER : V **HOURS: 2**

General objectives

1. To know methods of plant multiplication and nursery structures

2. To know Greenhouse farming, Methods of Harvesting, Packaging and Marketing

UNIT I

1.1 Gardening: definition, objectives and scope

1.2 Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

1.3 Preparation of Nursery beds,

1.4 Transplantation – steps and Methods.

UNIT II

2.1 Nursery technology – Introduction, Definition.

2.2 Methods of Propagation Sexual Propagation.

2.3 Vegetative Propagation – Grafting and Layering.

UNIT III

3.1 Nursery Structures – Store House, Potting and Packing Shed,

3.2 Nursery Bed, Mist Chamber,

3.3 Manures, compost, vermicompost.

UNIT IV

4.1 Green houses for tropical countries

4.2 Management, Pot culture, Pot mixture harvesting,

4.3 Packing, Storage and Marketing of Nursery Stock

UNIT V

5.1 Garden implements - Garden Hose, Pick Axe, Trenching Hoe, Knapsac sprayer, Mist Chamber, Trowel, Sprinkler, Rose Kittle, Crow Bar, Garden scissor, Grafting Knife, Rake, Sprayer, Pruning saw, Plant cutter

On completion of this course, the students will be able to:

1. Understand the importance of nursery technology.
2. Analyse the methods of water management and manuring .
3. Apply the knowledge of different propagation methods in gardening.
4. Understand the green house farming and its importance.
5. To develop different methods of new nursery technology .

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**		**Title of the Course**			**Hours**			**Credit**	
I	**21UBOMNE3**		**NURSERY TECHNOLOGY**			**2**			**2**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓	✓		✓	
CO4	✓		✓	✓		✓	✓	✓		✓
CO5	✓	✓		✓	✓	✓	✓		✓	
Number of Matches : 40						Relationship : High				

6.

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

References

1. Edmond Musser and Andres, .Fundamentals of Horticulture. McGraw Hill Book Co., 1957

2. Gardener,. Basic Horticulture. Mac Millan N.Y, 1996

3. Kumar N, Introduction to Horticulture. Rajalakshmi Publications Nagercoil, India, 1997 59

4. Lex Lauries and Victor H, Rice. Floriculture – fundamentals and practices,.Mc.Graw Hill publishers N.Y, 1979

5. ManibhushanRao,K, Text Book of Horticulture. Macmillon India Ltd., 1991

6. Mukherjee D, Gardening in India. Oxford IBH Publishing Co., New Delhi, 1977

7. Randhawa, Ornamental Horticulture in India. Today and Tomorrow Publishers New Delhi, 1997.

8. Sandhu M.K, Plant Propagation. Wiley Easter Ltd., New Delhi, 1989.

9. Sundararajan, J.S., Muthuswamy, J., Shanmugavelu, K.G. and Balakrishnan, R. A Guide to Horticulture. Thiruvenkadam Printers, Coimbatore.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://ncert.nic.in/vocational/pdf/kegr102.pdf
2. http://www.cazri.res.in/publications/PRathaKrishnan.pdf

SKILL ENHANCEMENT COURSE-I

MUSHROOM CULTURE

Semester IV **Hours/Week: 2**

Sub Code: 21UBOSEC1 **Credits: 2**

Objectives:

1. To acquire knowledge on various types of mushrooms.
2. To understand cultivable species of mushrooms.
3. To learn the culture techniques of edible mushrooms.
4. To understand the various recipe prepared from mushrooms.
5. To learn the preservation and storage of mushrooms.

UNIT I

1.1 Introduction - Classification –
1.2 Edible and Poisonous. Tests for identification
1.3 Nutritive value of mushrooms.

UNIT II

2.1 Characteristics of common edible mushrooms Paddy straw, Oyster and milky mushrooms.

2.2. Life cycle of a common mushroom (Agaricus).

UNIT III

3.1 Culture Techniques

3.2 Preparation of spawn

3.3. Preparation of compost

3. 4. Spawn running 3.1.5. Harvesting and Marketing.

UNIT IV

4.1 Preservation and storage of mushrooms

4.2 Diseases and pests of mushrooms.

UNIT V

5.1 Delicious recipes of mushroom
5.2 Economic importance of mushrooms.

On completion of this course, the students will be able to:

1. Understand the importance of mushroom technology.
2. Develop the methods of Mushroom cultivation .
3. Apply the knowledge of different propagation methods in Mushroom cultivation.
4. Analyse the nutritive value and importance of Mushroom in healthy life style.
5. To develop different methods of improving mushroom cultivation in large sale .

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course	Hours	Credit
I	21UBOSEC1	MUSHROOM CULTURE	2	2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO3	✓	✓	✓	✓		✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 40						Relationship : High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

References:

1. Nita Bahl (1984). Handbook on Mushrooms, Oxford and IBH Publishing Company
2. Dubey, RC. (2101) A text book of Biotechnology, S.Chand& Co. Ltd.

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://www.researchgate.net/publication/236011864_Button_Mushroom_Cultivation
2. http://nhb.gov.in/pdf/Cultivation.pdf
3. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20Mushroom.html

SKILL ENHANCEMENT COURSE- II

PLANT WEALTH FOR HUMAN LIFE

Semester V **Hours/Week: 2**

Sub Code: 21UBOSEC2 **Credits: 2**

General Objectives

1. To know how to use the plant resources to produce valuable products.

2. To know scope and potential of medicinal and aromatic plants

3. To know the potential plants for income generation.

Unit I : Flowers

1.1. Bouquet

1.2. Garlands and Strings

1.3. Regular and festival decorations

1.4. Hair designs

Unit II : Vegetables and Fruits

2.1 Pickle (Lime / Mango / Ginger)

2.2. Juice (Lemon / Sweet lime)/ squash (Graph / Orange)

2.3. Drying (Direct & treated)

2.4. Vegetable, pith and grain carving

Unit III: Fibers

3.1 Baskets and pans

3.2. Ropes and chords

3.3. Brushes and brooms

3.4 . Mats and Carpets

Unit IV: Cosmetics and Medicines

4.1. Medicinal oils / Application – Hair oils

4.2. Preparation of Decoctions - Syrups

4.3. Herbal Remedies – Ointments, Pain balms

4.4. Cosmetics, Face packs & Skin care

Unit V : Phytowastes to wealth

5.1. Shells and rinds (Useful and ornamental articles)

5.2. Waste/used papers and wood (recycling)

5.3. Leaves (cups and plates)

5.4 Phytojewellery (ear drops, studs, bangles / necklace)

On completion of this course, the students will be able to:

1. Understand the importance of Plant resources.
2. Know the potential values of different parts of plants .
3. Apply the knowledge of plant wealth in various fields.
4. Analyse the value and importance of plant in medicine and cosmetics.
5. To develop different methods of improving the uses of plant resources in better way .

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBOSEC2**	**PLANT WEALTH FOR HUMAN LIFE**				**2**			**2**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓		✓		✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓		✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓		✓	✓	✓		✓	✓	✓
Number of Matches : 40						Relationship : High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

References

1. Pandey, B.P. Economicbotany. S. Chand and Co. New Delhi, 2007.

2. Samba Murty, A.V.S., Subramaniyan, N.S. A Text book of economic botany. Wiley Eastern Ltd. New Delhi, 1989.

3. Siddappa, G.S. and Tandon, G.L. Preservation of fruits and vegetables. ICAR, New Delhi, 1998

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. http://www.fao.org/3/i2473e/i2473e.pdf
2. https://www.iucn.org/downloads/medicinal_plant_11_book.pdf

SS I - FLORICULTURE

SUB. CODE : 21UBOSS1 CREDITS: 2 SEMESTER : III

General objectives

1. To know methods of floriculture.

2. To know Greenhouse forming, Methods of Harvesting, Packaging and Marketing

Unit I

1.1 Floriculture: Importance,

1.2 Cut flower production – Chrysanthemum, Tulips, Lavendula, Gerbera, Gladiolus and Helichrysum.

UNIT II

2.1 Commercial Floriculture: Definition,

2.2 Cultivation of Calendula, Polyanthus and Marigold.

UNIT III

3.1 Cultivation Techniques: Cultivation of Anthurium, Orchids,

3.2 Cut flower production,

3.3 Package and export

UNIT IV

4.1 Value Added Products of flowers:

4.2 Importance of flowers in Perfumery

4.3 Extraction of Rose and Jasmine oil and their products

UNIT V

6.1 Flower arrangement: Introduction,

6.2 General Principles of Flower Arrangement, Western and Japanese,

6.3 Dry flower Decorations

Course Outcome

1. Gain information about cultivation of Indian Flowers
2. Understand flower cultivation of India.
3. Identify methods for producing value added products from flowers.
4. Learn about the production of export varieties of Ornamental Flowers.
5. Apply the knowlrdge of floriculture in different ways

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course				Hours			Credit	
I	21UBOSS1	FLORICULTURE							2	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓		✓		✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓		✓	✓	✓	✓	✓	✓	✓
Number of Matches : 402						Relationship : Very High				

6.

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

References

1.Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

2. Kumaresan,V. 2009. Horticulture, Saras Publication, Nagercoil.

3.Randhawa., G.S. 1973. Ornamental Horticulture in India.Today and Tomorrow Printers andPublishers, New Delhi.

4.Vishnu Swarap. 1997. Garden flowers. National Book Trust, India

Online Contents (MOOC, SWAYAM, NPTEL, Youtube, other websites)

1. https://www.ijmra.us/project%20doc/2017/IJRSS_JULY2017/IJMRA-11817.pdf
2. https://www.researchgate.net/publication/331082898_Commercial_Floriculture_Industry_in_India_Status_and_Prospects

SS II - FORESTRY

SUB. CODE: 21UBOSS1 **CREDITS: 2**

SEMESTER: IV

Objectives:

1. To acquire knowledge on various types of Forest.

2. To understand Forest degradation and protective measures.

3. To learn Forest management and conservation.

4. To understand the various aspects of Agroforestry.

5. To learn the preservation of forest.

UNIT I

Forest:

1.1 Definition, Scope and Classification ,
1.2 Importance/Functions of forest, Forest as a Balanced Eco system,
1.3 Types and Distribution of Forest with reference to India (Champion and Seth -Classification)

UNIT II

2.1 Forest Degradation: Damage caused by Fire, Climatic Factors and Injuries by Insects, Plants, Animals and Diseases, activities of Man including Encroachment and Shifting Cultivation,

2.2 Measures to Protect the Forest Damage caused by various Factors.

UNIT III

3.1 Forest Management and Conservation: Regeneration,Tending Operations, Sustainable Utilization of Forest Resources,

3.2 Forest Organization, Role of Remote Sensing in Forest Management.

UNIT IV

4.1 Agroforestry: Objectives, Advantages and Disadvantages.

4.2 Energy Plantation, Recreational Forestry,

4.3 Role of Biosphere reserves, National Parks, Sanctuaries and Botanical Gardens in Conservation of Wild life.

UNIT V

5.1 Forest Utilization: Conservation,

5.2 Storage and Disposal of Wood in Forest,

5.3 Major and Minor Forest Products,

5.4 Forest based Industries- Paper and Pulp Industry, Resin tapping and Turpentine manufacture..

Course Outcomes

On completion of this course, the students will be able to:

1. Understand the importance of forestry and its application.
2. Explain the significance of forestry in sustainable environment
3. Analyse the resources of forest and its uses
4. Describe the role of biosphere reserves and conservation of wild life .
5. Apply the knowledge of forestry in paper, pulp and resin industries.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**21UBOSS2**	**FORSTRY**							**2**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓		✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches : 44						Relationship : Very High				

6.

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

References:

1. Agrawal, K.C. (1987). Environmental Biology. Agro Botanical Publisher, India
2. Arumugam, N. (1994). Concepts of Ecology (Environmental Biology).Saras Publications, Nagercoil, Tamilnadu.
3. Kumar, H.D. (1992). Modern Concepts of Ecology (7th Edn.).Vikas Publishing Co., New Delhi.

4. Odum, E.P. (1971). Fundamentals of Ecology (2nd Edn.). Saunders & Co., Philadelphia &Natraj Publishers, Dehradun.
5. Sharma, P.D. (2000). Ecology & Environment.Rastogi Publications, Meerut, India.
6. Vashishta, P.C. (1990). Plant Ecology. Vishal Publications, Delhi, Jalandhar.
7. Verma, P.S. and Agarwal, V.K. (1999).Concept of Ecology (Enviromental Biology). S. Chand & Co., New Delhi.

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1. https://upscpdf.com/2019/07/01/forestry-study-notes-pdf-download/
2. https://upscpdf.com/2020/07/26/ifos-forestry-notes-pdf/
3. https://www.sscgyan.com/forestry-notes-pdf-rishav-gupta/

ALLIED COURSE 1

PLANT DIVERSITY-I

ALGAE, FUNGI, LICHENS,

BRYOPHYTES,PTERIDOPHYTES,GYMNOSPERM,ANGIOSPERM AND ECONOMIC BOTANY

SEMESTER I **HOURS / WEEK 6**

CODE 22UAB1 **CREDIT 3**

General Objectives

1.To Learn Morphological and Anatomical Features of Algae and Fungi.

2.To Acquire The basic Knowledge of the Morphology and Economic importance of Lichen and Bryophytes.

3.To Acquire Knowledge on the Structure and Reproduction of Genera in Pteridophytes & Gymnosperm.

4.To Comprehend the concept of Plant Taxonomy and Classification of Angiosperms.

5.To study Various Angiosperm families and it's Economic values.

UNIT - I

ALGAE

1.1 General Characters of algae and fungi,

1.2 Study of the structure and life history of *Nostoc* and *Aspergillus.*

1.3 Economic importance of Algae and Fungi.

FUNGI

1.4 General Characters of fungi,

1.5 Study of the structure and life history of *Aspergillus.*

1.6 Economic importance of Fungi.

UNIT - II

LICHENS

2.1 General characters of lichens(Crustose,Foliose,and Fruticose),

2.2 Economic importance of lichens.

BRYOPHYTES

2.3 Structure and life history of *Funaria.*

2.4 Economic importance of Bryophytes.

UNIT - III

PTERIDOPHYTES

3.1 Study of the structure and life history of *Marsilea.*

3.2 Economic importance of Pteridophytes.

GYMNOSPERMS

3.3 Study of the structure and life history of *Cycas.*

3.4 Economic importance of gymnosperms.

UNIT - IV

ANGIOSPERMS

4.1 Importance of Taxonomy.

4.2 Binomial nomenclature.

4.3 Bentham & Hooker system of classification,

4.4 Merits and Demerits

UNIT - V

5.1 Study of the following families and their economic importance .

5.2 Polypetalae-Annonaceae

5.3 Gamopetalae-Solanaceae

5.4 Monochlamideae-Amaranthaceae

5.5 Monocotyledon-Poaceae.

OUT COMES

On Completion of the course,students are able to:

1. Know the systematic,morphology and Life cycle Pattern of algae and fungi.
2. Understand the morphology and economic importance of Lichen and Bryophytes.
3. Understand the biodiversity of pteridophytes and Gymnosperms.
4. Know the concept of methodology in Taxonomy.
5. Know the systematic,Morphology and economic importance of Angiosperms.

Relationship matrix for COs, POs and PSOs

Semester	Sub.Code	Title of the Course				Hours			Credit	
I	22UAB1	ALLIED: PLANT DIVERSITY - I				6			3	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓
Number of Matches : 47						Relationship : Very High				

Mapping	1 - 20	21 - 40	41 - 60	61 - 80	81 - 100
Matches	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Relationship	Very Poor	Poor	Moderate	High	Very High

TEXT BOOKS

1. Vashista, B.R (2007) : Botany for degree students – Algae, S.Chand& Co., (P) Ltd., New Delhi.
2. Vashista, B.R (2007) : Botany for degree students – Fungi, S.Chand& Co., (P) Ltd., New Delhi.
3. Vashista, B.R (2007) : Botany for degree students – Bryophyta, S.Chand& Co., (P) Ltd., New Delhi.
4. Vashista, B.R (2007) : Botany for degree students – Pteridophyta, S.Chand& Co., (P) Ltd., New Delhi.
5. Vashista, B.R (2007) : Botany for degree students – Gymnosperms, S.Chand& Co., (P) Ltd., New Delhi.
6. Vashista, P.C (2005) : Taxonomy of Angiosperms. S.Chand& Co., (P) Ltd., New Delhi.

REFERENCES

1. Alexopoulos, C.J., Mims,. C.W. & Blackwell M. (1996) Introductory Mycology, John Wiley & Sons, Inc., Y. Chicester, Berisbance, Toronto, Singapore.
2. Sharma. O.P. (1990) Text Book of Pteridophyta, MacMillan India Ltd., New Delhi. Madras – 35 pp.
3. Chopra G.W & Verma Y (1998) Gymnosperms. Pradeep Publications, Jalandhar.
4. Sharma O.P (1997) Gymnosperms. Pragati Prakasan, Meerut, India.
5. Pandey B.P (1999) Taxonomy of angiosperms. S. Chand & Co. (P) Ltd., New Delhi.
6. Krishnamurhty, K.V & Rao K.N (1995) Angiosperms. S. Viswanathan Publications.

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1. https://swayam.gov.in/nd2_cec20_bt11/preview
2. https://www.swayamprabha.gov.in/index.php/program/archive/9
3. https://swayam.gov.in/NPTEL
4. https://swayam.gov.in/nc_details/NPTEL

ALLIED COURSE II PLANT DIVERSITY - II

CYTOLOGY, GENETICS, ANATOMY, EMBRYLOGY, ECOLOGY, EVOLUTION, PLANT PHYSIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER II HOURS / WEEK 5

CODE 22UAB2 CREDIT 3

General Objectives

1. To study the basic concept of cell and Mendelian genetics, its variations and applications
2. To understand the basic concepts of Anatomy and Embryology.
3. To understand the basic concepts of general Ecology and Evolution
4. To ascertain the basic principles of plant function, metabolism and cell physiology.
5. To understand the basic concepts of plant biotechnology.

UNIT – I CYTOLOGY AND GENETICS

Cytology:

1.1 Ultra structure of plant cell.

1.2 A brief outline of the organelles mitochondria, chloroplast, nucleus.

1.3 Cell division – mitosis and meiosis.

Genetics:

1.4 General account on Mendel's laws (monohybrid cross, dihybrid cross, back cross, test cross and incomplete dominance).

UNIT – II : ANATOMY AND EMBRYOLOGY

2.1 **Anatomy:**Simple permanent tissue, complex permanent tissue,

2.2 Primary structure of stem and root in dicot and monocot plants.

Embryology:

2.3 Structure of Mature Anther and Male gametophyte,

2.4 Structure of Ovule, it types and female gametophyte (Polygonum type),

2.5 Endosperm types (excluding endosperm haustoria any 3)

UNIT – III: ECOLOGY AND EVOLUTION

Ecology:

3.1 Plant habitat – climatic, edaphic and biotic factors.

3.2 Xerophytes – *Nerium*

3.3 Hydrophytes – *Hydrilla.*

Evolution:

3.4 Origin of life, theories of Lamarck and Darwin.

UNIT – IV: PLANT PHYSIOLOGY

4.1 Transpiration,

4.2 Photosynthesis,

4.3 Electron transport system,

4.4 Photophosphorylation (cyclic and non-cyclic).

4.5 Phytohormones – Auxins, GA3, Cytokinin, Ethylene & ABA.

4.6 Elementary knowledge about Photoperiodism and Vernalization.

UNIT – V:PLANT BIOTECHNOLOGY

5.1 An elementary account about plant tissue culture techniques

5.1.1 Micropropagation,

5.1.2. Organogenesis,

5.1.3 Somatic embryogenesis& its applications.

5.2 Gene cloning and its application.

On completion of the course, students are able to:

1. Structure and organization of cell and mitotic cell division.
2. Mendelian and Neo-mendelian genetics
3. Understand the scope & importance of Anatomy
4. Understand the growth and developmental processes in plants.
5. Know the concept of methodology in anatomy.

Relationship matrix for COs, POs and PSOs

Semester	**Sub.Code**	**Title of the Course**				**Hours**			**Credit**	
I	**22UAB3**	**ALLIED :PLANT DIVERSITY - II**				**5**			**3**	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches : 46						Relationship : Very High				

Mapping	**1 - 20**	**21 - 40**	**41 - 60**	**61 - 80**	**81 - 100**
Matches	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**
Relationship	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

TEXT BOOKS

1. Fahn A (1997 Plant Anatomy. Pergoman press, Oxford.
2. Bhojwani S.S & Bhatnagar S.P (2000) The Embryology of Angiosperms. Vikas publishing house private Ltd., & UBS publisher's distributors, New Delhi.

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1. Winchester A.M (1958) Genetics. Oxford & IBH publishing house, New Delhi.
2. Jain H.K (1999) Genetics - Principles, concepts & implications. Oxford & IBH publishing house, New Delhi.
3. Gupta P.K (2000) Genetics. Rastogi publications, Meerut, India.
4. Verma P.S. Agarwal V.K (1999) Cytology. S.Chand& Co., New Delhi.
5. Jain V.K. (1990) Fundamentals of Plant Physiology. S.Chand& Co., New Delhi.

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1. https://www.google.com/search?q=neela+bakore+reproduction+in+flowering+plant
2. http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.htm
3. https://www.biologydiscussion.com/stems-2/dicot-stem/secondary-growth-in-dicot-stem-with diagram/70

ALLIED COURSE PRACTICAL –I & 1I

SEMESTER II	**HOURS / WEEK 4**
CODE 21UAB2P	**CREDIT 3**

Course Objectives

1. To study the Internal structures of Lower Plant groups
2. To Compare the external and internal structure of the Thallophytes and Pteridophytes.
3. To study the internal structure of vascular plants.
4. Cell structure of Plants and its Organelles
5. Mitosis stages using permanent slides.

Detailed study of the following Genera:

1. **Algae:**
2. Nostoc
3. Fungi:
4. *Aspergillus.*
5. Lichens:
6. Usnea.
7. Bryophytes:
8. Funaria.
9. Pteridophytes:
10. Marsilea.
11. Gymnosperms:
12. Cycas
13. Angiosperms:
14. Polypetalae-Annonaceae
15. Gamopetalae-Solanaceae
16. Monochlamideae-Amaranthaceae
17. Monocotyledon-Poaceae

ANATOMY

1. Preparation of transverse section of the following plant parts to observe and record the internal structure.
2. Primary structures of Monocot stems & root.
3. Primary structures of Dicot stem & root.

EMBRYOLOGY

1. Permanent slides, T.S. of anther, ovule types.

ECOLOGY

1. Morphological and Anatomical features of Hydrophytes and Xerophytes.

PLANT PHYSIOLOGY

1.Demonstration of transpiration pull

2.Evolution of O2 during photosynthesis

3.Ganong's Potometer-Transpiration

PLANT BIOTECHNOLOGY

Vectors (any 4) Plant tissue culture techniques, photographs from standard publications