GOKUL GLOBAL UNIVERSITY
Approved By Govt. of Gujarat
(Recognized by UGC under Section 22 & 2(f) of 1956)
(Gujarat Private State University Act 4 of 2018)

COURSE STRUCTURE

Bachelor of Science

Botany

Faculty of Science
Gokul Science College
University Campus, State Highway-41,
Siddhpur - 384151, **Dist.** Patan, Gujarat, INDIA, **Mobile :** 9510973863
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B.Sc. Sem- 1
Teaching Scheme

Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		Total marks
							Internal	External	
1	Foundation Compulsory	B101FC	Foundation Compulsory-English	2	0	2	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC101UDSC	Introduction to Microbial world	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT101UDSC	Botany	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE101UDSC	Inorganic, Organic, Physical & Volumetric	4	0	4	30	70	100
5	PRACTICAL COURSE (PRA)	BBOT101UPRA	Botany practical	0	4	2	0	50	50
6	PRACTICAL COURSE (PRA)	BMIC101UPRA	Microbiology practical	0	4	2	0	50	50
7	PRACTICAL COURSE (PRA)	BCHE101UPRA	Chemistry Practical	0	4	2	0	50	50
8	Subject Elective	BBOT101USE	Horticulture	2	0	2	15	35	50
9	Elective Generic	B101EG	Elective Generic: Communication Skills	2	0	2	0	50	50
10	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO101UDSC	Non chordates – Protista to psudocoelomates	4	0	4	30	70	100

B.Sc. sem- II
Teaching Scheme

Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Examination		TOTAL MARKS
							Internal	External	
1	Foundation Compulsory	B201FC	Foundation Compulsory-English	2	0	2	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT201 UDSC	Biomolecules and Cell Biology	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC201 UDSC	Systematic Bacteriology	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE201 UDSC	Inorganic, Organic, Physical Chemistry	4	0	4	30	70	100
5	PRACTICAL COURSE (PRA)	BBOT201 UPRA	Botany Practical	0	4	2	0	50	50
6	PRACTICAL COURSE (PRA)	BMIC201 UPRA	Microbiology practical	0	4	2	0	50	50
7	PRACTICAL COURSE (PRA)	BCHE201 UPRA	Chemistry Practical	0	4	2	0	50	50
8	Subject Elective	BBOT201 USE	Natural Resource Management	2	0	2	15	35	50
9	Elective Generic	B201UEG	Elective Generic: Disaster Management	2	0	2	0	50	50
10	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO201 UDSC	Non chordates – Coelmates	4	0	4	30	70	100

Course Structure
B.Sc. sem- III
Teaching Scheme

							Examination		Total Marks
Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Internal	External	
1	Foundation Compulsory	B301FC	Foundation Compulsory -English	2	0	2	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT301UDSC	Mycology and Phytopathology	3	0	3	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT302UDSC	Archegoniate	3	0	3	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC301UDSC	Microbial physiology and metabolism	3	0	3	30	70	100
5	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC302UDSC	Soil and water Microbiology	3	0	3	30	70	100
6	PRACTICAL COURSE (PRA)	BBOT301UPRA	Botany Practical	0	6	3	0	100	100
7	PRACTICAL COURSE (PRA)	BMIC301UPRA	Microbiology practical	0	6	3	0	100	100
8	Subject Elective	BBOT301USE	Plant Diversity and Human Welfare	2	0	2	15	35	50
9	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO301UDSC	Principles of ecology	3	0	3	30	70	100
10	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO302UDSC	Chordates I	3	0	3	30	70	100
11	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE301UDSC	INORGANIC & ORGANIC CHEMISTRY	3	0	3	30	70	100
12	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE302UDSC	PHYSICAL CHEMISTRY	3	0	3	30	70	100
13	Elective Generic	B301EG	PERSONALITY DEVELOPMENT	2	0	2	0	50	50

Course Structure
B.Sc. sem- IV
Teaching Scheme

							Examination		Total Marks
Sr No.	Course Type	Course Code	Corse Name	Lecture (hrs.)	Practical (hrs.)	Credits	Internal	External	
1	Foundation Compulsory	B401FC	Foundation Compulsory -English	2	0	2	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT401UDSC	Anatomy of Angiosperms	3	0	3	30	70	100
5	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT402UDSC	Economic Botany	3	0	3	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC401UDSC	Microbial biodiversity	3	0	3	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BMIC402UDSC	Food and dairy microbiology	3	0	3	30	70	100
7	PRACTICAL COURSE (PRA)	BBOT401UPRA	Botany Practical	0	6	3	0	100	100
6	PRACTICAL COURSE (PRA)	BMIC401UPRA	Microbiology practical	0	6	3	0	100	100
8	Subject Elective	BBOT401USE	Plant Breeding	2	0	2	15	35	50
9	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE401UDSC	INORGANIC & ORGANIC CHEMISTRY	3	0	3	30	70	100
10	DISCIPLINE SPECIFIC COURSE (DSC)	BCHE402UDSC	PHYSICAL CHEMISTRY & SPECTROSOCPY	3	0	3	30	70	100
11	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO401UDSC	Comparative Anatomy of Vertebrates	3	0	3	30	70	100
12	DISCIPLINE SPECIFIC COURSE (DSC)	BZOO402UDSC	Chordates II	3	0	3	30	70	100
13	Elective Generic	B401EG	HUMAN RIGHTS	2	0	2	0	50	50

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Course Structure
B.Sc. sem- V
Teaching Scheme

Sr. No.	Course Type	Course Code	Course Name	Lecture (hrs.)	Practical (Hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	FOUNDATION COMPULSORY	B501FC	FOUNDATION COMPULSORY – ENGLISH	2	0	2	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT501DSC	ALGAE, FUNGI AND PLANT PATHOLOGY	3	0	3	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT502DSC	BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERMS	3	0	3	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT503DSC	ANGIOSPERM FAMILIES, PLANT ECOLOGY AND PLANT ANATOMY	3	0	3	30	70	100
5	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT504DSC	CELL BIOLOGY& GENETICS, MICROBIOLOGY AND BIOSTATISTICS	3	0	3	30	70	100
6	PRACTICAL COURSE (PRA)	BBOT501PRA	BOTANY PRACTICAL	0	12	6	0	200	200
7	SUBJECT ELECTIVE	BBOT501SE	AIR POLLUTION	2	0	2	15	35	50
8	ELECTIVE GENERIC	B501EG	ENVIRONMENT AND SUSTAINABLE DEVELOPMENT	2	0	2	0	50	50

Course Structure
B.Sc. sem- VI
Teaching Scheme

Sr. No.	Course Type	Course Code	Course Name	Lecture (hrs.)	Practical (Hrs.)	Credits	Examination		Total Marks
							Internal	External	
1	FOUNDATION COMPULSORY	B601FC	FOUNDATION COMPULSORY – ENGLISH	2	0	2	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT601DSC	MOLECULAR BIOLOGY, PLANT PATHOLOGY, LICHENS AND ANGIOSPERM FAMILIES	3	0	3	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT602DSC	BIOCHEMISTRY AND PLANTPHYSIOLOGY	3	0	3	30	70	100

4	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT603DSC	ECONOMIC BOTANY, PLANT TISSUE CULTURE & BIOTECHNOLOGY, GENETICS AND PLANT ECOLOGY	3	0	3	30	70	100
5	DISCIPLINE SPECIFIC COURSE (DSC)	BBOT604DSC	Plant Anatomy and Plant Breeding	3	0	3	30	70	100
6	PRACTICAL COURSE (PRA)	BBOT601PRA	BOTANY PRACTICAL	0	12	6	0	200	200
7	SUBJECT ELECTIVE	BBOT601SE	Fresh Water Ecology	2	0	2	15	35	50
		BBOT 602SE	Plant Breeding						
8	ELECTIVE GENERIC	B601EG	Stress Management	2	0	2	0	50	50

Syllubus

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** I

Course title:	Microbiology & Phycology	**Course code:**	BBOT101UDSC
Course type:	Discipline Specific Course	**Course credit:**	04

Pre-requisite: Having passed12th Science examination from recognized board with B or AB group.

Rationale: On completion of this coursethe student will be able to identify major groups of algae and microorganisms with reference to their adaptation, development &behavior.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

1. To learn important featuressuch as general characteristics of Plant viruses, Bacteria, thallus organization, reproduction and life history of Cynophyta, Chlorophyta, Phaeophyta&Rhodophyta.

Course Outcome:

After successful completion of the course, the student will be able to…….

1. Develop an understanding the concept of microbial nutrition.
2. Classify viruses based on their characteristics and structures
3. Examine the general characteristics of bacteria and their reproduction.
4. Increase the awareness and appreciation of human friendly viruses, bacteria, algae and their economic importance
5. Conduct experiments using skills appropriate to subdivisions

Content

Unit	Description in detail	Credit	Weightage
I	**Viruses and Bacteria**	1	25 %
	Plant Viruses: Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), RNA virus (TMV).		
	General characteristics of Bacteria; Cell structure- Salient features; Types of Bacteria based on flagella, Nutritional types (Brief explanation with suitable example).		
	Reproduction: Vegetative, Asexual and Recombination (conjugation, transformation and transduction).		
	Economic importance of Bacteria with reference to their role in agriculture, fermentation and medicine.		
II	**Algae**	1	25 %
	General characteristics of algae, occurrence, and range of thallus organization (included types); Classification system of Fritsch (included types up to family).		
	Cell structure and components: cell wall, pigment system, reserve food.		
	Reproduction in algae: Vegetative and Asexual methods.		
	Role of algae in the environment, agriculture, biotechnology and industry.		
III	**Cyanophyta and Chlorophyta**	1	25 %
	General characters of Cyanophyta and Chlorophyta.		
	Cell structure and components of Chlamydomonas.		
	Life history of Nostoc with reference to: Systematic position with reasons up to family. Habit and Habitat, Vegetative structure and Reproduction		
	Life history of Oedogonium with reference to: Systematic position with reasons up to family. Habit and Habitat, Vegetative structure and Reproduction.		
IV	**Phaeophyta and Rhodophyta**	1	25 %
	General characteristics of Phaeophyta and Rhodophyta.		
	Life cycle types: Haplontic, Diplontic and Haplodiplontic.		
	Life history of Ectocarpus with reference to: Systematic position with reasons up to family. Habit and Habitat, Vegetative structure & Reproduction.		
	Life history of Batrachospermum with reference to: Systematic position with reasons up to family. Habit and Habitat, Vegetative structure& Reproduction.		

Reference Books:

1. Bell J N B, Treshow M (2002) Air Pollution and Plant Life, John Wiley and Sons Ltd, NewYork.
2. Omasa K, Nouchi I, DeKok L J (2005) Plant responses to air pollution and global change, Springer Japan, Tokyo.
3. Agrawal S B, Agrawal M (1999) Environmental Pollution and Plant Responses, CRC Press, BocaRaton, USA.
4. Gurjar B R, Molina T, Ojha CSP (2010) Air Pollution Health and Environmental Impacts, CRC Press, BocaRaton, USA.
5. Vallero D A (2007) Fundamentals of Air Pollution, Elsevier Academic Press, Amsterdam.
6. Rao M N, Rao H V N (2009) Air Pollution, Mc Graw-Hill Pub Co Ltd, NewDelhi.

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley, J.M, Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Vashishta B.R., Sinha A.K. and Singh V. P. (2008). Botany for Degree Students. Algae. S Chand and Co, New Delhi.
4. Sharma T.A., Dubey, R.C. and Maheshwari, D.K. (1999). A Text Book of Microbiology. S Chand and Co, New Delhi.
5. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
6. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky P.V. and Jackson, R.B. (2008). Biology, 8th edition. Pearson Benjamin Cummings, USA.. 7. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

Online Resources:

1. www.mcq.biology.com
2. https://biologydictionary.net/bacteria/
3. https://www.biologydiscussion.com/algae/reproduction-algae/reproduction-in-algae-botany/53445/
4. https://www.biologydiscussion.com/algae/chlorophyta-features-and-distribution-algae/57905/

Practicals

1. To study viruses using electron micrographs/Models/charts: TMV.
2. To study bacteria using electron micrographs/Models/charts: Types of Bacteria based on flagella
3. To study cell structure of Chlamydomonas through chart/permanent slide.
4. To study the Life history of Nostoc through: Mountings - Thallus and Reproductive structure Permanent Slides of - Thallus and Reproductive structure (Heterocyst)
5. To study the Life history of Oedogonium through: Mountings - Thallus and Reproductive structure Permanent Slides of – Thallus, Cap cell, sex organ - oogonium
6. To study the Life history of Ectocarpus through: ÿ Mountings - Thallus and Reproductive structure Permanent Slides of – Thallus, Unilocular and plurilocular sporangia
7. To study the Life history of Batrachospermum through: Mountings - Thallus and Reproductive structure ÿ Permanent Slides of – Thallus and cystocarp.

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** I

Course title:	**Horticulture**	**Course code:**	**BBOT101USE**
Course type:	Subject Elective	**Course credit:**	02

Pre-requisite: Having passed12th Science examination from recognized board with B or AB group.

Rationale: The student will be able to do nursery management and use of technology in horticulture.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

1. To discuss important results on Plant Propagation, Nursery Management, Floriculture, Bonsai and Important Horticulture crops of Gujarat.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Understand the different classifications of horticultural crops, nursery management, and use of technology in horticulture.
2. Develop their competency on pre and post-harvest technology in horticultural crops

Content

Unit	Description in detail	Credit	Weightage
I	**Horticulture-I**	1	50 %
	Introduction: Aims, Objectives and Scope of Horticulture		
	Plant Propagation-Vegetative, Asexual and Sexual reproduction		
	Nursery Management		
	Ornamental Plants		
II	**Horticulture-II**	1	50 %
	Landscape: Principles, Types and Planning		
	Floriculture and its implements		
	Bonsai		
	Important Horticulture crops of Gujarat		

Reference Books:

1. C.R. Adams (2018). Principles of Horticulture. Amsterdam. Boston.
2. Michael A. Dirr (2009). Manual of Woody and land Plants. Stipes Pub .

Suggested Readings:

1. Salaria and Salaria (2013).A2Z Solutions Horticulture at a glance Vol.I. Jain Bros.
2. Chadha K. L. (2003).Handbook of Horticulture. Indian Council of Agricultural Research.

Online Resources:

5. https://www.britannica.com/science/horticulture/
6. https://www.canr.msu.edu/hrt/about-us/horticulture_is/

Program: Bachelor of Science	**Subject / Branch:**Botany
Year:	**Semester:** II

Course title:	**Natural Resource Management**	**Course code:**	**BBOT201SE**
Course type:	Subject Elective	**Course credit:**	02

Pre-requisite: Having passed B.Sc1st semester examination from recognized university with Botany subject including horticulture as a subject elective.

Rationale: The student will be able to evaluate the management strategies of different natural resources and efforts in resource management and conservation.

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

1. Develop understanding on the concept of Sustainable utilization, Soil degradation and management.

2.To discuss important results on Renewable and non-renewable sources of energy.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Understand the concept of different natural resources and their utilization.
2. Critically analyze the sustainable utilization land, water, forest and energy resources.
3. Reflect upon the different national and international efforts in resource management and their conservation

Content

Unit	Description in detail	Credit	Weightage
I	**Natural Resource Management - I**	1	50 %
	Natural Resource: Definition, types and management.		
	Sustainable utilization: Concept, approaches (economic, ecological and sociocultural).		
	Land: Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.		
	Water: Fresh water (rivers, lakes, groundwater, aquifers, watershed), Marine; Estuarine; Wetlands.		
II	**Natural Resource Management - II**	1	50 %
	Forests: Definition, Cover and its significance (with special reference to India); Major and minor forest products; Depletion; Management.		
	Energy: Renewable and non-renewable sources of energy.		
	Contemporary practices in resource management: EIA (Environmental Impact Assessment), Resource Accounting, Waste management.		
	National and international efforts in resource management and conservation		

Reference Books:

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Suggested Readings:

1. United States Government Accountability Office (2008) Natural Resource Management. Nova Science Publishers Inc, 10th Edition
2. Stacy Keach (2016) Natural Resources Management. Syrawood Publishing House
3. Rathor, V.S. and Rathor B. S. (2013) Management of Natural Resource for Sustainable Development. Daya Publishing House, New Delhi

Online Resources:

7. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/natural-resource-management
8. https://byjus.com/physics/manage-natural-resources/

B.Sc. Semester: 3

Program: Bachelor of Science	**Subject / Branch:** Botany
Year: 2022	**Semester:** III

Course title:	**Mycology and Phytopathology**	**Course code:**	**BBOT301UDSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B.Sc2nd semester examination from recognized university with Botany subject including microbiology ,phycology ,Biomolecules and Cell Biology topics.

Rationale: On completion of this course the student will be able to Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

2. To discuss important results on Thallus organization, Nutrition, lifecycle and classification of fungi.
3. To discuss important results on Host-Pathogen relationships and Disease cycle and control measures of plant diseases.

Course Outcome:

After successfully completion of the course, the student will be able to…….

6. Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
7. Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies

Content

Unit	Description in detail	Credit	Weightage
I	**Fungi-1**	1	34 %
	General characteristics; Affinities with plants. Thallus organization; Cell wall composition; Nutrition; Classification (Ainsworth).		
	Phycomycetes: Zygomycetidae: Characteristic features. Thallus organisation; Reproduction; Life cycle and classification with reference to Rhizopus.		
	Ascomycetes: General characteristics (asexual and sexual fruiting bodies); Life cycle and classification with reference to Claviceps.		
	Basidiomycetes: General characteristics; Life cycle and Classification with reference to Agaricus.		
II	**Fungi-2**	1	33 %
	Allied Fungi: General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.		
	Lichens: Occurrence; General characteristics; Classification; Study of thallus (morphological and anatomical), Reproduction; Economic importance.		
	Mycorrhiza: Ectomycorrhiza, Endomycorrhiza and their significance.		
	Applied Mycology: Application of fungi in food industry (Flavour& texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Medicines (Pharmaceutical preparations); Agriculture (Bio fertilizers).		
III	**Phytopathology**	1	33%
	Terms and concepts; General symptoms.		
	Geographical distribution of diseases. Host-Pathogen relationships.		
	Pathogen, Symptoms, Dissemination, Disease cycle and control measures of following plant diseases: Bacterial diseases – Citrus canker.		
	Fungal diseases – White rust of crucifers, Black rust of wheat.		

Reference Books:

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.

Suggested Readings:

1. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
2. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
3. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

Online Resources:

https://www.biologyexams4u.com/2013/02/classification-of-fungi.html/
https://pragatiprakashan.in/new-pattern-mycology-and-phytopathology-ii-sem-odisha.html/
https://www.apsnet.org/about/Pages/WhatisPhytopathology.aspx

Practicals

1. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides/photographs/charts.
2. Claviceps: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs/charts.
3. Agaricus: Specimens of button stage and full-grown mushroom; sectioning of gills of Agaricus. Permanent slides/photographs/charts.
4. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structure (apothecium) through Permanent slides/photographs/charts/specimen.
5. Mycorrhizae: Ectomycorrhiza and Endomycorrhiza (Photographs).
6. Phytopathology: Study of Plant diseases: Citrus Canker, White rust of crucifers and Black rust of wheat.

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** III

Course title:	**Archegoniate**	**Course code:**	**BBOT302UDSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B.Sc2nd semester examination from recognized university with Botany subject including microbiology ,phycology ,Biomolecules and Cell Biology topics.

1. **Rationale: :**On completion of this course the student will be able to basic Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

1. To discuss important results on Generalcharacteristics, morphology, anatomy and reproduction, Economic importance of Bryophytes, Pteridophytes and Gymnosperms.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. The student understands, Demonstrate an understanding of archegoniate, Bryophytes, Pteridophytes and Gymnosperms
2. Understanding of plant evolution and their transition to land habitat.
3. Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, Gymnosperms

Content

Unit	Description in detail	Credit	Weightage
I	**Bryophytes**	1	34 %
	General characteristics of Bryophytes; Adaptations to land habit; Classification (Rothmaler); Alternation of generations.		
	Classification (up to family), morphology, anatomy and reproduction of Marchantia.		
	Classification (up to family), morphology, anatomy and reproduction of Funaria		
	Vegetative reproduction and economic importance of bryophytes.		
II	**Pteridophytes**	1	33 %
	General characteristics of Pteridophytes; Classification (Smith); Economic importance of Pteridophytes.		
	Classification (up to family), morphology, anatomy and reproduction of Equisetum (Developmental details not to be included).		
	Classification (up to family), morphology, anatomy and reproduction of Nephrolepis (Developmental details not to be included).		
	Heterospory and seed habit.		
III	**Gymnosperms**	1	33 %
	General characteristics, classification of Gymnosperms (Sporne, 1965).		
	Affinities with Pteridophytes and Angiosperms.		
	Morphology, anatomy (leaflets and coralloid root) and reproduction of Cycas (Developmental details not to be included).		
	Economic importance of Gymnosperms.		

Reference Books:

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. &Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.

Suggested Readings:

1. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
2. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
3. Vanderpoorten, A. &Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Online Resources

1. https://www.biologydiscussion.com/bryophyta/bryophyta-features-classification-and-economic-importance/5654
2. https://www.biologydiscussion.com/pteridophytes/pteridophytes-meaning-general-characters-and-affinities/53012
3. https://www.biologydiscussion.com/gymnosperm/gymnosperms-definition-external-features-and-reproduction/53316

Practicals

1. Marchantia- Morphology of thallus, whole mount of rhizoids & scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
2. Funaria- Morphology, whole mount of leaf, antheridial and archegonial heads, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads; longitudinal section of capsule and protonema.
3. Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).
4. Nephrolepis- Morphology, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rachis, whole mount of prothallus with sex organs and young sporophyte (permanent slide).
5. Cycas- Morphology (coralloid roots, bulbil, leaf, microsporophyll, megasporophyll), vertical section of leaflet, whole mount of spores (temporary slides), vertical section of microsporophyll, longitudinal section of ovule (permanent slide).

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** III

Course title:	**Plant Diversity and Human Welfare**	**Course code:**	**BBOT301USE**
Course type:	Subject Elective	**Course credit:**	02

Pre-requisite: Having passed B.Sc2nd semester examination from recognized university with Botany subject including horticulture and natural resources management as a subject elective.

Rationale: The student will be able to Develop understanding of the concept and scope of plant diversity.

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

4. To discuss important results on Plant diversity and its scope, Conservation of diversity and Importance of forestry their utilization and commercial aspects.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Identify the causes and implications of loss of biodiversity
2. Apply skills to manage plant biodiversity
3. Utilize various strategies for the conservation of biodiversity
4. Conceptualize the role of plants in human welfare with special reference to India

Content

Unit	Description in detail	Credit	Weightage
I	**Plant Diversity**	1	50 %
	Plant diversity and its scope- Genetic diversity, Species diversity and Ecosystem diversity.		
	Values and uses of Biodiversity: Ethical and aesthetic values, uses of plants (Food value), Uses of microbes.		
	Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity.		
	Conservation of diversity, In situ and ex situ conservation, Sustainable development.		
II	**Human Welfare**	1	50 %
	Importance of forestry their utilization and commercial aspects.		
	Avenue trees of India.		
	Ornamental plants of India.		
	Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.		

Reference Books:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices.Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Singh, J.S., Singh, S.P. and Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

Suggested Readings:

1. Reddy, K.V. and Veeraiah, S. (2010). Biodiversity and Plant Resources. Aavishkar publication, New Delhi.
2. Heywood, V. H. and Watson, R. T. (1995). Global biodiversity and Assessment. Cambridge University Press

Online Resources:

https://cbs.umn.edu/wildlife-bioenergy/project-design/plant-diversity

https://byjus.com/neet/important-notes-of-biology-for-neet-microbes-in-human-welfare/

Program: Bachelor of Science	**Subject / Branch:** Botany
Year: 2022	**Semester:** IV

Course title:	**Anatomy of Angiosperms**	**Course code:**	**BBOT401UDSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B. Sc 3rd semester examination from recognized university with Botany subject including microbiology, phycology, Biomolecules, Cell Biology, Anatomy of Angiosperms Archegoniate topics.

Rationale: On completion of this course the student will be able to develop an understanding of concepts and fundamentals of plant anatomy.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

5. To discuss important results on Classification of tissues, types of vascular bundles, Evolution concept of organization of shoot and root apex, Secondary growth in plants.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. examine the internal anatomy of plant systems and organs
2. Develop critical understanding on the evolution of concept of organization of shoot and root apex.
3. Analyze the composition of different parts of plants and their relationships
4. Evaluate the adaptive and protective systems of plants

Content

Unit	Description in detail	Credit	Weightage
I	**Anatomy**	1	34 %
	The three tissue systems, types of cells and tissues.		
	Classification of tissues; Simple and complex tissues; tracheary elements and sieve elements.		
	Types of vascular bundles; Structure of dicot & monocot stem and leaf.		
	Ergastic substances (starch grains of Potato & Wheat, Aleurone layer of Maize, Aleurone crystal of Castor seed), Hydathodes, Cavities, Cystolith and Laticifers.		
II	**Meristems**	1	33 %
	Definition & characteristics of meristem, Evolution concept of organization of shoot apex (Apical cell theory, Histogen theory and Tunica Corpus theory).		
	Organization of root apex (Histogen theory, Korper-Kappe theory and Quiescent centre theory).		
	Epidermal tissue system; cuticle, epicuticular waxes.		
	Trichomes (Uni-and Multicellular, Glandular and Nonglandular, two examples of each), Stomata: types, location, structure & function, classification (Metcalfe and Chalk).		
III	**Secondary growth**	1	33 %
	Structure, function and activity of cambium; Secondary growth definition and typesnormal and anomalous.		
	Secondary growth in Sunflower stem and root.		
	Anomalous Secondary growth in Salvadora stem and Tinospora aerial root.		
	Sapwood and heartwood; Ring and diffuse porous wood; Tyloses, Periderm and Lenticels.		

Reference Books:

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.

Suggested Readings:

1. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
2. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

Online Resources:

https://byjus.com/jee/anatomy-of-flowering-plants/
https://byjus.com/biology/meristematictissue/#:~:text=Meristematic%20tissues%20contain%20living%20cells,exist%20is%20known%20as%20meristem.
https://byjus.com/biology/secondary-growth-vascular-cork-cambium/

Practicals

1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples.
2. Ergastic substances (Aleurone layer of Maize, Aleurone crystal of Castor seed), Hydathodes, Cavities, Cystolith (Ficus leaf).
3. Apical meristem of root and shoot.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings (Sunflower & Cucurbita stem).
5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood (chart).
6. Phloem: Sieve tubes-sieve plates; companion cells (Cucurbita stem).
7. Epidermal system: stomata types (Dicot & Monocot); trichomes: non-glandular (Abutilon/Cotton), glandular (Ocimum), Periderm (PS) & Lenticels (PS).
8. Root: Secondary growth (Sunflower root & aerial root of Tinospora).
9. Stem: secondary growth (Sunflower &Salvadora stem).

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** IV

Course title:	**Economic Botany**	**Course code:**	**BBOT402UDSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B.Sc 3rd semester examination from recognized university with Botany subject including microbiology ,phycology ,Biomolecules ,Cell Biology , Anatomy of Angiosperms Archegoniate topics.

Rationale : On completion of this course the student will be able to Increase the awareness and appreciation of plants & plant products encountered in everyday life and Appreciate the diversity of plants and the plant products in human use.

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

1.To discuss important results on Classification of economic important plants based on their uses and Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of plants.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.
2. Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership
3. Develop a basic knowledge of taxonomic diversity and important families of useful plants.

Content

Unit	**Description in detail**	**Credit**	**Weightage**
I	**Plant Resources-1**	1	34 %
	Introduction of plant resources.		

	Concept of centres of origin, their importance with reference to Vavilov's work.		
	Classification of economic important plants based on their uses.		
	Origin, morphology, processing and uses of Wheat and Rice, Brief account of millets.		
II	**Plant Resources- 2**	1	33 %
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Chick pea and Pigeon pea.		
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Potato.		
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of spices: Clove and Black Pepper		
	Morphology and processing of Sugarcane, products and by-products of sugarcane industry.		
III	**Plant Resources- 3**	1	33 %
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Groundnut and Mustard.		
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Fennel.		
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Tea.		
	Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Cotton and Jute.		

Reference Books:

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.

Suggested Readings:

1. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Online Resources:

1. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/plant-resource
2. https://www.mmcmodinagar.ac.in/econtent/botany/resource.pdf
3. https://www.biologydiscussion.com/plant-breeding/crop-genetic-resources/crop-genetic-resources-and-centers-of-diversity-crops-plant-breeding/80643

Practicals

Write Scientific name, Family, Useful part, Chemical constitutes, economic important and draw labelled diagram of plant:

1. Cereals: • Wheat (habit sketch, starch grains, micro-chemical tests).

- Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).

2. Legumes: • Chick pea and Pigeon pea (habit, fruit, seed structure, micro-chemical tests).
3. Sources of oils and fats: • Mustard and Groundnut –plant specimen, seeds; tests for fats in crushed seeds.
4. Sources of sugars and starches: • Sugarcane • Potato: Potato tuber morphology, w.m. starch grains, Iodine test).
5. Spices: • Black pepper (habit) • Fennel (habit) and •Clove (habit).
6. Beverages: • Tea (plant specimen and tea leaves).
7. Fiber-yielding plants: • Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), • Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** IV

Course title:	**Plant Breeding**	**Course code:**	**BBOT401USE**
Course type:	Subject Elective	**Course credit:**	02

Pre-requisite: Having passed B.Sc3rd semester examination from recognized university with Botany subject including horticulture and natural resources management, plant diversity and human welfare as a subject elective.

Rationale: The student will be able to develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

6. To discuss important results on Breeding systems, Important achievements and undesirable consequences of plant breeding, Selection methods and Hybridization procedure.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Familiarize with genetic basis of heterosis.
2. Explain monogenic and polygenic inheritance.
3. Reflect upon the role of various non- conventional methods used in crop improvement.

Content

Unit	Description in detail	Credit	Weightage
I	**Plant Breeding**	1	50 %
	Introduction, definition and objectives of plant breeding.		

	Breeding systems: modes of reproduction in crop plants.		
	Important achievements and undesirable consequences of plant breeding.		
	Vegetatively propagated plants – Procedure, advantages and limitations.		
II	**Inbreeding depression and heterosis**	1	50 %
	History, genetic basis of inbreeding depression and heterosis; Applications.		
	Selection methods: Mass selection and Pure line selection.		
	Hybridization procedure		
	Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.		

Reference Books:

1. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH.
2. 2ndedition. 2. Das, L.D. Vijendra (2006) Plant Breeding. New Age International Publishers, New Delhi.
3. 3. Sharma, J.R.(1994) : Principles and practices of Plant Breeding. Tata McGraw-Hill Publishing Company Ltd. , New Delhi

Suggested Readings:

1. Singh, B.D. (2012). Plant Breeding: Principles and Methods. Kalyani Publishers. 9thedition.
2. Singh, Phundan (1996): Essentials of Plant Breeding. Kalyani Publishers, New Delhi-2.

Online Resources:

9. https://www.britannica.com/science/plant-breeding#:~:text=plant%20breeding%2C%20application%20of%20genetic,certain%20individuals%20among%20the%20progeny.
10. http://eagri.org/eagri50/GBPR211/lec21.pdf

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** V

Course title:	**Algae, Fungi and Plant Pathology**	**Course code:**	**BBOT501DSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B. Sc 4th semester examination from recognized university with Botany subject including Microbiology & Microanatomy, Genome and Phanerogams, Palaeobotany, Plants and Human Welfare and Environmental Biology, Genetics, Plant Ecology, Plant Physiology embryology, Taxonomy and Anatomy, Bio Statistics, Bio Chemistry And Bio-Physics topics.

Rationale : On completion of this course the student will be able to identify major groups of algae and Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease**.**

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

7. To discuss important results on general characters, thallus organization, reproduction and life history of Cynophyta, Chlorophyta, Phaeophyta and Rhodophyta.
8. To discuss important results on Thallus organization, Nutrition, lifecycle and classification of fungi.
9. To discuss important results on Host-Pathogen relationships and Disease cycle and control measures of plant diseases.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

2. Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
3. Develop an understanding of microbes, fungi appreciate their adaptive strategies
4. Identify the common plant diseases according to geographical locations and device control measures.

Content

Unit	Description in detail	Credit	Weightage
I	**Algae**	1	34 %
	Cyanobacteria: General characters, Organization of Thallus: Unicellular forms, Collonial forms: Non-filamentous and Filamentous colonies. Economic importance of Cyanobacteria		
	General characters of Algae and Thallus organization of Algae: Colonial, Coenobium and Filamentous. Ultra structure of Algal (Eukaryotic) cell i.e., Chlamydomonas cell. Harmful aspects of Algae.		
	Typical life histories of algae belonging to various divisions including classification (Smith,1958), occurrence, structure, reproduction (excluding development):Cyanophyta: NostocChlorophyta: Oedogonium		
	Phaeophyta: EctocarpusRhodophyta: Batrachospermum		
II	**Fungi**	1	33 %
	General characters, Thallus organization: Unicelluar, Filamentous - aseptate and septate mycelia.		
	Typical life histories of fungi belonging to various division s including Classification (G C Ainsworth, 1973), occurrence, structure, reproduction (excluding development): Oomycetes: Pythium,Ascomycetes: Erysiphae Basidiomycetes: Agaricus		
	Forms of spore in Fungi: Asexual Spores, Sexual Spores.		
	Modes of nutrition of fungi		
III	**Plant Pathology**	1	33 %
	The Fundamentals of Plant Pathology: Plant Pathogens: Bacteria, Virus and Fungi.		
	Classification of plant diseases on the basis of nature of the causal agent and occurrence.		
	General symptoms, causal organism, disease cycle and control measures of following Plant diseases: White rust of Crucifer,		
	Black rust of Wheat and Wilt of Cotton		

Reference Books:

1. Hait G, Bhattacharya K and Ghosh A K (2008) A Text Book of Botany , Vol-I, New Central Book Agency (P) Ltd., Kolkata(1 st Edition's Reprint).
2. Singh V, Pande P C and Jain D K (2008-09) A Text Book of Botany, Rastogi Publications, Meerut(4 th Revised Edition's Reprint).

Vasishtha B R, Sinha A K and Singh V P (2007), Botany for degree students -Algae (5th edition), S. Chand & Co. Ltd., New Delhi.Pandey B P (2001), College Botany Vol. I, S. Chand & Co. Ltd., New Delhi.

3. Purohit S S and Deo P P (2005), UGC Unified College Botany –First Year, Student edition, Jodhpur.
4. Gangulee S.C., Das K.S., Dutta C.D. and Kar (1985), College Botany Vol. I, II &III , New Central Book Agency, Kolkata.

Suggested Readings:

1. Singh V, Pande P C and Jain D K (2008-09) A Text Book of Botany, Rastogi Publications, Meerut (4thRevised Edition's Reprint).
2. Sharma P D (2003) The Fungi, Rastogi Publications, Meerut (2nd Edition's Reprint).
3. Vashishta B R and Sinha A K (2007) Botany for Degree Student s –Fungi, S Chand & Company Ltd., New Delhi (1st Edition's Revised and Multicolour -Reprint).
4. Vasishtha B R and Sinha A K (2002), Botany for degree students -Fungi (5th edition), S. Chand & Co. Ltd., New Delhi Sharma O P (2002), Text Book of Fungi (9th edit ion), Tata McGraw-Hill Publishing Co Ltd.,Delhi

Online Resources:

11. https://www.biologydiscussion.com/algae/algae-definition-characteristics-and-structure-with-diagram/46727#:~:text=The%20algae%20are%20ubiquitous%20(present,mainly%20dwell%20in%20aquatic%20environments./
12. https://pragatiprakashan.in/new-pattern-mycology-and-phytopathology-ii-sem-odisha.html/
13. https://www.apsnet.org/about/Pages/WhatisPhytopathology.aspx

Practicals

Unit- 1: Algae

- Classify with reasons (up to family), identify and describe structural peculiarities of Algae mentioned in Theory syllabus.
- Cyanophyta: Nostoc
- Material: Vegetative structure.
- Permanent slide: Thallus, Heterocyst. Chlorophyta: Oedogonium

Material: Vegetative structure (Thallus), Antheridium: M acrandrous sp., Oogonium: Macrandrous sp.

- Permanent slide: Thallus, Antheridium: Macrandrous sp., Antheridium: Nanandrous species. Oogonium: Macrandrous species. Zygote.
- Phaeophyta: Ectocarpus
- Material: Veg.structure, asexual reproductive structures- Uni&Pluri-locular sporangia
- Permanent slide: Thallus, asexual reproduction - Uni and Pluri-locular sporangia. Rhodophyta: Batrachospermum
- Materail: Vegetativeand reproductive structure - carposporangia and cystocarp
- Permanent slide: Thallus, cystocarp.

Program: Bachelor of Science	**Subject / Branch:**Botany
Year: 2022	**Semester:** V

Course title:	**Bryophyta, Pteridophyta and Gymnos perms**	**Course code:**	**BBOT502DSC**
Course type:	Discipline Specific Course	**Course credit:**	03

Pre-requisite: Having passed B. Sc 4th semester examination from recognized university with Botany subject including Microbiology & Microanatomy, Genome and Phanerogams, Palaeobotany, Plants and Human Welfare and Environmental Biology, Genetics, Plant Ecology, Plant Physiology embryology, Taxonomy and Anatomy, Bio Statistics, Bio Chemistry And Bio-Physics topics.

Rationale : On completion of this course the student will be able to basic Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	60	00	20	10	70	100

Course Objective:

2. To discuss important results on Generalcharacteristics, morphology, anatomy and reproduction, Economic importance of Bryophytes, Pteridophytes and Gymnosperms.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1.The student understands, Demonstrate an understanding of archegoniate, Bryophytes, Pteridophytes and Gymnosperms
2.Understanding of plant evolution and their transition to land habitat.
3.Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, Gymnosperms

Content

Unit	Description in detail	Credit	Weightage
I	**Bryophyta**	1	25 %
	General characters of Bryophyta. Origin of Bryophyta: From Algae and From Pteridophytes.		
	Vegetative reproduction in Bryophytes		
	Typical life-histories of Bryophyta belonging to various divisions including Classification (Proskauer, 1957), Occurrence, External and Internal Structure of Thallus and Reproduction (excluding development). Hepaticopsida: Riccia Anthocerotopsida: Anthoceros Bryopsida: Funaria		
	Economic importance of bryophyta		
II	**Pteridophyta**	1	25 %
	General characters of Pteridophyta. Apospory and Apogamy.		
	Typical life-histories of Pteridophyta belonging to various divisions including Classification (Smith, 1955), Occurrence, External and Internal Structure of Plant body and Reproduction (excluding development). Lycophyta: Selaginella Arthrophyta: Equisetum		
	Pterophyta: Leptosporangiopsida :Marsilea		
	Types of Stele in Pteridophytes		
III	**Gymnosperms**	1	25 %
	Introduction: Affinities of Gymnosperms with Pteridophytes and Angiosperms		
	Economic importance of Gymnosperms.		
	General characters of Gymnosperms		
	Typical life-histories of Gymnosperms belonging to various divisions including Classification (Taylor, 1981), Occurrence, Structure and Reproduction (excluding developmnt). Coniferales: Pinus Ephedrales: Ephedra		

Reference Books:

1. Singh V, Pande P C and Jain D K (2008-09) A Text Book of Botany, Rastogi Publications, Meerut(4 th Revised Edition's Reprint)
2. Vashishta B R and Sinha A K (2007) Botany for Degree Students –Bryophyta, S Chand &CompanyLtd., New Delhi (1st Edition's Revised and Multicolour -Reprint).
3. Vashishta B R and Sinha A K (2007) Botany for Degree Students –Pteridophyta, S Chand &CompanyLtd., New Del hi (1st Edition's Revised and Multicolour -Reprint).

Suggested Readings:

1. Pandey B P (2003) College Botany –Vol.-II,S Chand & Company Ltd., New Delhi(1st Edition's Reprint)
2. Pandey S N, Misra S P and Trivedi P S (2003) A Text Book of Botany –Vol.-II,Vikas Publishing House Pvt Ltd., New
3. Delhi(11th Revised Edition's Reprint).
4. Singh V, Pande P C and Jain D K (2008-09) A Text Book of Botany, Rastogi Publications, Meerut(4 th Revised Edition's Reprint).
5. Pandey B P (2003) Simplified Course in Botany –B Sc-II,S Chand & Company Ltd., New Delhi(1 st Edition's Reprint)
   Bhatnagar S P and MoitraAlok (2006) Gymnosperms,,New Age International (P) Ltd,Publishers.,NewDelhi(1stEdition'sReprint)

Online Resources:

1. https://www.biologydiscussion.com/bryophyta/bryophyta-features-classification-and-economic-importance/5654
2. https://www.biologydiscussion.com/pteridophytes/pteridophytes-meaning-general-characters-and-affinities/53012
3. https://www.biologydiscussion.com/gymnosperm/gymnosperms-definition-external-features-and-reproduction/53316

Practicals

Unit- 1: Bryophyta

- Classify with reasons (up to family), identify and describe structural peculiarities of Bryophytes mentioned in Theory syllabus.
- Hepaticopsida: Riccia
- Material: Vegetative structure: Thallus, Reproductive body: Antheridia and Archegonia.
- Permanent slide: Tallus (W M), V S of Thallus, Reproductive structure: Antheridia (W M) and Archegonia (W M), V S of Sporophyte/Capsule.
- Anthocerotopsida: Anthoceros
- Material: Vegetative structure: Thallus, Reproductive body: Sporophyte/Capsule.

- Permanent slide: Tallus (W M), V S of Thallus, Reproductive structure: Antheridia (W M) and Archegonia (W M), T S of Sporophyte/Capsule V S of Sporophyte/Capsule.
- Bryopsida: Funaria
- Material: Vegetative structure: Thallus, Sex organs, Sporophyte/Capsule, Spores, Peristomal teeth.
- Permanent slide: Tallus (W M), Sex organs, L.S. of capsule, Peristom e, Protonema.

Unit- 2: Pteridophyta

- Classify with reasons (up to family), identify and describe structural peculiarities of Pteridophytes mentioned in Theory syllabus.
- Lycophyta: Selaginella
- Material: Plant body (Veg organs -root, stem, rhizophoe, leaf), reproduction - cone/ strobilus.Permanent slide: Plant body (WM), T.S. of root, T.S. of stem, T.S. of rhizophore, leaf (WM), reproduction: L. S. of cone, Megaspore (WM), Microspore (WM).
- Arthrophyta: Equisetum
- Material: Plant body (Veg. organs - stem, scaly leaves), reproduction - cone/ strobilus.
- Permanent slide: Plant body (WM), T. S. of stem, scaly leaves (WM), reproduction: L. S. of
- cone, T. S. of cone, Spores (WM).
- Pterophyta: Leptosporangiopsida – Marsilea
- Material: Vegetative structure (External and Internal): Root, Stem, Leaf. Reproductive body: Sporocarp.
- Permanent slide: T S of Root, Stem, Leaf, Reproductive structure: T S/V S of Sporocarp, Microspore, Megaspore.

Unit- 3: Gymnosperms

- Classify with reasons (up to family), identify and describe structural peculiarities of Gymnosperms mentioned in Theory syllabus.
- Coniferales: Pinus
- Material: Vegetative organs-leaves (needles), reproductive structures - male cone, female cone, Microspores (pollen grains).
- Permanent slide: Sections of stem, T.S. of leaf, reproduction: L. S. of male cone, T. S. of ovule,
- Microspores/Pollen grains (WM).
- Ephedrales: Ephedra
- Material: Vegetative organs. Reproductive structures - Male cone, Female cone, Microspores (pollen grains).
- Permanent slide: Sections of vegetative organs. L. S. of male cone, T. S. of ovule, Microspores/Pollen grains (WM).

Program: Bachelor of Science	**Subject / Branch:**Botany
Year : 2022	**Semester:** V

Course title :	**Angiosperm Families, Plant Ecology and Plant Anatomy**	**Course code :**	**BBOT503DSC**
Course type :	Discipline Specific Course	**Course credit :**	03

Pre-requisite: Having passed B. Sc 4th semester examination from recognized university with Botany subject including Microbiology & Microanatomy, Genome and Phanerogams, Palaeobotany, Plants and Human Welfare and Environmental Biology, Genetics, Plant Ecology, Plant Physiology embryology, Taxonomy and Anatomy, Bio Statistics, Bio Chemistry And Bio-Physics topics.

Rationale : On completion of this course the student will be able to Evaluate energy sources of ecological system, Assess terms and concepts related to Phylogenetic Systematics and develop an understanding of concepts and fundamentals of plant anatomy.

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

1.To discuss important results on Studies of Angiosperm families, Climatic Factors, Autecology, Stomata, Nodal Anatomy, Secretory Tissue and Ergastic substances.

Course Outcome:

After successfully completion of the course, the student will be able to…….

10. The student understands the concept of important results on understand core concepts of biotic and abiotic. Classify the soils on the basis of physical, chemical and biological

components Assess the adaptation of plants in relation to light, temperature, water, wind and fire.

11. Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium. Evaluate the Important herbaria and botanical gardens. Interpret the rules of ICN in botanical nomenclature. Generalize the characters of the families according to Bentham & Hooker's system of classification.
12. examine the internal anatomy of plant systems and organs. Develop critical understanding on the evolution of concept of organization of shoot and root apex. Analyze the composition of different parts of plants and their relationships. Evaluate the adaptive and protective systems of plants

Content

Unit	Description in detail	Credit	Weightage
I	**Angiosperm Families**	1	25 %
	Studies of Angiosperm families: Distinguishing characters and classification up to family with reasons as per Bentham and Hooker's (1862-80) system of classification of the following families including floral formula, floral diagram and botanical names of economically important any five plants.		
	Dicotyledons: **Polypetalae:** Tiliaceae, Rhamnaceae, Cucurbitaceae. **Gamopetalae:** Solanacae, Convolvulaceae, Scrophulariceae, Bignoniaceae,Lamiaceae.		
	Monochlamidae: Amaranthaceae.		
	Monocotyledons: Commelinaceae, Amaryllidaceae.		
II	**Plant Ecology**	1	25 %
	Climatic Factors: Light factor: Light in relations to Plants. Temperature factor: Effects of temperature on Plants, Variations in temperature and its effects on distribution on Plants. Precipitation (Rainfall), Humidity in air and Wind.		
	Abiotic environment: Liebig's Law of Minimum, Shelford's Law of Tolerance.		
	Autecology: Introduction, Regeneration of a species: Seed output, Seed dispersal, Seed viability, Seed germination and reproductive capacity.		
	Edaphic Factor: Soil: Soil Complex: Components and Properties: Mineral matter: Soil Texture, Soil structure and Porosity. Soil air, Soil Water, Soil Solution, Soil Organic matter and Soil Organisms.		
III	**Plant Anatomy**	1	25 %
	Stomata: Structure and Function, Types -According to Metcalfe and Chalk (1950).		
	Nodal Anatomy: Leaf Traces and Leaf gaps. Types of nodes.		
	Secretory Tissue: Glandular trichomes, Hydathodes, Resin ducts and Laticifers.		
	Ergastic substances: Food Pro ducts-Carbohydrates, Nitrogenous Products and		

	Fats. Mineral crystals and Alkaloids. Leaf fall and wound healing.		

Reference Books:

1.Lawrence G H M (1967) Taxonomy of Vascular Plants , Oxford & IBH Publishing Co.Pvt Ltd., New Delhi (1 st Indian Edition). Singh V Pande P C and Jain D K (1995) A Text Book of Botany-Angiosperms, Rastogi Publications, Meerut(1 stEdition'sReprint).

2.Singh V and Jain D K (1999) Taxonomy of Angiosperms, Rastogi Publications, Meerut (2 nd Edition's Reprint).

Suggested Readings:

1. Singh V, Pande P C and Jain D K (1998) Anatomy of Seed Plants , Rastogi Publications, Meerut(1 st Edition's Reprint).
2. Pandey B P (1997) Plant Anatomy, S Chand & Co. Ltd, New Delhi. (1st Edition's Reprint).
3. E John Jothi Prakash (2000) A Text Book of Plant Anatomy, Emkay Publications, Delhi. (2 nd Revised Edition).
4. Tayal M S (2001) Plant Anatomy, Rastogi Publications, Meerut(5 th Edition's Reprint).

Online Resources:

1. https://www.slideshare.net/AvishekDas47/plant-ecology-96989720/
2. https://bio.libretexts.org/Bookshelves/Botany/Botany_(Ha_Morrow_and_Algiers)/Unit_1%3A_Biodiversity_(Organismal_Groups)/08%3A_Angiosperm_Diversity/8.04%3A_Angiosperm_Families
3. https://byjus.com/jee/anatomy-of-flowering-plants/

Practicals

Unit- 1: Angiosperm Families

- Identify and classify (as per Bentham and Hooker's system) the family giving reasons and Draw diagrams: A flowering twig, L S of Flower, other floral structures, floral formula and floral diagram of locally available plant specimens of families as mentioned below.
- Dicotyledons:Polypetalae: Tiliaceae, Rhamnaceae, Cucurbitaceae.Gamopetalae: Solanacae, Convolvulaceae, Scrophulariceae, Bignoniaceae, Lamiaceae.
- Monochlamydae: Amaranthaceae.Monocotyledons: Commelinaceae, Amaryllidaceae.

Unit- 2: Plant Ecology

- Study of ecological instruments:
- Maximum and Minimum Thermometer, Dry and Wet Bulb Thermometer, Hygrometer
- Anemometer, Rain guage
- To determine Carbonate, Nitrate and Base deficiency in scale of 0-5 in soil sample.
- To determine Chloride content in a water sample.
- To determine pH in a water and soil sample.
- To determine Total hardness of a water sample.
- To determine Carbonate and Bi -carbonate in a water sample.
- To determine field/water holding capacity of different soil samples.
- Mechanical separation of soil sample to study the percentage of different particle s (contents) of soil samples.
- Study of Physical characters i.e., weight, length, width, volume, colour and shape of the seed.

Unit- 3: Plant Anatomy

- To study the various types of Stomata as per theory syllabus:
- Anomocytic: From any plant species of families Papaveraceae, Capparaceae, Nyctaginaceae. Anisocytic: From any plant species of families Brassicaceae, Solanaceae, Convolvulaceae. Diacytic: From any plant species of families Lamiaceae, Acanthaceae and Paracytic: From any plant species of family Rubiaceae.To study the Glandular Trichomes from Datura, Ocimum stem epidermis, fruit wall of Boerhaaviadiffusa. Hydathode from Colocasia leaf, Nephrolepisleaflet.Resin ducts from Pinus leaflet, Sunflower stem.
- To study Articulated or Non -Articulated Latex tissue from the plant species of families viz., Convolvulaceae, Sapotaceae, Caricaeae, Asteraceae, Euphorbiaceae, Asclepiadaceae, Moraceae, Papaveraceae and Apocynaceae.
- To study the UniTri and Multilacunar nodes from stem (Nodal region) of Annona, Azadirachta and Chenopodium respectively.
- To study the ergastic substances with appropriate staining:
- Starch grains: various types e.g., Caryopsis of Maize, Wheat, Rice and tuber of Potato.
- Aleurone layer e.g, Maize. Aleurone crystals e.g., Seed of castor. Fat particles e.g., seed of Castor, Groundnut and Coconut (endosperm). Mineral Crystals e.g., Calcium oxalate: Raphids-Petiole of Colocaciaand Stem of Commelina. Sphaeraphids: Nerium leaf. Calcium carbonate: Cystoliths-Ficus (Banyan) leaf Alkaloids e.g.Withania -Root, Vinca-Stem and Nicotiana-leaf and leaf of Adhatoda and Datura

Program: Bachelor of Science **Subject / Branch:**Botany

Year : 2022 **Semester:** V

Course title :	**Cell Biology & Genetics, Microbiology and Biostatistics**	**Course code :**	**BBOT504DSC**
Course type :	Discipline Specific Course	**Course credit :**	03

Pre-requisite Having passed B. Sc 4th semester examination from recognized university with Botany subject including Microbiology & Microanatomy, Genome and Phanerogams, Palaeobotany, Plants and Human Welfare and Environmental Biology, Genetics, Plant Ecology, Plant Physiology embryology, Taxonomy and Anatomy, Bio Statistics, Bio Chemistry And Bio-Physics topics.

8. **Rationale** : On completion of this course the student will be able to Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders, Develop understanding on the concept of microbial nutrition.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
3	45	00	20	10	70	100

Course Objective:

13. To discuss important results on Cell biology, Linkage maps, Cell structure of Bacteria, Measure of Dispersion and Theorems of Probability.

Course Outcome:

After successfully completion of the course, the student will be able to…….

1. The student understands the concept of Have conceptual understanding of Chromosomal Aberrations, genetic.Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders. Analyze the effect of mutations on gene functions and dosage. Examine the structure, function and replication of DNA.
2. Develop understanding on the concept of microbial nutrition.
3. Increase the awareness and appreciation of human friendly viruses and bacteria their economic importance.

Content

Unit	Description in detail	Credit	Weightage
I	**Cell Biology & Genetics**	1	25 %
	Cell biology: Mitochondria: Morphology and Ultra structure, Chemical composition and Functions. Plastids: Types of Plastids, Chloroplasts: Morphology, Chemical composition, Ultra structure and Functions.		
	Genetics:Non-Mendelian Inheritance: Genetic Inter action: 9:6:1 and 13:3. Crossing over and Linkage maps: Recombination frequencies from a test cross and F 2 data. Linkage groups: Introduction, Chi-square test for segregation ratios and detection of linkage.		
	Chromosomal Aberrations: Structural Changes in Chromosomes-Deletion, Duplication, Inversion, Translocation.Numerical Changes in Chromosomes -Euploidy: Monoploidy Polyploidy: Autopolyploids, Allopolyploids		
	Aneuploidy: Monosomy, Nullisomy, Trisomy and Tetrasomy.		
II	**Microbiology (Bacteriology)**	1	25 %
	Cell structure of Bacteria: Cellwall -structure and chemical composition, Cytoplasmic membrane, Mesosomes, Cytoplasmic inclusions and vacuoles, Nuclear material.		
	Preparation for light microscope examination: Wet mount and Hanging drop technique. Fixed stained smear- Gram staining.		
	Isolation, Maintenance and Preservation of Pure cultures: Streak -plate, Pour plate and Spread plate techniques. Maintenance and Preservation: Periodic transfer, overlaying cultures with mineral oil, Freeze-drying, storage at low temperatures.		
	The Immune response: Antigens, Antibodies, Monoclonal antibodies.		
III	**Biostatistics**	1	25 %
	Measure of Dispersion -I: Definition, computation, Merits and Demerits and Properties of: Mean Deviation and Standard Deviation: Ungrouped data, Grouped data: Discrete series and Continuous series.		
	Measure of Dispersion-II: Definition, computation, Merits and Demerits and Properties of: Variance and Co-efficient of Variance. Standard Error		
	Probability: Important terms, Definition of Probability		
	Theorems of Probability: The Addition Theorem and The Multiplication Theorem		

Reference Books:

1. Strickberger M W (2005) Genetics, Prentice-Hall of India Pvt Ltd., New Delhi (3 rd Edition-EEE).
2. Rastogi Veer Bala (1991-92) A Text Book of Genetics ,KedarNath Ram Nath, Meerut (9 th Revised Edition).

3. Singh B D (2001) Plant Breeding -Principles and Methods, Kalyani Publishers, Ludhiana (1st Edition's Reprint).
4. Gupta P K (2005) Genetics, Prentice-Hall of India Pvt Ltd., New Delhi (3 rd Edition-EEE)
5. Verma P S and Agarwal (2006) Cell Biology, Genetics , Molecular Biology, Evolution and Ecology .S Chand & Company Ltd., New Delhi(1st Multicolour Edition-Reprint).
6. Sambamurty ( ), Genetics (2nd edition)
7. Gupta P K (2007), Genetics-classical to modern (1st edition)
8. Patel B C (2012) Human Genetics (ManavJaninvignan -in Gujarati) Gujarat Vishvakosh Trust, Ahmedabad-380 013 (1st edition).
9. Chandel S R S (2006) A Hand Book of Agricultural Statistics, AchalPrakashanMandir, Kanpur(1st Edition).

Suggested Readings:

1.Banerjee P K (2004) Introduction to Biostatistics [A Textbook of Biometry], S Chand & Company Ltd., New Delhi(1 st Edition).
2.Prasad S (2001) Elements of Biostatistics, Rastogi Publications, Meerut(1 st Edition).

Online Resources:

1. https://www.toppr.com/guides/biology/the-fundamental-unit-of-life/structure-of-cell/
2. https://byjus.com/neet-questions/give-the-classification-of-bacteria-based-on-the-arrangement-and-number-of-flagella/
   https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_biostatisticsbasics/bs704_biostatisticsbasics_print.html

Program: Bachelor of Science	**Subject / Branch:**Botany
Year : 2022	**Semester:** V

Course title :	**Air Pollution**	**Course code :**	**BBOT501SE**
Course type :	Subject Elective	**Course credit :**	02

Pre-requisite: Having passed B. Sc**4**th semester examination from recognized university with Botany subject including DNA a molecule of life as subject elective.

Rationale **:** The student will be able to develop conceptual understanding of Criticallyanalyze the public participation for environmental protection.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

14. To discuss important results on Pollution and pollutants, Green House Effect, Global Warming and Prevention and control of air pollution.

Course Outcome:

After successfully completion of the course, the student will be able to…….

9. The student understands the concept of Understand the fundamental issues of environment Analyze different sources of environmental problems and methods of measurement of pollution. Examine economic growth and quality of life.

Content

Unit	Description in detail	Credit	Weightage
I	**Pollution and pollutants**	1	50 %
	Define Pollution and pollutants. Various principal environmental pollutants with examples		

	Kinds of pollutants: Non -degradable and Bio -degradable.		
	Air Pollution: Introduction, Air quality, sources and pollutants: Industrial Chimany wastes.		
	Thermal power station and Automobile.		
II	**Effect of pollution**	1	50 %
	Nitrogen oxides: Nitrogen oxide, Nitric oxide and Nitrogen dioxide.		
	Fluorocarbons and Hydrocarbons. Metals and Photo-chemicals products.		
	Prevention and control of air pollution.		
	Green House Effect, Global Warming, Ozone -depletion, and Acid rain.		

Reference Books:

Sharma P. D. (7th Edition - Reprint 2003). Ecology and Environment. Rastogi Publications, Meerut.

Suggested Readings:

Sharma P. D. (7th Edition - Reprint 2003). Ecology and Environment. Rastogi Publications, Meerut.

Online Resources:

https://www.yourarticlelibrary.com/essay/pollution-and-pollutants-classification-causes-effects-and-sources/27407/
https://www.sciencedirect.com/topics/earth-and-planetary-sciences/pollution-effect/

Program: Bachelor of Science	**Subject / Branch:**Botany
Year : 2022	**Semester:** VI

Course title :	Molecular Biology, Plant Pathology & Lichens and Angiosperm Families	**Course code :**	BBOT601DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Pre-requisite: Having passed B,sc 5th Semester examination from recognized university with botany subject including microbiology & microanatomy , Genome and phanerogams , Palaeobotany, plants and human welfare and environmental biology, genetics, Plant ecology, Plant physiology embryology, taxonomy and Anatomy, Bio statistics, Biochemistry and Bio-physics, Algae, fungi and Plant pathology, Bryophyta, Pteridophyta and Gymnosperms, Angiosperm families, Plant ecology and Plant anatomy, cell biology & genetics, Microbiology and Biostatistics topics.

Rationale : The student understands the concept of plant pathology in the control of plant disease and Assess terms and concepts related to Phylogenetic Systematics.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

1.To discuss important results on Chemical Nature of Genetic materials, Replication of DNA, Lichens, Dissemination of Plant Pathogens and Classification (as per Bentham and Hooker's system).

Course Outcome:

After successfully completion of the course, the student will be able to…….

10. The student understands the concept of Identify the principles and application of plant pathology in the control of plant disease, differentiate the main types of prokaryotes through their grouping abilities and their characteristic. Evaluate the experiments establishing central dogma and genetic code. Gain an understanding of various steps in transcription, protein synthesis and protein modification. Generalize the characters of the families according to Bentham & Hooker's system of classification.

Content

Unit	Description in detail	Credit	Weightage
I	Molecular Biology	1	34 %
	Chemical Nature of Genetic materials: Molecular structure of De -oxy riboNucleic Acid-Watson and Crick model, Molecular structure of RiboNucleic Acid and Types of RNA.		
	Replication of DNA: Mechanism of DNA replication in Eukaryotes and Prokaryotes		
	Transcription: Mechanism of Prokaryotic Transcription, Mechanism of Eukaryotic Transcription		
	Genetic Code and Translation: Genetic Code -Characteristics and Genetic codon/dictionary. Translation-Mechanism of Protein Synthesis.		
II	**Plant Pathology & Lichens**	1	33 %
	Plant Pathology: Defense Mechanisms in Plants: Morphological Defense Mechanism and Biochemical Defense Mechanism.		
	Dissemination of Plant Pathogens: Direct dissemination and Indirect dissemination. Study of Plant Diseases: Following diseases of Plants, their symptoms, causal organisms, disease cycle and their control measures: 1. Late Blight of Potato 2. Tikka disease of Groundnut and 3. Powdery mildew of Cucurbits .		
	Lichens: General Characters of Lichens, Classification of the Lichens - Ascolichens and Basidiolichens.		
	Structure of Thallus - Crustose, Foliose and Fruticose and Reproduction of Lichen- Asexual and Sexual		
III	**Angiosperm Families**	1	33 %
	Classification (as per Bentham and Hooker's system), distinguishing characters, floral formula, floral diagram, common examples of economically important plants of the following families. Dicotyledons: Polypetalae: Cruciferae (Brassicaceae), Papaveraceae, Rutaceae. Gamopetalae: Sapotaceae, Asteraceae. Monochlamydae: Moraceae.		
	Monocotyledons: Cannaceae, Cyperaceae, Poaceae.		
	Dichotomous Key		
	Angiosperm Taxonomy in relation to anatomy and embryology.		

Reference Books:

1. Verma P S and Agarwal (2006) Cell Biology, Genetics , Molecular
2. Biology, Evolution and Ecology .S Chand & Company Ltd.,New Delhi(1st

3. Multicolour Edition-Reprint).
4. Rangaswami G (1988) Diseases of Crop plants in India, Prentice -Hall of India
5. Pvt. Ltd., New Delhi (3rdEdition).
6. Pandey B P (2006) Plant Pathology -Pathogen and Plant Diseases, S Chand &
7. Co. Ltd., Ne w Delhi (1st Edition'sReprint).
8. Mehrotra R S (1991) Plant Pathology, Tata McGraw -Hill Publishing Co. Pvt.
9. Ltd., New Delhi (8th Edition's Reprint).
10. Agrios George N (2004) Plant Pathology, Academic Press, Reed Elsevier India

Suggested Readings:

1. Lawrence H M (1951) Taxonomy of Vascular Plants, Oxford Publication.
2. Sambamurty A V S S (2005) Taxonomy of Angiosperms, I K International P
3. L, New Delhi
4. Pandey B.P. (2005) Taxonomy of Angiosperms, S Chand A.S. Foster & E.M.
5. Gifford Comparative Morphology of Vascular Plants
6. K.R. SporneThe Morphology of Vascular Plants
7. R.N. SutariaA Text Book of Systematic Botany
8. Y.D. Tyagi&S.Kshetrapal An Introduction to Taxonomy of Angiosperms
9. P.C. VashishtaTaxonomy of Angiosperm

Online Resources:

14. https://www.nature.com/subjects/molecular-biology#:~:text=Molecular%20Biology%20is%20the%20field,the%20cell's%20functions%20and%20maintenance.
15. .https://pddc.wisc.edu/2015/07/28/lichens/
16. https://www.slideshare.net/YOGITASHARMA92/key-characters-of-some-major-angiosperm-families-220934133

Practicals

Molecular Biology, Plant Pathology & Lichens and Angiosperm Families

Unit- 1: Molecular Biology

- Study through Permanent Slides/Charts/Models/Photographs:
- Watson and Crick's model of DNA / Molecular structure of DNA,
- Types of RNA / Molecular structure of RNA,
- DNA Replication,
- Transcription and
- Translation: Genetic code and Protein synthesis

Unit- 2: Plant Pathology & Lichens

- Plant diseases: Study through Fresh/Preserved material and Permanent slide
- Late Blight of Potato - reproductive structure -sporangia
- Tikka disease of Groundnut - reproductive structure -conidia
- Powdery mildew of Cucurbits - reproductive structures
- Study of different specimens: Crustose, Foliose and Fruticose.
- Material/Permanent slide: Thallus of Lichen, Fruiting bodies, T S of Lichen Thallus and V S of fruiting bodies.

Unit- 3: Angiosperm Families

- Identify and classify (as per Bentham and Hooker's system) the family giving reasons and Draw diagrams: A flowering twig, L S of Flower, other floral structures, floral formula and floral diagram of locally available plant specimens of families as mentioned below.
- Dicotyledons:

oPolypetalae: Cruciferae (Brassicaceae), Papaveraceae, Rutaceae.
oGamopetalae: Sapotaceae, Asteraceae.
oMonochlamydae: Moraceae.
o Monocotyledons: Cannaceae, Cyperaceae, Poaceae.
o Prepare dichotomous key with the help of locally available plant species.

Program: Bachelor of Science **Subject / Branch:**Botany

Year : 2022 **Semester:** VI

Course title :	Biochemistry and Plant Physiology	**Course code:**	BBOT602DSC
Course type :	Discipline Specific Course	**Course credit:**	04

Pre-requisite: Having passed B.Sc 5th Semester examination from recognized university with botany subject including microbiology & microanatomy , Genome and phanerogams , Palaeobotany, plants and human welfare and environmental biology, genetics, Plant ecology, Plant physiology embryology, taxonomy and Anatomy, Bio statistics, Biochemistry and Bio-physics, Algae, fungi and Plant pathology, Bryophyta, Pteridophyta and Gymnosperms, Angiosperm families, Plant ecology and Plant anatomy, cell biology & genetics, Microbiology and Biostatistics topics.

Rationale : The student understands the concept of Water relation of plants with respect to various physiological processes and understands the concept of Comprehend different fundamental concepts related to plant biochemistry.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

15. To discuss important results on Lipid, Vitamins, Enzymes, Translocation of Food in Plants, Path of Carbon in Photosynthesis, Respiration, Respiration, Seed Dormancy and Physiological role of Phytohormones.

Course Outcome:
After successfully completion of the course, the student will be able to…….

11. The student understands the concept of Comprehend different fundamental concepts related to plant biochemistry like plant cell organelles, photosynthesis, respiration and lipid

metabolism etc. Analyze the structure and properties of various enzymes. Evaluate the process of ATP Synthesis, nitrogen metabolism and lipid metabolism

12. Explain chemical properties and deficiency symptoms in plants. Classify aerobic and anaerobic respiration. Explain the significance of Photosynthesis and respiration. Assess dormancy and germination in plants.

Content

Unit	Description in detail	Credit	Weightage
I	**Biochemistry**	1	34 %
	Lipids: Beta-Oxidation of Fatty acid: Activation of Fatty acid, Reaction of Fatty acid. Bio -synthesis of Fatty acid: Acetyl Co -A transport, Production of Malonyl Co -A, The Priming Phase and Elongation Phase		
	Vitamins: Definition, types and significance. Water soluble vitamins: their functions and deficiency disease. Fat soluble vitamins: their functions and deficiency disease.		
	Enzymes: Definition, Nomenclature and Classification		
	Isoenzymes, Properties of Enzymes, Factors influencing action of Enzymes.		
II	**Plant Physiology-I**	1	33 %
	Translocation of Food in Plants: Phloem sap composition, Mechanism of Phloem transport: Pressure-driven Flow, Factors affecting Translocation.		
	Photosynthesis-I: Light Reaction: Introduction, Hill reaction, Plant pigments, Light as a biological agent, Mechanism of Light absorption and emission, Light harvesting and transfer of Energy, Photosynthetic Unit, Red drop and Emerson Enhancement effect, Photosystem I and II.		
	Photo-phosphorylation: Non-cyclic electron flow and Photo - phosphorylation, Cyclic electron flow and Photo-phosphorylation.		
	Photosynthesis-II: Path of Carbon in Photosynthesis:C3 Photosyntheticcycle, C 4 Photosynthetic cycle, Anatomical characteristics of C 4 Plants, Significance of C 4 Cycle, Crassulacean Acid Metabolism (CAM), Significance of CAM, Relationship between C 4 and CAM.		
III	**Plant Physiology-II**	1	33 %
	Respiration: Introduction, Glycolysi s, Fermentation, Citric Acid Cycle, Oxidative Phosphorylation, Respiratory Quotient, Energy yield of Aerobic respiration.		
	Photoperiodism: Definition, critical day length and types of plants [i.e., SDPs, LDPs and Day neutral Plants] and importance of both d ark and light periods. Florigen concept and Vernalization.		
	Seed Dormancy: Definition, causes of seed dormancy and measures to break seed dormancy.		
	Physiological role of Phytohormones i.e., Auxins, Giberellins, Cytokinins, Abscisic acid and Ethylene.		

Reference Books:

1. Deb A C (2008) Fundamentals of Biochemistry, New Central Book (P) Ltd.,
2. Kolkata (9 thEdition Revised).
3. Jain J L, Jain Sanjaya and Jain Nitin (2005) Fundamentals of Biochemistry, S

4. Chand & Co. Ltd., New Delhi (6 th Revised Edition).
5. Mukherji S and Ghosh A K (2005) Plant Physiology, New Central Book
6. Agency (P) Ltd., Kolkata(1 st Central Edition).
7. Devlin Robert M and Witham Francis H (1986) Plant Physiology, CBS
8. Publishers and Distributors, Delhi(4 th Edition/ 1st Indian Edition)
9. Gill P S , Plant Physiology (1st edition)
10. Ross Salisbury , Plant Physiology (4th edition)
11. Srivastava H S (2004), Plant Physiology (2nd edition)
12. SundaraRajanS , Plant Physiology (edition).

Suggested Readings:

1. Sornathai Annie, Rajakumar K, Jayakumar M and Rajarathinam K , Plant
2. Physiology (edition).
3. Verma S K and VermaMohit , Plant Physiology, Biochemistry and
4. Biotechnology ,Verma V, A Text Book of Plant Physiology , Emkay
5. Publication, New Delhi.
6. SundaraRajan S (2001), Practical Manual of Plant Ecology and Plant
7. Physiology (1st edition), Jain V.K.,Fundamentals of Plant Physiology
8. Pandey S.N. and B.K. Sinha, Plant Physiology
9. Verma P.S. and P.K. Agarwal, Plant Physiology

Online Resources:

17. https://www.britannica.com/science/biochemistry
18. https://byjus.com/biology/plant-physiology/
19. https://www.biologydiscussion.com/plant-physiology-2/notes-plant-physiology/34597.

Practicals

Biochemistry and Plant Physiology
Unit- 1: Biochemistry

• Major Experiments:
• To determine the effect of different concentration of substrate on enzyme amylase.
• To determine the effect of concentration of enzyme amylase on substrate.
• Minor Experiments:
• Estimation of Free Fatty acids from fat/oil by titration method. Demonstration Experiment:
• Demonstration of respirator y enzymes in plant tissues: Polyphenol oxidase, Dehydrogenase.
Study of deficiency diseases through charts/photographs.

Unit- 2: Plant Physiology-I

- Physiological Experiments to be performed by students.
- Major experiments:
- To isolate Plant pigments by solvent extraction method using separating funnel.
- To determine Respiratory Quotient (RQ, i.e., CO2/O2) using Ganong's Respirometer.
- To determine rate of Photosynthesis under varying CO2 concentration.
- To determine rate of Photosynthesis under different wavelengths of light.
- To determine rate of Photosynthesis under various intensity of light.
- Minor experiments:
- To show the process of Photosynthes is by Simple glass appararus/Wilmott's Bubbler.
- To separate Plant pigments using Paper Chromatography.

Unit- 3: Plant Physiology-II

- Physiological Experiments to be demonstrated to the students.
- To demonstrate alcoholic fermentation using Kuhne's tube.
- To demonstrate light is essential using Ganong's light screen.
- To demonstrate CO2 is essential using Moll's half -leaf experiment.
- To demonstrate food translocation by phloem through ringing experiment.
- To demonstrateHill'sreactio

Program: Bachelor of Science	**Subject / Branch:**Botany
Year : 2022	**Semester:** VI

Course title :	Economic Botany, Plant Tissue Culture & Biotechnology and Genetics&Plant Ecology	**Course code :**	BBOT603DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Pre-requisite: Having passed B.Sc 5th Semester examination from recognized university with botany subject including microbiology & microanatomy , Genome and phanerogams , Palaeobotany, plants and human welfare and environmental biology, genetics, Plant ecology, Plant physiology embryology, taxonomy and Anatomy, Bio statistics, Biochemistry and Bio-physics, Algae, fungi and Plant pathology, Bryophyta, Pteridophyta and Gymnosperms, Angiosperm families, Plant ecology and Plant anatomy, cell biology & genetics, Microbiology and Biostatistics topics.

Rationale : The student understands the concept of concepts and fundamentals of plant biotechnology and genetic engineering and develop their competency on different types of plant tissue culture.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

16. To discuss important results on Economic Botany, Plant Tissue Culture, Recombination DNA Technology, Sex Determination and Sex Linkage, Maternal Effects and Cytoplasmic Heredity, Energy Flow in the Ecosystems and Production Ecology.

Course Outcome:

After successfully completion of the course, the student will be able to…….

13. The student understands the concept of Understand the core concepts and fundamentals of plant biotechnology and genetic engineering. Develop their competency on different types of plant tissue culture. Critically analyze the major concerns and applications of transgenic technology. Analyze the enzymes and vectors for genetic manipulations. Examine gene cloning and evaluate different methods of gene transfer.

Content

Unit	Description in detail	Credit	Weightage
I	**Economic Botany**	1	34 %
	Introduction, cultivation, scientific name, family, useful pa rt(s), chemical constituents and economic importance of the following plants: Oil seeds: Ground nut, Mustard, Sunflower.		
	Introduction, cultivation, scientific name, family, useful pa rt(s), chemical constituents and economic importance of the following plants: Fibres: Cotton, Jute		
	Medicinal Plants: Root: Ashwagandha. Underground stem: Turmeric. Leaf: Ardusi. Fruit: Amla. Seed: Isabgul		
	Dyes: Henna, Kesudo Wood: Timber: Teak and Fire wood: Baval.		
II	**Plant Tissue Culture & Biotechnology**	1	33 %
	Plant Tissue Culture-I: Nutrition medium: Media composition -Inorganic nutrients, Carbon and energy source, Vitamins, Growth regulators, Organic supplements, Gelling agents and pH. Sterilization Techniques: Steam sterilization, Dry sterilization and Chemical sterilization of explants.		
	Plant Tissue Culture-II: Types of Culture: Embryo culture, Callus culture and Meristem culture.		
	Recombination DNA Technology: Gene cloning -I: Basic events in gene cloning, Enzymes for cutting-Restriction Endo-Nuclease-II, Enzymes for joining- DNA ligase, DNA-modifying enzymes-Kinase, Alkaline Phosphatase, DNA Polymerase and Terminal transferase. Linkers and adaptors.		
	Recombination DNA Technology: Gene cloning-II: Features of vector, Vectors: Plasmids - pBR322, Cosmids and Bacteriophage -Lemda.		
III	**Genetics & Plant Ecology**	1	33 %
	Genetics: Sex Determination and Sex Linkage: Chromosome Theory: Sex - chromosomes and Autosomes, Types of chromosomal mechanisms of Sex - determination. Sex-linkage: Sex-linked inheritance in Drosophila, Sex -linked inheritance in Man, Sex - influenced and sex-limited genes.		
	Maternal Effects and Cytoplasmic Heredity: Maternal effect. Cytoplasmic Inheritance: Plastid inheritance in Mirabilis jalapa and male sterility in corn (Zea mays), Respiratory deficiencies.		
	Plant Ecology: Energy Flow in the Ecosystems: Single channel Energy model and Y-shaped Energy Flow Model. Bio-geo Chemical Cycles: Carbon, Nitrogen and water cycles.		
	Production Ecology: Productivity: Definition, Primary Productivity -GPP and NPP, Measurement of Primary Productivity -Harvest method, Leaf Area Index method and Chlorophyll estimation method. Secondary Productivity.		

Reference Books:

1. Singh V, Pande P C and Jain D K (1998) Anatomy of Seed Plants , Rastogi Publications,
2. Meerut(1 st Edition's Reprint).
3. Pandey B P (1997) Plant Anatomy, S Chand & Co. Ltd, New Delhi. (1 st Edition's Reprint).
4. E John Jothi Prakash (2000) A Text Book of Plant Anatomy, Emkay Publications, Delhi. (2ndRevised Edition).
5. Tayal M S (2001) Plant Anatomy, Rastogi Publications, Meerut (5th Edition's Reprint).
6. Chawla H S (2002) Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi (2 nd Edition).
7. Sambamurty , Genetics (2nd edition),
8. Rastogi Veer Bala A Text Book of Genetics (9th edition)
9. Gupta P K (2009), Genetics (3rd edition),
10. Gupta P K (2007), Genetics-classical to modern (1st edition)

Suggested Readings:

1. Sharma P D (2003) Ecology and Environment, Rastogi Publications, Meerut. (7th Edition's Reprint).
2. Agrawal K C (2001) Fundamentals of Environmental Bio logy, Nidhi Publishers (India),Bikaner. (1 st Edition).
3. Subrahmanyam N S and Sambamurty A V S (2000) Ecology, Narosa Publishing House, NewDelhi. (1 st Edition).
4. Kormondy E J (2002) Concept of Ecology, Prentice-Hall of India Pvt Ltd., New Delhi (12 thIndian Edition Reprint).
5. Patel B C (2012) Human Genetics (ManavJaninvignan -in Gujarati) Gujarat Vishvakosh
6. Trust, Ahmedabad -380 013 (1st edition)

Online Resources:

20. https://www.springer.com/journal/12231#:~:text=Economic%20Botany%20is%20a%20quarterly,and%20potential%20uses%20of%20plants.
21. https://www.banglajol.info/index.php/PTCB
22. https://academic.oup.com/aobpla/article/13/6/plab057/6364968

Practicals

Economic Botany, Plant Tissue Culture & Biotechnology and Genetics & Plant Ecology

Unit- 1: **Economic Botany**

Give scientific name, family, useful parts, chemical constituents and economic importance ofgiven plants.
Oil seeds: Ground nut,
Mustard, Sunflower.
Fibers: Cotton, Jute.
Root: Ashwagandha,
Undergroundstem: Turmeric,
Leaf: Ardusi, Fruit: Amla, Seed:
Isabgul
Dyes: Henna,
Kesudo Timber:
Teak.Fire wood:
Baval

Unit- 2: **Plant Tissue Culture & Biotechnology**

Prepare Nutrition Media for Embryo culture, Callus culture and Meristem culture.Learn various sterilization techniques required for ex plants and media.
Study of various vectors through charts/diagrams, etc.

Unit-- 3**: Genetics & Plant Ecology**

Study of sex determination, sex linkage, cytoplasmic inheritancethroughchart/diagram/photographs.
Solve Genetical problems as per theory syllabus.
To measure the Primary productivity a s per theory syllabus.
Study of energy models and bio -geo chemical cycles through chart/diagram/photographs.Calculation of leaf area index.
To determine above and below ground Biomass by monolith (25cm x25cm x30cm) method

Program: Bachelor of Science **Subject / Branch:**Botany

Year : 2022 **Semester:** VI

Course title :	Plant Anatomy and Plant Breeding	**Course code :**	BBOT604DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Pre-requisite: Having passed B.Sc 5th Semester examination from recognized university with botany subject including microbiology & microanatomy , Genome and phanerogams , Palaeobotany, plants and human welfare and environmental biology, genetics, Plant ecology, Plant physiology embryology, taxonomy and Anatomy, Bio statistics, Biochemistry and Bio-physics, Algae, fungi and Plant pathology, Bryophyta, Pteridophyta and Gymnosperms, Angiosperm families, Plant ecology and Plant anatomy, cell biology & genetics, Microbiology and Biostatistics topics.

Rationale : The student understands the concept of develop conceptual understanding of plant breeding, gene bank and gene pool and develop an understanding of concepts and fundamentals of plant anatomy.

Teaching Examination Scheme:

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	60	00	20	10	70	100

Course Objective:

17. To discuss important results on Root-Stem Transition, Methods in Plant Anatomy, Origin of Crop Plants, Artificial Vegetative Reproduction, Selection in Self-pollinated crops, Breeding Methods and Hybrid vigour.

Course Outcome:

After successfully completion of the course, the student will be able to…….

14. Gain knowledge about basicFamiliarize with genetic basis of heterosis. Classify Sexual and Asexual modes of reproduction. Explain monogenic and polygenic inheritance. Reflect upon the role of various non- conventional methods used in crop improvement.

15. examine the internal anatomy of plant systems and organs. Develop critical understanding on the evolution of concept of organization of shoot and root apex. Analyze the composition of different parts of plants and their relationships. Evaluate the adaptive and protective systems of plants.

Content

Unit	Description in detail	Credit	Weightage
I	**Plant Anatomy**	1	34 %
	Root-Stem Transition: Definition and Types. Anatomy of Special organs: Epiphytic root -Orchid and Aerial/Stilt root-Banyan.		
	Anatomy in relation to Taxonomy: Trichomes, Stomata, Epidermis, Internal structure of Leaf, Petiole and Node.		
	Methods in Plant Anatomy: Collection of Material, Fixation and Pres ervation, Dehydration, Infiltration, Embedding and Block making. Sectioning with Microtome Stains, Staining and Mounting.		
	Anomalous Secondary Growth: Stem - Boerhaavia, Achyranthes, and Dracaena. Root- Ipomoea batatas.		
II	**Plant Breeding-I**	1	33 %
	Introduction: Definition, Origin and evolution of Crop plants: Centres of Origin and Patterns of Evolution.		
	Origin of Crop Plants: Origin of Rice, Wheat, Cotton. Scope and Objectives of Plant Breeding.		
	Artificial Vegetative Reproduction: Cutting, Layering, Grafting, Budding, Potting and re -potting. Sexual Reproduction: Apomixis -apospory and apogamy, Significance of Apomixis.		
	Selection in Self-pollinated crops: The Pure -line selection - Purpose, Procedure, Merits and Demerits and Achievements. Mass selection - Purpose, Procedure, Merits and Demerits and Achievements. Comparison between Pure line selection and Mass selection		
III	**Plant Breeding-II**	1	33 %
	Breeding Methods: Hybridization: Purpose and General Technique -Choise of Parents, Crossing Schedule, Emasculation and Bagging, Tagging, Pollination, Harvesting and Storing F1 seeds, Raising F1 generation, Selfing, Consequences of hybridization.		
	Breeding Methods: Methods in Hybridization: Methods in Self - pollinated crop-Pedigree method: Procedure, and Merits and Demerits and Achievements		
	Bulk method -Procedure, Merits and Demerits and Achievements. Comparison between Bulk and Pedigree method.		
	Hybrid vigour (Heterosis): Definition, its various effects, Causes: Dominance hypothesis and over dominance hypothesis, Achievements, Utilization and limitations.		

Reference Books:

1. Singh V, Pande P C and Jain D K (1998) Anatomy of Seed Plants, Rastogi

Publications, Meerut(1 st Edition's Reprint).
2. Pandey B P (1997) Plant Anatomy, S Chand & Co. Ltd, New Delhi. (1st
3. Edition's Reprint).
4. E John Jothi Prakash (2000) A Text Book of Plant Anatomy, Emkay
5. Publications, Delhi. (2 ndRevised Edition).

Suggested Readings:

1. Tayal M S (2001) Plant Anatomy, Rastogi Publications, Meerut (5 th Edition's Reprint).
2. Kar Dipak Kumar and Halder Soma (2006) Plant Breeding and Biometry, NewCentral Book Agency (P) Ltd. Kolkata (1 st Edition).
3. Singh B D (2001) Plant Breeding-Principles and Methods , Kalyani Publishers, Ludhiana(1st Edition's Reprint).

Online Resources:

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/plant-anatomy#:~:text=Abstract%3A-,Plant%20anatomy%20is%20the%20study%20of%20the%20tissue%20and%20cell,light%20microscope%20or%20electron%20microscope.
https://www.britannica.com/science/plant-breeding#:~:text=plant%20breeding%2C%20application%20of%20genetic,certain%20individuals%20among%20the%20progeny.
23. https://byjus.com/biology/plant-breeding/

Practicals

Plant Anatomy and Plant Breeding

Unit- 1: Plant Anatomy

To study the Anomalous Secondary Growth in stems of Boerhaavia, Achyranthes, Dracaena and root of Ipomoea batatas.

To study the Anatomy of Orchid Root (Epiphyte) and Aerial/Stilt Root of Banyan.

Any 3/more examples which are helpful in Taxonomy of each organ viz., Trichome, Stomata, Epidermis, Node from Plant specimens of allied genera or family.

Paraffine Block making with Microtomy Technique of any plant material mentioned in Theory syllabus.

Use of Appropriate Double staining Technique applied for sections embedded in Paraffine Rib bon or hand sections of fresh material as per theory syllabus.

Unit- 2: Plant Breeding-I

Preparation of male flowers for hybridization.

Preparation of female flowers for hybridization

Unit- 3: Plant Breeding-II

Describe the horticulture techniques: Cutting, Layering, Grafting, Budding, Potting and re -potting.

Study of different methods of plant breeding through Charts/Models/Photographs/Specimens/Herbarium sheet.

Make a modern new world species from old X new variety breeding with chromosome

Program: Bachelor of Science	**Subject / Branch:**Botany
Year : 2022	**Semester:** VI

Course title:	**Fresh Water Ecology**	**Course code:**	BBOT601SE
Course type:	Subject Elective	**Course credit:**	02

Pre-requisite: Having passed B. Sc**5**th semester examination from recognized university with Botany subject including DNA a molecule of life and Air pollution as subject elective.

Rationale : The student will be able to understanding on commonly occurring marine and limnetic zones and its diversity.

Teaching Examination Scheme:

Teaching (Hours/week)			**Examination Scheme**			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	30	00	10	05	35	50

Course Objective:

18. To discuss important results on Properties of freshwater, Types of Freshwater Ecosystem, Global issues and legislation for conservation and management of aquatic systems.

Course Outcome:

After successfully completion of the course, the student will be able to…….

16. The student understands the concept of Reflect upon the values and uses of aquatic plans Develop their understanding on commonly occurring marine and limnetic planktons of Indian coasts along with the current understanding of its biology.

Content

Unit	Description in detail	Credit	Weightage
I	**Fresh water structure**	1	50 %
	Definitions: Freshwater, Limnology, Lakes, Ponds, Benthos, Bogs, Marshes and Swamps.		
	Properties of freshwater: Physio -chemical characteristic, Factors affecting to fresh water ecosystem: abiotic and biotic (Light, Temperature, Vegetation, etc.).		
	Types of Freshwater Ecosystem/Clasification of Freshwater Habitat - Lentic ecosystems (still water) and lotic ecosystems (flowing water).		
	Structure of lake (Freshwater Zonation). Aquatic biodiversity (Freshwater only): Aquatic flora (Algae, fresher plants).		
II	**Ecosystem**	1	50 %
	Aquatic food web and food pyramids, primary productivity. Aquatic ecosystem: goods and services.		
	Energy flow in freshwater ecosystem.		
	Threats to aquatic ecosystem and remediation: Eutrophication, Acidification, Pollution.		
	Global issues and legislation for conservation and management of aquatic systems.		

Reference Books:

1. Brown L. (1971). Ecology of Fresh Water. Heinemann Educational Books Ltd, London. Gopal, B, and Bhardwaj, N. (1979). Elements of ecology. Vikash Publishing House Pvt Ltd., New Delhi.
2. Shrma P. D. (7th Eedition - Reprint 2003). Ecology and Environment. Rastogi Publications, Meerut. Eugene P. Odum (1971). Fundamentals of Ecology. Toppan Company, Japan

Suggested Readings:
Online Resources:

https://www.earthreminder.com/freshwater-ecosystem-types-characteristics-and-animals/
https://byjus.com/biology/ecosystem/

Bachelor of Science Program outcomes (PO)

PO No.	Program Outcome Description
PO1	Foundational Knowledge: Graduates will possess a strong foundation in the fundamental concepts, theories, and principles of their chosen discipline, as per the prescribed curriculum.
PO2	Practical Skills: Students will acquire practical skills relevant to their field, including laboratory techniques, data collection, analysis, and interpretation.
PO3	Critical Thinking: Graduates will develop critical thinking skills to analyze, evaluate, and solve scientific problems, applying logical reasoning and evidence-based approaches.
PO4	Effective Communication: Students will demonstrate effective communication skills, both orally and in writing, to convey scientific ideas and findings to different audiences.
PO5	Collaboration and Teamwork: Graduates will work collaboratively in teams, engaging in effective communication, cooperation, and coordination to accomplish shared objectives.
PO6	Information Literacy: Students will develop information literacy skills to access, evaluate, and utilize scientific information from diverse sources, including digital resources.
PO7	Ethical Awareness: Graduates will demonstrate ethical awareness and responsibility in scientific practice, understanding the importance of integrity, honesty, and ethical conduct.
PO8	Lifelong Learning: Students will develop a commitment to lifelong learning, staying updated with advancements in their field and engaging in continuous professional development.
PO9	Societal Impact: Graduates will recognize the social and ethical implications of scientific knowledge and contribute positively to society through their discipline.

Subject Code: BBOT101UDSC **Semester: I**

Subject Name: Microbiology & Phycology **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop an understanding the concept of microbial nutrition.
CO2	Classify viruses based on their characteristics and structures
CO3	Examine the general characteristics of bacteria and their reproduction.
CO4	Increase the awareness and appreciation of human friendly viruses, bacteria, algae and their economic importance
CO5	Conduct experiments using skills appropriate to subdivisions

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**1**
CO2													**2**	**1**
CO3													**2**	**2**
CO4													**3**	**1**
CO5													**3**	**2**

Subject Code: BBOT101USE **Semester: I**

Subject Name: Horticulture **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Understand the different classifications of horticultural crops.
CO2	Understand about the Nursery Management.
CO3	Aware about to use of Horticulture technologies.
CO4	Develop their competency on pre and post-harvest technology in horticultural crops.
CO5	After this study get Successful growth and production of plants.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**-**	**-**	**2**	**3**	**2**	**1**	**2**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**1**	**3**	**-**	**-**	**2**	**2**	**2**	**3**	**3**			
CO4	**2**	**3**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO5	**1**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**3**	**2**
CO3													**3**	**1**
CO4													**3**	**1**
CO5													**3**	**2**

Subject Code: BBOT201UDSC **Semester: II**

Subject Name: Biomolecules and Cell biology **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student Develop understanding on chemical bonding among molecules.
CO2	The course Identify the concept that explains chemical composition and structure of cell organelles.
CO3	To offer detailed knowledge of bimolecular for living systems.
CO4	Describe the evolution, diversity and replication of cells.
CO5	Students will understand how these cellular components are used to generate and utilize energy in cells.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**-**	**2**	**3**	**1**	**3**	**3**			
CO2	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**2**			
CO3	**3**	**2**	**-**	**-**	**3**	**3**	**2**	**3**	**2**			
CO4	**3**	**2**	**-**	**-**	**2**	**3**	**1**	**3**	**2**			
CO5	**3**	**1**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**3**	**-**
CO5													**2**	**-**

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Subject Code: BBOT201USE **Semester: II**

Subject Name: Natural Resource and Management **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Understand the concept of different natural resources and their utilization.
CO2	Critically analyze the sustainable utilization land, water, forest and energy resources.
CO3	Reflect upon the different national and international efforts in resource management and their conservation.
CO4	Develop understanding on the concept of Sustainable utilization, Soil degradation and management.
CO5	Aware knowledge about important results on Renewable and non-renewable sources of energy.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**-**	**-**	**2**	**1**	**1**	**3**				
CO2	**2**	**1**	**-**	**-**	**2**	**2**	**1**	**2**				
CO3	**3**	**1**	**-**	**-**	**2**	**1**	**1**	**2**				
CO4	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**3**				
CO5	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**2**	**1**
CO3													**2**	**2**
CO4													**3**	**2**
CO5													**1**	**3**

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Subject Code: BBOT301UDSC **Semester: III**
Subject Name: Mycology and Phytopathology **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
CO2	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies.
CO3	Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
CO4	Identify the common plant diseases according to geographical locations and device control measures.
CO5	Study about the general characters, somatic structures, reproduction of Plant diseses.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**3**	**-**	**-**	**3**	**3**	**3**	**3**				
CO2	**3**	**1**	**-**	**-**	**2**	**2**	**1**	**1**				
CO3	**3**	**1**	**-**	**-**	**2**	**2**	**3**	**2**				
CO4	**2**	**3**	**-**	**-**	**2**	**3**	**3**	**3**				
CO5	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**2**	**1**
CO3													**3**	**1**
CO4													**3**	**1**

CO5													**3**	**1**

Subject Code: BBOT302UDSC **Semester: III**
Subject Name: Archegoniate **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands; Demonstrate an understanding of archegoniate, Bryophytes, Pteridophytes and Gymnosperms.
CO2	Understanding of plant evolution and their transition to land habitat.
CO3	Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, and Gymnosperms.
CO4	To discuss important results on General characteristics, morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
CO5	Understand the economic importance of Bryophytes, Pteridophytes and Gymnosperms.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**-**	**-**	**2**	**3**	**2**	**2**	**2**			
CO2	**3**	**1**	**-**	**-**	**2**	**3**	**1**	**2**	**2**			
CO3	**1**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**2**			
CO4	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**2**	**3**			
CO5	**3**	**1**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**1**
CO2													**3**	**1**
CO3													**2**	**1**
CO4													**3**	**2**
CO5													**3**	**3**

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Subject Code: BBOT301USE **Semester: III**

Subject Name: Plant Diversity and human Welfare **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Identify the causes and implications of loss of biodiversity.
CO2	Apply skills to manage plant biodiversity.
CO3	Utilize various strategies for the conservation of biodiversity.
CO4	Conceptualize the role of plants in human welfare with special reference to India.
CO5	Understand Students about diversity of plants.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**-**	**-**	**2**	**2**	**2**	**3**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**3**	**3**			
CO3	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**2**	**3**	**3**	**1**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**1**	**3**	**3**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**2**	**3**
CO4													**2**	**3**
CO5													**3**	**3**

Subject Code: BBOT401UDSC **Semester: IV**
Subject Name: Anatomy of Angiosperms **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Examine the internal anatomy of plant systems and organs .
CO2	Develop critical understanding on the evolution of concept of organization of shoot and root apex.
CO3	Analyze the composition of different parts of plants and their relationships.
CO4	Evaluate the adaptive and protective systems of plants.
CO5	Students know about the internal structure of plant organs.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**1**			
CO2	**3**	**2**	**-**	**-**	**3**	**2**	**2**	**2**	**1**			
CO3	**3**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**1**			
CO4	**3**	**3**	**-**	**-**	**2**	**3**	**2**	**3**	**1**			
CO5	**3**	**3**	**-**	**-**	**2**	**2**	**3**	**2**	**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**3**	**1**
CO3													**3**	**1**
CO4													**2**	**1**
CO5													**3**	**2**

Subject Code: BBOT402UDSC **Semester: IV**
Subject Name: Economic Botany **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Understand core concepts of Economic Botany.
CO2	It is relate with environment, populations, communities, and ecosystems.
CO3	Develop critical understanding on the evolution of concept of organization of apex new crops/varieties.
CO4	Understand about importance of germplasm diversity, issues related to access and ownership.
CO5	Develop a basic knowledge of taxonomic diversity and important families of useful plants.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**-**	**3**	**2**	**2**	**3**	**3**			
CO2	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO3	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**1**	**3**	**3**	**3**	**3**			
CO5	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**3**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**3**	**2**
CO3													**3**	**2**
CO4													**2**	**3**
CO5													**3**	**3**

Subject Code: BBOT401USE **Semester: IV**
Subject Name: Plant Breeding **Faculty Name/s: Ms. SnehalThakor**

Course Outcomes: At the end of the course, students shall be able to

CO1	Familiarize with genetic basis of heterosis.
CO2	Explain monogenic and polygenic inheritance.
CO3	Reflect upon the role of various non- conventional methods used in crop improvement.
CO4	Acquire knowledge about proper breeding method.
CO5	Cultivation skill in emasculation and Pollination of various crop plants.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**-**	**3**	**2**	**2**	**3**	**2**			
CO2	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**2**	**2**			
CO3	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**2**			
CO4	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**3**	**3**			
CO5	**3**	**3**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**2**	**3**
CO4													**2**	**3**
CO5													**3**	**3**

Subject Code: BBOT501DSC **Semester: V**

Subject Name: Algae, Fungi and Plant Pathology **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease
CO2	Demonstrate skills in laboratory, field and glasshouse work related to mycology
CO3	Demonstrate skills in laboratory, field and glasshouse work related to plant pathology
CO4	Develop an understanding of microbes, fungi appreciate their adaptive strategies
CO5	Identify the common plant diseases according to geographical locations and device control measures

CO-PO Competency and Program Indicators (PI)

Course Outcomes	**Program Outcomes**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**-**	**-**	**3**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO3	**3**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO5	**3**	**3**	**-**	**-**	**3**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	**Program Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**1**
CO2													**2**	**1**
CO3													**2**	**2**
CO4													**2**	**1**
CO5													**3**	**2**

Subject Code: BBOT502DSC **Semester: V**

Subject Name: Bryophyta, Pteridophyta and Gymnosperm **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands of archegoniate, Bryophytes, Pteridophytes and Gymnosperms
CO2	The student Demonstrate an understanding of archegoniate, Bryophytes, Pteridophytes and Gymnosperms
CO3	Understanding of plant evolution and their transition to land habitat.
CO4	Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, Gymnosperms
CO5	Know about the structure , life history and economic importance of some plant of Bryophytes, Pteridophytes, Gymnosperms

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**-**	**-**	**2**	**1**	**2**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO5	**3**	**3**	**-**	**-**	**1**	**2**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**3**	**-**
CO5													**3**	**-**

Subject Code: BBOT503DSC **Semester: V**

Subject Name: Angiosperms families, Plant Ecology and Plant Anatomy **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of important results on understand core concepts of biotic and abiotic
CO2	Classify the soils on the basis of physical, chemical and biological components Assess the adaptation of plants in relation to light, temperature, water, wind and fire.
CO3	Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium. Evaluate the Important herbaria and botanical gardens.
CO4	Interpret the rules of ICN in botanical nomenclature. Generalize the characters of the families according to Bentham & Hooker's system of classification.
CO5	examine the internal anatomy of plant systems and organs. Develop critical understanding on the evolution of concept of organization of shoot and root apex. Analyze the composition of different parts of plants and their relationships. Evaluate the adaptive and protective systems of plants

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**3**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**1**	**2**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**2**	**2**
CO4													**3**	**1**
CO5													**3**	**2**

Subject Code: BBOT504DSC **Semester: V**

Subject Name: Cell Biology & Genetics, Microbiology and Biostatistics **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of Have conceptual understanding of Chromosomal Aberrations,genetic
CO2	Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
CO3	Analyze the effect of mutations on gene functions and dosage. Examine the structure, function and replication of DNA.
CO4	Develop understanding on the concept of microbial nutrition
CO5	Increase the awareness and appreciation of human friendly viruses and bacteria their economic importance

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**		**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**2**	**-**
CO5													**3**	**-**

Subject Code: BBOT501SE **Semester: V**

Subject Name: Air pollution **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of Understand the fundamental issues of environment . .
CO2	Analyze different sources of environmental problems
CO3	Analyze different methods of measurement of pollution
CO4	The student Examine economic growth
CO5	The student Examine quality of life

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO2	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**3**	**3**			
CO3	**2**	**3**	**-**	**-**	**3**	**2**	**3**	**2**	**2**			
CO4	**2**	**2**	**-**	**-**	**2**	**1**	**2**	**3**	**2**			
CO5	**1**	**2**	**-**	**-**	**1**	**3**	**2**	**3**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**2**	**-**
CO5													**3**	**-**

Subject Code: BBOT601DSC **Semester: VI**

Subject Name: Molecular Biology, Plant Pathology & Lichens and Angiosperm Families **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of Identify the principles and application of plant pathology in the control of plant disease, differentiate the main types of prokaryotes through their grouping abilities and their characteristic.
CO2	Acquaintance with various laboratory equipment and their uses in plant pathology
CO3	Evaluate the experiments establishing central dogma and genetic code
CO4	Gain an understanding of various steps in transcription, protein synthesis and protein modification
CO5	Generalize the characters of the families according to Bentham & Hooker's system of classification.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**-**	**-**	**1**	**2**	**2**	**2**	**3**			
CO2	**2**	**1**	**-**	**-**	**3**	**2**	**2**	**3**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**3**	**-**	**-**	**2**	**2**	**2**	**1**	**3**			
CO5	**3**	**2**	**-**	**-**	**1**	**2**	**2**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**1**
CO2													**2**	**1**
CO3													**2**	**1**
CO4													**2**	**1**
CO5													**3**	**1**

Subject Code: BBOT602DSC **Semester: VI**

Subject Name: Biochemistry and Plant Physiology **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of Comprehend different fundamental concepts related to plant biochemistry like plant cell organelles, photosynthesis, respiration and lipid metabolism etc.
CO2	The student Analyze the structure and properties of various enzymes
CO3	The student Evaluate the process of ATP Synthesis, nitrogen metabolism and lipid metabolism
CO4	The student Explain chemical properties and deficiency symptoms in plants. Classify aerobic and anaerobic respiration
CO5	The student Explain the significance of Photosynthesis and respiration. Assess dormancy and germination in plants

CO-PO Competency and Program Indicators (PI)

Course Outcomes	**Program Outcomes**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**3**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	**Program Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**1**
CO2													**2**	**1**
CO3													**2**	**2**
CO4													**3**	**1**
CO5													**3**	**2**

Subject Code: BBOT603DSC **Semester: VI**

Subject Name: Economic Botany, Plant Tissue Culture & Biotechnology and Genetics&Plant Ecology

Faculty Name/s: Ms. Hasti Patel

Course Outcomes: At the end of the course, students shall be able to

CO1	The student understands the concept of Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.
CO2	The student Develop their competency on different types of plant tissue culture.
CO3	The student understands Critically analyze the major concerns and applications of transgenic technology.
CO4	The student is able toAnalyze the enzymes and vectors for genetic manipulations.
CO5	The studentExamine gene cloning and evaluate different methods of gene transfer.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**3**	**2**	**2**	**3**			
CO3	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**3**	**3**			
CO4	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**3**	**2**
CO5													**3**	**2**

Subject Code: BBOT604DSC **Semester: VI**

Subject Name: Plant Anatomy and Plant Breeding **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The students Gain knowledge about basicFamiliarize with genetic basis of heterosis.
CO2	The students Classify Sexual and Asexual modes of reproduction. Explain monogenic and polygenic inheritance.Reflect upon the role of various non- conventional methods used in crop improvement.
CO3	The students examine the internal anatomy of plant systems and organs.
CO4	The students Develop critical understanding on the evolution of concept of organization of shoot and root apex
CO5	The students Analyze the composition of different parts of plants and their relationships.Evaluate the adaptive and protective systems of plants

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			
CO2	**2**	**3**	**-**	**-**	**3**	**2**	**2**	**2**	**3**			
CO3	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**2**	**3**			
CO4	**2**	**3**	**-**	**-**	**3**	**1**	**2**	**2**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**2**	**1**	**2**	**3**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**3**	**2**
CO3													**2**	**2**
CO4													**2**	**2**
CO5													**3**	**2**

Subject Code: BBOT601SE **Semester: VI**

Subject Name: Fresh Water Ecology **Faculty Name/s: Ms. Hasti Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The students understands the concept of Reflect upon the values Fresh water
CO2	The students understands uses of aquatic plans
CO3	The studentsDevelop their understanding on commonly occurring marine planktons of Indian coasts along with the current understanding of its biology.
CO4	The studentsDevelop their understanding on commonly occurring limnetic planktons of Indian coasts along with the current understanding of its biology.
CO5	The students develop skills in working in a team environment.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**2**	**2**			
CO2	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**3**			
CO3	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**1**	**2**			
CO4	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**			
CO5	**3**	**2**	**-**	**-**	**2**	**1**	**2**	**2**	**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**2**
CO2													**2**	**2**
CO3													**3**	**1**
CO4													**3**	**3**
CO5													**3**	**3**