

Holy Cross College (Autonomous), Nagercoil-629004

Kanyakumari District, TamilNadu.

Nationally Re-Accredited with A+ by NAAC IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli



DEPARTMENT OF BOTANY

SYLLABUS FOR UNDERGRADUATE PROGRAMME

Issued from the Deans Office

(With effect from the Academic year 2020– 2021)

DEPARTMENT OF BOTANY
With effect from the academic year 2020 – 2021



Vision

Imbibing the spirit of the Holy Cross, the institution envisions a harmonious society by empowering women for global competency and ecological sustainability through holistic approach with innovative skills.

Mission

1. To provide quality education and to promote scholarly activities catering to global competencies.
2. To nurture participatory leadership to enhance social consciousness and social responsibility.
3. To uphold ethical values of honesty, personal accountability and transparency through professional commitment.
4. To create global professionals and entrepreneurs with innovative spirit and zeal.
5. To create empowered women of competence, commitment and compassion.
6. To instill in students the awareness of interconnectedness between man and nature

Programme Educational Objectives (PEOs)

PEO-1	The graduates will apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.
PEO-2	The graduates pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.
PEO-3	The graduates acquire basic and specialized science skills that instill qualities of self-confidence and self-reliance that make them contribute valuably in the biological issues of national and international interest.

Programme Outcomes(POs)

PO	Upon completion of B.Sc Programme, the graduates will be able to:
PO – 1	utilize scientific knowledge to pursue higher studies in the relevant field.
PO – 2	create innovative ideas to enhance entrepreneurial skills for economic independence.
PO – 3	face challenging competitive examinations that offer rewarding careers.
PO – 4	reflect upon green initiatives and take responsible steps to build a sustainable environment.
PO – 5	handle ethical issues with social responsibility.
PO – 6	communicate effectively and collaborate successfully with peers to become competent professionals.

Programme Specific Outcomes (PSOs)

PSOs No.	Upon completion of B.Sc. Degree Programme, the graduates of Botany will be able to :	PO Addressed
PSO - 1	develop a strong and competent knowledge in Botany.	1
PSO - 2	communicate appropriately and effectively in science and also interact productively with people from diverse background.	6
PSO - 3	understand the basic professional skills through various laboratory technical training, to analyze the relevant biological situations.	2
PSO - 4	create green environment to protect nature for future sustenance.	4
PSO - 5	seek entrepreneurship through skill based, value added and related courses.	2
PSO - 6	understand the professional, ethical, legal and social issues related to gender.	5
PSO - 7	integrate the related topics from other branches of science to carry out projects to have a successful career.	3

Eligibility Norms for Admission

Those who seek admission to B.Sc. Botany Course must have passed Higher Secondary Examination conducted by the Board of Higher secondary Examination, Tamil Nadu with Botany or Biology as one of the subjects or any other examinations recognized and approved by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

Duration of the Programme: 3 years

Medium of Instruction: English

Passing Minimum

A minimum of 40% in the external examination and an aggregate of minimum 40% is required.

There is no minimum pass mark for the continuous internal assessment.

Components of the B.Sc. Botany programme

Part III (Major and Allied)

Major	Core – Theory papers	10x100	1000
	Practical (Core applied)	5x100	500
	Elective - Theory papers	3x 100	300
	Project	1x100	100
	Total marks		1900
Allied (I & II)	Theory	4x100	400
	Practical	2x100	200
	Total marks		600
Part III - Total marks			2500

Major&Allied Practical carry 100 marks each.

Practical examinations will be conducted at the end of even semesters for major and allied

Course Structure
Distribution of Hours and Credits

Course	Sem. I	Sem. II	Sem. III	Sem. IV	Sem. V	Sem. VI	Total	
							Hours	Credits
Part I - Language	6 (4)	6 (4)	6 (4)	6 (4)	-	-	24	16
Part II - English	6 (4)	6 (4)	6 (4)	6 (4)	-	-	24	16
Part-III								
Major Core – Theory	4(4)	4(4)	4(4)	4(4)	6(6)+ 6(6)+ 6(5)	6(6)+ 6(6)+ 6(5)	52	50
Major – Practical	2(-)	2(2)	2(-)	2(2)	2(-)+ 2(-)+ 2(-)	2(2)+ 2(2)+ 2(2)	20	10
Elective/ Project	-	-	4(3)	4(3)	4(3)	4(3)	16	12
Allied –Theory	4(3)	4(3)	4(3)	4(3)	-	-	16	12
AlliedPractical	2(-)	2(2)	2(-)	2(2)	-	-	8	4

Part IV								
Add on Course(Professional English)	2(2)	2(2)	2(2)	2(2)	-	-	8	8
Non Major Elective (NME)	2(2)	2(2)					4	4
SEC(Skill Enhancement Course)	2(2)	2(2)	-	-		2(2)	6	6
Ability Enhancement Course (AEC)					2(2)		2	2
Total	30 (21)	30 (25)	30 (20)	30 (24)	30 (22)	30 (28)	180	140
Non -academic Courses								
Part V								
FC –I (Values for Life)	-	(1)					-	1
FC– II(Personality Development)			-	(1)			-	1
FC–III (Human Rights Education)					(1)		-	1
FC –IV (Gender Equity Studies)						(1)	-	1
SLP-Community Engagement Course		-	(2)				-	2
SLP-Extension Activity (RUN)			-	(2)				2
STP - Clubs & Committees / NSS	-	-	-	(2)			-	2

Total number of Hours = 180

Total number of Compulsory Credits = 140+10

- Non - academic Courses are mandatory and conducted outside the regular hours
- Skill Development Programme (Mandatory Certificate Course – 60 hours) is offered in the first year for all the students.

Courses Offered

Semester	Course	Course Code	Title of the Course	Hours/ Week	Credits
I	Part I	TL2011/ FL2111	Language: Tamil / French	6	4
	Part II	GE2111	General English	6	4
	Part III	BC2011	Major Core I : Algae, Fungi and Lichens	4	4
		BC20P1	Major Practical I : Algae, Fungi and Lichens	2	-
		BA2011	Allied I : Chemistry of Life	4	3
		BA20P1	Allied I Practical : Chemistry of Life	2	-
	Part IV	ALS201	Add- on Course Professional English for Life Sciences	2	2
		BNM201	Non-Major Elective (NME) : Gardening and Floriculture	2	2
		SEC201/ SEC202	Skill Enhancement Course : Meditation and Exercise / Computer Literacy	2	2
	Part V	FCV201	Foundation Course I : Values for Life	-	-
		STP201	Student Training Programme (STP) : Clubs & Committees/NSS	-	-
II	Part I	TL2021/ FL2121	Language: Tamil / French	6	4
	Part II	GE2121	General English	6	4
	Part III	BC2021	Major Core II : Plant Anatomy and Developmental Botany	4	4
		BC20P1	Major Practical I : Algae, Fungi and Lichens & Plant Anatomy and Developmental Botany	2	2
		BA2021	Allied I : Taxonomy of Angiosperms and Herbal Technology	4	3
		BA20P1	Allied I Practical : Chemistry of life & Taxonomy of Angiosperms and Herbal Technology	2	2
	Part IV	ALS202	Add -on Course : Professional English for Life Sciences	2	2
		BNM202	Non-Major Elective (NME) : Biofertilizers, Biofuels and Biopesticides	2	2
		SEC201/ SEC202	Skill Enhancement Course : Meditation and Exercise / Computer Literacy	2	2

	Part V	FCV201	Foundation Course I : Values for Life	-	1
		SLP201	Service Learning Programme (SLP): Community Engagement Course	-	-
		STP201	Student Training Programme (STP) : Clubs & Committees/NSS	-	-
III	Part I	TL2031/ FL2031	Language: Tamil / French	6	4
	Part II	GE2031	General English	6	4
	Part III	BC2031	Major Core III : Archegoniate	4	4
		BC2032 BC2033 BC2034	Major : Elective I (a) Herbal Botany (b) Nursery and Gardening (c) Agricultural Botany	4	3
		BC20P2	Major Practical II : Archegoniate	2	-
		BA2031	Allied II : Theory: Plant Diversity -I (Algae, Fungi, Bryophyta and Pteridophyta)	4	3
		BA20P2	Allied Practical II : Plant Diversity -I	2	-
	Part IV	ALS203	Add -on Course : Professional English for Life Sciences	2	2
	Part V	FCV202	Foundation Course II : Personality Development	-	-
		SLP201	Service Learning Programme (SLP) : Community Engagement Course	-	2
		SLP202	Service Learning Programme (SLP) : RUN	-	-
		STP201	Student Training Programme (STP): Clubs & Committees/NSS	-	-
IV	Part I	TL2041/ FL2041	Language: Tamil / French	6	4
	Part II	GE2041	General English	6	4
	Part III	BC2041	Major Core IV : Plant Ecology and Phytogeography	4	4
		BC2042 BC2043 BC2044	Major : Elective II (a) Biological Resources (b) Food Science (c) Biodiversity and Human Welfare	4	3
		BC20P2	Major Practical II : Archegoniate & Plant Ecology and Phytogeography	2	2
		BA2041	Allied II : Theory: Plant Diversity - II (Gymnosperms and Angiosperms) and Plant Physiology	4	3

		BA20P2	Allied II Practical: Plant Diversity – I & II and Plant Physiology	2	2
	Part IV	ALS204	Add - on Course : Professional English for Life Sciences	2	2
	Part V	FCV202	Foundation Course II : Personality Development	-	1
		SLP202	Service Learning Programme (SLP) : RUN	-	2
		STP201	Student Training Programme (STP) : Clubs & Committees/NSS	-	2
V	Part III	BC2051	Major Core V : Taxonomy of Angiosperms and Economic Botany	6	6
		BC2052	Major Core VI : Biochemistry and Biophysics	6	6
		BC2053	Major Core VII : Microbiology and Plant Pathology	6	5
		BC20PR	Major Elective III : Project	4	3
		BC20P3	Major Practical III : Taxonomy and Economic Botany	2	-
		BC20P3	Major Practical III : Biochemistry and Biophysics	2	-
		BC20P5	Major Practical V : Microbiology and Plant Pathology	2	-
	Part IV	AEC201	Ability Enhancement Course (AEC) Environmental Studies	2	2
	Part V	FCV203	Foundation Course III : Human Rights Education	-	1
VI	Part III	BC2061	Major Core VIII : Genetics, Biostatistics and Bioinformatics	6	6
		BC2062	Major Core IX : Biotechnology and Molecular Biology	6	6
		BC2063	Major Core X : Plant Physiology and Metabolism	6	5
		BC2064 BC2065 BC2066	Major : Elective IV (a) Marine Botany (b) Organic Farming (c) Ecotourism	4	3
		BC20P3	Major Practical III : Taxonomy and Economic Botany & Biochemistry and Biophysics	-	2
		BC20P4	Major Practical IV : Genetics, Biostatistics and Bioinformatics & Biotechnology and Molecular Biology	4	2

		BC20P5	Major Practical V : Microbiology and Plant Pathology & Plant Physiology and Metabolism	2	2
	Part IV	SEC203	Skill Enhancement Course (SEC) : Global Environmental Issues	2	2
	Part V	FCV204	Foundation Course IV : Gender Equity Studies	-	1
			TOTAL	180	140+10

Self-Learning Courses - Extra Credit Course

Semester	Course Code	Title of the Course	Credit
III/ V	BC20S1	Plant Resource Utilization	2
IV/VI	BC20S2	Algal Biotechnology	2
III - VI		Online Course (SWAYAM / NPTEL)	2

Value Added Courses (Mandatory)

Semester	Course Code	Title of the Course	Total hours
I/II	VAB201	Mushroom Culture Technology	30
III/IV	VAB202	Food Preservation Technology	30

Instruction for Course Transaction

Distribution of total hours for Theory (Major Core)

Components	Sem. I	Sem. II	Sem. III	Sem. IV	Sem. V	Sem. VI
Lecture hours	45	45	45	45	60 / 75	60 / 75
Continuous Internal Assessment	5	5	5	5	5	5
Internal Test (2)						
Quiz (2)	1	1	1	1	1	1
Class test (3)	3	3	3	3	3	3
Class assignment / Group discussion / Problem Solving	6	6	6	6	6	6
Total Hours	60	60	60	60	75 / 90	75 / 90

Distribution of total hours for Theory (Elective/ Allied)

Components	Elective				Allied	
	Sem. III	Sem. IV	Sem. V	Sem. VI	Sem. I/III	Sem. II / IV
Lecture hours	45	45	45 (Project)	45	45	45
Continuous Internal Assessment Internal Test (2)	5	5	-	5	5	5
Quiz (2)	1	1	-	1	1	1
Class test (3)	3	3	-	3	3	3
Class assignment /Group discussion / Problem Solving	6	6	15	6	6	6
Total Hours	60	60	60	60	60	60

Distribution of total hours for Practical

	Semester	Hours /Week	Total Hours / Semester
Major	I / II / III / IV	2	30
	V / VI	2+2+2 = 6	90
Allied	I / II / III / IV	2	30

Examination Pattern

- i) **Part III(Major / Elective / Allied)**
Ratio of Internal and External: 30:70

Continuous Internal Assessment (CIA)

Internal Components and Distribution of Marks

Internal Components	Marks
Internal Test (2)	15
Quiz (2)	4
Class test (3)	6
Home Assignment / Field Assignment / Article Review/ Field Report	5

Total	30
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Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4x1 (No Choice)	4	Part A 10x1 (No Choice)	10
Part B 3x4 (Internal Choice)	12	Part B 5x4 (Internal Choice)	20
Part C 3x8 (Internal Choice)	24	Part C 5x8 (Internal Choice)	40
Total	40	Total	70

Practicals: Major Core & Allied papers

Ratio of Internal and External = 40:60

Total = 100 marks

Internal Components and Distribution of Marks

Internal Components	Marks
Performance during practical hours	10
Regularity in attending practical	5
Record	10
Model exam	15
Total	40

Question pattern

External Exam	Marks
Marks will be allotted as per the practical syllabus	60
Total	60

Project:

Ratio of Internal and External = 40:60

Total = 100 marks

ii) Part IVRatio of Internal and External = **50: 50****a) Add-on Course: Professional English for Life Science -Botany****Internal Components and Distribution of Marks**

Internal Components	Marks
Listening and speaking	25
Reading and Writing	25
Total	50

Question pattern

External Exam	Marks
Written Test : Open choice – 5 out of 7 questions (5 x 10)	50
Total	50

b) Non – Major Elective (NME)
Continuous Internal Assessment (CIA)
Internal Components and Distribution of Marks

Internal Components	Marks
Internal test (2)	20
Quiz (2)	15
Class assignment/ Home assignment/ Project report	15
Total	50

Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4 x 1 (No Choice)	4	Part A 5 x 1 (No Choice)	5
Part B 3 x 4 (Internal Choice)	12	Part B 5 x 3 (Internal Choice)	15
Part C 3 x 8 (Internal Choice)	24	Part C 5 x 6 (Internal Choice)	30
Total	40	Total	50

c) Skill Enhancement Course (SEC) - Computer Literacy**Internal Components**

Component	Marks
Objective type questions (30x1)	30
Exercise (Book) compulsory (2x10)	20

Total	50
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External Components

Component	Marks
Exercise 1	20
Exercise 2	10
Procedures for both Exercises	20
Total	50

d) Skill Enhancement Course (SEC) - Meditation and Exercise

Internal Components

Component	Marks
Objective type questions (20x1)	20
Exercise (2x10)	20
Assignment	10
Total	50

External Components

Component	Marks
Quiz	20
Written test : Open choice –10 out of15 questions (10x3)	30
Total	50

e) Ability Enhancement Course (AEC) - Environmental Studies

Internal Components

Component	Marks
Project Report	30
Viva voce	20
Total	50

External Components

Component	Marks
Quiz	20
Written Test : Open choice – 10 out of15 questions (10x3)	30
Total	50

iii) Part V

- i) Foundation course (Values for life, Personality development, Human rights education and Gender equity studies)

Ratio of Internal and External = 50: 50

a) Foundation Course I: Values for Life**Internal Components**

Component	Marks
Song, Mime, Skit	20
Book Activities	20
A Kind Action	10
Total	50

External Components

Component	Marks
Quiz	20
Written Test : Open choice – 5 out of 7 questions (5 x 6)	30
Total	50

b) Foundation Course II: Personality Development**Internal Components**

Component	Marks
Exercise from book	20
Skit	10
Group Album	20
Total	50

External Components

Component	Marks
Quiz	20
Written Test : Open choice – 5 out of 7 questions (5 x 6)	30
Total	50

c) Foundation Course III: Human Rights Education

Internal Components

Component	Marks
Album on current issues	20
Group Song/ Mime/ Skit	10
Open book test (Objective type questions)	20
Total	50

External Components

Component	Marks
Quiz	20
Written Test : Open choice – 5 out of 7 questions (5 x 6)	30
Total	50

d) Foundation Course IV: Gender Equity Studies

Internal Components

Component	Marks
Album on current issues	20
Group Song/ Mime/ Skit	10
Open book test (Objective type questions)	20
Total	50

External Components

Component	Marks
Quiz	20
Written Test : Open choice – 5 out of 7 questions (5 x 6)	30
Total	50

e) SLP -Community Engagement Course (CEC)

(Field Work – 15 hrs; Class Hours – 15 hrs)

Internal Components

Component	Marks
Assignment	10
Group Discussion	10
Attendance (Field work)	30

Total	50
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External Components

Component	Marks
Project Report / Case Study(10-15 pages in print)	50
Group project	
Total	50

f) SLP –Service Learning Programme: Reaching the Unreached Neighbourhood (RUN)

- 60 Hours mandatory programme (2 credits).

g) STP – Student Training Programme

- Compulsory for all I & II year students (2 credits).
- Clubs and Committees – Eco Club, YRC, Rotract Club, NSS/ RRC, AICUF, Consumer Club, Sports, Legal Literacy and Women’s Cell.
- Each student can opt for one club/ committee.

Semester - I
Major Core I : Algae, Fungi and Lichens

Sub. Code: BC2011

No. of hours per week	Credit	Total no. of hours	Marks
4	4	60	100

Objectives: 1.To understand the salient features of different classes of Algae and Fungi
2. To study in detail the different genera belonging to various classes of Algae, Fungi, Lichens and their economic importance.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the salient features of different classes of Algae, Fungi and Lichens and their adaptive strategies	PSO - 1	R
CO - 2	understand the importance of lower plants to the economy and environment	PSO - 4	U
CO - 3	interpret the values of AM Fungi	PSO - 3	Ap
CO –4	correlate the structure, reproduction and life cycle of different classes of Algae and Fungi	PSO - 1	E
CO –5	differentiate diverse group of Algae and Fungi based on their hierarchy	PSO - 5	An

Unit I

Algae: Classification of Algae according to Fritsch (1945). General Characters, Salient features of the classes, occurrence, structure, reproduction and life cycle of the following (Excluding developmental studies)

Cyanophyceae– *Nostoc*

Chlorophyceae- *Volvox*, *Caulerpa*

Phaeophyceae- *Sargassum*

Unit II

Rhodophyceae- *Gracilaria*

Xanthophyceae – *Vaucheria*

Bacillariophyceae – *Diatoms*

Economical and Ecological importance of Algae

Unit III

Fungi: Classification of fungi according to Alexopoulos and Mims (1979). General characters, Salient features of the classes, occurrence, structure, reproduction and life cycle of the following (Excluding developmental studies)

Oomycetes - *Albugo*

Zygomycetes - *Rhizopus*

Economic importance of Fungi

Unit IV

Ascomycetes - *Aspergillus*, *Peziza*

Basidiomycetes - *Polyporus*

General account on Glomeromycota-VAM Fungi

Unit V

Lichens: General characters of Lichens, Classification of Lichens

Ascolichen- *Usnea*

Economic importance of Lichens

Text Book

1. Pandey, B.P. (2013). *College Botany* Vol I. New Delhi:S. Chand & Company.

Reference Books

1. Vashishta, B.R. (1997). *Algae*. New Delhi: S. Chand & Company.
2. Vashishta, B.R. (1993). *Fungi*. New Delhi: S. Chand & Company.
3. Fritsch, F.E. (1972). *The Structure and Reproduction of Algae* Vol. I & II. London: Cambridge University Press.
4. Sharma, O.P. (1997). *Text book of Algae*. New Delhi: Tata Mc Graw- Hill Publications.
5. Dubey, H.C. (1993). *Introduction to Fungi*. New Delhi: Vikas Publishing House.

Semester - I
Major Practical I
Algae, Fungi and Lichens
Sub. Code: BC20P1

No. of hours per week	Credit	Total no. of hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	preparation of plant material for microscopic observation	PSO - 3	Cr
CO - 2	draw appropriate anatomical diagrams from the sectioned plant material using microscope	PSO - 3	An
CO - 3	identify different microalgae from water bodies	PSO - 1	U
CO - 4	identify the microscopic structures of Algae, Fungi and Lichens	PSO - 1	U
CO - 5	record the locally available seaweeds	PSO - 1	U

To make suitable micro preparations of types prescribed in the syllabus

Caulerpa – Rhizome
Sargassum – Stipe, ‘leaf’
Gracilaria– Thallus
Albugo – Conidia
Peziza -Apothecium
Puccinia – Uredosorus and Teleutosorus
Lichens – Thallus

To identify the Specimens

Nostoc – Filament
Volvox – Vegetative colony with daughter colonies, antheridium and oogonium
Sargassum – Entire thallus, Male and Female Conceptacles
Gracilaria– Thallus with cystocarp
Vaucheria– Sexual reproduction
Diatoms- Pennate and Centric
Algal mixture
Aspergillus – Conidia
Rhizopus - Conidia
Puccinia – Aecidium and pycnidium
Lichens – Apothecium and Soredium

Algal Field Visit- Submission of field report with 10 Geo-tagged photographs- 5 marks
(Continuous assessment)

Semester - I

Allied I : Chemistry of Life

Sub. Code: BA2011

No. of hours per week	Credit	Total no. of hours	Marks
4	3	60	100

Objectives: 1.To study the structure and functions of cell organelles and biomolecules
2. To learn the different techniques in cell biology

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	learn the structure, chemistry and functions of cellular organelles and non-living inclusions	PSO - 1	R
CO – 2	understand the structure, properties and fundamentals of biomolecules	PSO - 1	U
CO – 3	identify the characteristics and stages of mitosis, meiosis and cell cycle	PSO - 1	U
CO – 4	compare the beneficial effects of vitamin and mineral supplements in the diet	PSO - 2	An
CO – 5	learn the technique of Cell biology	PSO - 7	An

Unit I

Cell – Structure: Prokaryotic and Eukaryotic; difference between Prokaryotic and Eukaryotic cell. Structure of plant cell, chemical composition and functions of the following: Plasma membrane (fluid mosaic model), Chloroplast and Mitochondria

Unit II

Ultrastructure and functions of nucleus. Cell division – cell cycle, mitosis and meiosis - significance. Non living inclusions – starch grains, aleurone grain, cystolith and raphide.

Unit III

Chemical bonds – types (co-ordinate, covalent, hydrogen); Carbohydrate classification; Monosaccharides: Structure and properties of glucose. Disaccharides: Structure and properties of sucrose. Polysaccharides: Structure and properties of starch.

Unit IV

Protein: Structure– primary, secondary, tertiary (myoglobin) and quaternary (hemoglobin). Vitamins - importance, sources, deficiency symptoms of water soluble and fat soluble vitamins.

Lipids -General account of simple lipids (Triglycerides), compound lipids (Phospholipids) and derived lipids (Cholesterol).

Unit V

Cellular Photosynthesis- Mechanism of photosynthesis, pigment systems, light dependent reactions (cyclic and non-cyclic), C₃ Cycle. Factors affecting photosynthesis.

Defence mechanism in plants.

Text Books

1. Verma, P.S. & Agarwal, V.K.S. (2004). *Cell Biology*. New Delhi: S. Chand and Company Ltd.,
2. Jain, J.L. (2000). *Fundamentals of Biochemistry*. New Delhi: S. Chand and Co.

Reference Books

1. Powar, C.B. (2005). *Cell Biology*. New Delhi: Himalaya Publishing House.
2. De Robertis, E.D.P., & De Robertis, D.M.P. (1980). *Cell and Molecular Biology*. Philadelphia: Saunders College
3. Gupta, P.K. (1997). *Cytology, Genetics and Evolution*. Meerut: Rastogi Publications.
4. Conn, E.J. and Stumpf, P.K. (2009). *Outlines of Biochemistry*. (5th ed.) New Jersey: Wiley Eastern Ltd.,
5. Lehninger, A.L. (2002). *Principles of Biochemistry*. New Delhi: CBS Publishers and Distribution,
6. Arun Mittal, C. (2002). *Biochemistry*. New Delhi: A.P.H. Publishing Corporation.
7. Sathyanarayana, U. and Chakrapani, U. (1999). *Biochemistry*. Kolkata: Books and Allied (P) Ltd.
8. Vashista, B.R R. (1997). *The Plant Anatomy*, Chand and Co., New Delhi.

Allied I : Practical
Chemistry of Life
Sub. Code: BA20P1

No. of hours per week	Credit	Total no. of hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	identify electron micrographs of the cell organelles	PSO - 7	U
CO - 2	prepare root tip squash of onion to identify the various stages of mitosis	PSO - 3	E
CO - 3	know the importance of non -living inclusions in plant cells	PSO - 5	U
CO - 4	Know the effect of transpiration and photosynthesis	PSO - 7	An

1. To identify electron micrographs of the cell organelles.
2. To prepare root tip squash of onion and to identify the various stages of mitosis.
3. Sectioning, staining, mounting and identification of nonliving inclusions (Cystolith, Raphide, Starch Grain and Aleurone grain)
4. Demonstration only
 - a. Transpiration pull
 - b. Oxygen evolved during photosynthesis
 - c. Light- screen experiment

Add on Course: Professional English for Life Sciences

Semester I

Course Code: ALS201

Hours / Week	Credits	Total Hours	Marks
2	2	30	100

Objectives:

1. To enhance the lexical, grammatical and socio-linguistic and communicative competence in an increasingly complex, interdependent world.
2. To develop intellectual flexibility, creativity and critical thinking skills of students by offering adequate practice in professional contexts.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO-1	Recognise the words used in life science and improve their competence in using the language	1	R
CO-2	Comprehend unfamiliar texts and describe biological processes	2	U
CO-3	Apply language for speaking and writing with confidence in an intelligible and acceptable manner	3	AP
CO-4	Apply critical and theoretical approaches to the reading and analysis of various texts in life sciences	3	AP
CO-4	Analyze critically, negotiate and present without committing errors and develop entrepreneurship skills.	4	An

Unit I

Communication

1. Listening to Audio Text & answering Questions
2. Pair Walk
3. Comprehension passage
4. Developing a story with pictures
5. Vocabulary

Unit II

Description

1. Listening to Process Description – Online shopping
2. Speaking – Role play – sample I
3. Reading Passages on Products
4. Process Description – Compare & Contrast
5. Vocabulary

Unit III

Negotiation Strategies

1. Listening to interviews of specialists
2. Brainstorming (Mind mapping)
3. Economic System (Longer Reading Text)
4. Why learn the skill of writing an essay
5. Vocabulary

Unit IV

Presentation Skill

1. Listening to lecture – I
2. Short Talks – I
3. Reading comprehension – passage I
4. Writing Recommendations
5. Vocabulary

Unit V

Critical Thinking Skills

1. Listening comprehension
2. Speaking – Making Presentation – Task 1 & 2
3. Reading – Comprehension Passages, Note making
4. Writing – Problem & Solution Essays, Creative writing
5. Vocabulary

Textbook

Tamil Nadu State Council for Higher Education (TANSCH), Professional English for Life Sciences – I.

Semester - I
Non- Major Elective (NME) : Gardening and Floriculture
Sub. Code: BNM201

No. of hours per week	Credit	Total no. of hours	Marks
2	2	30	100

Objectives:

1. To know the techniques of gardening
2. To evaluate the importance of floriculture and ornamental plant cultivation on economy.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
1	understand the importance of nursery management and gardening.	PSO - 5	Un
2	compare the different methods of vegetative propagation in order to propagate ornamental and commercial flowers.	PSO- 1	Ev
3	analyze the different methods of weed control and harvest treatments of horticultural crops.	PSO- 4	An
4	design methods to grow a variety of garden plants in a diverse set of environment to become an entrepreneur.	PSO - 5	Ap

Unit 1

Garden Nursery Structures – Nursery Bed, Mist Chamber, Manures and Vermicompost.

Unit II

Plant Propagation: Asexual methods - Air layering and Veneer Grafting. Micropropagation - Induction of rooting and flowering.

Unit III

Green houses for tropical countries – Pot mixture, Pot culture, Packaging and Marketing of Nursery Stock

Unit IV

Indoor Gardening: Layout of lawns, Rockery, Bonsai and Hanging basket.

Unit V

Commercial Floriculture: Cultivation of cut flowers - Rose and Orchids. Flower arrangements; Methods to prolong vase life

Text Books

1. Randhawa, G.S. and Mukhopadhyay A. (1986). *Floriculture*. New Delhi: Mac Milan India Ltd.
2. Kumar, N. (1986). *Introduction to Horticulture*. Nagercoil: Rajalakshmi Publishers

Reference

1. Ray. R. Larsen. (2013). *Introduction to Floriculture*. London: Academic Press.
2. Charles. P. Griner. (2011). *Floriculture – Designing and Merchandising*. U.S.: Cenage Publishers.
3. Rao K.M. (1991). *Text book of Horticulture*. New Delhi: Mac Milan India Ltd.
4. Sheela V.L. (2011). *Horticulture*. Chennai: M.P.J. Publishers.
5. Sandhu, M.K. (1989). *Plant Propagation*. New Delhi: Wiley Eastern Ltd.

Semester I / II

Skill Enhancement Course (SEC) : Meditation and Exercise

Sub. Code: SEC201

No. of hours per week	Credit	Total No. of hours	Marks
2	2	30	100

Objectives:

1. To promote good - health and emotional stability among students.
2. To increase relaxation of body and mind.
3. To equip the students with traditional understanding of yogasanas and meditation.
4. To prevent stress-related health problems.

Unit I

Physical Health: Physical Structure of Human Body- Five Factors to Balance in Life- Nadisuthi- Neuro-Muscular Breathing Exercises - Eye exercises - Kapalabathi.

Unit II

Yogasanas: Surya Namaskar- Eka Pada Asana (Viruchchasana) - Chakrasana (sideways) - Uthkadasana - Padmasana- Vajrasana- Pachi Mothasana- Navasana- Pavana Mukthasana- Salabhasana-Dhanurasana- Makkarasana.

Unit III

Mind: Mind-Mental frequency- Meditation- Benefits of Meditation.

Unit IV

Personality Development: Analysis of Thought - Six roots for thought – Introspection for analysis of thought -Practical technique for analysis of thought - Moralization of desire - Analysis of desire - Practical technique for moralization of desire.

Unit V

Human Resources Development: Eradication of worries- Analyse your problems and eradicate worry – Practical exercise to eradicate worries- Benefits of Blessings - Effect of good vibrations - practicing blessing a daily habit.

Text Book

Value Education - Vision for Wisdom World Community Service Centre , Aliyar.

Reference books

1. Handbook on Yoga-N.C.Narayanan
2. Simplified Physical Exercises – Thathuvagnani Vethathiri Maharishi
3. Mind – Thathuvagnani Vethathiri Maharishi
4. Yoga for modern age – Thathuvagnani Vethathiri Maharishi.
5. Yogasanas-- Vision for Wisdom World Community Service centre, Aliyar.

Semester I & II
Foundation Course I : Values for Life
Course Code: FCV201

No. of hours per week	Credit	Total no. of hours	Marks
1	1	30	100

Objectives:

1. To inculcate the importance of values among the students.
2. To instill personal, family, social and religious values among the learners.
3. To equip them as responsible human beings.

**Course Outcomes
(COs)**

CO No.	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO-1	understand the human values, its importance and components	PSO-	U
CO-2	apply the values learnt in real life situation	PSO-	Ap
CO-3	comprehend the different personal values and its components	PSO-	U
CO-4	realize the personal values and to practice them	PSO -	Ap
CO - 5	understand the family values	PSO -	U

Unit I

Values – meaning- definition –value education - importance – objectives – essence – components- process - issues to be taught – benefits – significance of values in the present scenario - core value concerns – role of educators

Unit II

Personal Values – importance – purpose – factors that form personal values – components -assistance, truth, hard work, perseverance, respect for elders and teachers.

Unit III

Family Values - types – selfless love and service, sacrifice, Affection, gratitude, sharing humanity, kindness, peace, obedience

Infatuation – love – marriage – relationship

Familial love – brotherly love – sisterly love – parental love – definition – quotes from title

Unit IV

Social values – function – benefits - Components – honesty, integrity, compassion, empathy, commitment, responsibility, discipline, punctuality, respect, courtesy, dedication, attitude.

Unit V

Religious values – faith, belief, forgiveness, surrender. Prayer – definition – components – types, benefits
God's love and protection – relevant quotes and reflections.

Text Book

Ed. Jansi, Mary, Jeyaseeli, Mary Helen Stella and Anitha Malby. Values for Life. Saras Publication. Nagercoil.

Mushroom Culture Technology

Sub. Code: VAB201

Semester	Course Code	Name of the Course	Total hours
I/II	VAB201	Mushroom Culture Technology	30

Objectives: 1.To learn the technique of mushroom culture.
2. To provide self-employment opportunity

Unit I

Introduction, history, morphology, types and life cycle of mushrooms. Identification of edible mushroom. Nutritional and medicinal value of edible mushrooms

Unit II

Cultivation of mushroom – Oyster mushroom (*Pleurotus* sp.) Button mushroom (*Agaricusbisporus*) Paddy Straw Mushroom (*Volvariella* sp.). Isolation, Spawn Production, Substrate for mushroom cultivation. Spawn running and harvesting.

Unit III

Post harvest technology of mushroom, protection of mushroom from insect pest, nematodes, mites, viruses, fungal competitors and other diseases

Unit IV

Spawn Production technique – Microbiological technique, mother spawn and commercial spawn

Unit V

Few recipes, value added Products, packing techniques, marketing in India and abroad, Commercial production- model unit, Banking, Government, Help-Line

Text book

1. Tewari Pankaj, Kapoor, S.C. (1988). *Mushroom Cultivation*. Delhi: Mittal Publications,

Reference

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R. (1991). *Oyster Mushrooms*. Coimbatore: Tamil Nadu Agricultural University.
2. Swaminathan, M.(1990). *Food and Nutrition*, Bangalore: The Bangalore Printing and Publishing Co. Ltd.
3. Nita Bahl.(1984-1988). *Hand book of Mushrooms*. II Edition. Vol. I & II. New Delhi:Oxford and IBH Pub. Co.

Semester - II
Major Core II : Plant Anatomy and Developmental Botany
Sub. Code: BC2021

No. of hours per week	Credit	Total no. of hours	Marks
4	4	60	100

Objective: 1.To know the internal structure of plants.

2. To learn the structure and development of reproductive units in higher plants.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the structure and functions of meristem, simple and complex tissues.	PSO - 1	R
CO - 2	differentiate primary and secondary structures.	PSO - 1	U
CO - 3	examine the nodal anatomy types.	PSO - 1	An
CO - 4	interpret the different types of endosperms.	PSO - 1	U
CO - 5	learn about double fertilization and their significance.	PSO - 1	U
CO - 6	understand the basic knowledge of apomixis and polyembryony in the field of crop improvement.	PSO - 1	Ev

Unit I

Meristems – Classification (origin, position and function); Evolution of concept of organization of shoot apex (Histogen theory, Tunica Corpus theory). Organization of root apex (Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap. Tissues – Structure and function of simple tissue (parenchyma, collenchyma and sclerenchyma) and complex tissue (xylem and phloem). Types of vascular bundles.

Unit II

Primary growth; Primary structure of dicot and monocot stem, root and leaf. Secondary growth in stem and root – Formation of cambial ring, activity of cambial ring, secondary vascular tissue, formation of periderm, lenticels, dendrochronology, annual ring, Wood (heartwood and sapwood).

Unit III

Anomalous secondary thickening in dicot stem (*Boerhaavia*) and monocot stem (*Dracaena*).

Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni-and multicellular, glandular and nonglandular, two examples of each), stomata and its types; Nodal anatomy types - unilacunar (*Justicia*), trilacunar (*Azadirachta*) and multilacunar (*Aralia*), Hydathodes and laticifers.

Unit IV

Embryology – Structure of anther; Structure of microsporangium, microsporogenesis, structure of pollen; development of male gametophyte. Structure and types of ovules; Structure of megasporangium, megasporogenesis and development of female gametophyte.

Unit V

Types of embryo sac – Monosporic – Polygonum type. Pollination mechanisms and adaptations. Fertilization, endosperm - types- nuclear, cellular and helobial, ruminate endosperm, perisperm. Development of embryo in dicot (*Capsella*) and monocot (*Luzula*). Apomixis and polyembryony.

Text Books

1. Vashista, B.R. (1997). *The Plant Anatomy*. New Delhi: S. Chand & Co.
2. Bhojwani, S.S., & Bhatnagar, S.P. (2011). *Embryology of Angiosperms*. (5th ed.). New Delhi: Vikas Publication House Pvt. Ltd.

Reference Books

1. Mauseth, J.D. (1988). *Plant Anatomy*. USA: The Benjamin/Cummings Publisher.
2. Pandey, B.P. (1982). *Plant Anatomy*. New Delhi: S. Chand & Co.
3. Fahn, A. (1987). *Plant Anatomy*. New York: Maxwell House.
4. Arthur J Eames., & Laurence H Macdaniels. (2005). *An Introduction to Plant Anatomy*. New Delhi: Tata McGraw-Hill Publishing Company.
5. Maheswari, P. (1976). *An introduction to the embryology of Angiosperms*, New Delhi: Tata McGraw Hill Publishing Company.

Major Practical I
Plant Anatomy and Developmental Botany
Sub. Code: BC20P1

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	observe and identify different types of tissues and stomata.	PSO - 3	U
CO – 2	prepare plant material for microscopic observation.	PSO - 7	C
CO – 3	draw appropriate anatomical diagrams from the sectioned plant material using microscope.	PSO - 3	An
CO – 4	differentiate and draw diagrams of nodes.	PSO - 3	An
CO – 5	observe and identify the slides of different stages of microsporogenesis.	PSO - 3	U
CO – 6	dissect and display the different stages of <i>Tridax</i> embryo.	PSO - 3	E

- To observe and identify different types of tissues
- Sectioning, staining, mounting and identification of primary structure of dicot stem, dicot root, monocot stem and monocot root; Dicot and monocot leaf.
- Normal secondary thickening of dicot stem and dicot root.
- Anomalous secondary thickening – Dicot stem (*Boerhaavia*) and monocot stem (*Dracaena*)
- Nodal types – Unilacunar, trilacunar and multilacunar.
- Stomatal types – anomocytic, anisocytic, paracytic, diacytic and graminaceous.
- To observe and identify the slides of
 - T.S of Anther - Sporogenous, Tetrad and Mature
 - L.S of Ovule – Orthotropous and Anatropous
- Photomicrograph of
 - Dicot Embryo
 - Monocot Embryo
 - Apomixis
 - Polyembryony
- Dissection of *Tridax* embryo (Globular or Cordate stage).

Major Practical I
Algae, Fungi and Lichens & Plant Anatomy and Developmental Botany
Sub. Code: BC20P1

Number of Hours Per week	Number of Credit	Total Number of Hours	Marks
2+2	2	30+30	100

Algae, Fungi and Lichens(to be conducted during the I Semester)

To make suitable micro preparations of types prescribed in the syllabus

Caulerpa – Rhizome

Sargassum – Stipe, ‘leaf’

Gracilaria– Thallus

Albugo – Conidia

Peziza -Apothecium

Puccinia – Uredosorus and Teleutosorus

Lichens – Thallus

To identify the Specimens

Nostoc – Filament

Volvox – Vegetative colony with daughter colonies, antheridium and oogonium

Sargassum – Entire thallus, Male and Female Conceptacles

Gracilaria– Thallus with cystocarp

Vaucheria– Sexual reproduction

Diatoms- Pennate and Centric

Algal mixture

Aspergillus – Conidia

Rhizopus - Conidia

Puccinia – Aecidium and pycnidium

Lichens – Apothecium and Soredium

Algal Field Visit- Submission of field report with 10 Geo-tagged photographs- 5 marks
(Continuous assessment).

Plant Anatomy and Developmental Botany

(to be conducted during the II Semester)

1. To observe and identify different types of tissues
2. Sectioning, staining, mounting and identification of primary structure of dicot stem, dicot root, monocot stem and monocot root; Dicot and monocot leaf.
3. Normal secondary thickening of dicot stem and dicot root.
4. Anomalous secondary thickening – Dicot stem (*Boerhaavia*) and monocot stem (*Dracaena*)
5. Nodal types – Unilacunar, trilacunar and multilacunar.
6. Stomatal types – anomocytic, anisocytic, paracytic, diacytic and graminaceous.
7. To observe and identify the slides of
 - i) T.S of Anther - Sporogenous, Tetrad and Mature
 - ii) L.S of Ovule – Orthotropous and Anatropous
8. Photomicrograph of
 - Dicot Embryo
 - Monocot Embryo
 - Apomixis
 - Polyembryony
9. Dissection of *Tridax* embryo (Globular or Cordate stage).

Semester - II
Allied I: Taxonomy of Angiosperms and Herbal Technology
Sub. Code: BA2021

No. of hours per week	Credit	Total no. of hours	Marks
4	3	60	100

Objectives: 1. To impart basic knowledge of morphology to understand Taxonomy.
2. To study the vegetative and floral characters of Angiosperm families.
3. To understand the ancient medicinal practices and its importance.
4. To recognize and utilize medicinal plants.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	understand the basic knowledge of taxonomy by learning selected families of angiosperms.	PSO – 1	R
CO - 2	understand the characters of the families according to Bentham & Hooker's system of Classification.	PSO – 1	U
CO - 3	improve the awareness and appreciation of traditional medicinal practices.	PSO – 2	Ap
CO - 4	apply the basic medicinal plants and its utilization.	PSO – 7	An
CO - 5	create new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India.	PSO – 4	Cr
CO - 6	evaluate the drug adulteration through the biological testing.	PSO – 7	An

Unit I

Brief account of morphology: Root, stem, leaf, inflorescence and fruits. Classification – Bentham & Hooker, Binomial nomenclature.

Unit II

Study of the following families and their economic importance - Rutaceae, Apiaceae, Lamiaceae, Euphorbiaceae and Liliaceae.

Unit III

Herbal medicines-History and scope: Knowledge on-Ayurveda, Siddha, Unani and Homeopathy.
Herbal preparation: decoction, extract, infusions, oils, shampoos and powders.

Unit IV

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withaniasomnifera* (drugs acting on nervous system), *Clerodendronphlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

Unit V

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

Text Books

1. Pandey, B.P. (1997). *Taxonomy of Angiosperms*. New Delhi: S. Chand & Co.
2. Kokate, C.K., Purohit, A.P. and Gokhale. S.B. (1999). *Pharmacognosy*. New Delhi: NiraliPrakashan

Reference Books

1. Singh., and Jain. (1997). *Taxonomy of Angiosperms*. Meerut: Rastogi Publications.
2. Agnes Arber, (1999). *Herbal Plants and Drugs*. Jaipur: Mangal Deep Publications.
3. KannyLall Dey and Raj Bahadur(1984). *The indigenous drugs of India*. Dehradun: International Book Distributors.
4. Sivarajan, V.V. Balachandran and Indra.(1994). *Ayurvedic drugs and their plant source*. New Delhi: Oxford IBH publishing Co.

Semester - II
Allied I Practical
Taxonomy of Angiosperms and Herbal Technology
Sub. Code: BA20P1

No. of hours per week	Credit	Total no. of hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	dissect and display the floral parts of the families studied and draw floral parts and write floral formula.	PSO - 1	An
CO - 2	assign the plant provided to the respective families.	PSO - 3	E
CO - 3	know the relevance of herbal drugs in Indian system of medicine.	PSO - 7	U
CO - 4	analyze the phyto chemicals present in plant parts.	PSO - 7	An

1. To make dissections of the floral parts of the families prescribed in the syllabus and to make drawings to bring out the salient features including floral diagram and floral formula.
2. Assigning plants to their respective families.
3. Spotters: Fruit types; inflorescence types and medicinal plants prescribed in the syllabus
4. Demonstration Only: Basic qualitative phyto chemical analysis

Semester - II
Allied I Practical
Chemistry of Life & Taxonomy of Angiosperms and Herbal Technology
Sub. Code: BA20P1

No. of hours per week	Credit	Total no. of hours	Marks
2+2	2	30 +30	100

Chemistry of Life (To be conducted in Semester – I)

1. To identify electron micrographs of the cell organelles.
2. To prepare root tip squash of onion and to identify the various stages of mitosis.
3. Sectioning, staining, mounting and identification of nonliving inclusions

(Cystolith, Raphide, Starch Grain and Aleurone grain)

4. Demonstration only

- a. Transpiration pull
- b. Oxygen evolved during photosynthesis
- c. Light- screen experiment

Taxonomy of Angiosperms and Plant Physiology

(To be conducted in Semester – II)

1. To make dissections of the floral parts of the families prescribed in the syllabus and to make drawings to bring out the salient features including floral diagram and floral formula.
2. Assigning plants to their respective families.
3. Spotters: Fruit types; inflorescence types and medicinal plants prescribed in the syllabus
4. Demonstration Only: Basic qualitative phyto chemical analysis

Semester II
Add on Course : Professional English for Life Sciences
Course Code: ALS202

Hours / Week	Credits	Total Hours	Marks
2	2	30	100

Objectives:

1. To enhance the lexical, grammatical and socio-linguistic and communicative competence in an increasingly complex, interdependent world.
2. To develop intellectual flexibility, creativity and critical thinking skills of students by offering adequate practice in professional contexts.

CO	Upon completion of this course, the students will be able to:	PSO addressed	CL
CO-1	recognise the words used in life science and improve their competence in using the language.	1	R
CO-2	comprehend unfamiliar texts and describe biological processes.	2	U
CO-3	apply language for speaking and writing with confidence in an intelligible and acceptable manner.	3	Ap
CO-4	apply critical and theoretical approaches to the reading and analyses of various texts in life sciences.	3	Ap
CO-5	analyse critically, negotiate and present without committing errors and develop entrepreneurship skills	4	An

Unit1

Communication:

1. Listening to instruction
2. Small group work
3. Comprehension – Difference between facts & opinions
4. Developing a short poem with pictures
5. Vocabulary

Unit II

Description:

1. Listening to Process Description – Cartographic Process
2. Speaking- Role play- sample 2
3. Reading passages on Equipment& gadgets
- 4.Paragraph: Sentence Definition & Extended Definitions, Free writing
5. Vocabulary

Unit III

Negotiation Strategies:

1. Listening to interviews of inventors in fields
2. Small Group Discussion – Specific

3. Longer reading text- The Art of Loving
4. Essay writing
5. Vocabulary

Unit IV

Presentation Skill:

1. Listening to Lecture- 2
2. Short Talks- Poverty and the need to alleviate it
3. Reading comprehension – passage2
4. Interpreting Visual Inputs
5. Vocabulary

Unit V

Critical Thinking Skills:

1. Listening for information
2. Making Presentation Task 3&4
3. Motivational Articles on Professional Competence, Professional Ethics & Life Skill
4. Problem & Solution Essays, Summary Writing
5. Vocabulary

Textbook

Tamil Nadu State Council for Higher Education (TANSCHE). *Professional English for Life Sciences* - 1

Semester - II
Non Major Elective (NME) : Biofertilizers, Biofuels and Biopesticides
Sub. Code: BNM202

No. of hours per week	Credit	Total no. of hours	Marks
2	2	30	100

Objectives: 1. To enable the students to acquire knowledge on the importance of biological resources
2. To be self-employable.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	design novel mechanisms for the sustainable utilization of natural resources.	PSO – 4	Ap
CO - 2	understand the role of microbes in bio - composting.	PSO – 3	An
CO - 3	utilize the technique studied for bio-fuel production using suitable production.	PSO -4	C
CO - 4	learn different skills in bio-product processing to become an entrepreneur.	PSO – 5	Ap
CO - 5	know the efficacy of bio-control mechanism over chemical application.	PSO – 4	U

Unit I

Biofertilizer: Scope and importance of biofertilizers. Reasons for preference of biofertilizer to chemical fertilizer. Biofertilizers using nitrogen fixing microbes, Mass Multiplication of *Azolla*.

Unit II

Biofuel Production: Major algal species for biofuel production, downstream processing for the biofuel production, advantages of biofuel production.

Unit III

Vasicular Arbuscular Mycorrhizae (VAM) –Isolation, multiplication, application Carrier-based inoculants, quality control, agronomic importance. Vermicomposting- Methods and preparation of vermicomposting and its application.

Unit IV

Biopesticides: Advantages and disadvantages of biopesticides; biological methods of pest control. Mode of action of *Bacillus thuringiensis*.

Unit V

Biocontrol- Microbial control of plant pathogens- *Trichoderma*.

Biological Control – Use of Baculovirus, protozoa & fungi in biological control.

Text Book

Ignacimuthu, S. (2012). *Biotechnology – An introduction*. U.K.: Alpha Science International Ltd;

Reference Books

1. Norris, J. R., Read, D. J. and Verma, A. K. (1992). *Methods in Microbiology*. Vol. XXIV. London: Academic Press.
2. Whitton, B.A and Carr, N.G. (1982). *Biology of Cyanobacteria*. Oxford: Blackwell Scientific
3. John Jothi Prakash, E. (2004). *Outlines of Plant Biotechnology*. New Delhi: Emkay Publications
4. Sathe, T.V. (2004). *Vermiculture and Organic Farming*. New Delhi: Daya publishers.
5. Subha Rao, N.S. (2000). *Soil Microbiology*. New Delhi: Oxford & IBH Publishers,
6. Lakshman, H.C and Channabasava, A. (2014) *Biofertilizers and Biopesticides*. Jaipur: Pointer Publishers
7. Subba Rao N. S. (1982). *Advances in Agricultural Microbiology*. Oxford: Butterworth-Heinemann

Semester I & II
Skill Enhancement Course (SEC): Computer Literacy
Course Code: SEC202

Hours/Week	Credits	Total no. of hours	Total marks
2	2	30	100

Objective

To enable students to understand the basic working of ms office which includes ms word, excel and powerpoint.

Unit I

Microsoft Word: Starting MS-Word – Introduction to word 2007 user interface – Understanding document views – Creating a new document – Saving a file – Printing a document – Opening an existing file – Microsoft word 2007 basic features.

Unit II

Formatting text – Formatting paragraphs – Graphics – Tables – Page Setup – Bullets and Numbering – Columns and Ordering – Text Boxes – Mail Merge.

Unit III

Microsoft Excel: Starting MS- Excel – Introduction to Excel 2007 user interface – Creating a New workbook – Saving a workbook – Opening an Existing workbook – Entering data into a cell – Selecting cells – Entering data using autofill – Using merge & center – Sorting data – Creating a table – Formatting a table.

Unit IV

Adjusting cell data alignment – Changing cell data orientation - Adding borders to cell – Basic operations on worksheet – Advanced operations on worksheets – Resizing columns and rows in a worksheet – Using formulas and functions – Charts.

Unit V

Microsoft PowerPoint: The PowerPoint window – PowerPoint views – Create a new presentation - Changing a slide layout – Inserting text on a new slide – Inserting a new slide – Rearrange the order of slides – Delete a slide – Save a presentation – Applying themes to a presentation – Change background style – Creating a textbox – Format textboxes – Add an image – Format an image – WordArt – Slide transitions – Slide animation - Setup slide show.

Text Book

1. J. Anto Hepzie Bai & S. J. Jenepha Mary, “Step Into Microsoft Office 2007”.

LAB EXERCISES

MS WORD

1. Design an Invitation
2. Design a Book Cover
3. Prepare a Calender
4. Mail Merge

MS EXCEL

1. Mark Sheet Preparation
2. Chart
3. Macro
4. Built-in Functions

MS POWERPOINT

1. Creating Resume
2. Birthday Greeting Card

Semester II & III
Service Learning Programme (SLP): Community Engagement Course
Course Code: SLP201

Credits	Total no. of hours	Total marks
2	30 (15 classroom + 15 field)	100 (50 + 50)

Objectives

- To develop an appreciation of rural culture, life-style and wisdom among students
- To learn about the status of various agricultural and rural development programme
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and there by improve quality of learning

Learning Outcomes

After completing this course, student will be able to

- Gain an understanding of rural life, culture and social realities
- Develop a sense of empathy and bond so mutuality with local community
- Appreciate significant contributions of local communities to Indian society and economy
- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements

Credit: 2credits, 30hours, atleast 50% in field, compulsory for all students.

Contents:

Course Structure:

2 Credits Course (1Credit for Classroom and Tutorials and 1 Credit for Field Engagement)

S. No.	Module Title	Module Content	Assignment	Teaching/ Learning Methodology	No.of Classes
1	Appreciation of Rural Society	Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of “soul of India lies in villages’(Gandhi), rural infrastructure	Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	- Class room discussions - Field visit** - Assignment Map	2 4 2

2	Understanding rural economy & livelihood	Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets	Rural household economy, its challenges and possible pathways to address them	- Field visit**	3
				- Group discussions in class	4
				-Assignment	1
3	Rural Institutions	Traditional rural organisations, Self-help Groups, Panchayatiraj institutions (GramSabha, GramPanchayat, Standing Committees), local civil society, local administration	How effectively are Panchayatiraj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual)	Classroom	2
				- Field visit**	4
				- Group presentation of assignment	2
4	Rural Development Programmes	History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.	Describe the benefits received and challenges faced in the delivery of one of these programmes in the rural community; give suggestions about improving implementation of the programme for the rural poor.	- Classroom	2
				- Each student select one program for field visit**	4
				Written assignment	2

****Recommended field-based practical activities:**

- Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities
- Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the worksite
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP)
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization

- Visit Rural Schools/ mid-day meal centres, study Academic and infrastructural resources and gaps
- Participate in Gram Sabha meetings, and study community participation
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries
- Attend Parent Teacher Association meetings and interview school dropouts
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries,
- Organize awareness programmes, health camps, Disability camps and cleanliness camps
- Conducts oil health test, drinking water analysis, energy use and fuel efficiency surveys
- Raise understanding of people's impacts of climate change, building up community's disaster preparedness
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
- Formation of committees for common property resource management, village pond maintenance and fishing

Teaching & Learning Methods

A large variety of methods of teaching must be deployed:

UGC will prepare an ICT based MOOC for self-paced learning by students for the 1 credit to be conducted in the classroom.

Reading & classroom discussions, Participatory Research Methods & Tools, Community dialogues, Oral history, social and institutional mapping, interactions with elected panchayat leaders and government functionaries, Observation of Gram Sabha, Field visits to various village institutions.

Recommended Readings

Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs/
4. M.P. Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journals of Rural development, (published by NIRD & PR Hyderabad)
2. Indian Journal of Social Work, (by TISS, Bombay)
3. Indian Journal of Extension Education (by Indian Society of Extension Education)
4. Journal of Extension Education (by Extension Education Society)
5. Kurukshetra (Ministry of Rural Development, GoI)
6. Yojana (Ministry of Information and Broadcasting, GoI)

Semester - III
Major Core III :Archegoniate
Course. Code: BC2031

Hours / Week	Credits	Total Hours	Marks
4	4	60	100

Objectives:

1. To acquire knowledge on early land plants.
2. To understand the life cycle patterns of archegoniate.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	describe the general characters of early land plants	PSO - 1	U
CO – 2	interpret the ecological and economic importance of archegoniate	PSO - 4	Ap
CO – 3	describe the external, internal structure and reproduction of archegoniate	PSO - 7	U
CO – 4	differentiate the life cycle patterns of archegoniate	PSO - 1	An
CO – 5	classify cryptogams and comment on the stelar evolution in pteridophytes	PSO - 1	U
CO – 6	compare the fossil members of pteridophytes and gymnosperms	PSO - 1	An

Unit I

Unifying features of Bryophytes, transition to land habit, classification by Rothmaler (1951). Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Marchantia* and *Polytrichum* (Developmental details not to be included). Ecological and economic importance of Bryophytes.

Unit II

General characteristics of Pteridophytes, classification by Smith (1955) and life cycle patterns. Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Psilotum* (Developmental details not to be included).

Unit III

Distribution, systematic position, morphology, anatomy, reproduction and life cycle of *Selaginella* and *Marsilea* (Developmental details not to be included). Heterospory, seed habit, stelar evolution and types of stele. Ecological and economical importance of Pteridophytes.

Unit IV

General characteristics of Gymnosperms, classification by Chamberlain (1935). Distribution, systematic position, morphology, anatomy and reproduction of *Pinus* (Developmental details not to be included). Ecological and economical importance of Gymnosperms.

Unit V

Geological time scale. Fossils –Types and methods of fossilization and importance of fossils. Distribution, systematic position, morphology, anatomy and reproduction of *Rhynia* and *Lyginopteris*.

Text Books

2. Vashista, P.C. (1997). *Bryophyta*. New Delhi: S. Chand and Co.
2. Vashista, P.C., Sinha, A.K. and Kumar, A (2005). *Pteridophyta*. Revised Edition. New Delhi: S. Chand & Company Ltd.
3. Vashista, P.C., Sinha, A.K. and Kumar, A. (2006). *Gymnosperms*. Revised Edition. New Delhi: S. Chand & Company Ltd.
4. Pandey, B. P. (2004). *College Botany*. (Volume I & II). S. New Delhi: S. Chand & Company Ltd.

Reference books

1. Johri, R.M., Latha, S. and Sharma, S. (2004). *Textbook of Bryophytes*. New Delhi: Dominant Publishers and distributors.
2. Srivastava, H.N. (1990). *Fundamentals of Pteridophytes*. Jalandhar: Pradeep Publications.
3. Rashid, A. (1990). *An Introduction to Pteridophytes*. New Delhi: Vikas Publications.
4. Sharma, O.P. (2006). *Text Book of Pteridophyta*. New Delhi: Macmillan Publishers India Ltd.
5. Chamberlain, C.J. (2000). *Gymnosperms*. New Delhi: CBS Publishers and Distributors.
6. Pandey, S.N., Misra, S.P. & Trivedi, P.A. (1998). *Text book of Botany*. (Vol. II). New Delhi: Vikas Publishing Pvt Ltd.
7. Mishra, S.R. (2010). *Text book of Paleobotany*. New Delhi: Discovery publishing Pvt. Ltd.

Semester - III
Major Practical Paper II : Archegoniate
Sub Code: BC20P2

Hours / Week	Credits	Total Hours	Marks
2	-	30	

Objectives:

1. To learn the technique of preparing plant material for microscopic observation
2. To compare morphological and anatomical features of the lower and higher land plants

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	identify the archegoniate from their morphological features	PSO - 1	U
CO – 2	examine the internal anatomy of few bryophytes, pteridophytes and gymnosperms	PSO - 3	An
CO – 3	prepare plant material for microscopic observation	PSO - 3	An
CO – 4	gain knowledge on fossil plants	PSO - 7	U
CO – 5	identify the archegoniate plants through field visit	PSO - 1	R

Archegoniate (Bryophytes, Pteridophytes and Gymnosperms)

Morphological and Anatomical study of the following:

1. Bryophytes: *Marchantia* –Dorsal view, Ventral view, T.S of the thallus
 Slides – Antheridiophore, Archegoniophore, Sporophyte
Polytricum– Habit
 Slides – Antheridiophore, Archegoniophore, Sporophyte
2. Pteridophytes: *Psilotum* – Habit, T.S of stem
 Slide, T.S of Synangium,
Selaginella – Habit, T.S of stem, Rhizophore
 Slide – L.S of cone
Marsilea – Habit, C.S. of petiole, rhizome
 Slide – Sporocarp V.S.
Rhynia(fossil)
3. Gymnosperms: *Pinus* – Twig, T.S. of stem, needle
 Slide – male cone L.S, Female cone L.S
 Entire male & female cone
Lyginopteris (fossil)

Semester – III
Major Elective I (a) : Herbal Botany
Sub. Code: BC2032

Hours / Week	Credits	Total Hours	Marks
4	3	60	100

Objectives

1. To develop awareness for utilization of herbal medicines for home remedies.
2. To identify the plants to be conserved/cultivated in-situ at the different agro-climatic regions and those to be cultivated /conserved in the fields (Ex-situ).

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	develop skills to grow herbs and empower entrepreneurship	PSO – 5	C
CO – 2	compare the side effects of allopathic medicine with native medicine	PSO – 3	An
CO – 3	understand the different types of indigenous medicine	PSO – 2	An
CO – 4	incorporate the novel values of herbs as food supplement	PSO – 5	Ap
CO – 5	make aware of natural resources and the importance of conserving the same.	PSO – 4	U
CO – 6	demonstrate the use of locally available medicinal plants to the neighbourhood.	PSO – 7	U

Unit I

History, definition and scope of herbal medicines; Systems of Indian Medicines – Siddha, Unani, Ayurveda, Homeopathy. Brief knowledge on Ethnomedicine, most commonly used ethnomedicinal plants of Kanyakumari District.

Unit II

Folk medicines including grandmother medicinal practices (Home remedies) for common ailments like cold, fever, cough and diarrhoea

Introduction to Ayurvedic formulations with methods of preparation: Churna, Arishta, Taila and Lehyam.

Skin and hair care: Herbal preparation of oils, shampoos and powders.

Unit III

Botanical name, family, morphology of medicinally important useful parts, active principles and utilization of the following medicinal herbs: *Catharanthus roseus*, *Ocimum sanctum*, *Curcuma longa* and *Centella asiatica*.

Drug yielding plants: therapeutic and habit-forming drugs with special reference to *Cinchona officinalis*, *Withania somnifera* and *Cannabis sativa*.

Unit IV

Evaluation and standardization of herbal drugs. Physicochemical properties – Ash and Fluorescence analysis.

Analytical pharmacognosy: Drug adulteration and detection.

Phytochemical screening tests for secondary metabolites

(alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

Unit V

Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants.

Trigonella foenum-graecum (seed), *Adathodavasic* (stem) and *Zingiber officinale* (rhizome).

Conservation of medicinal plants: *in situ* and *ex situ*.

Text Book

1. Kokate, C.K., Purohit, A.P. and Gokhale. S.B. (1999). *Pharmacognosy*. New Delhi: Nirali Prakashan.

Reference Books

1. Agnes Arber. (1999). *Herbal Plants and Drugs*. Jaipur: Mangal Deep Publications.
2. Sivarajan, V.V., Balachandran, Indra. (1994). *Ayurvedic drugs and their plant source*. New Delhi: Oxford IBH publishing Co.
3. Light Miller and Bryan Miller. (2012). *Ayurveda and Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing*. New Delhi: Motilal Banarsidass Publishers Pvt. Ltd.
4. Vasant Balaji Athavale. (2000). *Basic Principles of Ayurveda*. New Delhi: Chaukhamba Sanskrit Pratishthan Publishers.
5. Wendy Applequist. (2006). *The Identification of Medicinal Plants*. Austin: American Botanical council.

Semester - III
Major Elective I (b) : Nursery and Gardening
Sub. Code: BC2033

Hours / Week	Credits	Total Hours	Marks
4	3	60	100

Objectives

1. Understand the propagation and cultural practices of useful vegetable and garden plants.
2. Understand the basic concepts of landscaping and garden designing.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	incorporate lab to land programme by raising home garden and nurseries	PSO - 5	Ap
CO – 2	practice different techniques in propagating horticultural plants	PSO - 5	Ap
CO – 3	explain the different methods of vegetative propagation and hardening	PSO - 7	U
CO – 4	understand the types of garden and its operation	PSO - 3	U
CO – 5	explain the cultivation of different vegetables	PSO - 5	U

Unit I

Nursery: Definition, objectives, scope and building up of infrastructure for nursery.

Planting - direct seeding and transplants.

Nursery practices for some important crops – Coconut, Areca nut, Pepper and Cardamom.

Unit II

Importance and scope of ornamental horticulture in India. Commercial cultivation of Rose, Canna, Marigold and Gladiolus. Making and maintenance of lawn, hedges and edges. Flower arrangement and techniques to prolong vase life of flowers.

Unit III

Vegetative propagation: Brief introduction about grafting, cutting and layering - air and ground layering, cutting, selection of cutting, treatment of cutting, rooting medium and planting of cuttings.

Hardening of plants – greenhouse, mist chamber, shade house and glass house.

Unit IV

Gardening: definition and scope, types of gardens- formal (Mughal) and informal (Japanese) Special types of gardens – Rock garden, water garden, Bog or Marsh garden, Sunken garden and roof garden.

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

Unit V

Cultivation of vegetable crops – Tomato and Brinjal.

Root Crops – Radish and Carrot.

Cucurbits-Cucumber and Bitter gourd.

Storage and marketing procedures.

Text Book

1. Kumar, N. (1997). *Introduction to Horticulture*. Nagercoil: Rajalakshmi Publications.

Reference Books

1. Sandhu, M.K. (1989). *Plant Propagation*. Bangalore: Wile Eastern Ltd.
2. Sheela, V.L. (2011). *Horticulture*. Chennai: MJP Publishers.
3. Barton West, R. (1999). *Practical Gardening in India*. New Delhi: Discovery Pub. House.
4. Kumar, N. (1994). *Introduction to Horticulture*. Nagarcoil: Rajalakshmi Pub.
5. Schilletter, J.C., Richey, H.W. (1999). *Text Book of General Horticulture*. New Delhi: Biotech Books.

Semester - III
Major Elective I (c) : Agricultural Botany
Sub. Code: BC2034

Hours / Week	Credits	Total Hours	Marks
4	3	60	100

Objectives:

- 1.To study the various parameters and their influence on agriculture
2. To give elementary information on basic agronomic principles and practices.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand the various factors influencing agricultural practices.	PSO - 1	U
CO – 2	integrate economic and ecological objectives into sustainable agricultural management strategies.	PSO - 3	An
CO – 3	gain knowledge on biological and technological aspects of seed production and certification.	PSO - 5	E
CO – 4	study the cultivation methods of cereals, millets, pulses and oil seeds.	PSO – 2	U
CO – 5	develop skills to improve agriculture by incorporating microorganisms.	PSO – 4	C

Unit I

Introduction to agriculture, Agricultural Finance, Crop rotation-principles, limitation, advantages, rotational intensity, cropping scheme, cropping intensity. Cropping system – intercropping, mixed cropping, multiple cropping and relay cropping.

Unit II

Cultivation – area, soil, seed rate requirements, manuring, weed management and harvest of the following:

- a. Cereals and Millets: Rice and Maize
- b. Pulses: Green gram and Black gram
- c. Oil Seeds: Ground nut and Sesame

Unit III

Seed technology: Seed Viability, Dormancy, Methods of breaking dormancy, Seed processing, Seed treatment for storage and seed certification.

Unit IV

Factors affecting agricultural crops: Biotic: Insects, Pests, Rodents, Weeds. Abiotic: Soil, Wind, Water, Atmospheric air, Humidity, Temperature. Agricultural Machinery: primary and secondary tillage, seed drills, paddy transplanters, plant protection and harvesting tools.

Unit V

Beneficial microorganisms in Agriculture; Brief account on Biofertilizer(Cyanobacteria), microbial insecticides, microbial agents for control of plant diseases. Genetically Modified Crops (Bt – Cotton and Golden rice). Implications of GM crops.

Text Book

1. Chandrasekaran, B. Annadurai, K. Somasundaram, E. (2010). *A textbook of Agronomy*. New Delhi: New Age International Publishers.

Reference Books

1. Kochhar, S.L. (1986). *Economic Botany in the Tropics*. Chennai: Macmillan India Ltd.
2. Satyanarayana, U. (2008). *Biotechnology*. Kolkata: Books and Allied (P) Ltd.
3. Rajni Gupta, and Mukherji, K.G. (2001). *Microbial Technology*. New Delhi: A.P.H Publishing Corporation.
4. Yellamananda Reddy, T. and Sankara Reddy, G.H. (1997). *Principles of Agronomy*. New Delhi: Kalyani Publishers.
5. Sankaran, S. and Subbiah Mudaliar, V.T. 1997. *Principles of Agronomy*. Bangalore: The Bangalore Printing and Publishing Co. Ltd.

Semester - III
Allied II: Plant Diversity - I
(Algae, Fungi, Bryophytes and Pteridophytes)
Sub. Code: BA2031

Hours / Week	Credits	Total Hours	Marks
4	3	60	100

Objectives:

- 1.To understand the importance of different groups of lower plants and their diversity.
2. To study in detail the different genera belonging to various classes of Algae, Fungi, Bryophytes and Pteridophytes.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	categorize different groups of plants based on their morphological variation	PSO -1	R
CO - 2	study and impart knowledge about the reproduction and life cycle of given genera of algae, fungi, bryophytes and pteridophytes.	PSO - 2	U
CO - 3	interpret the economic importance of algae, fungi, bryophytes and pteridophytes	PSO -1	Ap
CO-4	Compare the common characters shared by bryophytes and pteridophytes	PSO-2	An

Unit I

Algae: General Characters, Classification of algae according to Fritsch, 1945 (up to class level) thallus structure, reproduction and life cycle of the following (Development aspect not included)

Cyanophyceae– *Nostoc*

Chlorophyceae- *Volvox*

Unit II

Phaeophyceae- *Sargassum*

Rhodophyceae- *Gracilaria*

Economic importance of Algae

Unit III

Fungi: General characters, a brief introduction of fungi classification by Alexopoulos and Mims, 1979 (upto class level), thallus structure, reproduction and life cycle of the following (Development aspect not included)

Ascomycetes - *Aspergillus*

Basidiomycetes - *Puccinia*

Economic importance of Fungi

Unit IV

Bryophytes: General characters, A brief introduction of bryophyte. Classification by Rothmaler, 1951 (upto class level), morphology, anatomy, reproduction and life cycle of *Polytrichum*. (Developmental details not to be included). Economic importance of Bryophytes.

Unit V

Pteridophytes: General characteristics, A brief introduction of pteridophyte. Classification by Smith, 1955 (upto class level) morphology, anatomy, reproduction and life cycle of *Selaginella* (Developmental details not to be included). Economic importance of Pteridophytes.

Text Books

1. Vashishta, B.R. (1997). *Algae*. New Delhi: S. Chand & Co.
2. Vashishta, B.R. (1993). *Fungi*. New Delhi: S. Chand & Co.
3. Vashista, P.C. (1997). *Bryophyta*. New Delhi: S. Chand and Co.
4. Vashista, P.C. (1997). *Pteridophyta*. New Delhi: S. Chand and Co.

Reference Books

1. Sharma, O.P. (1997). *Text book of Algae*. New Delhi: Tata Mc Graw- Hill Publications.
2. Kumar, H.D., & Singh, N.A. (1982). *A text book of Algae*, New Delhi: East West Press Pvt. Ltd
3. Pandey, S.N., & Trivedi, P.S. (1977). *Text book of Botany* (Vol. I). New Delhi: Vikas Publishing House Pvt. Ltd.
4. Fritsch, F.E. (1972). *The Structure and Reproduction of Algae* (Vol. I & II). London: Cambridge University Press.
5. Dubey, H.C. (1993). *Introduction to Fungi*. New Delhi: Vikas Publishing House.
6. Watson, E.V. (1974). *Structure and life cycle of Bryophytes*. New Delhi: B.I. Publications.
7. Srivastava, H.N. (1990). *Fundamentals of Pteridophytes*. Jalandhar: Pradeep Publications.
8. Rashid, A. (1990). *An Introduction to Pteridophytes*. New Delhi: Vikas Publications.
9. Sharma, O.P. (2006). *Text Book of Pteridophyta*. New Delhi: Macmillan Publishers India Ltd.

Semester - III
Allied II: Practical
(Algae, Fungi, Bryophytes and Pteridophytes)
Sub. Code: BA20P2

Hours / Week	Credits	Total Hours	Marks
2	-	30	-

Objectives:

1. To learn the technique of preparing plant material for microscopic observation
2. To distinguish different orders of plants based on their morphology and anatomy

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	practice the preparation of plant material for microscopic observation	PSO - 3	Ap
CO - 2	draw appropriate anatomical diagrams from the sectioning of plant material using microscope	PSO – 3	U
CO – 3	identify and distinguish the various reproductive bodies of bryophytes and gymnosperms prescribed in the syllabus using microscopic slides	PSO – 2	An

1. Algae:

Nostoc – Filament
Volvox – Vegetative colony with daughter colonies
Sargassum – Stipe, ‘leaf’
Sargassum – Entire thallus, Male and Female conceptacles
Gracilaria– Thallus
Gracilaria– Thallus with cystocarp

2. Fungi:

Aspergillus - Conidia
Puccinia – Habit
Puccinia – Uredosorus and Teleutosorus
Puccinia – Aceidium and pycnidium

3. Bryophytes:

Polytricum– Habit
 Slides – Antheridiophore, Archegoniophore, Sporophyte

4. Pteridophytes:

Selaginella – Habit, L.S of cone
Selaginella – T.S of stem

Semester III
Add on Course : Professional English for Life Sciences
Course Code: ALS203

Hours / Week	Credits	Total Hours	Marks
2	2	30	100

Objectives:

1. To enhance the creative and academic writing skills and workplace communication.
2. To develop competence and competitiveness and thereby improve employability skills and life-long learning.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	CL
CO-1	define concepts related to communicative and digital competence.	1	R
CO-2	illustrate academic writing and creativity in digital media.	2	U
CO-3	apply communicative skills with digital competence in the workplace.	3	Ap
CO-4	analyse a variety of formats, including research papers, reflective writing and critical reviews of life sciences.	3	An
CO-5	analyse lectures, scripts, blogs, e-content and short films related to biology.	4	An

Unit1

Communicative Competence

1. Listening – Answering comprehension exercises
2. Speaking – Reading passages -open ended questions
3. Reading – One Subject based reading of text followed by comprehension activities/exercises
4. Writing- Summary writing based on the reading passages (semi-guided)

Unit II

Persuasive Communication

1. Listening – Announcement
2. Speaking – Just-a-minute activities
3. Reading – Analysing Ads
4. Writing- Summary writing based on the reading passages (semi-guided)

Unit III

Digital competence

1. Listening – Listening to interviews (subject based)
2. Speaking – Interview with subject teachers/ professionals (using video conferencing skills).
3. Reading – Selected sample of web page
4. Writing- Creating web pages
5. Reading Comprehension- Essay on digital competence for academic and professional life

Unit IV

Creativity and Imagination

1. Listening – General videos
2. Speaking – Movie review, book review
3. Poster making – writing slogans/ captions (subject based)
5. Reading - Essay on creativity and imagination

Unit V

Workplace Communication & Basics of Academic Writing

Speaking- Presentation using PowerPoint

Reading/ Writing- Circulars, minutes of meeting and paraphrasing

Textbook

Tamil Nadu State Council for Higher Education (TANSCHE). *Professional English for Life Sciences –II*

Semester III & IV
Foundation Course II
Personality Development Course Code:
FCV202

No. of hours per week	Credit	Total no. of hours	Marks
1	1	30	100

Objectives

1. To practice personal and professional responsibility.
2. To develop and nurture a deep understanding of personal motivation.

Course Outcome

CO No.	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO-1	identify various dimensions and importance of effective personality	PSO-6	A
CO-2	apply the models of positive thinking in real life situations	PSO-2	A
CO-3	To overcome shyness and loneliness and cope up with the society.	PSO-6	Y

Unit I

Personality – Factors influencing personality – Theories on personality – Types of personality. Self acceptance – self awareness – self concept – elements - self esteem – types of self esteem – impact of self esteem – importance – low self esteem.

Unit II

Self actualization – characteristics – Positive thinking – The profile of a positive thinker – Positive attitude – Models of positive thinking. Worry – Why to worry – ways to overcome – ways to turn negative thinking into positive.

Unit III

Motivation – Sources of motivation – Types of motivation – Factors determining motivation

– characteristics of motivation. Goal setting – Types of goals – ways to achieve goals.
Decisionmaking – Steps for decision making.

Unit IV

Time Management – Definition – Controversies regarding time management – importance – Ways to manage time – controlling interruption – Leisure. Leadership and team building – types – qualities of a good leader – group formation – types – responsibilities of group members
– instructions to form groups. Communication – classification – verbal and non verbal – rules – hindrance to communication.

Unit V

Process of coping or adjustments – coping – mal adjustment – frustration – types – techniques to overcome frustration. Mental stress – types – mechanism of coping – positive and negative mechanism – steps for adjustment in life – coping with shyness – loneliness – techniques to overcome shyness and loneliness.

Textbook

Aazhumai Vazhampera – Dr. Sr. Mary Jhonsy, Dr. M. Mary Helen Stella and Dr. Anitha Malbi

Reference books

1. Personality Development (1999). Selvaraj, Palayamkottai Community College, V.M. Chattram, Tirunelveli.
2. Resource book for Value Education (2002). Mani Jacob, Institute of Value Education, New Delhi
3. You can win (1998). Shiv Kheera, published by Rajive Beri, Macmillan India Ltd, New Delhi.
4. The seven habits of highly effective people (1990). Covey Stephen, R. Simon and Schuster, New York.
5. Change or be changed (2008). Dr. Xavier Alphonse, S. published by ICRDCE, Chennai.

Semester - IV
Major Core IV : Plant Ecology and Phytogeography
Sub. Code: BC2041

Hours / Week	Credit	Total Hours	Marks
4	4	60	100

Objectives:

1. To understand the ecological groups and their interactions
2. To have a brief knowledge on phytogeography

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explicate the ecological interconnectedness between soil texture and water in plants	PSO - 2	U
CO - 2	compare the relationships between the different ecological groups	PSO - 1	An
CO - 3	relate formation of continents from the land mass	PSO – 6	An
CO - 4	create an awareness to safeguard endemic and native plants and for sustainable utilization of natural resources	PSO – 4	C
CO - 5	become employable in relevant areas related to ecology	PSO – 5	Ap

Unit I

Ecosystem: components of ecosystem. Fresh water (pond) ecosystem; marine ecosystem; trophic organization, energy flow in ecosystem, autotrophy, heterotrophy, food chains and webs and ecological pyramids. Plant interactions-Mutualism, symbiosis, commensalism, parasitism.

Unit II

Soil(edaphic factors)- importance; origin; types, formation; composition; physical, chemical and biological components; Soil profile; Role of climate in soil development.

Unit III

Water -importance: states of water in the environment; atmospheric moisture; precipitation types (rain, fog, snow, hail, dew); water in soil; water table; water bodies: aquifers, water shed management.

Unit IV

Ecological groups: study of hydrophytes, xerophytes and halophytes with reference to their morphological, anatomical and physiological adaptations; Study of vegetation- Quadrat and Transect.

Unit V

Phytogeography- principles of phytogeography; Types of plants distribution - continuous, discontinuous and endemic. Plate tectonics, Continental drift, Theory of land bridges, Age and Area Hypothesis. Centres of Origin of cultivated crops.

Text book

1. Sharma, P.D. (2010). *Ecology and Environment*. (8th ed.). Meerut: Rastogi Publications.
2. Shukla, R.S and Chandel, P.S (2015). *A Textbook of Plant Ecology*. New Delhi: S. Chand Publication

Reference Books

1. Singh, J.S., Singh, S.P., Gupta, S. (2006). *Ecology Environment and Resource Conservation*. New Delhi: Anamaya Publications.
2. Odum, E.P. (2005). *Fundamentals of Ecology*. (5th ed.). New Delhi: Cengage Learning India Pvt. Ltd.
3. Wilkinson, D.M. (2007). *Fundamental Processes in Ecology- An Earth Systems Approach*. U.S.A: Oxford University Press.
4. Kormondy, E.J. (1996). *Concepts of Ecology*. (4th ed.). New Delhi: PHI Learning Pvt. Ltd.
5. Leon Croizat (1952). *Manual of Phytogeography*. U.S.A: Springer- science+business Media.

Semester - IV
Major Practical II
Plant Ecology and Phytogeography
Sub Code: BC20P2

Hours / Week	Credits	Total Hours	Marks
2	-	30	-

CO	<i>Upon completion of this course the students will be able to :</i>	PSO addressed	CL
CO - 1	record the locally available hydrophytes, xerophytes and halophytes	PSO - 1	R
CO - 2	construct a quadrat for vegetative analysis.	PSO - 4	Cr
CO - 3	demonstrate the measurement of soil permeability	PSO - 3	Ap
CO - 4	practice the preparation of plant material for microscopic observation	PSO - 5	Ap
CO - 5	distinguish the phytogeography models	PSO - 7	An

Plant Ecology & Phytogeography

1. Methods of studying vegetation – Quadrat and Belt transect
2. Morphology of locally available Hydrophytes, Xerophytes and Halophytes
3. To make suitable micro preparations of:
 - a. *Hydrilla* stem T.S.
 - b. *Eichhornia* petiole T.S.
 - c. Phylloclade T.S. (*Casuarina*)
 - d. Phyllode T.S. (*Parkinsonia*, *Acacia*)
4. Demonstration – Soil permeability – (Percolation and soil holding capacity).
5. Models –Related to phytogeography
6. Field visit – One day.

Semester - IV
Major Elective II (a) : Biological Resources
Sub. Code: BC2042

Hours / Week	Credits	Total Hours	Marks
4	4	60	100

Objectives:

- 1.To know the potentiality of major biomass systems.
2. Utilize and apply methods to keep the planet healthy.

CO	<i>Upon completion of this course the students will be able to:</i>	PSO addressed	CL
CO – 1	understand the basic concepts renewable energy	PSO - 3	U
CO – 2	know the nutritive value of Single Cell Protein and learn the techniques of producing them	PSO - 2	U
CO – 3	recognize the need to protect and conserve Mother Nature	PSO - 4	An
CO – 4	find ways to have sustainable management of natural resources	PSO - 4	E
CO – 5	gain awareness of career options in the field of biological resources	PSO - 5	C

Unit I

Brief introduction of biological resources and types. Biofertilizers: Scope and importance. Bacteria –*Rhizobium* – mass production and uses. Algae- *Nostoc* - mass production and application. Pteridophyte *Azolla*- mass production and application. Vermicompost – Mass production and application.

Unit II

Single Cell Protein and Mycoprotein: Sources of single cell protein, Nutritive value of single cell protein. Mass cultivation of *Spirulina*. Mushroom Cultivation-*Pleurotus* and *Agaricus*, nutritional values and value- added products.

Unit III

Forest cover, forest resources – Utility (Major and Minor Products) and Values of forests: Commercial benefits, ecological benefits and aesthetic benefits. Forest management and conservation - Regeneration - Tending operations - Sustainable utilization of forest resources.

Unit IV

Biofuels: Importance of biofuel, Biodiesel Production –*Pongamia* and *Jatropha*. Alcohols – liquid fuel- bioethanol production. Gaseous fuels: Biogas production and Hydrogen fuel.

Unit V

Biopesticides: Introduction, desirable qualities of biopesticides. Microbial pesticides – fungi, viruses and bacteria. Advantages and disadvantages of microbial pesticides. Application of Biopesticides.

Text Book

1. Dubey, R.C. (2006). *Text Book of Biotechnology*. New Delhi: S. Chand & Company Ltd.
2. Aneja, K. R. (2002). *Experiments in Microbiology, Plant Pathology and Biotechnology*. New Delhi: New Age International Pvt. Ltd.
3. Rajni Gupta., and Mukherji, K.G. (2001). *Microbial Technology*. New Delhi: A.P.H Publishing Corporation.

Reference Books

1. Ramawat, K.G. (2003). *Plant Biotechnology*. New Delhi: S. Chand & Company.
2. Adrian Slater., Nigel Scott., and Mark Fowler. (2003). *Plant Biotechnology*. New York: Oxford University Press.
3. Satyanarayana, U. (2008). *Biotechnology*. Kolkata: Books and Allied (P) Ltd.
4. Ignacimuthu, S (2012). *Biotechnology: An Introduction*. Chennai: Narosa Book Distributors Private Limited.

Semester - IV
Elective II (b) : Food Science
Sub. Code: BC2043

Hours / Week	Credits	Total Hours	Marks
4	4	60	100

Objectives:

- 1.To learn about the chemical and physical changes taking place during cooking, processing, storage and preservation of food
2. To know the importance of balanced diet for a healthy living.

CO	<i>Upon completion of this course the students will be able to:</i>	PSO addressed	CL
CO – 1	list the different constituents of food, methods of cooking and preservation	PSO - 5	R
CO – 2	realize the side effects of food additives	PSO - 3	U
CO – 3	prepare value - added products	PSO - 5	C
CO – 4	explain the industrial production of beer, ethyl alcohol, vinegar and amylase	PSO - 5	U
CO – 5	design balanced diet	PSO - 2	C
CO – 6	test for detection of food adulterants and colourants	PSO - 3	E

Unit I

Food science – Definition, aim, constituents of food and their value. Energy value of balanced diet, carbohydrates, proteins, lipids, enzymes and vitamins.

Cooking- Objectives of cooking, Preliminary preparations, Cooking methods, (Moist heat methods, Dry heat methods, Microwave cooking, Solar cooking).

Unit II

Food colourants: Natural, Artificial and Special flavours: Spices and Condiments.

Food additives – Sweeteners, Emulsifiers and Stabilisers, Antioxidants, Flavour improvers, Safety measures of food additives.

Fermented Food Products: Milk (butter and cheese), Vegetable (sauerkraut and cucumber).

Food Enrichment - Fortification.

Unit III

Preparation of Jam: Tomato and Pineapple

Preparation of Jelly: Grapes and Plums

Preparation of squash: Grapes and Mango

Preparation of pickle: Gooseberry and Lemon

Unit IV

Food preservation: Aims and objectives of preservation & processing of foods, Food spoilage, Methods of food preservation – preservation by low (freezing, types of freezing i.e. slow

freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food). and high temperature (Sterilization, Pasteurization, and Blanching.) Canned food.

Unit V

Industrial production of the following:

Alcoholic beverages –Beer and Wine

Non- alcoholic beverages - Coffee and Tea.

Text Book

1. Sumathi R. Mudambi and Rajagopal, M.V. (2012). *Fundamentals of Food and Nutrition*. Kochi: New Age Publishers.

Reference Books

1. Adams, M.R. and Moss, M.O. (2003). *Food microbiology*. (3rded.) New Delhi: Panima Publishing Corporation.
2. Sivasankar, B. (2002). *Food processing and Preservation*. New Delhi: Prentice Hall of India Pvt. Ltd.
3. El-Mansi, E.M.T and Bryce, C.F.A. (2002). *Fermentation Microbiology and Biotechnology*. USA: Taylor and Francis Group.
4. Srilakshmi, B. (2010). *Food Science*. (5th ed.). New Delhi: New Age International Pvt. Ltd.
5. Norman. A Potter and Joseph. H Hotchkiss. (2007). *Food Science*. (5th ed.). New Delhi: CBS Publishers & Distributors Pvt. Ltd.
6. Anandan Kumaravelan, R. (2005). *Environmental Science and Engineering*, Chennai: Seitech publication, (India) Pvt. Ltd.

Semester - IV
Elective II (c) : Biodiversity and Human Welfare
Sub. Code: BC2044

Hours / Week	Credits	Total Hours	Marks
4	4	60	100

Objectives:

- 1.To understand the biodiversity and its importance.
2. To utilize the plants for human use.

CO	<i>Upon completion of this course the students will be able to:</i>	PSO addressed	CL
CO – 1	record the biodiversity of taxa at different region	PSO – 4	R
CO – 2	organize biodiversity awareness programmes	PSO – 7	C
CO – 3	engage with GO or NGO on the conservation of biodiversity	PSO - 4	Ap
CO – 4	assess the value of biodiversity through valid methodologies	PSO - 7	E
CO – 5	categorize the hot spots of biodiversity in national level	PSO - 6	An

Unit I

Biodiversity: scope and types - Genetic diversity, species diversity and ecosystem biodiversity. Agro biodiversity and cultivated plant taxa, wild taxa. Values of biodiversity; Ethical and aesthetic values of biodiversity.

Unit II

Biodiversity Hot spots- History and origin of hotspots. Critical role of hotspots in species richness and endemism. Biodiversity in tropics, National biodiversity hotspots, hottest biospots of Western Ghats, Biodiversity of Tamilnadu.

Unit III

Economical values of biodiversity- plants, animals and microbes. Loss of genetic diversity, loss of species diversity, loss of ecosystem diversity, loss of agro biodiversity, consequences and implications; projected scenario for biodiversity loss.

Unit IV

Organizations associated with Biodiversity management- IUCN, UNEP, UNESCO, WWF, NBPGR, CITES and CBD; National Biodiversity Authority, Nature Conservation Foundation. Rio de Janeiro, 2012

Unit V

Conservation of Biodiversity- Role of NGOs in biodiversity conservation, Conservation of genetic diversity, species diversity and ecosystem diversity, *in situ* and *ex situ* conservation, social approaches for conservation, biodiversity awareness programmes, sustainable development.

Text Book

1. Singh, J.S, Singh, S.P. and Gupta, S. (2006). *Ecology Environment and Resource Conservation*. New Delhi: Anamaya Publications.

Reference Books

1. Krishnamurthy, K.V. (2004). *An Advanced Text Book of Biodiversity - Principles and Practices*. New Delhi: Oxford and IBH Publications Co. Pvt. Ltd.
2. Odum, E.P. (2005). *Fundamentals of Ecology*. (5thed.). New Delhi: Cengage Learning India Pvt. Ltd.
3. Trivedi, P. Trivedi, R. and Gurdeep Raj. (2002). *Environmental Ecology*. New Delhi: Akashdeep Publishing House.
4. Kasturi Reddy. (2010). *Biodiversity and Land Conservation*. New Delhi: Pacific Publication.
5. Rao, M. K. (2011). *Environmental and Climate Change*. New Delhi: Manglam Publications.
6. Tyler Miller, G. Scott, and E. Spoolman, (2013). *Environmental Studies*. United States: Cengage Publishers.

Semester - IV
Allied II
Plant Diversity II: (Gymnosperms, Angiosperms) and Plant Physiology
Subject Code: BA2041

Hours / Week	Credits	Total Hours	Marks
4	3	60	100

Objectives

1. To impart knowledge on structure and reproduction of selected gymnosperms.
2. To know the diagnostic features of selected families and their economic importance.
3. To understand biological, chemical and internal activities of plant cells.

CO	<i>Upon completion of this course the students will be able to :</i>	PSO addressed	CL
CO – 1	know about the unique characters and economic importance of gymnosperms	PSO – 1	U
CO – 2	understand the plant morphology and basic taxonomy	PSO – 2	U
CO – 3	know the floral variations seen in the selected families	PSO – 1	R
CO – 4	relate complementary metabolic pathways such as photosynthesis and respiration in energy acquisition	PSO – 3	An
CO – 5	identify the major effects and physiological mechanisms of growth regulators in plants	PSO - 2	E

Unit I

Gymnosperms: General characters of Gymnosperms, Classification of gymnosperms by Chamberlain, 1935 (up to class level). Distribution, Systematic Position, Morphology, Anatomy, Reproduction and Life History of *Pinus*. Economic importance of Gymnosperms.

Unit II

Morphology: Root, stem, leaf, inflorescence, flower and fruit – their modifications.

Unit III

Taxonomy: Study of the following families and their economic importance- Brassicaceae, Rutaceae, Lamiaceae, Euphorbiaceae and Poaceae

Unit IV

Photosynthesis: Pigment systems, mechanism of photosynthesis: light dependent (cyclic and non-cyclic photophosphorylation) light independent (C_3 cycle). Factors affecting photosynthesis.

Unit V

Seed biology: Seed dormancy, seed viability and breaking of seed dormancy, physiology of seed germination.

Phyto hormones – physiological role of auxin, gibberellin and ethylene.

Brief introduction to Photoperiodism

Text Book

1. Vashista, P.C. (1997). *Gymnosperms*. New Delhi: S. Chand and Co.
2. Jain V. K. (2006). *Fundamentals of Plant Physiology*. New Delhi: S. Chand and Company Ltd.
3. Sharma O.P. (1993). *Plant Taxonomy*. New Delhi: Tata McGraw Hill Publishing Co Ltd.

References Books

1. Chamberlain, C.J. (2000). *Gymnosperms*. New Delhi: CBS Publishers and Distributors.
2. Pandey, S.N., Misra, S.P.& Trivedi, P.A. (1998). *Text book of Botany*. Vol. II. New Delhi: Vikas Publishing Pvt Ltd.
3. Taiz Zeiger (2002). *Plant Physiology*. (2nd Ed.), Massachusetts: Sinauer Associates, Inc Pub.
4. Pandey, K.K. and Sinha, B.K. (1988). *Plant Physiology*. New Delhi: Vikas Publications.
5. Pandey, B.P.S. (1997). *Taxonomy of Angiosperms*. New Delhi: S. Chand and Company Ltd.

Semester - IV
Allied Practical II
Plant Diversity II : (Gymnosperms, Angiosperms) and Plant Physiology
Subject Code: BA20P2

Hours / Week	Credits	Total Hours	Marks
2	-	30	-

Objectives:

1. To learn the technique of preparing plant material for microscopic observation
2. To acquire knowledge in identifying plants morphologically
3. To understand the relationship between various metabolic activity among plants

CO	<i>Upon completion of this course the students will be able to :</i>	PSO addressed	CL
CO – 1	prepare plant material for microscopic observation.	PSO – 7	C
CO-2	draw appropriate anatomical diagrams from the sectioned plant material using microscope.	PSO – 3	An
CO –3	dissect and display the floral parts of the families studied and draw floral parts and write floral formula.	PSO – 1	An
CO –4	assign the given plant to its family giving reasons	PSO – 3	E
CO – 5	observe principal metabolic events in plants	PSO - 3	U

Gymnosperms:

1. *Pinus* – Twig,
2. T.S. of needle.
3. Entire male cone& female cone.
4. L.S of male cone, female cone and ovule.

Angiosperms:

1. Dissect out and draw the floral parts of the plants belong to the families prescribed in the syllabus.
2. Assigning plants to their respective families.

Plant Physiology:

1. Demonstration only
 - i. Evolution of oxygen during photosynthesis
 - ii. Ganong's Light- Screen experiment
 - iii. Ganong's Respirometer
 - iv. Khune's fermentation apparatus

Semester - IV
Major Practical Paper II
Archegoniate & Plant Ecology and Phytogeography
Sub Code: BC20P2

Hours / Week	Credits	Total Hours	Marks
2 + 2	2	30 +30	100

Archegoniate (Bryophytes, Pteridophytes and Gymnosperms)
(To be conducted during the Semester – III)

Morphological and Anatomical study of the following:

1. Bryophytes: *Marchantia* –Dorsal view, Ventral view, T.S of the thallus
 Slides – Antheridiophore, Archegoniophore, Sporophyte
 Polytricum– Habit
 Slides – Antheridiophore, Archegoniophore, Sporophyte
2. Pteridophytes: *Psilotum* – Habit, T.S of stem
 Slide, T.S of Synangium,
 Selaginella – Habit, T.S of stem, Rhizophore
 Slide – L.S of cone
 Marsilea – Habit, C.S. of petiole, rhizome
 Slide – Sporocarp V.S.
 Rhynia(fossil)
3. Gymnosperms: *Pinus* – Twig, T.S. of stem, needle
 Slide – male cone L.S, Female cone L.S
 Entire male & female cone
 Lyginopteris (fossil)

Plant Ecology & Phytogeography (Semester IV)

1. Methods of studying vegetation – Quadrat and Belt transect
2. Morphology of locally available Hydrophytes, Xerophytes and Halophytes
3. To make suitable micro preparations of:
 - a. *Hydrilla* stem T.S.
 - b. *Eichhornia* petiole T.S.
 - c. Phylloclade T.S. (*Casuarina*)
 - d. Phyllode T.S. (*Parkinsonia*, *Acacia*)
4. Demonstration – soil permeability – (Percolation and soil holding capacity).
5. Models –Related to phytogeography
6. Field visit – One day.

Semester - IV
Allied Practical II

Plant Diversity I : (Algae, Fungi, Bryophyta and Pteridophyta); Plant Diversity II
(Gymnosperms, Angiosperms) and Plant Physiology
Subject Code: BA20P2

Hours / Week	Credits	Total Hours	Marks
2+2	2	30+30	100

To be conducted during the Semester - III

1. Algae:

Nostoc – Filament
Volvox – Vegetative colony with daughter colonies
Sargassum – Stipe, ‘leaf’
Sargassum – Entire thallus, Male and Female conceptacles
Gracilaria– Thallus
Gracilaria– Thallus with cystocarp

2. Fungi:

Aspergillus - Conidia
Puccinia – Habit
Puccinia – Uredosorus and Teleutosorus
Puccinia – Aceidium and pycnidium

3. Bryophytes:

Polytricum– Habit
Slides – Antheridiophore, Archegoniophore, Sporophyte

4. Pteridophytes:

Selaginella – Habit, L.S of cone
Selaginella – T.S of stem

To be conducted during the Semester - IV

1. Gymnosperms:

Pinus – Twig,
T.S. of needle.
Entire male cone& female cone.
L.S of male cone, female cone and ovule.

2. Angiosperms:

Dissect out and draw the floral parts of the plants belong to the families prescribed in the syllabus.

Assigning plants to their respective families.

3. Plant Physiology:

Demonstration only

- v. Evolution of oxygen during photosynthesis
- vi. Ganong's Light- Screen experiment
- vii. Ganong's Respirometer
- viii. Khune's fermentation apparatus

Semester IV
Add on Course : Professional English for Life Sciences
Course Code: ALS204

No. of hours/week	No. of credits	Total no. of hours	Marks
2	2	30	100

Objectives:

1. To enhance the creative and academic writing skills and workplace communication.
2. To develop competence and competitiveness and thereby improve employability skills and life-long learning.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	CL
CO-1	define concepts related to communicative and digital competence.	1	R
CO-2	illustrate academic writing and creativity in digital media.	2	U
CO-3	apply communicative skills with digital competence in the workplace.	3	Ap
CO-4	analyse a variety of formats, including research papers, reflective writing and critical reviews of life sciences.	3	An
CO-5	analyse lectures, scripts, blogs, e-content and short films related to biology.	4	An

Unit1

Communicative Competence

1. Listening – Listening to two talks/Lectures by specialists on selected subjects
2. Speaking – Small Group Discussions
3. Reading – One Subject based reading text followed by comprehension activities/exercises
4. Writing- Summary writing based on the reading passages (Free Writing)

Unit II

Persuasive Communication

1. Listening – Product Launch
2. Speaking – Debates
3. Reading – Reading Texts on Advertisements (On product relevant to the subject areas) and answering inferential questions
4. Writing- Writing an argumentative/ persuasive essay

Unit III

Digital competence

1. Listening – Interview by a famous celebrity

2. Speaking – Interviewing any professional/ Creating Vlogs (How to become vlogger and use vlogging to nurture interest – subject related)
3. Reading – Blog
4. Writing- Blog Creation

Unit IV

Creativity and Imagination

1. Listening – Listening academic videos (Prepared by EMRC Other MOOC videos on Indian academic sites)
2. Speaking – Making oral presentations through short films – subject based
3. Reading-How is creativity possible in Science (Continuation of essay in semester III)
4. Writing – Creating flyers and Brochures (Subject Based)

Unit V

Workplace Communication & Basics of Academic Writing

Speaking- Presentation (Without Aids)

Reading& Writing- Product Profiles/ Writing an Introduction

Textbook

Tamil Nadu State Council for Higher Education (TANSCHE). *Professional English for Life Sciences - II*

Self-learning Course
Algal Biotechnology
Sub. Code: BC20S2

Semester	Course Code	Name of the Course	Credit	Total hours
IV/VI	BC20S2	Algal Biotechnology	2	30

Objectives: 1. Understand the potentiality of algal resources
2. Develop skill to become employable

Unit I

Introduction to algal biotechnology, Resource potential of algae; commercial utility of algae. Algae as a source of food and feed; Algae as a source of pigments, fine chemicals, fuel and bio-fertilizers.

Unit II

Uses (economic and medicinal) of the following algae:

Cyanophyceae: *Spirulina* and *Nostoc*

Chlorophyceae: *Chlorella* and *Ulva*

Phaeophyceae: *Sargassum* and *Laminaria*

Rhodophyceae: *Gracilaria* and *Gelidium*

Unit III

Cultivation of seaweeds: Strain selection; Culture media; indoor cultivation methods

Measurement of algal growth. Large-scale cultivation of algae Harvesting, Drying and marketing.

Unit IV

Bio-fertilizers: Blue-green algal bio-fertilizers, Methods of preparation, application and its advantages over inorganic fertilizers.

Unit V

Biodiesel from algae: algae producing biodiesel; Advantages over other sources of biodiesel; Cultivation and extraction methods. Phycoremediation. Role of algae in nano biotechnology.

Text Book

1. Dubey, R.C. (2006). Text Book of Biotechnology. New Delhi: S. Chand & Company Ltd.

Reference Books

2. Tait, R.V. (2013). Elements of Marine Ecology. U.K.: Butterworth and co (Publisher) Ltd.
2. Barsanti, Laura and Paolo Gualtieri. (2005). Algae-Anatomy, Biochemistry and Biotechnology. New York: Taylor & Francis.
3. Becker, E.W. (1994). Microalgae-Biotechnology and Microbiology. London: Cambridge University Press.
4. Tivedi, P.C. (2001). Algal Biotechnology. Jaipur: Pointer publishers.
5. Venkataraman, L.V. and Becker, E.W. (1985). Biotechnology and Utilization of Algae – The Indian Experience. New Delhi: Dept. Science and Technology.

Semester - V
Major Core-V Taxonomy of Angiosperms and Economic Botany
Sub. Code: BC2051

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

Objectives: 1. To know the principles of classification of taxa.
 2. To evaluate the medicinal importance of selected angiosperms.
 3. To acquire knowledge on the botanical vocabulary and taxonomical terminology to identify plants.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	relate the modifications in plant parts.	PSO–1	U
CO - 2	differentiate the artificial, natural and phylogenetic classification and learn about ICN rules.	PSO–2	An
CO - 3	evaluate the taxonomists of India.	PSO–1	Ev
CO - 4	recall the characters of some important families.	PSO–1	R
CO - 5	understand the economically important products of plants and their use at various levels.	PSO - 2	U
CO - 6	construct digital herbarium and learn about Herbarium techniques.	PSO - 5	C

UNIT I:

Introduction and importance of taxonomy, systematics: Botanical nomenclature: Principles and rules of International Code of Nomenclature (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Morphology – root, stem, leaf, inflorescence, flower and fruit – their modifications.

UNIT II:

Systems of classification; Detailed study on Sexual system-Carolus Linnaeus, Natural System – Bentham and Hooker, Phylogenetic System –Engler and Prantl (1886), Modern System of classification - APG Classification (2016).

Field inventory: Functions of Herbarium; Virtual herbarium; E-flora; Herbarium techniques.
Contribution to systematic botany by Indian Taxonomists: K.M. Mathew and Hermenegild Santapau.

UNIT III:

Detailed study of the following families with their economic importance: Annonaceae, Rutaceae, Meliaceae, Caesalpiniaceae, Anacardiaceae, Cucurbitaceae, Rubiaceae and Sapotaceae.

UNIT IV:

Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, Amaranthaceae, Cannaceae, Orchidaceae and Poaceae.

UNIT V:

Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Cereals - Paddy, Wheat; Pulses - Green gram, Bengal gram; Tuber crops - Tapioca, Potato; Spices - Pepper, Cardamom; Beverages - Tea, Coffee; Oil yielding plants - Coconut, Groundnut; Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood; Latex yielding plants - Para rubber, Sapota; Ornamental plants - Rose, Orchids.

Text Book:

1. Sharma O.P. (2013). *Plant Taxonomy*. New Delhi: McGraw Hill Education Pvt. Ltd. New Delhi.
2. Subramanyam, N.S. (1999). *Modern Plant Taxonomy*. New Delhi: Vikas Publishing House.
3. Mondal, A.K. (2005). *Advanced Plant Taxonomy*. New Delhi: New Central Book Agency (P) Ltd.

Reference Books:

1. Singh, V. and Jain, D.K., (1997). *Taxonomy of Angiosperms*. New Delhi: Rastogi Publications.
2. Pandey, B.P.S. (1997). *Taxonomy of Angiosperms*. New Delhi: S. Chand and Company Ltd.
3. Rendle, A.B. (1979). *The Classification of Flowering Plants (I & II)*. London: Cambridge University Press.

4. Pullaiah, T. (2007). *Taxonomy of Angiosperms*. (3rded.). New Delhi: Regency Publication.
5. Roslin, A.S. (2005). *A Text Book on Taxonomy of Flowering Plants*. Nagercoil: Assisi Offset Press.
6. Vashista, P.C. (1985). *Taxonomy of Angiosperms*. New Delhi: Vikas Publications.
7. Lawrence, G.H.M. (1951). *Taxonomy of Vascular Plants*. New York: MacMilan Publishers.
8. Simpson, M.G. (2006). *Plant Systematics*. London: Academic Press.
9. Simpson, B.B. and Conner – Ogorzaly, M (1986). *Economic Botany: Plants in Our World*. New York: McGraw Hill Book Company.

Web Links

<https://uou.ac.in/sites/default/files/slm/BSCBO-201.pdf>

<https://bmcbgenomics.biomedcentral.com/articles/10.1186/s12864-016-3100-9>

<https://byjus.com/neet/important-notes-of-biology-for-neet-plant-taxonomy/>

Major Practical - III
Taxonomy of Angiosperms and Economic Botany
Sub. Code: BC20P3

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO- 1	understand and identify the locally available common plants.	PSO -1	U
CO-2	identify the family and describe the plant parts and floral parts.	PSO - 3	An
CO-3	record the economically important products from the prescribed families in the syllabus.	PSO - 1	U

1. Technical description of plant parts, including floral parts (L.S. of flower, floral diagram and floral formula) with reference to the families prescribed in theory.
2. Identification of the plant specimens with reference to their families following the Bentham & Hooker's classification.
3. Survey of locally available plant species belonging to the families prescribed in the syllabus
4. Taxonomic field trip under supervision and submission of 10 herbarium sheets. Field note book to be submitted for external evaluation.
5. Study of different types of inflorescence, root, leaf, fruit and economically important part from the members of the families prescribed in the syllabus.
6. Submission - Record note book, Herbarium sheets and Field note book.

Semester - V
Major – Core VI -Biochemistry and Biophysics
Sub. Code:BC2052

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

- Objectives:** 1.To understand the structure and properties of bio-molecules.
2. To reflect on the sources and benefits of vitamins.
3.To learn the emerging field of biophysics and principles of bioenergetics.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO– 1	apply the usage of P ^H and buffers in biological experiments.	PSO–3	Ap
CO– 2	understand the importance of Bio-molecules.	PSO–1	U
CO– 3	describe its biological roles and significance of lipids.	PSO– 1	U
CO– 4	analyze enzyme activity.	PSO–2	An
CO–5	demonstrate thermodynamic principles in biological energy conversion.	PSO– 7	E

UNIT I:

Introduction to biomolecules, types and information about plant resources rich in biomolecules. Chemical bonds – types (co-ordinate, covalent, hydrogen); Acids and Bases - pH and Buffer system. Classification of carbohydrates; Monosaccharides: Structure of glucose (linear, open chain, ring form) and fructose, properties of monosaccharides. Disaccharides: Structure and properties of maltose, sucrose and lactose. Polysaccharides: Structure and properties of starch and cellulose.

UNIT II:

Amino acids - classification, structure and properties. Protein – primary, secondary, tertiary (myoglobin) and quaternary (haemoglobin). Protein denaturation and biological roles of proteins. Vitamins: structure, importance, sources and deficiency symptoms of water-soluble

vitamins e.g., Thiamine, Riboflavin and Niacin; fat-soluble vitamins e.g., vitamin A- retinol, Vitamin D – Ergosterol.

UNIT III:

Lipids: saturated and unsaturated fatty acids. Classification- structure and properties of simple lipids (waxes and triglycerides), compound lipids (phospholipid and glycolipid) and derived lipids (cholesterol, carotenoids and terpenes).

UNIT IV:

Enzymes: Classification, nomenclature based on IUB, activation energy, active site, cofactors, coenzymes (NAD, CoA), isoenzyme; mechanism of enzyme action (lock and key model, induced - fit theory), enzyme inhibition and factors affecting enzyme activity.

UNIT V:

Biophysics: Photobiology- Dual nature of light and its characteristics. Electromagnetic Spectrum, Action and Absorption spectrum, Emission spectrum – excitation and de-excitation. phosphorescence, fluorescence and bio-luminescence. Bioenergetics: Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.

Text Books

1. Jain, J.L. (2000). *Fundamentals of Biochemistry*. New Delhi: S. Chand and Co.
2. Mahesh., S. (2003). *Biotechnology, Molecular Biology and Biophysics*. New Delhi: New Age International publishers.

Reference Books

1. Conn, E.J. and Stumpf, P.K. (2009). *Outlines of Biochemistry*. (5th ed.) New Jersey: Wiley Eastern Ltd.
2. Lehninger, A.L. (2002). *Principles of Biochemistry*. New Delhi: CBS Publishers and Distribution.
3. Arun Mittal, C. (2002). *Biochemistry*. New Delhi: A.P.H. Publishing Corporation.

4. Satyanarayana, U. and Chakrapani, U. (1999). *Biochemistry*. Kolkata: Books and Allied (P) Ltd.
5. Campbell, P.N. and Smith, A.D. (2011). *Biochemistry* (4th ed.). New York: Churchill Livingstone Publishers.
6. Pranab Kumar Banerjee. (2008). *Introduction to Biophysics*. New Delhi: S. Chand & Company Pvt. Ltd.

Web Links:

<https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/hydrogen-bond>
https://www.csus.edu/indiv/d/dulaik/drduhai.com/csustan/cellmolbio/3310Support/CMB7_L7.ppt
<https://www.slideshare.net/arijabuhaniyeh/biochemistry-ch4-protein-structure-and-function>
<https://www.uwyo.edu/molecbio/courses/molb-4600/files/s15-miller-chap-3a-lecture.ppt>
<https://byjus.com/biology/enzymes/>
<https://www.toppr.com/guides/biology/biomolecules/enzymes/>

Major Practical III- Biochemistry and Biophysics

Sub Code: BC20P3

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	prepare buffer solution for biological and biotechnological experiments.	PSO - 1	Ap
CO - 2	estimate and compare the biomolecules quantitatively.	PSO - 3	Ev
CO - 3	identify spotters (i.e., Photos/Models/Instruments) related to biochemistry and biophysics.	PSO - 1	R
CO - 4	do qualitative analysis of glucose, starch, protein and lipids.	PSO - 3	Ev

A. Experiments:

1. Verification of Beer's law
2. Quantitative estimation of soluble starch by Colorimetry (Iodine-Test method)
3. Quantitative estimation of insoluble starch by gravimetric method
4. Quantitative estimation of sugar by Colorimetry (Phenol - Sulfuric Acid method)
5. Quantitative estimation of proteins in plant samples. (Lowry's method)
6. Titration of weak acid against strong base
7. Preparation of Buffers
8. Separation of dye mixture by circular paper chromatography

B. Spotters:

- a. Enzyme model - Lock and Key, Koshland's induced fit model
- b. Effect of pH on enzyme activity
- c. Effect of substrate concentration on enzyme action
- d. Fluorescence
- e. Phosphorescence

C. Demonstration only:

- a. Qualitative estimation of Glucose (Benedict's Test)
- b. Qualitative estimation of Starch (Iodine Test)

- c. Qualitative estimation of Protein (Biuret Test)
- d. Qualitative estimation of Lipid (Sudan III Test)

Semester - V

Major Core – VII – Microbiology and Plant Pathology

Sub. Code: BC2053

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	5	90	100

- Objectives:**
1. To provide the students with the comprehensive understanding and appreciation for the diversity and significance of microbes on planet earth.
 2. To study the interaction between plant and pathogen and to develop method of disease management.
 3. To know the working principal and mechanism of action of instruments related to microbiology.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	get an insight on the structure and reproduction of bacteria and viruses.	PSO - 1	U
CO – 2	explore the role and relevance of bacteria and viruses in the field of microbiology.	PSO - 1	An
CO–3	learn the sterilization techniques and preparation of culture media.	PSO–2	Ap
CO– 4	Become an expert in operating microbiological instruments thereby undertaking careers in that field.	PSO - 5	Ap
CO -5	Understand the economic and pathological importance of bacteria, viruses and fungi.	PSO - 1	U

UNIT I:

Contributions to Microbiology: Anton Van Leeuwenhoek, Louis Pasteur and Robert Koch. Sterilization of glassware, preparation of agar medium. Bacterial growth- growth curve- pure

culture, batch culture and continuous culture. Physical and chemical agents for controlling microorganisms. Dry and Wet sterilization. Working principles of Autoclave, Laminar Air Flow and Incubator.

UNIT II:

Introduction to microbial world: Bacteria: General characteristics; Archaeobacteria, Eubacteria and mycoplasma. Ultrastructure; Nutritional types of bacteria - autotrophs and heterotrophs, Reproduction and recombination (conjugation, transformation and transduction). Binary fission and endospore. Economic importance of bacteria with reference to their role in agriculture and industry.

UNIT III:

Viruses: Properties, classification (Baltimore), structure and replication of DNA virus (T4), lytic and lysogenic cycle; RNA virus (TMV, Corona Virus), viroids and prions. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases.

UNIT IV:

Industrial Microbiology: General account of microbial products; antibiotics (Penicillin), alcohol (wine) and dairy (cheese).

Spoilage through microbes. Sources of milk contamination, Pasteurization technique, Test for grading milk quality. Food borne infections and preventions – Botulism and Salmonellosis.

Environmental Microbiology:

Water: Potable and non-potable water, Municipal sewage treatment process: Primary, Secondary, (aerobic and anaerobic process), Test for detection of coliform bacteria

Soil: Role of soil microbes and soil fertility.

UNIT V:

Plant Pathology: Terms and concepts; General symptoms; Etiology; Symptoms; Host-Pathogen relationships, defence; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot of Cotton. Viral diseases – Bunchy Top of Banana, Vein clearing in lady's finger. Fungal diseases – Late blight of Potato and Tikka Disease of Groundnut

Text Books:

1. Dubey, R.C and Maheshwari, D.K. (2003). *A text Book of Microbiology*. New Delhi: S. Chand and Company.
2. Singh, R.S.(1988).*Introduction to Principles of Plant Pathology*. New Delhi: Oxford and IBH Publishing Company.

Reference Books:

1. Prescott, L.M, Harley, J.P and Klein D.A. (1999).*Microbiology*. New York: McGraw Hill Publications.
2. John Ingraham, L and Catherine Ingraham, A.(2000).*Introduction to Microbiology*.Singapore: Thomson Books.
3. Purohit, S.S. (2006).*Microbiology*.India:Agro Botanical Publishers.
4. Pelzar, M.H, Chan, E.C.S and Erieg, N.R.(1993).*Text Book on Microbiology*.NewDelhi:Tata McGraw Hill Pub. Co. Ltd.
5. Mehrotra, R.S.and Ashok Agarwal (2017).*Plant Pathology*. New Delhi: Tata McGraw Hill Publishing Company Ltd.
6. Rangaswami, G.(1998).*Diseases of Crop Plant in India*. New Delhi: Prentice Hall of India Pvt. Ltd.

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<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/plant-pathology>

<https://www.elexbio.com/an-introduction-of-food-and-water-microbiology.html>

<https://www.ncbi.nlm.nih.gov/books/NBK562919/>

Major Practical -V
Microbiology and Plant Pathology
Sub Code: BC20P5

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO-1	apply sterilization technique and prepare sterile bacterial culture media.	PSO - 2	Ap
CO-2	detect coliform bacteria in water samples.	PSO - 3	An
CO-3	identify the spotters.	PSO - 1	Ap
CO-4	know the importance of pasteurization through field visit.	PSO - 3	U

Demonstration/Spotters

1. Sterilization - autoclave, pressure cooker, laminar air flow, sprit lamp, inoculation needle.
2. Ultrastructure of Bacteria and Bacteriophage
3. Incubator
4. Plant pathology specimens
 - a. Citrus Canker
 - b. Angular Leaf Spot of Cotton
 - c. Bunchy Top of Banana
 - d. VeinClearing in Lady's Finger
 - e. Late Blight of Potato
 - f. Tikka Disease of Groundnut
5. Experiments
 - a) Bacterial culture(plate, slant).
 - b) Gram's staining of bacteria.
Demonstration Only
 - c) Analysis of milk – Dye reduction test.
 - d) Detection of Coliform bacteria in water samples.
5. Visit to dairy farm

Semester - VI
Major Core VIII - Genetics, Biostatistics and Bioinformatics
Sub. Code: BC2061

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

- Objectives:**
1. To have knowledge of Mendelian and non-Mendelian inheritance.
 2. Develop skills in data tabulation, its treatment, analysis and interpretation of data.
 3. Introduce the vast repositories of biological data knowledge.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	understand Mendelian principle and predict genetic inheritance patterns.	PSO - 1	U
CO – 2	analyze the facts of non-Mendelian inheritance and have conceptual knowledge on alleles and their linkage.	PSO - 3	Ap
CO – 3	examine the various stages of cell division and also a clear knowledge on DNA structure.	PSO - 3	U
CO – 4	generate biological interpretations and conclusions from data of scientific research.	PSO -3	C
CO – 5	develop skills to become employable as professionals in biochemical industries.	PSO - 5	C

UNIT I:

Genetics as a science: History; Experiments of G.J. Mendel with *Pisum sativum*, Principles of inheritance, Mendelian laws-monohybrid and dihybrid cross, test cross and back cross. Modification of Mendelian ratio: Incomplete dominance – *Mirabilis jalapa*, Co-dominance – MN blood group in man, Lethal genes: Dominant lethality - Coat colour in Mice, Recessive lethality – Chlorophyll content in Maize.

UNIT II:

Genetic interaction: Dominant Epistasis – fruit colour in summer squashes, Recessive epistasis – coat colour in mice; Complementary genes – flower colour in sweet pea. Non-epistasis - comb pattern in Fowls.

Sex Linked inheritance (eye colour in *Drosophila*) Polygenic inheritance with reference to (ear length in maize), Multiple alleles -ABO blood group in man, Rh factor. Non-Mendelian inheritance Extra-chromosomal inheritance: chloroplast mutation –variegation in 4 O'clock plant; Linkage: Morgan's views on linkage, crossing over – types, mechanism of crossing over and its significance, Holliday model for genetic recombination.

UNIT III:

Cell cycle, Cell division (mitosis and meiosis), Significance of mitosis and meiosis. Chromosomes: Chromosome morphology – (metacentric, submetacentric, acrocentric and telocentric) and Chromosome. Structure. Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).

Brief account on Nucleic acids; DNA as the genetic material: Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment, DNA Structure (Watson and Crick), Types of RNA: structure and functions of mRNA, rRNA and tRNA.

UNIT IV:

Biostatistics: Importance of statistics in Biology, sampling - random sampling, collection and interpretation of data, tabulation, presentation of data - frequency distribution, frequency curve, frequency polygon, histogram and bar diagrams. Measures of central tendencies -mean, median and mode. Measures of dispersion – standard deviation, standard error, Null hypothesis - Chi - square test.

UNIT V:

Introduction to Bioinformatics: aims and scope and applications- Virtual library, e-books and e- journals. Major areas of biological data bases- classification; primary, secondary, specialized. Importance data bases- NCBI, SWISS-PROT, DDBJ. Tools and softwares in Bioinformatics – similarity search – BLAST – FASTA sequence alignment tools. Application of Bioinformatics.

Text Books:

1. Verma, P.S. Agarwal, V.K., (1994). *Genetics*. New Delhi: S. Chand and Company Ltd.
2. John De Britto. (2011). *Biosatistics*. Sivakasi: Anto Art

3. Mani K and Vijayaraj N. (2003). *Bioinformatics for the Beginners*. Coimbatore: KalailatheerAchagam.

Reference Books:

1. Gupta P.K. (1997). *Cytology, Genetics and Evolution*. Meerut: Rastogi Publications.
2. Gardner, E.J. Simmons, M.J. Snustad, D.P. (1991). *Principles of Genetics*. (8th ed.)
3. India: John Wiley & Sons Inc.
4. Snustad, D.P. and Simmons, M.J.(2010). *Principles of Genetics*. (5th ed). India: John Wiley & Sons Inc.
5. Klug, W.S. Cummings, M.R., Spencer, C.A. (2009). *Concepts of Genetics*. (9thed.).U.S.A: Benjamin Cummings Publishers
6. Griffiths, A.J.F. Wessler, S.R. Carroll, S. B. and Doebley, J. W. H. (2010). *Introduction to Genetic Analysis*. (10th ed.). U.S.A: Freeman and Co.
7. Gurumani, N. (2005). *An Introduction to Biostatistics*. (2nd ed.). Chennai: MJP Publishers.
8. Prasad S. (1990). *Elements of Biostatistics*. Meerut: Rastogi Publications.
9. Krane Dan, E. and Raymer M.L. (2004). *Fundamental concepts of Bioinformatics*. New Delhi: Pearson Education.

Web Link

https://en.wikipedia.org/wiki/Plant_genetics

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/>

[https://sphweb.bumc.bu.edu/otlt/mph-](https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_biostatisticsbasics/bs704_biostatisticsbasics_print.html)

[modules/bs/bs704_biostatisticsbasics/bs704_biostatisticsbasics_print.html](https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_biostatisticsbasics/bs704_biostatisticsbasics_print.html)

Major Practical -IV
Genetics, Biostatistics and Bioinformatics

Sub Code: BC20P4

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	identify the different stages of mitosis from the root tip squash of Onion.	PSO –3	U
CO – 2	solve genetic problems related to monohybrid, dihybrid ratio and interaction of genes.	PSO – 3	An
CO – 3	interpret experimental data using biostatics.	PSO - 3	Ap
CO – 4	identify spotters (Photos/Models).	PSO - 1	R

1. To prepare root tip squash of onion and to identify the various stages of mitosis.
2. Solving genetic problems related to monohybrid, dihybrid ratio and interaction of genes (minimum of five problems in each category).
3. Calculation of mean and standard deviation for the given data.
4. Problems using Chi-square test.
5. Study of Photos/ Models showing:
 - a. DNA-Structure (Watson and Crick Model)
 - b. Clover Leaf Model of tRNA
 - c. Giant chromosomes- Salivary gland chromosome
 - d. Lamp brush chromosomes
 - e. Crossing over
 - f. Pictural representation of data
 - g. Central Processing Unit
 - h. Pen drive
 - i. Search Engine

Semester - VI

Major Core IX - Biotechnology and Molecular Biology

Sub. Code: BC2062

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

- Objectives:** 1.To learn and apply the general principles of biotechnology and ensure adequate training in modern biotechnology.
2. To understand the various steps in DNA replication, protein synthesis and gene regulation in prokaryotes.
3. To gain knowledge on different types of IPR.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	acquaint the core concepts and fundamentals of plant biotechnology.	PSO – 1	U
CO – 2	develop competency on different types of plant tissue culture.	PSO – 3	Ap
CO – 3	understand the mechanisms of genetic information.	PSO –1	U
CO – 4	get an insight of chromosome abnormalities and related human syndromes.	PSO –7	An
CO – 5	develop skills to become employable as professionals in Biotechnology Industries.	PSO –7	C

UNIT I:

Definition, history and scope of biotechnology, Principles of recombinant DNA technology, steps and applications of rDNA technology; Restriction Enzymes – Nomenclature and Classification; Cloning Vectors - Plasmids, Cosmids, Phagemids and shuttle vectors; DNA cloning - Steps and Applications; Basic techniques – Agarose gel electrophoresis, Northern blotting, Southern blotting and RFLP.

UNIT II:

Scope, importance and applications of plant tissue culture, Totipotency of cells, Tissue culture laboratory- organization and requirements, MS medium composition and preparation; Sterilization techniques; Types of tissue culture - Callus culture, apical meristem culture, Micropropagation and Protoplast culture; Artificial seed: production, applications and limitations; Cryopreservation techniques.

UNIT III:

General Features of DNA Replication: General principles –conservative and semi conservative and discontinuous. Semi conservative model of replication – Watson and Crick, DNA damage; DNA repair mechanism. Photoreactivation, Mismatch repair; Mutations – mutagens, Gene mutation and Chromosomal mutation; Chromosomal abnormalities- Down Syndrome and Klinefelter Syndrome.

UNITIV:

Genetic code and wobble hypothesis; Transcription in prokaryotes and eukaryotes; Assembly of ribosomes; Protein synthesis - initiation, elongation and termination; Gene regulation in Prokaryotes- Operon concept, Lac Operon; Transposons in Prokaryotes and Eukaryotes.

UNIT V:

DNA transfer techniques: Physical method (Microinjection), Chemical method (Calcium phosphate method), Electrical method (Electroporation); Gene transfer in plants – *Agrobacterium* transformation; GM plants –Bt Brinjal, BtCotton; Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice).

IPR – Scope and different kinds of IPR.

Text Books:

2. Dubey, R.C. (2006). *Text Book of Biotechnology*. New Delhi: S. Chand and Company.
3. Ajoy Paul, (2011). *Text book of Cell and Molecular Biology*. Jaipur: Books and Allied Pvt. Ltd.

Reference Books:

1. Ignacimuthu.S. (1999). *Basic Biotechnology*. New Delhi: Tata McGraw Hill Publishing Company Ltd.

2. Ramawat K.G. (2003). *Plant Biotechnology*. New Delhi: S.Chand and Company.
3. Adrian Slater, Nigel Scott and Mark Fowler. (2003). *Plant Biotechnology*. New York: Oxford University Press.
4. Rajni Gupta and Mukerji K.G. (2001). *Microbial Technology*. New Delhi: A.P.H Publishing Corporation.
5. Chawla, H.S. (2004). *Introduction to Plant Biotechnology*. (2nd ed.). London: Oxford University.
6. David Freifelder. (2002). *Essentials of Molecular Biology*. New Delhi: Narosa Publishing House.
7. William H. Elliot and Daphne C. Elliot. (2001). *Biochemistry and Molecular Biology*. (2nd ed.). London: Oxford University Press.
8. Robert. F. (2003). *Molecular Biology*. (2nd ed.). New Delhi: McGraw Hill Publishers.
9. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). *Molecular Biology of the Gene*. (6th ed.). New York: Pearson Benjamin Cummings Press.

Web Link

<https://microbenotes.com/recombinant-dna-technology-steps-applications-and-limitations/>

<http://www.jiwaji.edu/pdf/ecourse/pharmaceutical/Plant%20tissue%20culture-converted.pdf>

<http://www.jiwaji.edu/pdf/ecourse/biotechnology/MSc%20biotechnology%202%20semwobble%20hypothesis2.pdf>

Major Practical IV
Biotechnology and Molecular Biology
Sub Code: BC20P4

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	be familiar with sterilization techniques.	PSO - 3	An
CO - 2	demonstrate Preparation of MS medium.	PSO - 1	U
CO - 3	analyse PCR Technique: Southern and Northern Blotting technique.	PSO - 3	Ap
CO - 4	identify spotters (Photos/Models).	PSO –1	E

1. Preparation of MS medium.
2. Demonstration of *in vitro* sterilization of seeds and germination in MS media containing petriplates.
3. *In vitro* selection and inoculation methods using leaf and nodal explants.
4. Demonstration: DNA Isolation
5. Spotters: (Photos/models)
 - a. Anther culture, Pollen culture and Protoplast fusion.
 - b. Vectors/Plasmids
 - c. Southern and Northern Blotting Technique
 - d. Methods of direct gene transfer –Microinjection and Short Gun Method
 - e. Transgenic plants – Bt-Cotton and Golden Rice

Semester - VI

Major Core X - Plant Physiology and Metabolism

Sub. Code: BC2063

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	5	90	100

- Objectives:**
1. Comprehend the fundamental concepts of plant physiology.
 2. Describe the physiological mechanisms of plant growth, function, and development.
 3. Recognize and describe how plants respond to their environment.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand water relation of plants with respect to various physiological processes.	PSO - 1	U
CO – 2	Explained efficiency symptoms of macro and micro nutrients in plants.	PSO –2	U
CO – 3	relate complementary metabolic pathways such as photosynthesis and respiration in energy acquisition.	PSO –1	An
CO – 4	analyse nitrogen metabolism and its significance.	PSO –1	An
CO – 5	assess dormancy and germination in plants.	PSO –1	An

UNIT I:

Plant and cell architecture: water relations to plant life; Physical properties of water; Imbibition, diffusion, osmosis and plasmolysis. Concepts of water potential and its components. The Concept of the Soil Plant Atmosphere Continuum (SPAC). Transpiration –Definition, types of transpiration, structure and opening and closing mechanism of stomata; guttation and anti-transpirants. Factors affecting transpiration.

UNIT II:

Mineral nutrition: Essential elements, micro and macronutrients; Criteria of essentiality of elements; General functions, specific role and deficiency symptoms of macronutrients (Nitrogen, Phosphorus, and Potassium) and micronutrients (Iron, Magnesium, and Zinc) Absorption and translocation of solutes (organic and inorganic) – active & passive uptake. Hydroponics, types, aquaponics and significance.

UNIT :III

Photosynthesis: Importance of photosynthesis for food security and environment. Ultrastructure of chloroplast: (a) Light reaction: Radiant energy, photosynthetic apparatus, light harvesting complex; light absorption, composition and characteristics of pigment systems, photolysis of water and photosynthetic electron transport, (b) Dark reaction: Carbondioxidefixationin C3, C4 and CAM plants, photorespiration and its significance, factors affecting photosynthesis.

UNIT IV:

Respiration: Ultrastructure of mitochondria. Aerobic and anaerobic respiration; fermentation;Glycolysis, Krebs cycle and generation of ATP synthesis through oxidative electron transferchain (Cytochrome system),chemiosmotic regeneration of ATP, Gluconeogenesisand factors affecting respiration.

Nitrogen Metabolism: Nitrogen nutrition, organic nitrogen, nitrogen fixation in microbes/legumes, nitrate and ammonia assimilation, role of nitrogenase in nitrogen metabolism.

UNIT V:

Phytohormones: Growth and development, Phytochromes and light control, role of phytochrome intropism, flowering and fruiting. Physiological roles of Auxin, Gibberellin, Absciscic acid and Ethylene. Vernalization and devernialization.

Dormancy ofseeds, methods of breaking dormancy, mechanism of seed germination, Plant response to environmental stresses (salt and water) - Polyamines, brassinosteroids and their functions.

Text book:

1. Jain V. K. (2006). *Fundamentals of Plant Physiology*. New Delhi: S. Chand and CompanyLtd.
2. Srivastava, H.S. (2005). *Plant Physiology, Biochemistry and Biotechnology*. Meerut:Rastogi Publications.

Reference Books:

1. Taiz, L., Zeiger, E. Mollar, I. M. and Murphy, A. (2015). *Plant physiology and Development* (6th ed.) USA: Sinauer Associates Inc.
2. Hopkins, W.G. Q. and Huner, N.P. A. (2009). *Introduction to Plant Physiology*. (4th ed.) U.S.A: John Wiley and Sons.
3. Bajracharya, D. (1999). *Experiments in Plant Physiology- A Laboratory Manual*. New Delhi: Narosa Publishing House.

4. Pandey, K.K. and Sinha, B.K. (1988). *Plant Physiology*. New Delhi: Vikas Publications.
5. Ross and Salisbury. (2009). *Plant Physiology*. New Delhi: Cengage Learning.

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<https://www.uv.es/hegigui/Kasper/2004-6.pdf>

Major Practical -IV
Plant Physiology and Metabolism

Sub Code: BC20P4

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	-	30	-

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	demonstrate and interpret the results to physiology experiments.	PSO - 3	R
CO- 2	Able to analyse the relationship between absorption and transpiration.	PSO - 3	Ap
CO - 3	identify the spotters.	PSO - 1	Ap

Experiments

2. Imbibition – by direct weighing method
3. Plasmolysis – Onion Peel / Rhoeo leaf
4. Determination of water potential by Chardakov's method.
5. Determination of water absorption and transpiration ratio.
6. Rate of photosynthesis under varying concentration of CO₂
7. Effect of quality of light on evolution of O₂ during photosynthesis -colour filters.
8. Quantification of plant pigments by spectrophotometric method.
9. Respiration- R.Q using Ganong's respirometer.

Demonstration only

1. Imbibition - Dialatometer
2. Tissue tension
3. Suction due to transpiration
4. Ganong's potometer
5. Hydroponics
6. Khune's fermentation tube.
7. Anaerobic respiration
8. Growth – Arc auxanometer
Phototropism

Semester - VI
Elective –IV (a) Marine Botany
Sub. Code:BC2064

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

- Objectives:** 1.Understand the diversity of marine organisms.
2. Learn about the marine plants and their medicinal property.
3. Acquire knowledge on marine pollution and conservation methods.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	describe the types of marine habitat and their relationship with environment	PSO - 1	R
CO – 2	compare the threats and conservation of seaweeds and sea grasses	PSO –4	An
CO – 3	evaluate how natural events and human activities affect coastal habitats	PSO – 4	Ev
CO – 4	create a broad knowledge about themarine products and their economic value	PSO – 5	C
CO – 5	describe the role of mangroves in conservation of marine flora and fauna.	PSO –4	U

UNIT I:

Classification of marine habitat – pelagic, neritic and oceanic province, benthic – zonation – shore environment – muddy, rocky and sandy, waves and tides deep sea bottom – pelagic deposits. Physical and chemical properties of sea water. Salt marshes and sand dune vegetation.

UNIT II:

Marine biodiversity – phytoplankton- Nekton, Benthos. Marine Phytoplankton- Dino - flagellates, Nano-plankton, Ultra-plankton, marine bacteria, marine fungi, marine Lichens, seaweedsand sea grasses.

UNIT III:

Marine products: traditional uses - human food and agriculture. Isolation of agar–agar. Scope of the seaweed industry: Brown and Red seaweeds as food. Medicinal uses of marine seaweeds and sea grasses.

UNIT IV:

Threats and conservation of marine organisms; Marine pollution: Pollution due to heavy metals - radioactive wastes, thermal, sewage, algal blooms and oil spills – possible remedies – oil eating bacteria – GMO and pollution abatement. Biomagnification.

UNIT V:

Mangroves – Salient features of *Rhizophora* and *Avicennia*. Definition, distribution, stresses on mangroves, regeneration of mangroves, coral reefs – ecology, species interaction, economic importance and conservation.

Text Book:

1. Newell, G.E., and Newell, R.C. (1977). *Marine Plankton- A Practical Guide*. U.K.: Hutchinson and Co Ltd.

Reference Books:

1. Clinton, J. Dawes. (1981). *Marine Botany*. New York: John Wiley and Sons.
2. Tait, R.V. (2013). *Elements of Marine Ecology*. U.K.: Butterworth and Co. (Publisher) Ltd.
3. Pringsheim, E.G. (2016) *Pure Cultures of Algae*. New York: Hafner Publishing Company.
4. Sinha, P.C. (1998). *Marine Pollution*. New Delhi: Anmol Publications Pvt. Ltd.
5. Grant Gross, M. (1993) *Oceanography: A view of the earth*. New Jersey: Prentice - Hall Inc.
6. James W. Nybakker (2001). *Marine Biology*, San Francisco: Benjamin Cummings Publishing House.
7. Colin Munn, (2011). *Marine Microbiology*. (2nd). New York: Garland Science.

Web Links:

<https://www.studocu.com/en-nz/document/university-of-otago/marine-and-freshwater-botany/freshwater-and-marine-botany-study-notes/7182854>

<https://www.fao.org/3/y4765e/y4765e06.htm#:~:text=A%20short%20and%20simplified%20description,to%20remove%20the%20residual%20seaweed.>

<https://www.mapsofindia.com/my-india/society/marine-pollution-causes-types-effects-prevention#:~:text=The%20marine%20environment%20becomes%20polluted,spills%20C%20and%20many%20such%20factors.>

Semester - VI

Elective –IV (b) Organic Farming

Sub. Code: BC2065

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

Objectives: 1. Identify various sources of organic manures and their application.
2. To develop trainers at village level on organic management practices.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand the concept of organic farming and its importance.	PSO–1	U
CO – 2	apply the knowledge of organic nutrients and organic pest management in farming.	PSO–3	Ap
CO – 3	demonstrate the use of biocontrol agents, botanicals and other plant growth promoting preparations in organic farming.	PSO–4	An
CO–4	learn the techniques of different concepts of composting methods.	PSO–1	U
CO–5	empower the employment opportunity of rural youth at village level in organic market as organic growers, stakeholders, and entrepreneurs.	PSO–7	Ap

UNIT I:

Introduction, definition, concept and development of organic farming. principles of organic farming, objectives, types and benefits of organic farming. Social and marketing aspects of organic farming. Brief account on Soil- Soil types, Soil pH and Soil reclamation.

UNIT II:

Nutrient management: Organic Manure – uses of farm yard manure, rural compost, city compost, vermicompost, oil cakes, animal wastes – (cattle dung and urine, poultry wastes, slaughter wastes, piggery and fishery wastes), green manures, biofertilizers; recycling of organic wastes and sludge management, brief account of nutrient deficiency symptoms.

UNIT III:

Preparation of fertilizer mixtures: preparation of bio-fertilizers-Rhizobium, mass production of VAM fungi, preparation of organic nutrient solutions-‘panchagavya’, preparation of Neem Kernel Aqueous Extract (NKAE), chemical and physiological methods of increasing fertilizer use efficiency.

UNIT IV:

Pest management in organic farming: Role of Botanicals- Neem oil emulsion, Neem oil garlic emulsion (2%), Tobacco decoction, Bio-control agents – Entomopathogens (fungi, bacteria and virus), Preparation of Permitted Fungicides for Organic Farming (Bordeaux mixture (1%)). Integrated Pest Management (IPM).

UNIT V:

Traditional and Organic Farming System: Systems of farming- wet land, garden land and dry land farming systems. Familiarization of farm equipment & implements, concept of different cropping systems in relation to organic farming – pure organic farming and integrated organic farming (cash crops, permaculture and polyculture).

Text Book:

1. Arun K Sharma (2005). *Handbook of Organic Farming*. Jodhpur: Agrobios.

Reference:

1. Charles.A. Francis.(2009). *Organic Farming – The ecological System*. U.S.A: Book and Multimedia Publishing Committee.
2. Lockeretz, W. (2007). *Organic Farming – An international History*. U.K.: Cornwell Press.
3. Dilip Nandwani.(2016) *Organic Farming for Sustainable Agriculture*. Switzerland: Springer International Publishing.
4. Mukesh Gupta. (2004). *Organic agriculture development in India*. Jaipur: ABD Publishers.
5. Ann Larkin Hansen. (2010). *The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm*. Massachusetts: Storey Publishing.
6. Vayas, S.C, Vayas, S., Modi, H.A. (1998). *Bio-fertilizers and organic Farming*. Gujarat: Akta Prakashan.
7. Nair, G.M.(2015). *Chemical and biopesticides for crop protection: A handbook for technical officers*. Thiruvananthapuram: Department of Agriculture, Govt. of Kerala.

Web Link

<https://www.nabard.org/demo/auth/writereaddata/File/OC%2038.pdf->
<https://www.tractorjunction.com/blog/organic-farming-in-india-types-methods-advantages/>
<https://byjus.com/commerce/organic-farming/>
<https://www.24mantra.com/blogs/organic-lifestyle/types-of-organic-farming-methodologies-objectives-and-advantages/>
<https://farmingbase.com/organic-farming-types-importances-advantages-and-benefits/>

SEMESTER – VI

Major Elective IV (c) Ecotourism

Sub. Code: BC2066

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

Objectives: 1.To highlight the need for sustainable tourism.
2. To appreciate and acknowledge the rich heritage of our country.
3. To be aware about the role of various movements in the protection of nature and natural resources.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	recognize the values of natural heritage	PSO - 2	U
CO – 2	create environmental and cultural awareness to develop sustainable eco-tourism spots.	PSO - 4	C
CO – 3	understand the impact of ecotourism on economy, socio-economic and environment of a country.	PSO - 1	U
CO – 4	appreciate and admire the varieties of tourist centres.	PSO –1	Ap
CO – 5	evaluate the role of local community in eco-tourism	PSO - 4	Ev

UNIT I:

Definition scope and importance of ecotourism. Classification of tourism: religious, cultural, heritage, monumental, adventure, wildlife, consumptive and non-consumptive tourism.

UNIT II:

Interesting Eco-Tourism Places - global, national, regional (any five in each category).
Identification of nature- based ecotourism. Maintenance of tourist centres.

UNIT III:

Ecotourism spots - dam sites, waterfalls, mangroves, bird sanctuaries, forest area, botanical garden, sacred groves, beaches, wildlife sanctuaries and national parks.

UNIT IV:

Impact of Ecotourism: Ecotourism-based/related employment socio, economic, cultural and environmental impacts. Ecotourism and education. Ecotourism related organizations.

Ecotourism research. Disasters and ecotourism. Coastal management activities related to ecotourism. Need for sustainable tourism.

UNIT V:

Infrastructural facilities for ecotourism. Funding agencies- government and private. Legislations to be followed, Ecotourism and local community. Strategies to maintain these areas in an ecological sustainable way. Ecotourism and conservation.

Text Books:

1. Dasman, R.F. (1968) *Environmental Conservation*. New York: John Wiley and Sons.
2. Jadhav, H.V. and Bhosale, V.M. (1995). *Environmental Protection and Laws*. Bangalore: Himalaya publishing House.

Reference Books:

1. Mukherjee, N. (2008). *Ecotourism and sustainable Development*. New Delhi: Cybetech Publications.
2. Prabhas Chandra. (2003). *Global Ecotourism*. New Delhi: Kaniskha Publishers.
3. Sinha, P.C. (2003) *Encyclopedia of Ecotourism*. (Vol. I, II and III). New Delhi: Anmol Publications Pvt. Ltd.
4. Weaver, D.B. (2001) *The Encyclopedia of Ecotourism*. U.K.: CABI Publishing.

Web Links

<https://backup.pondiuni.edu.in/sites/default/files/Ecotourismt200813.pdf>

<http://www.uvm.edu/rsenr/rm230/2012%20Fall%20syllabus.pdf>

<https://www.conserve-energy-future.com/principles-importance-benefits-ecotourism.php>

Major Practical - III

Taxonomy of Angiosperms and Economic Botany & Biochemistry and Biophysics

Sub. Code: BC20P3

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2 + 2	2	30 + 30	100

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO-1	understand and identify the locally available common plants.	PSO -1	U
CO-2	identify the family and describe the plant parts and floral parts.	PSO - 3	An
CO-3	record the economically important products from the prescribed families in the syllabus.	PSO - 1	U
CO - 4	prepare buffer solution for biological and biotechnological experiments.	PSO - 1	Ap
CO - 5	estimate and compare the biomolecules quantitatively.	PSO - 3	Ev
CO - 6	identify spotters (i.e., Photos/Models/Instruments) related to biochemistry and biophysics.	PSO - 1	R
CO - 7	do qualitative analysis of glucose, starch, protein and lipids.	PSO - 3	Ev

Taxonomy of Angiosperms and Economic Botany

1. Technical description of plant parts, including floral parts (L.S. of flower, floral diagram and floral formula) with reference to the families prescribed in theory.
2. Identification of the plant specimens with reference to their families following the Bentham & Hooker's classification.
3. Survey of locally available plant species belonging to the families prescribed in the syllabus
4. Taxonomic field trip under supervision and submission of 10 herbarium sheets. Field note book to be submitted for external evaluation.
5. Study of different types of inflorescence, root, leaf, fruit and economically important part from the members of the families prescribed in the syllabus.

Submission - Record note book, Herbarium sheets and Field note book.

Biochemistry and Biophysics

A. Major Experiments:

1. Verification of Beer's law
2. Quantitative estimation of soluble starch by Colorimetry (Iodine-Test method)
3. Quantitative estimation of insoluble starch by gravimetric method
4. Quantitative estimation of sugar by Colorimetry (Phenol - Sulfuric Acid method)
5. Quantitative estimation of proteins in plant samples. (Lowry's method)
6. Titration of weak acid against strong base
7. Preparation of Buffers
8. Separation of dye mixture by circular paper chromatography

B. Spotters:

- f. Enzyme model - Lock and Key, Koshland's induced fit model
- g. Effect of pH on enzyme activity
- h. Effect of substrate concentration on enzyme action
- i. Fluorescence
- j. Phosphorescence

C. Demonstration only:

- e. Qualitative estimation of Glucose (Benedict's Test)
- f. Qualitative estimation of Starch (Iodine Test)
- g. Qualitative estimation of Protein (Biuret Test)
- h. Qualitative estimation of Lipid (Sudan III Test)

Major Practical -IV

Genetics, Biostatistics and Bioinformatics & Biotechnology and Molecular Biology

Sub Code: BC20P4

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2 + 2	2	30 + 30	100

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	identify the different stages of mitosis from the root tip squash of Onion.	PSO –3	U
CO – 2	solve genetic problems related to monohybrid, dihybrid ratio and interaction of genes.	PSO – 3	An
CO – 3	interpret experimental data using biostatistics.	PSO - 3	Ap
CO – 4	identify spotters (Photos/Models).	PSO - 1	R
CO – 5	be familiar with sterilization techniques.	PSO - 3	An
CO – 6	demonstrate Preparation of MS medium.	PSO - 1	U
CO – 7	Analyse PCR Technique: Southern and Northern Blotting technique.	PSO - 3	Ap

Genetics, Biostatistics and Bioinformatics

1. To prepare root tip squash of onion and to identify the various stages of mitosis.
2. Solving genetic problems related to monohybrid, dihybrid ratio and interaction of genes (minimum of five problems in each category).
3. Calculation of mean and standard deviation for the given data.
4. Problems using Chi-square test.
5. Study of Photos/ Models showing:
 - a. DNA-Structure (Watson and Crick Model)
 - b. Clover Leaf Model of tRNA
 - c. Giant chromosomes- Salivary gland chromosome
 - d. Lamp brush chromosomes
 - e. Crossing over
 - f. Pictorial representation of data
 - g. Central Processing Unit
 - h. Pen drive
 - i. Search Engine

Biotechnology and Molecular Biology

1. Preparation of MS medium.
2. Demonstration of *in vitro* sterilization of seeds and germination in MS media containing petriplates.
3. *In vitro* selection and inoculation methods using leaf and nodal explants.
4. Demonstration: DNA Isolation
5. Spotters: (Photos/models)
 - a. Anther culture, Pollen culture and protoplast fusion.
 - b. Vectors/Plasmids
 - c. Southern and Northern Blotting Technique
 - d. Methods of direct gene transfer – Microinjection and Short Gun Method
 - e. Transgenic plants – Bt-Cotton and Golden Rice

Major Practical -V

Microbiology and Plant Pathology & Plant Physiology and Metabolism

Sub Code: BC20P5

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2 + 2	2	30 + 30	100

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO-1	apply sterilization technique and prepare sterile bacterial culture media.	PSO - 2	Ap
CO-2	detect coliform bacteria in water samples.	PSO - 3	An
CO-3	identify the spotters.	PSO - 1	Ap
CO-4	know the importance of pasteurization through field visit.	PSO - 3	U
CO - 5	demonstrate and interpret the results to physiology experiments.	PSO - 3	R
CO- 6	able to analyse the relationship between absorption and transpiration.	PSO - 3	Ap

Microbiology and Plant Pathology

I. Demonstration/Spotters

1. Sterilization - autoclave, pressure cooker, laminar air flow, spirit lamp, inoculation needle.
2. Ultrastructure of Bacteria and Bacteriophage
3. Incubator
4. Plant pathology specimens
 - a. Citrus Canker
 - b. Angular Leaf Spot of Cotton
 - c. Bunchy Top of Banana
 - d. Vein Clearing in Lady's Finger
 - e. Late Blight of Potato
 - f. Tikka Disease of Groundnut

II. Experiments

- e) Bacterial culture (plate, slant).
- f) Gram's staining of bacteria.
Demonstration Only
- g) Analysis of milk – Dye reduction test.
- h) Detection of Coliform bacteria in water samples.

III. Visit to dairy farm

Plant Physiology and Metabolism

I. Physiology Experiments

1. Imbibition – by direct weighing method
2. Plasmolysis – Onion Peel
3. Determination of water potential by Chardakov's method.
4. Determination of water absorption and transpiration ratio.
5. Rate of photosynthesis under varying concentration of CO₂
6. Effect of quality of light on evolution of O₂ during photosynthesis -colour filters.
7. Quantification of plant pigments by spectrophotometric method.
8. Respiration- R.Q using Ganong's respirometer.

II. Demonstration only

1. Imbibition - Dialatometer
2. Tissue tension
3. Suction due to transpiration
4. Ganong's potometer
5. Hydroponics
6. Khune's fermentation tube.
7. Anaerobic respiration
8. Growth – Arc auxanometer
Phototropism

Semester - VI
PART -IV Skill Enhancement Course (SEC)
Global Environmental Issues
Sub. Code: SEC203

No. of hours per week	Credit	Total no. of hours	Marks
2	2	30	100

Objectives: 1. To understand the fundamental issues of environment.

2. To acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment.

3. To discuss social, psychological, economical and political issues surrounding each of the global environmental issues covered in the syllabus.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	analyse the causes and effects of pollution on various spheres of earth.	PSO –4	An
CO – 2	understand the causes of climate change and its effect on environment.	PSO – 4	U
CO – 3	examine the anthropogenic activities in soil desertification.	PSO –4	An
CO – 4	be aware of the importance of wet lands.	PSO – 4	U
CO – 5	explain the reasons for biodiversity loss.	PSO - 1	Ap

UNIT I:

Lithosphere: Geogenic and anthropogenic sources of environmental degradations, causes and their impacts, Soil degradation and desertification. Impact of quarrying.

UNIT II:

Hydrosphere: Importance of wetlands. Eutrophication; Point and non-point source of water pollution. Impact of water pollution in fresh water (lentic and lotic) and marine ecosystem.

UNIT III:

Atmosphere: Global warming, Acid rain, PC smog, Ozone depletion and its remedial measures. Types and sources of air pollutants; emission and air quality standards, PUC and air pollution control.

UNIT IV:

Noise Pollution: Sources and impacts of Noise Pollution; management of noise pollution. Radiation Pollution: Sources, Biological impact of radiation, radioactive waste disposal.

UNIT V:

Biosphere: Loss of Biodiversity, Invasive Species and its management. Antibiotic Resistance, Infectious Disease and Pandemic, Deforestation, Revival of Mother Nature through eco restoration, education, awareness and training activities.

Text Book:

1. Frances, H. (2012). *Global Environmental Issues*. (2nd ed.). New York: Willey-Blackwell and Sons.

Reference Books:

1. Mahesh Rangarajan, (2007). *Environmental Issues in India: A Reader*. New Delhi: Pearson-Longman Publishers.
3. Adger, N. Brown, K. and Conway, D. (2012). *Global Environmental Change: Understanding the Human Dimensions*. Washington DC: The National Academic Press.
4. Turekian, K. K. (1996). *Global Environmental Change-Past, Present, and Future*. New Jersey: Prentice-Hall

Web Links

<https://www.conserve-energy-future.com/15-current-environmental-problems.php>

<https://www.env.go.jp/en/wpaper/2002/08.pdf>

<https://www.econstor.eu/bitstream/10419/49556/1/258288639.pdf>