

DEPARTMENT OF BOTANY



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)

PO No.	Upon completion of M.Sc. Degree Programme, the graduates will be able to :
PEO1	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.
PEO2	The graduates pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.
PEO3	The graduates will develop strong and competent knowledge with diversified professional skills in accordance with dynamic real – time challenges and career opportunities.

Programme Outcomes (POs)

PO No.	Upon completion of M.Sc. Degree Programme, the graduates will be able to :
PO – 1	carry out internship programmes and research projects to develop scientific skills and innovative ideas
PO – 2	analyse complex problems, think independently, formulate and perform quality research
PO – 3	become successful professionals and entrepreneurs
PO – 4	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe
PO – 5	emerge as expressive, ethical and responsive citizens with proven expertise
PO – 6	utilize the obtained scientific knowledge to create eco- friendly environment

Programme Specific Outcomes (PSOs)

PSO No.	Upon completion of M.Sc. Degree Programme, the graduates of Botany will be able to:	PO Addressed
PSO – 1	apply fundamental mathematical tools and physical principles in analysing biological situations	PO – 2
PSO – 2	evaluate ecological interconnectedness of life on earth	PO – 4, 6
PSO - 3	experience in seeking external funds for their research from a diversity of resources	PO – 1, 2
PSO – 4	apply the acquired conceptual knowledge by connecting disciplinary and interdisciplinary aspects of Botany	PO – 4
PSO – 5	integrate the knowledge of botany for global sustainable development	PO – 3, 4
PSO – 6	understand the professional, ethical, legal and social issues related to gender	PO – 3, 5

Eligibility Norms for Admission

A pass in the B.Sc. or equivalent examination as per the norms of Manonmaniam Sundaranar University, Tirunelveli with Botany as major with the minimum of 50%. For SC/ST candidates, a pass in B.Sc. Botany is sufficient.

Duration of the Programme: 2 Years

Medium of Instruction: English

Passing Minimum

A minimum of 50% in the external examination and an aggregate of minimum 50% is required. There is no minimum pass mark for the continuous internal assessment.

Components of M.Sc. Botany Programme

Paper		Total Marks
Major Core Theory (3+3+2+3)	11 x 100	1100
Major Core Practical	4 x 100	400
Major Electives (Theory Papers)	4 x 100	400
Major Project	1 x 100	100
Total Marks		2000

Course Structure

Distribution of Hours and Credits

Course	Sem. I	Sem. II	Sem. III	Sem. IV	Total	
					Hours	Credits
Major Core - Theory	6 (5) + 6 (5) + 6 (5)	6 (5) + 6 (5) + 6 (5)	6 (5) + 6 (5)	6 (5) + 6 (5) + 6 (5)	66	55
Major Core -	2+2+2 (-)	2+2+2 (3+3)	3+3 (-)	2+2+2 (3+3)	24	12
Major Elective	6 (4)	6 (5)	6 (4)	6 (5)	24	18
Major Project	-	-	6 (5)	-	6	5
Total	30 (19)	30 (26)	30 (19)	30 (26)	120	90
Non – Academic Courses						
Life Skill Training - I	-	(1)				1
Life Skill Training - II	-	-	-	(1)	-	1
Service Learning Programme (SLP) – Community Engagement Course	-	-	(2)	-	-	2
Summer Training Programme	-	-		(1)	-	1

Total number of Hours : 120

Mandatory Credits required: 90+5

- Non-Academic Courses are mandatory and conducted outside the regular working hours
- **SLP (Service-Learning Programme) - Community Engagement Course is conducted** outside the regular working hours on Saturdays and holidays (UBA) for all the students.
No. of hours allotted for each of this programme is 30 and is supervised by the faculty in charge
- **STP (Summer Training Programme)** (Mandatory Course - 30 hours) at the end of Semester II.

Courses offered

Semester	Course Code	Title of the Course	Hours/Week	Credits
I	PB2011	Core I - Plant Diversity I – Algae, Fungi, Lichens and Bryophytes	6	5
	PB2012	Core II – Microbiology	6	5
	PB2013	Core III – Plant Anatomy & Embryology	6	5
	PB2014 PB2015	Elective I – (a) Marine Biology / (b) Organic Farming	6	4
	PB20P1	Practical I - Plant Diversity I – Algae, Fungi, Lichens and Bryophytes, Microbiology and Plant Anatomy & Embryology	6	-
	LST201	Life Skill Training (LST) – I	-	-
II	PB2021	Core IV – Plant Diversity II - Pteridophyta, Gymnosperms and Palaeobotany	6	5
	PB2022	Core V – Research Methodology	6	5
	PB2023	Core VI – Cell Biology and Biomolecules	6	5
	PB2024 PB2025	Elective II – (a) Herbalism / (b) Evolutionary Biology	6	5
	PB20P1	Practical I - Plant Diversity I – Algae, Fungi, Lichens and Bryophytes, Microbiology and Plant Anatomy & Embryology	-	3
	PB20P2	Practical II - Plant Diversity II- Pteridophyta, Gymnosperms and Palaeobotany, Research Methodology and Cell Biology and Biomolecules	6	3
	LST201	Life Skill Training (LST) – I	-	1
	SLP201	Service Learning Programme (SLP) - Community Engagement Course		-
	STP201	Summer Training Programme	-	1
III	PB2031	Core VII - Taxonomy of Angiosperms	6	5
	PB2032	Core VIII – Genetics and Molecular Biology	6	5
	PB2033	Elective III – (a) Horticulture	6	4
	PB2034	(b) Forestry		
	PB20P3	Practical III - Taxonomy of Angiosperms & Genetics and Molecular Biology.	6	-
	PB20PR	Project	6	5
	LST202	Life Skill Training (LST) – II	-	-
	SLP201	Service Learning Programme (SLP) - Community Engagement Course	-	2
IV	PB2041	Core IX - Plant Physiology	6	5

	PB2042	Core X – Plant Ecology and Phytogeography	6	5
	PB2043	Core XI – Biotechnology & Bioinformatics	6	5
	PB2044	Elective IV – (a) Phytochemistry and Pharmacognosy	6	5
	PB2045	(b) Entrepreneurial Botany		
	PB20P3	Practical III - Taxonomy of Angiosperms & Genetics and Molecular Biology.	-	3
	PB20P4	Practical IV - Plant Physiology, Plant Ecology and Phytogeography and Biotechnology & Bioinformatics	6	3
	LST202	Life Skill Training (LST) – II	-	1
		TOTAL	120	90+5

Self Learning Courses – Extra Credit Course

Semester	Course Code	Title of the Course	Hours/ Week	Credits
III	PB20S1	Biology for Competitive Exam – I	-	2
IV	PB20S2	Biology for Competitive Exam – II	-	2
II - IV		Online Course MOOC – SWAYAM / NPTEL	-	2

Instruction for Course Transaction Theory (Major Core / Elective) paper hours

Components	Sem. I	Sem. II	Sem. III	Sem. IV
Lecture hours	70	70	70	70
Continuous Internal Assessment Internal Test (2)	5	5	5	5
Quiz (2)	1	1	1	1
Class Test	2	2	2	2
Class Assignment / Group Discussion / Problem Solving / Open Book Test / Book or Article Review	2	2	2	2
Seminar	10	10	10	10
Total hours	90	90	90	90

Examination Pattern: Allotment of Marks for PG Programme

Ratio of Internal and External

a) Core/Elective: 40:60

Internal Components	Marks
Internal Test (2)	20
Seminar	4
Class test (2)	4
Quiz (2)	4
Open book test/ Problem solving/ Book review/ Article review/ Group Discussion	4
Online home assignment	4
Total	40

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 5x3 (Internal Choice)	15
Part C 3x8 (Internal Choice)	24	Part C 5x7 (Internal Choice)	35
Total	40	Total	60

(b) Practical 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

c) Project

Ratio of Internal and External 40 : 60

Internal (Supervisor)	Marks
I Review	10
II Review	10
Report	20
External (External Examiner)	
Report	40
Viva-voce (individual, open viva-voce)	20
Total	100

d) Life Skill Training- I (I Year)

Internal Component

Component	Marks
Album (20 pages)	40
Group Song, Mime, Skit(Group of 5 students)	20
Total	60

External Component

Course	Summative Examinations	Marks
Life Skill Training- I	Written exam Part A 5x8 = 40 marks (Any 5 out of 7 questions)	40
	Total	40

Life Skill Training- II (II Year)

Internal Component

Component	Marks
Case Study (30 page)	60
Total	60

External Component

Course	Summative Examinations	Marks
Life Skill Training- II	Written exam Part A 5x8 = 40 marks (Any 5 out of 7 questions)	40
	Total	40

Community Engagement Programme

SLP Extension Activity (II & III Sem)

Courses / Programmes conducted outside the regular working hours on Saturdays and holidays. No. of hours allotted for each of these programmes is 30 and is supervised by the faculty incharge.

[Field work (15hrs); Class hours (15 hrs); Total 30 hrs]

Internal Components

Component	Marks
Assignment	10
Group Discussion	10
Attendance (Field Work)	30
Total	50

External Components

Course	Summative Examinations	Marks
Community Engagement Programme	Project Report / Case study (10 – 15 pages in print)	50
	Total	50

Self Learning Courses

Internal Test	Marks	External Exam	Marks
Part A 10x1 (Objective)	10	Part A 20x1 (Objective)	20
Part B 5x2 (Objective)	10	Part B 10x2 (Objective)	10
Part C 5x4 (High Order Thinking-Objective)	20	Part C 5x4 (High Order Thinking-Objective)	20
Total	40	Total	60

Semester I
Plant Diversity I - Algae, Fungi, Lichens and Bryophytes
Sub. Code: PB2011

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To understand the diversity, life cycle patterns and major evolutionary trends of algae, fungi, lichens and bryophytes.
2. To comprehend the economic importance of the major groups.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	remember the basic concepts of plant diversity	PSO – 4	R
CO - 2	understand the morphological diversity of thallophytes	PSO – 3	U
CO - 3	evaluate the life history of different thallophytic members	PSO – 2	E
CO - 4	analyze the thallophytes found in water bodies	PSO – 2	An
CO - 5	create a protocol to assess the role of thallophytes with industrial applications	PSO – 3	C
CO - 6	apply the knowledge attained from evolutionary aspects of plant diversity towards research	PSO – 6	Ap

Unit I

General characters of algae including similarities and diversities; Classification of algae by Fritsch (1954); Thallus organization in algae; Life-cycle patterns and alternation of generations. Detailed study on occurrence, habitat, structure, reproduction and life history of Cyanophyceae and Chlorophyceae.

Unit II

Detailed study on occurrence, habitat, structure, reproduction and life-history of Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae, Fossil algae; Economic importance - Role of algae in soil fertility; Algal blooms; symbiotic associations; nitrogen fixation; Pollution indicators; SCP.

Unit III

General characters of fungi; Classification of fungi proposed by **C.J Alexopoulos and C.W Mims (1979)**; Homothallism and Heterothallism in fungi; Parasexuality in fungi; An overview and life history of Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes. Economic importance of fungi.

Unit IV

General account of Lichens; Classification by Miller (1984); Structure, nutrition and reproduction of the three major groups – Crustose, Foliose and Fruticose; Economic importance of Lichens.

Unit V

Classification, Distribution, Origin (including fossil evidence), Primitive and advanced features of Bryophytes; Evolution of gametophytes and sporophytes; Ecological adaptations; Economic importance. A comparative study of the morphological and anatomical features of Polytrichales, Bryales, Marchantiales, Jungermanniales and Anthocerotales.

Reference Books:

1. Bilgrami, K.S., & Sinha, L.B. (2004). *A Text Book of Algae*. New Delhi: CBS Publication and Distributors.
2. Cavers, F. (1988). *The Interrelationships of the Bryophyta*. New Delhi: Technico Publishing Pvt. Ltd.
3. Chapman, V.J., & Chapman, D.J. (1960). *The Algae*. London: Elbs and Macmillian Pvt. Ltd.
4. Chopra, R.N., & Kumar, P.K. (2004). *Biology of Bryophytes*. London: Wiley Eastern Ltd.
5. Fritsch, F.E. (1972). *The Structure and Reproduction of Algae*. Vol I and II, London: Cambridge University Press.
6. Kumar, H.D. (2004). *Introductory Phycology*. New Delhi: Affiliated East Press.
7. Peter George. (2010). *Hand Book of Bryophyta*. New Delhi: Rajat Publications.
8. Prem Puri, P. (1981). *Bryophytes*. New Delhi: Atma Ram and Sons Publishing Company.
9. Rashid, A. (1999). *An Introduction to Bryophyta*. New Delhi: Vikas Publishing House Pvt. Ltd.
10. Robert Edward Lee, T. (2008). *Phycology*. London: Cambridge University Press.
11. Sharma, O.P. (1986). *Text Book of Algae*. New Delhi: Tata McGraw Hill Publishing Co.
12. Vashishta, B.R., Sinha, A.K., & Singh, V.P. (1960). *Algae*. New Delhi: Chand and Company Ltd.

Semester I
Microbiology
Sub. Code: PB2012

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To provide an understanding of microorganisms and the role they play in health and disease.
2. To understand the role of pathogens on selected economically important plants.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the basic concepts of microbiology and immunology	PSO – 1	U
CO - 2	remember the classification and nomenclature of microorganisms and plant diseases	PSO – 4	R
CO - 3	apply modern techniques to detect antigen, antibodies, pathogens and its controlling measures	PSO –5	Ap
CO - 4	evaluate the role of antimicrobial drugs and its resistance	PSO – 5	E
CO - 5	analyze the microbes present in milk, water, soil and plants	PSO – 4	An
CO - 6	create a protocol for identification of gram positive and gram negative bacteria	PSO - 3	C

Unit I

Scope and milestones of Microbiology: General properties of bacteria; Morphology and fine structure of Bacteria; Classification of bacteria as per Bergey's Manual of Systematic Bacteriology; Bacterial Nutrition; Bacterial Growth curve; Sterilization and disinfection; Culture media and its types; Methods of isolation - Pure culture; Identification of bacteria.

Unit II

General properties of viruses; Classification and nomenclature; Structure of virus; Cultivation of virus; Morphology of bacteriophages; life cycle – Lytic cycle and Lysogenic cycle; General properties of Actinomycetes and Mycoplasma; General characteristics of antimicrobial drugs; Antibacterial drugs – Sulfonamides, Penicillins; Drug resistance.

Unit III

Microbial flora of soil - Significance of soil microorganisms. Microbial flora of municipal water and its Purification; Bacteriological examination of drinking water; Microbial flora of milk - Pasteurization of milk - Phosphatase Tests for grading milk sample; Food spoilage by bacteria – *Clostridium botulinum*, *Salmonella* sps, *Shigella* sps, *Staphylococcus* sps.

Unit IV

Immunity – Definition and its types; Properties of Antigens; Antibodies – Basic structure and its types; Strength of Antigen - Antibody interactions; Agglutination reactions; Precipitation reactions; Cytokines - Properties and attributes; Monoclonal antibody production; Immunodiffusion; ELISA; Immune response during bacterial (Tuberculosis), parasitic (Malaria) and viral (HIV) infections.

Unit V

Classification of plant diseases - Symptoms - Infection process - Host parasite interaction - Defense mechanisms in plants; Disease control methods - Physical, chemical, Cultural and Biological - Integrated disease management. Detailed study of the plant diseases- Citrus canker, White rust disease, Blast of rice, Red rot of Sugarcane, Little leaf of Brinjal.

Reference Books:

1. Sharma, P.D. (2000). *Microbiology and Plant Pathology*. Meerut: Rastogi Company.
2. Singh, R.S. (1988). *Introduction to Principles of Plant Pathology*. New Delhi: Oxford IBH Publishing Company.
3. Dubey, R.C., & Maheswari, D.K. (2000). *A Text book of Microbiology*. New Delhi: S. Chand and Co. Ltd.
4. Prescott, P., Harley, H., & Klein, K., (2003). *Microbiology*. New York, NY: McGraw Hill Publishers.
5. Rangaswami, G. (1988). *Diseases of Crop Plants in India*. Delhi: Prentice Hall of India Pvt. Ltd.
6. Michael J. Pelczar, J.R., Chan, E.C.S., & Noel R. Krieg. (1998). *Microbiology*. New Delhi: Tata McGraw Hill Publishing Company.
7. Ananthanarayan, R., & Jayaram Paniker, C.K. (2005). *Textbook of Microbiology*. Hyderabad: Orient Longman Publication.
8. Gerard, J., Tortora, A., Berdell, R., Funke, M., & Christine Case, L. (2002). *Microbiology: An Introduction* (8th Ed.). New York, NY: Pearson Education, Inc.
9. Lansing, M., Prescott John, P., Harley, L., & Donald A Klein. (1999). *Microbiology* (4th ed.). New York, NY: McGraw Hill International Editions.

Semester I
Plant Anatomy & Embryology
Sub. Code: PB2013

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To understand the characteristics of specialized cells and their components.
2. To impart an insight about the process of anomalous secondary growth of plants.
3. To imbibe knowledge regarding the secret of seed development.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the characteristics of specialized cells and their components	PSO – 4	U
CO - 2	remember the knowledge of plant cells , tissues and functional theories	PSO – 5	R
CO - 3	analyze the structural differences among different taxa of vascular plants	PSO – 3	An
CO - 4	apply the knowledge of anatomical studies in different field	PSO – 1	Ap
CO - 5	evaluate the nature and secret of seed development	PSO – 2	E

Unit I

Introduction to Developmental Botany- Nuclear- Cytoplasmic interaction- Division- Differentiation- Polarity and Symmetry, organization of Shoot Apical Meristem (SAM) and Root Apical Meristem (RAM); vascular cambium- origin, structure and seasonal activity.

Unit II

Xylem, Phloem and their elements- primary and secondary structures, phylogenetic trends and specialization of xylem and phloem. Secondary growth- Periderm- structure- development of lenticels, Anomalous secondary growth- Bougainvillea, Bignonia, Achyranthes and Dracaena.

Unit III

Wood anatomy- physical, chemical and mechanical properties. Defects in wood- natural defects, knots and defects due to diseases. Reaction wood- Tension and Compression wood- Durability of wood. Ontogeny of dicot and monocot leaves. Differentiation of epidermis with special reference to stomata and trichomes.

Unit IV

Microsporogenesis- Pollen morphology- pollen wall- pollen development- pollen dimorphism- pollen storage, pollen allergy. Microsporogenesis- Pollen- Pistil interaction- structure of style- stigma and significance. Megasporogenesis. Different types of embryo sac development- fertilization- barriers of fertilization- self- incompatibility- types, physiology and biochemistry, methods to overcome self-incompatibility.

Unit V

Fertilization- changes, physiological and biochemical changes during maturation. Seed- seed coat development and specialization. Endosperm- types- haustoria. Embryogenesis and organogenesis of dicot and monocot embryos- Apomixis- Polyembryony- parthenocarpy.

Reference Books:

1. Bhojwani, S.S., & Bhatnagar, S.P. (2000). *The Embryology of Angiosperms*. New Delhi: Vikas publishing House.
2. Davis, C.L., & John Willey. (1965). *Systematic embryology of Angiosperms*. New Delhi.
3. Erdtman, G. (1969). *Hand book of Palynology*. New York, NY: Hafuer Publication Co.
4. James, A.J. (1960). *Morphology of Angiosperms*. New York, NY: McGraw Hill Publishing Company Ltd.
5. Maheswari, A. (1950). *An Introduction to the Embryology of Angiosperm*. New York, NY: McGraw Hill Publishers.
6. Nair, P.K.K. (1970). *Pollen Morphology of Angiosperms*. Delhi: Scholar Publication, London and Vikas Publication.
7. Lars Hennig, A., & Claudia Kohler, K. (2011). *Plant Developmental Biology: Methods and Protocols*. London: Humana Press.
8. Paul, M., Wassarman., & Elsevier. (2016). *Essays on Developmental Biology*. New York, NY: McGraw Hill Publishing Company Ltd.

Semester I
Marine Biology (Elective I)
Sub. Code: PB2014

No. of hours per week	Credit	Total no. of hours	Marks
6	4	90	100

Objectives:

1. To make the students realize the potentiality of marine environment.
2. To create an awareness among the students, about the usage of different marine products.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Understand the basic characteristics and biological processes of marine habitat	PSO – 4	U
CO – 2	remember the diversity of marine habitat	PSO – 2	R
CO – 3	create a protocol for producing useful products by cultivating marine organisms	PSO – 3	C
CO – 4	analyse the different types of pollution in marine environment	PSO – 2	An
CO – 5	apply different techniques to identify bioactive compounds	PSO – 4	Ap
CO – 6	evaluate the inter-relationships of mangroves, sea grasses, corals and salt marsh plants	PSO – 2	E

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. Characteristics of marine habitat – physical parameters – temperature, illumination, specific gravity, pressure and buoyancy, ocean current. Chemical constituents – major and minor constituents, deep sea nodules. Plate tectonics – earthquakes and tsunami.

Unit II

Marine biodiversity – phytoplankton – characteristics, sampling and measuring. Marine bacteria, marine fungi, seaweeds and sea grasses; Energy relationship – primary production, grazing food chain, detritus chain and energy balance sheet. Green house effect, Carbon pump.

Unit III

Marine products – Production and uses of Agar-agar, Alginates, Carrageenan; Marine lipids; Marine pharmacology –Bioactive compounds from marine organisms; Sea grasses – structure, reproduction and ecological roles.

Unit IV

Culture of microalgae – Open pond method, Photobioreactors, Batch culture, Continuous culture; Maintenance of culture – Stock culture and Sub culture; Commercial cultivation of seaweeds; Marine pollution – thermal pollution, oil pollution, heavy metal pollution, radioactive pollution ; Eutrophication.

Unit V

Mangroves - Structure, Reproduction and ecological roles; Present status of mangroves with special reference to Pitchavaram; Salt marsh plants – Structure, Adaptations and ecological roles; Restoration of mangroves; Coral reefs – Formation, Types, Ecology, Species interaction and economic importance.

Reference Books:

1. Cliton J Dawes. (1981). *Marine Botany*. New York, NY: Wiley - Intersciences Publication John Wiley and sons.
2. Dring, M.J., & Edward Arnold, A. (1982). *The Biology of Marine Plants*. New York, NY: John Wiley and sons.
3. Kumudranjan Naskar,D., & Rathindrandath, A. (1999). *Ecology and Biodiversity of Indian Mangroves Vol. I & II*. Delhi: Daya Publishing House.
4. Michael, P. (1986). *Ecological Methods for Field and Laboratory Investigations*. New Delhi: Tata McGraw – Hill publishing company Ltd.
5. Raymond, P. (1980). *Plankton and Productivity*. Michigan: University Press.
6. Sinha, P.C. (1998). *Marine Pollution*. New Delhi: Anmol publications Pvt. Ltd.
7. Warren, W.B. (1971). *Biology and Water Pollution Control*. London: Toronto, Saunders Company, Philadelphia.

Semester I
Organic Farming (Elective I)
Sub. Code: PB2015

No. of hours per week	Credit	Total no. of hours	Marks
6	4	90	100

Objectives:

1. To maximize ecological productive efficiency.
2. To adopt cost effective farming to bring equity of food price and wage.
3. To achieve an evergreen revolution in agriculture.

CO No.	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand the role of micro and macro nutrients in plant growth and development	PSO – 4	U
CO – 2	remember the principles of organic and ecological approaches in agriculture	PSO – 5	R
CO – 3	analyse the soil types, agricultural waste and nature of pests in fields	PSO – 4	An
CO – 4	create organic farming and gardening methods that sustain profitable production, and environmental health.	PSO – 2	C

Unit I

Soil – Profile, formation, Types, Soil fertility- micronutrients and macronutrients – functions and deficiency symptoms.

Unit II

Green manuring Definition, types of green manure- Insitu, leaf manuring, Benefits, Green Manure crops Azadiracta, Tephrosia, farming system- mulching, GM in Agroforestry

Unit III

Agricultural wastes Types – Crop residues, agro industrial waste- rice husk, bagasse, coir waste, Types of manures, Utilization of agro waste.

Unit IV

Composting - Definition, classification- Aerobic, anaerobic and vermicompost, Preparation of compost, importance of composting, factors affecting composting- oxygen, moisture, C:N ratio and temperature.

Unit V

Pest management - Physical and mechanical control, biological control, increasing the effectiveness of biological control, merits and demerits of biological control.

Reference Books:

1. Arun, K.S. (2007). *A Hand Book of Organic Farming*. Agrobios, India.
2. Trivedi, P.C. (2010). *Organic farming for sustainable agriculture*. Aavishkar, New Delhi
3. Bennett, H.H. (2004). *Soil Conservation for sustainable development*. Scientific Books suppliers. Delhi.
4. Palaniappan, S. P. (2010). *Organic farming theory and practice*. Scientific Books, New Delhi.
5. Singh, A. (2014). *Organic farming*. Pointed publishers, New Delhi.
6. Philip Stewart & Sabine Globig (2011). *Phytopathology in Plants*, Apple Academic Press.

**Semester I
Practical I
Sub. Code: PB20P1**

(Practical I - Plant Diversity I – Algae, Fungi, Lichens and Bryophytes, Microbiology and Plant Anatomy & Embryology)

Number of hours per week	Credit	Total number of hours	Marks
6	3	90	100

CO No:	Expected Learning Outcomes Upon completion of this course, the students will be able to:	PSO Addressed	CL
CO - 1	understand the thallophytes by micropreparation	PSO – 4	U
CO - 2	analyze the cryptogams on the basis of morphological characters	PSO – 1	An
CO - 3	evaluate the methodology to differentiate gram positive and gram negative bacteria	PSO – 2	E
CO - 5	apply the knowledge of anatomical studies in research	PSO – 3	Ap
CO - 6	evaluate the nature and defects of wood	PSO – 2	E

Algae:

Collection and Microscopic Identification of fresh water algae

Gleocapsa, Anabaena, Oscillatoria, Microcystis, Chlorella, Cladophora, Oedogonium

Micropreparation and specimen identification:

Caulerpa – Rhizome, *Ulva* – Thallus, *Padina* - Thallus, *Chara* – Sex organs, *Cladophora* – Sex organs, *Codium* – Thallus, *Hypnea* – Thallus, *Gelidium* – Morphology, *Dictyota* – Thallus, *Vaucheria* – Thallus and sex organs, *Turbinaria* – Receptacle.

Fungi:

Observation and study of fungi under natural habitat

Aspergillus, *Mucor*, *Penicillium*, *Peziza* - Apothecium, *Lichens* – Foliose thallus, *Fruticose- Usnea* – Thallus, Apothecium

Bryophytes:

Micropreparation and specimen identification:

Porella - Stem, *Anthoceros* - Thallus, *Plagiochasma*, *Sphagnum* – Stem, *Polytrichum* – Stem, Leaf, Sporophyte.

Microbiology

1. Sterilization of glasswares.
2. Streaking techniques.
3. Serial dilution and Pour plate method
4. Simple staining.
5. Gram's staining.
6. Indole production test.
7. Methyl red test.
8. Voges – Proskauer test.
9. Citrate utilization test.

Plant Anatomy & Embryology

1. Anatomy of epidermal hairs, trichomes, glandular hairs, tyloses, periderm, lenticels.
2. Anomalous secondary growth, root and stem of - *Bougainvillea*, *Bignonia*, *Achyranthes* and *Dracaena*
3. Leaf Anatomy – Dicot, Monocot (C4)
4. Stomatal type, stomatal index
5. Wood anatomy of some common Indian timbers such as *Mangifera indica*, *Azadirachta indica*.
6. Study on ovary, ovules and their modifications.
7. Organization of anthers and pollens, pollen wall patterns, pollen germination and pollen tube growth.

Semester I
Life Skill Training - I
Course Code: LST201

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

Objectives:

- To understand the fundamental rules of success
- To practice integrity in day to day life

CO No.	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO-1	understand the human values to lead a successful life	PSO-	U
CO-2	apply the ethics in real life situation	PSO-	A
CO-3	analyse and improve one's attitude	PSO-	Y

Unit I

Success - Success formulae.

Goals - The law of Karma, The law of clarity, and The law of flexibility.

Positive Mental Attitude - The law of optimism and self-confidence.

Unit II

Purposeful-Burning desire - The law of desire and The law of energy.

Planning and Preparation - The law of planning.

Unit III

Resources - The law of maximization - Time and its management: health, courage, strengths and weaknesses, attitude, will and skill, enthusiasm, initiative, creativity/resourcefulness/ingenuity, experience, appearance, orderliness and neatness, courtesy, politeness and manners, charisma, live life, have luck and skills.

Unit IV

Self-discipline -The law of time preference and The law of direction.

Action - The law of applied effort and The law of compensation.

Persistence.

Unit V

Prayers - The partnership with God - work with commitment towards the goal - work and prayer.

Values - to attain stability in life -Benjamin Franklin's thirteen virtues.

Text Book

Rao, C.N. (2014). 10 Fundamental Rules of Success. India: V &S Publisher.

Reference Books:

1. Bellamy, D.R. (1999). 12 Secrets for Manifesting your Vision, Inspiration and Purpose. India: Master Mind Books.
2. Iyer, S.S. (2009). Managing for Value. New Delhi: New Age International Publishers.
3. Sharma, S.P. (1999). Success Through Positive Thinking. Delhi: Pustak Mahal
4. Raj, A.S. (2015). Personality Development. Delhi: Firewall Media.

Semester II
Plant Diversity II -Pteridophyta, Gymnosperms and Palaeobotany
Sub. Code: PB2021

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To understand the diversity, life cycle and major evolutionary trends of non-flowering plants.
2. To have a broad knowledge on fossils and methods of fossilization.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the life cycle and major evolutionary trends of non – flowering plants	PSO - 1	U
CO - 2	remember, recognize and identify the non – flowering plants	PSO – 2	R
CO - 3	analyze the inter - relationship between Pteridophytes and Gymnosperms	PSO – 2	An
CO - 4	evaluate and compare the evolution of gametophytes and sporophytes of Pteridophytes	PSO – 5	E
CO - 5	apply the knowledge attained from evolutionary aspects of plant diversity towards research	PSO – 3	Ap
CO - 6	create methods to extract, prepare, preserve and catalogue fossils	PSO – 3	C

Unit I

Origin and evolution of vascular plants; Stelar evolution; Telome theory; Apogamy and apospory; Economic importance of Pteridophytes. Classification of pteridophytes by G.M.Smith

Unit II

Range of thallus structure, reproduction and evolution of gametophytes and sporophytes of the following orders: *Psilotales*, *Lycopodiales*, *Selaginellales*, *Isoetales*, *Equisetales*.

Unit III

Ophioglossales, *Osmundales*, *Filicales* and *Salviniales*. Sporangial development - Eusporangiate and Leptosporangiate types, heterospory and origin of seed habit and soral evolution.

Unit IV

Affinities and evolution of gymnosperms; Classification of gymnosperms (K.R. Sporne, 1965); General characters - morphological, reproductive characters, phylogeny and interrelationship of the orders - *Cycadales*, *Ginkgoales*, *Coniferales* and *Gnetales*.

Unit V

Geological time scale; Methods of fossilization and determination of the geological age of fossils, carbon dating. A brief study of the following fossil Pteridophytes: *Rhynia*, *Lepidodendron*, *Sphenophyllum* and *Calamites*. A brief study of the following fossil Gymnosperms: *Lyginopteris*, *Cycadoidea*, *Pentaxylon* and *Cordaitea*.

Reference Books:

1. Johri, R.M., Sneha Lata., & Kavita Tyagi. (2012). *Text Book of Gymnosperms*. New Delhi: Wisdom Press.
2. Ernest., Gifford., Foster. (1996). *Morphology and Evolution of Vascular Plants*. New York, NY: W.H. Freeman and Company.
3. Meyan, V. (1987). *Fundamentals of Palaeobotany*. London: Chapman and Hall.
4. Rashid, A. (1985). *An Introduction to Pteridophyta*. New Delhi: Vikas Publishing House Pvt. Ltd.
5. Shukla, A.C., & Misra, S.P. (1982). *Essentials of Palaeobotany*. New Delhi: Vikas Publishing House Pvt. Ltd.
6. Sundara Rajan, S. (2009). *Introduction to Pteridophyta*. New Delhi: New Age International Publishers.
7. Vashishta, B.R., Sinha, A.K., & Kumar. (2005). *Botany for Degree Students – Pteridophyta*. New Delhi: Chand and Co.
8. Vashishta, P.C., Sinha, A.K., & Anil Kumar. (2007). *Botany for Degree Students: Gymnosperms*. New Delhi: S. Chand and Co.

Semester - II
Research Methodology
Sub. Code: PB2022

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To understand some basic concepts of research and its methodologies.
2. To select and define appropriate research problem and parameters.
3. To organize and conduct research in a more appropriate manner and write a research report and thesis.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	remember the basic concepts of research and its methodologies	PSO – 4	R
CO - 2	understand the principles and working mechanisms of various instruments	PSO – 5	U
CO - 3	apply computer skills in research	PSO – 3	Ap
CO - 4	analyze the biological data in solving biological problems	PSO –1	An
CO - 5	create skills in qualitative and quantitative data analysis and presentation	PSO – 3	C

Unit I

Research- Objectives of research, Types of research, Significance, Literature collection- Index card, reference card and Abstract card. Literature citation- Different systems of citing references- Name year system, Citation sequence system and Alphabet number system. Research report, components of a project report, tables, figures, foot note, thesis format, journal format- appendices, e- journal and e- book. Role of supervisors/ Guides in research.

Unit II

Microscopy – Principle, Instrumentation and uses of Light Microscope, Dark–Field Microscope, Phase contrast Microscope, Fluorescent Microscope, Electron Microscope – SEM and TEM, Confocal Microscope; Micrometry; Photomicrometry.

Unit III

Spectrophotometer- Principle, Instrumentation and uses of UV–Vis Spectrometry, Atomic Adsorption Spectrometry, Nuclear Magnetic Resonance Spectrometry, Flame Photometer. Chromatography – Affinity Chromatography, Ion exchange chromatography and High Performance Liquid Chromatography.

Unit IV

Centrifugation – Principles of sedimentation, Types of rotors, Differential centrifugation, Density gradient centrifugation, Ultracentrifuge. Electrophoresis – Agarose gel electrophoresis (AGE), Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE). PCR – Principle and technique. Cryobiology – Lyophilization and its application in Biology.

Unit V

Data collection and Analysis of data– Mean, Medium, Mode, Standard deviation, Standard error, Student ‘T’ test, Chi – square test, Correlation, Regression, ANOVA, SPSS.

Reference Books:

1. Jayaraman, J. (1972). *Techniques in Biology*. Madras: Higginbothams Pvt. Ltd.
2. Khan, I. A., & Khannum, A. (1994). *Fundamentals of Biostatistics*. Hyderabad: Vikas Publishing.
3. Khan, J.A. (2008). *Research Methodology*. New Delhi: A.P.H Publishing Corporation.
4. Kothari, C.R. (2004). *Methodology: Methods and Techniques*. Research New Age International Publishers Ltd.
5. Kothari, C. R. (1991). *Research Methodology: Methods and Techniques*. New Delhi: Wiley Eastern Ltd.
6. Michael T. Madigan., John M. Martinko., & Jack Parker. (2003). *Brock Biology of Microorganisms* (10th ed.). USA: Pearson Education International.
7. Ranjit Kumar, A. (2011). *Research Methodology: a step by step guide by beginners* (3rd ed.). London: SAGE Publications Ltd.
8. Sree Ramulu, V. S. (1988). *Thesis Writing*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
9. Thomas, A. Scruggs., & Margo, A. (2006). *Mastropiere, Applications of Research Methodology*. London: Elsevier Ltd., JAI Press.

Semester II
Cell Biology and Biomolecules
Sub. Code: PB2023

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To enable the students to know about the different biomolecules and their functions.
2. To understand the basic principles and concepts of thermodynamics.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the diversity of cells and the role of compartmentalization and cell signaling	PSO - 4	U
CO - 2	remember the role of inorganic and organic molecules to life	PSO –2	R
CO - 4	understand the structure and functions of different biomolecules	PSO –4	U
CO - 5	apply the basic principles and concepts of enzyme regulation	PSO – 5	Ap
CO - 6	analyze the modern techniques in cellular biology	PSO – 3	An

Unit I

Cell Type: History and origin. Prokaryotic and Eukaryotic cell. Difference between Prokaryotic and Eukaryotic cell; Plasma Membrane: History, Ultrastructure, and chemical composition of plasma membrane (Lamellar-models, micellar models and fluid mosaic model). Functions of plasma membrane; Mitochondria: History and structure of mitochondria, biogenesis and functions of mitochondria (Respiratory chain complex and Electron transport mechanism).

Unit II

Endoplasmic Reticulum, Ribosome, Golgi Bodies: History, structure, functions and importance. Lysosomes, Centrioles, Microtubules: History, structure, functions and Importance
Nucleus: History, structure, functions and importance; Chromosomes: History, types and functions of chromosomes. Giant chromosomes, Polytene chromosome and Lamp brush chromosome; Cell Division: Mitosis (cell cycle stages, cytokinesis) Meiosis (reproductive cycle stages, synaptonemal complex, recombination nodules). Comparison between meiosis and mitosis

Unit III

Carbohydrates - structure and properties of Monosaccharides - ring structure – Oligosaccharides - sucrose and maltose, Polysaccharides – starch and cellulose; structure, classification and properties of amino acids and proteins; Denaturation and renaturation of proteins ; purification of proteins.

Unit IV

Lipids- Classification- Structure and properties- Triglycerides, compound lipids- phospholipids- cholesterol. Structure- Biosynthesis of DNA and RNA. Secondary metabolites- Alkaloids, Glycosides, Steroids and Terpenoids. Vitamins.

Unit V

Enzyme - Nomenclature and classification - IUB system – properties - Active site - Mechanism of enzyme action (Fisher's Lock and Key model and Koshland's Induced fit model) - Activation energy. Enzyme regulation - activators and inhibitors - coenzymes. Isoenzymes.

Reference Books:

1. Gupta P.K. (1997) *Cytology, Genetics and Evolution*, Rastogi Publications, Meerut.
2. Alberts, B. Bray D. Lewis J. Ralf, M. Roberts, K. and Watson, J.D., (1999). *Molecular Biology of the Cell*, Garland Publishing Inc., New York.
3. C.J. Avers. (1986). *Molecular Cell Biology*, Addison Wesley Publishing Company, New York,
4. De, D.N. (2000). *Plant Cell Vacuoles: An Introduction*, CSIRO Publication, Collingwood, Australia.
5. Kleinmith, L.J. and Kish, V.M. (1995) *Principles of Cell and Molecular Biology*, 2nd Edition, Harper Collins College Publishes, New York, USA.
6. Krishna Murthy, K.V. (2000) *Methods in Cell wall cytochemistry*, CPC Press, Boca Raton, Florida.
7. Lodish, Berk A, Zipursky, S.L. Matsdaira P, Baltimore D and Darnell, J. (2000) *Molecular Cell Biology*, 4th Edition, W.H. Freeman and Co., New York, USA.
8. Lehninger. (2008). *Principles of Biochemistry*. Delhi: CBS publishers and distributors.
9. Conn and Stumpf. (2009). *Outlines of Biochemistry* (5th ed.). New York, NY: John Wiley & Sons.
10. Pamela, C., Champe., Richard A. Harvey., Lippincott's Williams., & Wilkins. (1994). *Lippincott's Illustrated Reviews: Biochemistry* (2nd ed.). A Wolters Kluwer Company.
11. Thomas M. Devlin., WILEY – LISS. (2002). *Text book of Biochemistry with Clinical Correlations* (5th ed.). John Wiley & Sons, Inc. Publications.
12. Alexander, J., Ninfa and David P., Ballou. (1998). *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*. Maryland: Fitzgerald Science Press, Inc. Bethesda.
13. Jeremy, M., Berg., John L. Tymoczko., & Lubret Stryer. (2002). *Biochemistry* (5th ed.). New York, NY:Freeman and Compay.
14. Albert B. Hoplkin, K., Johhson, A.D.,Morgan, D, Raff, M., Roberts, K & Walter, P. (2018) *Essential Cell Biology, 5th Edn., (Paper Back)*, W.W.Norton & Company p. 864.
15. Karp G., Iwasa, J & Masall W. (2015) *Karp's Cell & Molecular Biology- Concepts & Experiments*. 8th Edn, John Wiley and Sons. p.832.
16. Hardin J. and Bertoni G. (2017) *Becker's World of the Cell*. 9th Edn (Global Edition). Pearson Education Ltd., p. 923
17. Urry L.A., Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014) *Campbell Biology in Focus*. Pearson Education. p.1080

Semester II
Herbalism (Elective II)
Sub. Code: PB2024

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To impart knowledge about different medicinal systems.
2. To learn about the extraction procedures for active principles.

CO No:	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	remember the traditional systems of medicines in terms of Siddha, Ayurvedha, and Unani	PSO – 6	R
CO - 2	understand the conservation of medicinal plants – <i>in situ</i> and <i>ex situ</i>	PSO – 5	U
CO - 3	apply the methods that extract oil from <i>Eucalyptus</i> , <i>Cymbopogon</i> , Rose, and <i>Santalum</i>	PSO - 3	Ap
CO - 4	create the protocol for extracting withanolides, hyoscyamine and vinblastine.	PSO – `1	C
CO - 5	analyze crude drugs both qualitatively and quantitatively	PSO – 4	An

Unit I

Medicinal Botany – Definition – Aim and Scope – History – Importance – Present status and future prospects of medicinal crops; Traditional systems of medicine – Siddha, Ayurveda and Unani; Conservation of Medicinal plants – in situ and ex situ; Herbal gardens; IPR.

Unit II

Study the following plants with reference to their habitat, systematic position, morphology, useful parts, cultivation of *Aloe vera*, *Ocimum sanctum*, *Zingiber officinale*, *Catharanthus roseus*, *Phyllanthus amarus*, *Emblica officinalis* and *Azadirachta indica*.

Unit III

Methods of extraction of oil in the following plants – Eucalyptus, Cymbopogan, Rose and Santalum. Extraction procedures for active principles – Withaonalides, Hyocycamine, Vinblastine.

Unit IV

Pharmacognosy – Definition, Classification of drugs – Morphological, Taxonomical, Pharmacological and Chemical; Collection and Processing of crude drugs – Antichemical, Phytochemical, Antimicrobial and Chemical.

Unit V

Screening and WHO standardization of crude drugs (WHO guidelines); Physicochemical (Ash and Extraction values); Fluorescence analysis – Qualitative and Quantitative analysis; Basic chromatographic and Spectroscopic analysis of crude drugs.

Reference Books:

1. Bhattacharjee, S.K. (2004). *Handbook on Medicinal Plants*. Jaipur: Pointer Publishers.
2. Faroqi, A. A., & Sreeramu, B.S. (2001). *Cultivation of Medicinal and Aromatic Crops*. Universities Press.
3. Joshi, S.G. (2000). *Medicinal plants*. New Delhi: Oxford and JBH Company Private Ltd.
4. Kokate, K., Purohit., & Gokhale. (1999). *Pharmacognosy*. Nirali Publications.
5. Sharma, P., & Etal, C. (2000). *Database on Medicinal Plants Used in Ayurveda*, Ministry of Health and Family Welfare.
6. Srivastava, A.K. (2006). *Medicinal Plants*. Dehradun: International Book Distributors.
7. Evans, W.C. (1997). *Pharmacognosy*. Harcourt Brace and Company Asios Pvt., Ltd.

Semester II
Evolutionary Biology (Elective II)
Sub. Code: PB2025

No. of hours per week	Credit	Total no. of hours	Marks
6	5	90	100

Objectives:

1. To provide a deeper insight into the evolutionary processes.
2. To teach students the basic methods of analysing the evolutionary relationships between species.

CO No:	Course Outcomes Upon completion of this course, students will be able to	PSO Addressed	CL
CO - 1	analyze the major genetic and ecological processes underlying evolution and selection	PSO – 2	An
CO - 2	remember the theory of evolution considering Darwinism and Modern Synthetic Theory	PSO – 4	R
CO - 3	understand the population genetic consequences of selection	PSO –5	U
CO - 4	create evolutionary hypotheses for a wide variety of biological phenomena	PSO - 1	C
CO - 5	apply evolutionary principles in research	PSO - 2	Ap

Unit I

Pre-Darwinian ideas – List of contributors influencing Darwin indicated as a timeline; Lamarckism – Merits and demerits; Darwinism – Merits and demerits; Post-Darwinian era – Modern synthetic theory; biomathematics and the theory of population genetics leading to Neo-Darwinism.

Unit II

Sources of evolution - Types of variations – Continuous and discontinuous; heritable and non-heritable. Causes, classification and contribution to evolution – Gene mutation; chromosomal aberrations; recombination and random assortment (basis of sexual reproduction); gene regulation . Concept of micro- and macro-evolution.

Unit III

Natural selection as a guiding force -attributes and action; Basic characteristics of natural selection; Colouration, camouflage and mimicry; Co-adaptation and co-evolution; Man-made causes of change – Industrial melanism, drug, pesticide, antibiotic and herbicide resistance in various organisms; Modes of selection, Polymorphism, Heterosis and Balanced lethal systems.

Unit IV

Population genetics – Gene pool; gene/allele frequency; genotypic frequency; phenotypic frequency (simple problems for calculation); Conservation of gene frequencies (when selection does not operate) ; Hardy-Weinberg's Law of Genetic Equilibrium; Alterations in gene frequency (when selection operates) ; Calculation based on Selection Coefficient and Fitness; Fluctuations in gene frequency ; Calculation based on standard deviation.

Unit V

Evolution of Plants - Origin of land plants – Terrestrial algae and Bryophytes; alternation of generations; Early vascular plants – Stelar evolution; Sporangium evolution; Phylogeny of Angiosperms ; Phylogenetic evolution a) Fossil based – Phylogeny of horse as a model. b) Molecule based – Protein model (Cytochrome C); gene model (Globin gene family).

Reference Books:

1. Hafner, M.S. (1994). *Evolution laboratory: Laboratory exercises and discussions in evolutionary biology*. Baton Rouge, LA: Louisiana State University.
2. Hall, B. K. and Hallgrimson, B. (2008) Strickberger's Evolution. IV Edn. Jones and Barlett
3. Zimmer, C. and Emlen, D. J. (2013). *Evolution: Making Sense of Life*. Roberts & Co.
4. Futuyma, D. (1998). *Evolutionary Biology*. III Edn. Sinauer Assoc. Inc.
5. Barton, Briggs, Eisen, Goldstein and Patel. (2007) *Evolution*. Cold Spring Harbor Laboratory Press.
6. Herron, J. C., and S. Freeman. (2014). *Evolutionary Analysis*, 5th edition. Pearson Education, Boston, USA.
7. Kardong, K.V. (2005). *An Introduction to Biological Evolution*. 1st Edition. 322 pp. McGraw-Hill Publishers.
8. Minkoff, E. C. (1983). *Evolutionary biology*. Reading, MA: Addison-Wesley Publishing Company.
9. Hartl, D. L. (1988). *A primer of population genetics* (2nd edition). Sunderland, MA: Sinauer Associates.

**Semester II
Practical II
Sub. Code: PB20P2**

**(Practical II - Plant Diversity II- Pteridophyta, Gymnosperms and Palaeobotany, Research
Methodology and Cell Biology and Biomolecules)**

Number of hours per week	Credit	Total number of hours	Marks
6	3	90	100

CO No:	Expected Learning Outcomes Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	understand vascular cryptogams by micropreparation	PSO –4	U
CO - 2	analyse Pteridophytes and Gymnosperms based on their anatomical features	PSO – 2	An
CO - 4	evaluate macromolecules in biological samples	PSO – 3	E
CO – 5	analyze different biological data using biostatistics	PSO –1	An

Pteridophyta:

Micropreparation and specimen identification:

Psilotum - Synangium, *Lycopodium* – Cone, *Selaginella* – Cone, *Pteris* – rachis, sporophyll,
Pteridium - rachis *Adiantum* – rachis, sporophyll,, *Gleichenia* - rachis, *Marsilea* –Sporocarp,
Azolla – Habit, *Salvinia* –Habit, *Isoetes* – Root, Sporophyll,

Gymnosperms

Anatomy and wood structures of *Gnetum* – Leaf, Stem, *Araucaria* - Stem,Cone *Cupressus* –
Cone, *Podocarpus* - Cone, *Ovule*, *Cryptomeria* – stem, cone

Research Methodology

1. Problems in Biostatistics
2. Thin Layer Chromatography
3. Microtome
4. Photomicrography
5. Gel moulding in Agarose gel electrophoresis.
6. Visiting different laboratories and report submission.

Cell Biology and Biomolecules

1. Make acetocarmine squash preparation of onion root tip and to identify different stages of Mitosis
2. Make squash preparation of flower buds of Rheo to identify different stages of Meiosis
3. Determination of pKa value of acetic acid
4. Determination of isoelectric point of amino acid
5. Estimation of protein
6. Estimation of free amino acid
7. Separation and determination of Rf value of aminoacid.
8. Determination of saponification value of oil
9. Determination of Km value – Nitrate reductase

Semester II
Life Skill Training - II
Course Code: LST201

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

Objectives:

- To understand the fundamental rules of success
- To practice integrity in day to day life

Course Outcomes (COs)

CO No.	<i>Upon completion of this course, the students will be able to:</i>	Cognitive Level
CO-1	understand the importance of soft skills	U
CO-2	apply the tools and techniques for effective communication	A
CO-3	analyse and improve mental health	Y

Unit I

Soft and Hard Skills - significance of soft skills.

Communication Skills - Types of communication - elements of communication - constituents of communication - characteristics of effective communication.

Unit II

Body Language - Body language interpretation - tips for better body language.

Interpersonal Skills - Tools for effective conversation and building interpersonal skills.

Unit III

Listening Skills - Listening types - tips for listening - listening and leadership.

Soft Skills and Johari Window - Johari windows - advantages of Johari window.

Unit IV

Change Management - Change Vs Zones - tips for managing change.

Stress Management - Types, causes of stress, symptoms of stress and tackling stress.

Unit V

Motivation - Types of motivation - Hierarchy of needs - tips for motivation.

Time Management - Pareto's principle - tools and techniques for time management.

(Compilation will be provided to the students)

Reference Books:

1. Melgosa, J. (2013). Positive Mind. (3rd ed.). Spain: Safeliz.
2. Shukla, A. (2010). The 4-Lane Expressway to Stress Management. New Delhi: Unicorn Books.
3. Pease, A. (1990). Body Language. India: Sudha Publications Pvt. Ltd.

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	Rural household economy, its challenges and possible pathways to address them	- Field visit** - Group discussions in class -Assignment	3 4

		entrepreneurs, rural markets			1
3	Rural Institutions	Traditional rural organisations, Self-help Groups, Panchayatiraj institutions (Gram Sabha, Gram Panchayat, 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 - Field visit** - Group presentation of assignment	2 4 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 - Each student select one program for field visit** Written assignment	2 4 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 VII - Taxonomy of Angiosperms

Course Code: PB2031

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

- To be familiar in identifying the botanical name of plants.
- To enable the students to get knowledge of modern trends in taxonomy of Angiosperms.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	differentiate between natural and artificial system of classification	PSO – 2	U
CO - 2	apply sketches to identify the flora	PSO – 5	Ap
CO - 3	collect and prepare herbaria for future use	PSO – 4	C
CO - 4	record the rules and regulations framed by ICBN	PSO – 2	R
CO - 5	interpreting biological knowledge in comparing and ranking plants	PSO – 3	An
CO - 6	evaluation of plants by using dichotomous keys	PSO – 5	E

Unit I

Aim and scope of plant taxonomy – Taxonomic Tools: Taxonomic literatures – floras, revisions, manuals, monographs and check lists; Identification and preparation of intended keys and bracketed keys; Herbarium techniques – Types and functions of herbarium; Digital Herbarium. Systems of angiosperm classification; Linnaeus, Bentham and Hooker and Engler and Prantle; APG Classification. Merits and demerits of these classifications.

Unit II

Botanical nomenclature – ICN, Principles and Role of ICN, Rules – principle of priority,

rejection of names, limitations in the principle of priority, typification, author citation, effective and valid publications; Taxonomical Evidences - Numerical taxonomy, chemotaxonomy, cytotaxonomy, and phytotaxonomy; Molecular tools used in Taxonomy.

Unit III

Systematic position, diagnostic features, distribution, description and economic importance of Capparidaceae, Polygalaceae, Caryophyllaceae, Tiliaceae, Zygophyllaceae.

Unit IV

Systematic position, diagnostic features, distribution, description and economic importance of Rhamnaceae, Sapindaceae, Passifloraceae, Sapotaceae, Oleaceae, Boraginaceae, Scrophulariaceae, Bignoniaceae.

Unit V

Systematic position, diagnostic features, distribution, description and economic importance of Verbenaceae, Nyctaginaceae, Aristalochiaceae, Casuarinaceae, Orchidaceae, Commelinaceae, Araceae, Cyperaceae.

Reference Books

1. Davis, P.H. and V.M. Heywood. (1983). *Principles of Angiosperms Taxonomy*. London: Olive and Byod Publishers.
2. Gurcharan Singh. (2004). *Plant Systematics*. New Delhi: Oxford & IBH Publishing Company Ltd.
3. Nair, R. (2010). *Taxonomy of Angiosperms*. Hyderabad: A.P.H. Publishing Corporation.
4. Pandey, B.P. (2004). *Taxonomy of Angiosperms*. New Delhi: S. Chand and Company.
5. Sambamurty A. V. S. S. (2005). *Taxonomy of Angiosperms*. New Delhi: I.K. International Pvt. Ltd.
6. Sharma O.P. (1996). *Plant Taxonomy*. New Delhi: Tata McGraw Hill Publishing Company Limited.
7. Sivaraman V.V. (1996). *Introduction to the principles of Plant Taxonomy*. New Delhi: Oxford and IBH Publishing Company Limited.
8. Vahishta P.C. (1989). *Taxonomy of Angiosperms*, New Delhi: S. Chand and Co.

Semester - III

Major Core VIII – Genetics and Molecular Biology

Course Code: PB2032

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To understand the organization and regulation of genes.
2. To acquire advanced training with opportunities to get employability in genetics and molecular biology laboratories.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the organization of cell organelles and genes	PSO – 2	U
CO - 2	differentiate between mitochondrial DNA and chloroplast DNA	PSO – 6	U
CO - 3	evaluate the dissociation and re - association kinetics of DNA	PSO – 6	An
CO - 4	construct different types of plasmids and operons	PSO – 2	C
CO - 5	analyze Transcription and Translation of Prokaryotes and Eukaryotes	PSO – 5	An
CO - 6	evaluate the problems in genetics	PSO – 6	E

Unit I

Contribution of Gregor Johann Mendel, T.H. Morgan, Karl Landsteiner; Mendel's law of heredity – Monohybrid and Dihybrid cross; Gene interaction – Dominant epistasis (12: 3:1), Recessive epistasis (9:3:4), Duplicate recessive genes (9:7), Duplicate dominant genes (15:1); Sex determination in plants - theories of sex determination; Sex linked characters; Linkage and crossing over, construction of chromosome map, and three point cross.

Unit II

Mutation – Types of mutation, molecular mechanism of mutation. DNA- types (A, B, C & Z), Watson and Crick model of DNA, viral DNA, bacterial DNA, Mitochondrial and Chloroplast

DNA; T_m value and cot value; DNA replication of prokaryotes and eukaryotes; Genetic diseases – Sickle cell anaemia, Cystic fibrosis, Duchennes muscular dystrophy.

Unit III

DNA damage and repair mechanism – photo reactivation – excision repair – mismatch repair; Genetic recombination - generalised and site specific; Lysogenic and lytic cycle; Bacterial Transformation, Transduction and Conjugation. Super Vectors – Bacterial Artificial Chromosomes, Yeast Artificial Chromosome.

Unit -IV

RNA – types; Transcription - Initiation, elongation, termination, post transcriptional events; Genetic code, Wobble hypothesis; Translation – steps in translation, posttranslational modification events; Molecular tools for studying genes – northern blotting, southern blotting, western blotting, FISH.

Unit -V

Fine structure of the gene; Transposons – Tn3, Tn5; Gene regulations in Prokaryotes – lac operon, trp operon; gene regulation in Eukaryotes; Gene cloning – steps, Pros and Cons in gene cloning, Construction of genomic library; Construction of cDNA library; Gene silencing; Human Genome Project.

Reference Books

1. Benjamin Lewin. (2000). *Genes VII*. New York: Oxford University Press.
2. Bernard R. Glick and Jack J. Pasternack. (1996). *Molecular Biotechnology* (4th edition): *Principles and Manipulation of Recombinant DNA*, New Delhi: Panima Publishing Corporation.
3. Brown T.A. (2001). *Essential Molecular Biology Volume 2*. New York: Oxford University Press.
4. Brown, T.A. (2002). *Genomes* (Second Edition). New York: BIOS Scientific Publishers Ltd.
5. Edward I. Alcamo. (2001). *DNA Technology* (Second Edition). New York: Academic Press.
6. Freifelder. (1990). *Molecular Biology*. New Delhi: Narosa Publishing House.
7. Robert F. Weaver (2002). *Molecular Biology* (Second Edition). New York. McGraw Hill Higher Education.
8. Daniel L. Hartl and Elizabeth W. Jones. (2002). *Essential Genetics: A Genomics Perspective* (Third Edition). Sudbury: Jones and Bartlett Publishers.

Semester - III
Major Elective III a - Horticulture

Course Code: PB2033

Hours / Week	Credits	Total Hours	Marks
6	4	90	100

Objectives

1. To learn the techniques and applications of horticulture.
2. To motivate the students to get acquainted with nursery management.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	categorize the propagation of horticultural crops	PSO – 2	An
CO - 2	describe orchard cultivation	PSO – 5	U
CO - 3	design a kitchen garden in growing vegetables and greens	PSO – 3	C
CO - 4	state the importance and principles of lawns, topiary and pergolas	PSO – 5	R
CO - 5	understand the methods involved in hybridization	PSO – 3	U
CO - 6	evaluate the molecular approaches for crop improvement	PSO – 2	E

Unit I

Horticulture: Concepts and Scope; Famous gardens in world and India. Tools & Implements; Plant growing structures – Green house, Glass house, Mist chamber, Shade net and Poly house. Arches, Pergolas, and Topiary. Lawns and Landscapes, Hydroponics and Aquaponics.

Unit II

Plant Propagation: Cutting, Layering, Grafting & Budding; Cultural practices – Thinning, Training, Trimming & Pruning; Fertilizers, Biofertilizers, Green manures, NPK, Compost, Vermicompost; Out-door horticulture – Vegetable garden, Medicinal plant garden, Roof garden, Fruit garden, Kitchen garden, Terrace garden; Bonsai.

Unit III

Plant Breeding & Plant Reproduction: Mode of reproduction and breeding; Mechanisms of Self-pollinations and Cross-pollinations; Floral Biology in relation to selfing and crossing techniques; Sexual reproduction – objectives, emasculation and pollination methods; raising F1 hybrids; Asexual reproduction – Vegetative and Nonrecurrent apomixes; diplospory, apospory, parthenogenesis, Role of apomixes in plant breeding.

Unit IV

Hybridization: Objectives, choice of parents, purelines, failure of hybridization – problems & causes; Incompatibility and sterility. Methods of overcoming genetic consequences of hybridization; Methods of handling, segregating hybrids for isolation of superior strains – bulk & pedigree selection methods; Role of interspecific and intergeneric hybridization and plant improvement; Selection- principles, genetic basis and methods; Mass selection, pure line selection and clonal selection.

Unit V

Back-cross breeding: Theory & procedure for transferring various types of characters; Inbreeding depression; Hybrids & Heterosis theories – genetic and physiologic basis – Applications – steps in production of single cross, double cross, three way cross & synthetic cross; male sterility (cytoplasmic, genetic) in hybrid production.

Reference Books

1. Manibhusan Rao. (1991). *Text book of Horticulture*. New Delhi: Mac Millan India.
2. Sheela V. (2011). *Fundamentals of Horticulture*. Chennai: MJP Publications.
3. Shukla. R. S. Chandel. (1996). *Cytogenetics, Evolution and plant breeding*. New Delhi: Chand. S. c. Ltd.
4. Edmund Senn – Andrew – Halfacre. (1977). *Propagation of horticultural crops*. New Delhi: Tata McGraw – Hill.
5. Chopra. (2004). *Approaches for Incorporating Drought and Salinity Resistance in Crop Plants*. New Delhi: Salish Book Enterprise.
6. Kader, A.A. (2002). *Post-Harvest Technology of Horticultural Crops*. New Delhi: UCANR Publications.
7. Kumar, N. (2006). *Breeding of Horticultural Crops: Principles and Practices*. New Delhi: Publishing Agencies.
8. Singh, D and Manivannan, S. (2009). *Genetic Resources of Horticultural Crops*. Lucknow: IBDC Publishers.
9. Chahal G. S. and S. S. Gosal. (2002). *Principles and Procedures of plant breeding*. New Delhi: Narosa publishing House.

Semester - III

Major Elective III b – Forestry

Course Code: PB2034

Hours / Week	Credits	Total Hours	Marks
6	4	90	100

Objectives

1. To enable the students to have broad knowledge about forest, its management and forest products.
2. To prepare the students to involve in tree plantings and to provide and improve wildlife habitat.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	categorize the types of forests in Tamilnadu	PSO – 3	An
CO - 2	identify the reasons for degradation of forest	PSO – 2	R
CO - 3	summarize the methods in managing and conserving the forest	PSO – 5	AP
CO - 4	understand the objectives, advantages and disadvantages of agroforestry	PSO – 3	U
CO - 5	determine the role of botanical gardens, zoos, national parks, and sanctuaries	PSO – 6	U
CO - 6	evaluate the utilization of forest	PSO – 3	E

Unit I

Forest – definition, role of forest; forest as a balanced ecosystem; types and distribution of (Champion and Seth's classification). Forest types in Tamilnadu – evergreen forest, deciduous and scrub jungle.

Unit II

Forest management and conservation; regeneration; tending operations; sustainable utilization of forest resources – forest organizations. Forest mensuration and remote sensing – methods of measuring diameter, girth, height, and volume of trees, geographic information systems for management (GIS).

Unit III

Forest utilization – harvesting, conservation, storage and disposal of wood in forest; major and minor forest products; forest based industries – paper and pulp industry, resin tapping and turpentine manufacture. Forest education in India.

Unit IV

Forest degradation – damage caused by fire, climatic factors and injuries by insects, plants, animals, and diseases, activities of man including encroachment and shifting cultivation; measures to protect the forest damage caused by various factors;

Unit V

Agroforestry – objectives, advantages and disadvantages, energy plantations; recreational forestry- role of botanical gardens, zoos, national parks and sanctuaries in recreation/conservation of wild life; Social forestry.

Reference Books

1. Kasturi Reddy. (2010). *Biodiversity and Land Conservation*. New Delhi: Pacific Publication N-187, ShivajiChowk. Sadatpur Extension.
2. Rana S.V.S . (2009). *Essential of Ecology and Environmental Science* (IV Edition). New Delhi: PHI learning Private Ltd.
3. Rao M.K. *Environemntal and Climate Change*. (2011). Delhi: Manglam Publications.
4. Shukla R.S.& Chandel P.S. (2006). *A Text Book of Plant Ecology*. Ram Nagar, New Delhi: S. Chand and Company Ltd.
5. Trivedi, P.R. Trivedi and Gurdeep Raj.(2002). *Environmental Ecology*. New Delhi: Akashdeep Publishing House.
6. Tyler Miller G. (2004). *Environmental Science*. Singapore: Thomson Brooks/cole,

Semester - III

Practical III – Taxonomy of Angiosperms, Genetics and Molecular Biology

Course Code: PB20P3

Hours / Week	Credits	Total Hours	Marks
6	-	90	100

Objectives

1. To learn the taxonomical terminology, morphology, structure and functions of various parts of plants.
2. To have broad knowledge on genetics problems and to carry out molecular biology experiments and interpret the results.

Course Outcome

CO	Expected Learning Outcomes Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	isolate the DNA from plant materials	PSO – 4	Ap
CO - 2	separation of biomolecules using spectrophotometry	PSO – 1	Ap
CO - 3	analyse the floral parts and relate to its corresponding family	PSO –5	An
CO - 4	solve genetics related problems	PSO – 1	E

Taxonomy of Angiosperms

1. Assigning plants to their respective families.
2. Technical description of floral parts with reference to families prescribed.
3. Identification of modification and economically important products from the members of the families prescribed in the syllabus (Botanical name, common name, morphology of the useful part-family and uses).
4. Preparing intended keys and bracketed keys for the locally available plants.
5. Field trip, Submission of field note book, with a report on the field trip.
6. Preparation of 5 herbaria of the locally available weed.

Genetics and Molecular Biology

1. Genetics Problems – Monohybrid cross, Dihybrid cross.
2. Genetics Problems – Interaction of genes.
3. Isolation of DNA (Demo)
4. Agarose gel electrophoresis (Demo)
5. Estimation of DNA by UV- Spectrophotometric method.
6. PCR (Demo)

Semester III Project
Course Code: PB20PR

Hours/ Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To enable students to design experiment, analyse data and interpret results.
2. To develop skills to identify subject related problems in the neighbourhood and report to the scientific community.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explore new areas of research in Botany and allied field of life science.	PSO - 1	Ap
CO - 2	analyze a research problem and construct tools for data collection.	PSO - 2	An
CO - 3	write research reports and present results in the scientific community.	PSO - 3	Ap
CO - 4	develop skills to serve in Life science related industries and agencies.	PSO - 3	E
CO - 5	develop skills to publish articles in reputed journals.	PSO - 4	C

Guidelines

- All the students must undertake dissertation work at the final year (III semester).
- The students, with the consent of the Supervisor, HoD and the Principal can pursue their project in another institution, especially with MoU/ Collaboration for the successful completion of the project work.
- Evaluation

Evaluation	Marks	Month/ Date	Evaluator
Proposed title, review of literature and objectives.	-	3 rd Week of III Semester	-
I Review	10	July	Supervisor
II Review	10	August	Supervisor
Final- Internal	20	September/ October	Supervisor
External - Dissertation *Viva-voce (individual & open)	40 20	October /November	Ext. examiner
Total marks	100		

* Mode of presentation by Power Point

Dissertation framework

I. The dissertation format should be in:

- Font - Times New Roman
- Heading - Font size 14 (Bold) - Uppercase
- Sub headings - Font size 12 (Bold) – Lowercase; should be numbered.
(Eg: Introduction 1; Subheading 1.1; 1.2)
- Text, the content of the dissertation – Font size -12 (Normal).
- Citation - Any works of other researchers, if used either directly or indirectly should be indicated at appropriate places in the text.

The citation may assume any one of the following forms:

- i) A paper, a monograph or a book with single author may be designated by the name of the first author followed by the year of publication, placed inside brackets at the appropriate places in the text.
- ii) A paper, a monograph or a book with two authors may be designated by the name of the first and second author followed by the year of publication, placed inside brackets at the appropriate places in the text.
- iii) A paper, a monograph or a book with more than two authors may be designated by the name of the first author followed by et al, and the year of publication, placed inside brackets at the appropriate places in the text.

- Line space - 1.5
- Margin - 2” on the left and 1” on the right, Gutter -0.5.
- Page Numbering – Bottom middle alignment; excluding initial pages and reference
- Total number of pages - Minimum 30 - Maximum 50 (excluding initial pages and reference).
- The Tables and Figures should be included subsequently after referring them in the text of the Thesis.
- The thesis from Chapters should be printed on both sides.

II. Dissertation must be completed within the stipulated time.

III. Submission of Dissertation:

- one soft copy (PDF format in CD)
- three hard copies (soft binding) duly signed and endorsed by the Supervisor and the Head.

The report - dissertation will have three main parts:

I. Initial Pages - in the following sequence

- i. Title Page
- ii. Certificate from the Supervisor

- iii. Declaration by the candidate endorsed by the Supervisor and HOD.
- iv. Acknowledgement (within one page - signed by the candidate).
- v. Table of Contents
- vi. List of abbreviations
- vii. Abstract

II. Main body of the dissertation

- i) Introduction with Literature review and Objectives
- ii) Methodology
- iii) Results
- iv) Discussion
- v) Summary
- vi) References (DOI number of the journals can be included)

The guidelines for reference

Journal Article : with Single Author

Waldron, S 2008, "Generalized Welch bound equality sequences are tight frames", IEEE Transactions on Information Theory, vol. 49, no. 9, pp. 2307-2309.

Journal Article : with Two Authors

Conley, TG & Galeson, DW 1998, "Nativity and wealth in mid-nineteenth century cities", Journal of Economic History, vol. 58, no. 2, pp. 468-493.

Journal Article : with more than two Authors

Alishahi, K, Marvasti, F, Aref, VA & Pad, P 2009, „Bounds on the sum capacity of synchronous binary CDMA channels“, Journal of Chemical Education, vol. 55, no. 8, pp. 3577-3593.

Books

Holt, DH 1997, Management Principles and Practices, Prentice-Hall, Sydney. Centre for Research, M S University - Ph.D. Revised Guidelines Page | 39 / 41

E-book

Aghion, P & Durlauf, S (eds.) 2005, Handbook of Economic Growth, Elsevier, Amsterdam. Available from: Elsevier books. [4 November 2004].

Conference Proceeding Paper with editors

Riley, D 1992, „Industrial relations in Australian education“, in Contemporary Australasian industrial relations: proceedings of the sixth AIRAANZ conference, ed. D. Blackmur, AIRAANZ, Sydney, pp. 124-140.

Conference Proceeding Paper without editors

Fan, W, Gordon, MD & Pathak, R 2000, "Personalization of search engine services for effective retrieval and knowledge management", Proceedings of the twenty-first international conference on information systems, pp. 20-34.

Website

Australian Securities Exchange 2009, Market Information. Available from: . [5 July 2009].

Thesis

Unpublished Hos, JP 2005, Mechano chemically synthesized nano materials for intermediate temperature solid oxide fuel cell membranes. Ph.D. thesis, University of Western Australia.

Newspaper Print Ionesco, J 2001, 'Federal election: new Chip in politics', The Advertiser 23 October, p. 10.

Semester III
Life Skill Training (LST) – II
Values in Family Life - I
Sub. Code: LST202

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

Objectives:

- To develop values on Indian family, culture, Inter personal relationship and socialization.
- To develop skills necessary to lead a happy life.

Course Outcomes (COs)

CO No.	<i>Upon completion of this course, the students will be able to:</i>	Cognitive Level
CO-1	recognise the importance values of relationship within the family and the society.	U
CO-2	analyse different values, relationships and responsibility	A
CO-3	develop the skill of adjustment and problem solving	C

Unit I:

Family Life Education - Definition - Objective - Aim - Value and Choice - Commitment to Values - Sources and Categories of Values - Professional and Operational Values - Personal and Social Values - Abdication of Responsibility.

Unit II:

Family- Meaning - Types - Indian Family - Types of Family Pattern - Joint Family - Advantages, disadvantages - Social Functions of the Family - Indian Ideal of Family Life - Family as a Unit of Society - Family as a Custodian and Transmitter of Values.

Unit III:

Relationship - Types - Relationship with the Mother - Adolescent - Meaning - Adolescence - Meaning - Needs of the Adolescent - Obstacles to Adolescent - Effects of Non-satisfaction of Needs.

Unit IV:

Socialisation - Process - Friendship - Infatuation - Peer Groups - Harmful Friendship - Signs of Affection.

Unit V:

Women and Men - Status of Women - Indian Woman - Man as Husband and Father - Husband's role in Marriage - Dowry - Divorce.

Text Book:

Marie Mignon Mascarenhas, *Family Life Education*, A Publication of All India Association for Christian Higher Education, Bangalore.

Semester III
Self-Learning Course – Biology for Competitive Exam I
Course Code: PB20S1

No. of credits	Marks
2	100

Objectives

1. To understand the structure and organization of plant cells.
2. To know about the control of gene expression.

Course outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the organization of cell organelles	PSO – 2	U
CO - 2	know the molecular and metabolic mechanisms of plants	PSO – 6	U
CO - 3	evaluate gene interactions	PSO – 6	E
CO - 4	analyze Transcription and Translation of Prokaryotes and Eukaryotes	PSO – 5	An
CO - 5	classify the plant diseases	PSO – 4	U

Unit I

Structure and functions of plant cell - cell wall, nucleus, mitochondria, golgi bodies, endoplasmic reticulum, chloroplast; Cell division - mitosis and meiosis; Apoptosis.

Unit II

Glycolysis, Kreb's cycle, Electron transport chain, responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

Unit III

Law of dominance, segregation, independent assortment; Allele, multiple alleles, pseudoallele; Codominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage; Structural and numerical alterations of chromosomes - deletion, duplication, inversion, translocation.

Unit IV

DNA replication – conservative, semi conservative and dispersive; homologous and site-specific recombination; Structure and function of different types of RNA, Protein synthesis and processing; Control of gene expression at transcription and translation level prokaryotic and eukaryotic genes.

Unit V

Biological nomenclature - Concepts of species and hierarchical taxa; classical & quantitative methods of taxonomy of plants; Classification of plants; Common parasites and pathogens of crops; Rare and endangered species. Conservation strategies.

Reference Books

1. Experiments in plant Tissue Culture, Dodds, J.H. and L.W. Roberts, Cambridge University Press, London, 1995.
2. Molecular Biology, Freifelder, D. Narosa publishing house, New Delhi, 1990.
3. Plant Molecular Biology, II Edn. Grierson and S.N. Covery, Blackie, New York, 1988.
4. Molecular Biotechnology : Principles and Manipulation of Recombinant DNA, 4th edition, Bernard R. Glick and Jack J. Pasternack, Panima Publishing Corporation, New Delhi, 1996.
5. Plant Cell and Tissue Culture, Narayanaswamy, S. Tata McGraw – Hill publishing Co. New Delhi, 1994.
6. Plant Biotechnology, Comprehensive Biotechnology series, Murray Moo Young. Pergamon press, 1992.
7. Protein Targets for structure based Drug Design, Walklindahaw, Ned, Res. Rev P. 317-372, 1992.

Semester - IV

Major Core IX – Plant Physiology

Course Code: PB2041

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To facilitate the study of integrated activities in plants.
2. To evaluate the stress related mechanism of plants.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	relate the physical and chemical process occurring in plants	PSO – 2	R
CO - 2	understand the molecular and metabolic mechanisms of plants	PSO – 1	U
CO - 3	generalize a minor research using their theory knowledge	PSO – 5	Ap
CO - 4	examine, compare and conclude the stressed and stress free plants	PSO – 3	An
CO - 5	measure the biological mechanisms that takes place inside the plants	PSO – 2	E
CO - 6	design a protocol for plant regeneration under aseptic condition.	PSO – 4	C

Unit I

Physico-chemical properties of water - water potential; Mechanism of absorption of water - active and passive transport - Apoplast and symplast concept. Transpiration - Stomatal mechanism. Antitranspirants. Ascent of sap – SPAC; Mineral nutrition - criteria for essentiality. Macro and micro nutrients, their role and deficiency symptoms. Absorption of solutes - passive, active diffusion and facilitated diffusion. Hydroponics – Nutrient Film Technique (NFT).

Unit II

Properties of light - Interaction between radiant energy and phosphorescence; Photosynthetic apparatus and thylakoid organization; Two pigment systems - Light harvesting systems. Reaction center, P680, P700, water oxidation complex, electron transport system - cyclic - non cyclic - photophosphorylation; photosynthetic carbon reduction pathways in C3, C4 and CAM plants. Photorespiration and its significance.

Unit III

Respiration - Glycolysis – Anaerobic (Fermentation) and Aerobic (Kreb's cycle); Electron transport system and oxidative phosphorylation - mechanism - Energetics - Respiratory inhibitors - Cyanide resistant respiration; Integration of metabolic pathways.

Nitrogen Metabolism – Sources of nitrogen. Biological nitrogen fixation – symbiotic and asymbiotic; Nitrate and Ammonia assimilation (GS-GOGAT pathway).

Unit IV

Plant growth regulators and elicitors: Physiological effect and mechanism of action of auxin, gibberellins, cytokinins, ethylene, abscissic acid, morphactins, brassinosteroids.

Photomorphogenesis – phytochrome mediated photoresponses. Physiology of flowering; Fruit ripening.

Unit V

Physiology of senescence and abscission; Biological clock; Stress physiology – biotic and abiotic stress- salinity stress, drought stress, water stress, freezing stress, radiation stress, and heavy metal stress. Stress proteins in plants – stress resistance mechanism.

Reference Books

1. Bidwell, R.G.S.(1974). *Plant physiology*. New York: Macmillan Publishing Company.
2. Devlin, R.M. and F.H. Witham.(1983). *Plant Physiology*.U.S.A: Willard Grant Press.
3. Hall, D.O and Rao. K.K. (1994). *Photosynthesis* (Fifth Edition).U.K: Cambridge University Press.
4. Hess, D. (1981). *Plant Physiology*.New Delhi: Narosa Publishing House.
5. Jain, V.K. (2004). *Fundamentals of Plant Physiology*.New Delhi:S. Chand and Company Ltd.
6. Noggle, G.R. and Fritz G.J.(2002). *Introductory Plant Physiology*. New Delhi: Prentice Hall India.
7. Salisbury, F.B. and Ross. C. (1991). *Plant Physiology*. Belmont: Wadsworth Publishing Company.

Semester - IV

Major Core X – Plant Ecology and Phytogeography

Course Code: PB2042

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To impart basic knowledge about the environment and its allied problems.
2. To acquire skills to help the concerned individuals in identifying and solving environmental problems.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the scope and importance of ecosystem	PSO – 3	U
CO - 2	distinguish the difference between hydrosere and xerosere	PSO – 2	An
CO - 3	list out the various food chains in ecosystem	PSO – 1	R
CO - 4	implement the mode of studying vegetation	PSO – 4	Ap
CO - 5	understand the importance of conservation strategies	PSO – 5	U

Unit I

Habitat Ecology - Freshwater and Marine water ecosystems; Wetlands and their Characteristics – Classification of Wetlands and Examples; Succession - Causes of succession, Types of succession; Process of succession; Concept of Climatic Climax; Hydrosere; Xerosere.

Unit II

Structure of Ecosystem; Productivity of ecosystem; Food chains in ecosystem; Ecological Pyramids; Energy flow in ecosystem; Biogeochemical cycle – Water cycle, Carbon cycle, Oxygen cycle, Nitrogen cycle, Sedimentary cycle; Ecological Genetics of Population – Ecads, Ecotypes, Ecoclines, Ecospecies; Population Ecology - Characteristics of a population; Population Structure – Population Dispersal and interactions among population;

Unit III

Phytogeography: Definition and Principles of Phytogeography; Distribution – Wides, Endemics and Discontinuous species; Theories of Discontinuous distribution; Factors affecting distribution of species; Climate of India; Vegetation of India; Global environment changes – Global warming and Ozone depletion; Bioremediation, Biofueling, Biofilm and Biocorrosion, Carbon sequestration method, Carbon trading.

Unit IV

Current practices in conservation: Habitat or Ecosystem Approaches - Species-based Approaches - Social Approaches: Chipko Movement – In-situ conservation: Afforestation, Social Forestry, Agroforestry, Botanical gardens, Zoos, Biosphere Reserves, National Parks, Sanctuaries, Protected Area Network, Sacred Groves and Sthalavrikshas – Ex-situ conservation: Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks.

Unit V

Status and protection of species in National and International levels – Role of CITES and IUCN – Convention on Biological Diversity (CBD) – Nagoya Protocol – Man and Biosphere Programme (MAB) – Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002 – Ecosystem restoration.

Reference Books

1. Ambasht R.S. (1974). *A Text Book of Plant Ecology* (3rd Edn). Varanasi, India: Students' Friends & Co.
2. Chapman, J.L. and Reiss, M.J. (1999). *Ecology: Principles and Applications* (2nd Ed). New York: Cambridge University Press.
3. Chawla, S. (2011). *A text book of Environment & Ecology*. New Delhi: Tata McGraw-Hill.
4. Good, R. (1974). *The Geography of Flowering Plants*. London: Longman's Publication.
5. Odum E.P. Gray, W. Barrelet Thomas. (2004). *Fundamentals of Ecology* (5th Edition). Asia Pvt. Ltd.
6. Sharma, P.D. (2005). *Ecology and Environment*. New Delhi: Rastogi Publications.
7. Rana, S.V.S. (2008). *Energy, Ecology and Environment*. I.K. International Publishing House Pvt. Ltd.
8. Yadav.P.R, Shubhrata R. Mishara. (2004). *Environmental Biology*. New Delhi: Discovery Publishing House.
9. Subrahmanyam N.S. and Sambamurty A.V.S.S. (2011). *Ecology* (2nd Edition). New Delhi: Narosa Publishing House.
10. Shukla. R.S and Chandel P., S. (2012). *A Textbook of Plant Ecology including Ethnobotany and Soil Science*. New Delhi: Chand and Company Pvt. Ltd.
11. Verma. P.S and Agarwal. V.K. (2008). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. New Delhi: Chand and Company Pvt. Ltd.

Semester - IV

Major Core XI – Biotechnology and Bioinformatics

Course Code: PB2043

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To apply the knowledge of biotechnology in different fields to produce high value products.
2. To develop skill and get employment in biotechnology and bioinformatics laboratories and industries.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	understand the importance of biotechnology and design a plant tissue culture laboratory	PSO – 3	U
CO - 2	differentiate batch, continuous and fed batch culture	PSO – 4	An
CO - 3	evaluate the pros and cons of Transgenic plants	PSO – 6	E
CO - 4	recall the different aspects of pharmaceuticals	PSO – 5	R
CO - 5	apply different databases in biological sciences	PSO – 1	Ap

Unit I

rDNA Technology: Restriction enzymes - Nomenclature, classification and properties; Types of cloning vectors - Plasmids, Cosmids, ssDNA phages, Ti plasmid; Yeast vectors -YIP, YEP, YRP and YAC ; shuttle vectors; Construction of genomic library; Construction of cDNA library.

Unit II

Plant tissue culture – laboratory organization; sterilization of explants; composition and preparation of MS media; Meristem culture; suspension culture; protoplast culture and somatic

hybridization; production of haploid plants; somatic embryogenesis; synthetic seed production; Transgenic plants – Bt cotton, Golden rice.

Unit III

Industrial Biotechnology – Fermentor design; Immobilization of enzymes; Production of ethanol, acetic acid, citric acid and Penicillin; Biosafety – possible dangers of GEOs; biosafety guidelines; physical and biological containments; Process of patenting application.

Unit IV

Pharmaceutical Biotechnology: Edible vaccines, Plantibodies; Gene therapy – types of gene therapy, production of monoclonal antibodies and its application; Production of DNA vaccine; Production of subunit vaccine; Nanotechnology – nanomaterials, Synthesis of nanodrugs.

Unit V

Bioinformatics: The internet, World Wide Web, search engines Primary nucleotide sequence databases - Genbank, DDBJ; Primary protein sequence databases - NCBI, PIR, EMBL; Sequence Analysis - Pair-wise alignment; BLAST & FASTA types; Multiple sequence alignment; CADD.

Reference Books

1. Olsen R.C and Chrishtopher. (1992). *Computer assisted Drug Design*. Washington D.C: Americal Chemical Society.
2. Dodds, J.H. and L.W. Roberts. (1995). *Experiments in plant Tissue Culture*. London: Cambridge University Press.
3. Freifelder.(1990).*Molecular Biology*. New Delhi:Narosa Publishing house.
4. Grierson and Coverly, S.N. (1988).*Plant Molecular Biology* (II Edn).New York: Blackie Publishing Pvt. Ltd.
5. Bernard R.Glick and Jack.J.Pasteunack. (1996). *Molecular Biotechnology: Principles and Manipulation of Recombinant DNA* (4th edition). New Delhi: Panima Publishing Corporation.
6. Narayanaswamy. (1994). *Plant Cell and Tissue Culture*. New Delhi:Tata McGraw Hill Publishing Company.
7. Murray Moo Young. (1992). *Plant Biotechnology, Comprehensive Biotechnology series*. Pergamon Press.
8. Peter F. Stanbury, Allan Whittaker, Stephen J Hall, Elsevier. (1984). *Principles of Fermentation Technology*. United States.

Semester - IV

Major Elective IV a – Phytochemistry and Pharmacognosy

Course Code: PB2044

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To learn about the extraction procedures for active compounds.
2. To impart knowledge about different medicinal systems.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	classify and understand secondary metabolites in plants	PSO – 5	U
CO - 2	remember the traditional systems of medicines in terms of Siddha, Ayurvedha, and Unani	PSO – 6	R
CO - 3	apply phytochemistry in different industries	PSO – 3	Ap
CO - 4	create the protocol for healing procedures in ethnobotany	PSO – 1	C
CO - 5	analyze crude drugs both qualitatively and quantitatively	PSO – 4	An

Unit I

Phytochemistry - Definition, history, principles; Secondary metabolites - definitions, classification, occurrence and distribution in plants, their functions, chemical constituents. Alkaloids, Terpenoids, Flavonoids, Steroids, and Coumarins.

Unit II

Techniques for isolation of medicinally important Biomolecules - solvent extraction, steam distillation, soxhlet extraction; Purification, concentration, determination and quantification of compounds (TLC, Column, HPLC). Characterization of phytochemicals by spectroscopic methods.

Unit III

Biosynthetic pathways and Application of phytochemicals: Biosynthetic pathways of secondary compounds: Shikimic Acid pathway; Mevalonic Acid Pathway; Pathways for

commercially important phytochemicals: Forskolin, Taxol and Vinca alkaloids. Applications of phytochemicals in medicine, pharmaceuticals, food, flavour and cosmetic industries.

Unit IV

Herbalism and Ethnobotany: Herbs and healing; Historical perspectives local, national and global level; Herbal cultures: origin and development of human civilizations; Ethnomedicine - Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

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). Medicinal plant banks, micro propagation of important species (*Wihania somnifera*, *Azadirachta indica* and *Ocimum sanctum* - Herbal foods-future of pharmacognosy)

Reference Books

1. Bannerman, R. H., J. Burton and C. Wen Chen (eds). 1983. Traditional medicine and health care coverage. WHO, Geneva.
2. Harborne, JB. 1984. Phytochemical Methods (2nd Ed.). Chapman &Hall, London.
3. Agarwal, P. K. and R. S. Thakur, C. M Bansal. 1989. Carbon-13 NMR of Flavonoids. Elsevier Science Publishers, Amsterdam.
4. AlerGingauz. 2001.Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Braithwaite, A. and F. J. Smith. 1996. Chromatographic Methods (5th Edition) Blackie Academic & Professional London.
6. Mann J. Davidson, R. S and J. B. Hobbs, D. V. Banthorpe, J. B. Harborne. 1994. Natural Products. Longman Scientific and Technical Essex.
7. Schwedt, G. 1997. The Essential Guide to Analytical Chemistry. John Wiley & Sons, New York.
8. Wilson, K. and J. Walker (Eds). 1994. Principles and Techniques of Practical Biochemistry (4thEdition) Cambridge University Press, Cambridge.
9. Cotton, CM. 1996. Ethnobotany:Principles& Applications. John Wiley & Sons, New York.
10. Gopalan, C., B. V. Ramasastri and S. C. Balasubramanian. 1985. Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad.

Semester - IV

Major Elective IV b – Entrepreneurial Botany

Course Code: PB2045

Hours / Week	Credits	Total Hours	Marks
6	5	90	100

Objectives

1. To enable the students to become self-employable.
2. To introduce the students about the funding agencies.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	create protocol for the production of mushroom	PSO – 1	C
CO - 2	understand the nutritive value of SCP	PSO – 4	U
CO - 3	justify the impact of organic fertilizers over synthetic fertilizers	PSO – 5	E
CO - 4	summarize the aesthetic sense of gardening	PSO – 6	U
CO - 5	know the different funding agencies	PSO – 3	R

Unit I

Mushroom Cultivation - Introduction to mushroom fungi, nutritional value, edible and poisonous type, medicinal value of mushrooms, Spawn Production; Cultivation techniques; problems in cultivation – disease and pest management strategies; harvesting, packing and storage.

Unit II

Single Cell Protein Production – Introduction, Importance, nutritive value, production process, properties, microbes employed in the production of SCP. Biomass production of SCP from *Spirulina*. Advantages of SCP.

Unit III

Organic Farming – Introduction, advantages and importance of organic farming, biofertilizers – production of biofertilizers – *Azolla*; large scale production and applications of humic acid and panchagavya.

Unit IV

Gardening – Indoor – Green House, Hydroponics, Terrarium, Bonsai, Hanging pots, Miniature Rockerym Orchidarium and water garden.

Outdoor – Kitchen Garden and roof top garden.

Unit V

Entrepreneurship – Role of funding agencies (NABARD), Rural Banking, FAO, STEP (Science & Technology Entrepreneurship Programme) - Govt and NGO's, Yojana Schemes. Entrepreneurship Development Programme (EDP).

Reference Books

1. Don Ellison, 2002. Garden Plants of the world. New Holland Publishers. V.K.
2. Lakshman, H.C and Channabasava, A. (2014)*Biofertilizers and Biopesticides*. Jaipur: Pointer Publishers.
3. Peter Mc Hoy., Barbara Segall and Stephanie Donaldson. 1997. Practical Small Gardening.
4. Pratibha Trivedi. 1996. Home Gardening ICAR, New Delhi. 9. Jane Fearnley 1995. Gardening Made Fast, Wedenfeld London.
5. Vijaya Ramesh, K. 2007. Food Microbiology, MJP Publisher, Chennai.
6. Suresh Gopalani, 2011. Fundamentals of Applied Nutrition.
7. Dubey, H.C. and Maheswari D.K. (2000). *A Text Book of Microbiology*. New Delhi: S. Chand & Co Ltd.

Semester - III

Practical III – Taxonomy of Angiosperms, Genetics and Molecular Biology

Course Code: PB20P3

Hours / Week	Credits	Total Hours	Marks
6	3	90	100

Objectives

1. To learn the taxonomical terminology, morphology, structure and functions of various parts of plants.
2. To have broad knowledge on genetics problems and to carry out molecular biology experiments and interpret the results.

Course Outcome

CO	Expected Learning Outcomes Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	isolate the DNA from plant materials	PSO – 4	Ap
CO - 2	separation of biomolecules using spectrophotometry	PSO – 1	Ap
CO - 3	analyse the floral parts and relate to its corresponding family	PSO – 5	An
CO - 4	to solve genetics related problems	PSO – 1	E

Taxonomy of Angiosperms

7. Assigning plants to their respective families.
8. Technical description of floral parts with reference to families prescribed.
9. Identification of modification and economically important products from the members of the families prescribed in the syllabus (Botanical name, common name, morphology of the useful part-family and uses).
10. Preparing intended keys and bracketed keys for the locally available plants.
11. Field trip, Submission of field note book, with a report on the field trip.
12. Preparation of 5 herbaria of the locally available weed.

Genetics and Molecular Biology

7. Genetics Problems – Monohybrid cross, Dihybrid cross.
8. Genetics Problems – Interaction of genes.
9. Isolation of DNA (Demo)
10. Agarose gel electrophoresis (Demo)
11. Estimation of DNA by UV- Spectrophotometric method.
12. PCR (Demo)

Semester - IV

Practical IV – Plant Physiology, Plant Ecology & Phytogeography and Biotechnology & Bioinformatics

Course Code: PB20P4

Hours / Week	Credits	Total Hours	Marks
6	3	90	100

Objectives

1. To understand the methodology involved in environment and conservation biology.
2. To learn the physiochemical analysis of plant materials in the context of plant physiology.
3. To achieve skills in practical aspects regarding plant tissue culture.

Course Outcome

CO	Expected Learning Outcomes Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO - 1	analyze DO, BOD and COD of water	PSO – 2	An
CO - 2	prepare tissue culture media, initiate callus culture, anther culture, pollen culture, etc	PSO – 4	Ap
CO - 3	identification of phytoplanktons in water bodies	PSO – 5	U
CO - 4	evaluate the metabolic reactions in plants	PSO – 4	E
CO - 5	report on common environmental problems, their consequences and possible solutions	PSO – 2	E

Plant Physiology:

1. Hill reaction – Ferricyanide / DCPIP by isolated chloroplast with reference to light and time.
2. Determination of osmotic potential by plasmolytic methods.
3. Estimation of Carotenoids

4. Determination of stomatal index and stomatal frequency by cellulose acetate film method.
5. Estimation of Proline (stress and unstressed plants)
6. Membrane permeability based on temperature, detergent and pH
7. Effect of age (C3 and C4 plants)

Environment and Conservation Biology:

1. Determination of Dissolved oxygen
2. Determination of Total Dissolved solids.
3. Determination of Chemical Oxygen Demand
4. Determination of Salinity
5. Preparation of activated carbon from waste materials
6. Identification of Planktons in the water.
7. Students should be aware of the common environmental problems, their consequences and possible solutions (Submit a report).

Applied Biotechnology:

1. Preparation of media and Sterilization
2. Callus culture
3. Immobilization of yeast cells
4. Anther culture
5. Synthetic Seed preparation
6. Fermentor (Demo)
7. Isolation of amylase producing microorganism from soil sample
8. Isolation of lactic acid producing bacteria from milk
9. Wine preparation

Semester IV
Life Skill Training (LST) – II
Values in Family Life - II
Sub. Code: LST202

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

Objectives:

- To recognize importance of marriage, diet and hygiene, role of working wife and mother.
- To develop skills necessary to cope up with family problems.

Course Outcomes (COs)

CO No.	<i>Upon completion of this course, the students will be able to:</i>	Cognitive Level
CO-1	compare marriages in different religion, problems of working wife and mother, family problem, barriers to good listening.	U
CO-2	analyse problems marriage relationship,	A
CO-3	apply the skills obtained through counselling for married life and to coping with family problem.	C

Unit I:

Marriage Preparation - Indian Culture - Stage of Preparation for Marriage - Myths before Marriage - Essential Values - Marriage Beatitudes Delayed and Late Marriage - Christian Marriage, Hindu Marriage and Muslim Marriage.

Unit II:

Working Wife and Mother - Pros and Cons - Health, Diet and Hygiene.

Unit III:

Marital Pathology, Breakdown, Counselling for Reconciliation - Principle Facilitating Relationship.

Unit IV:

Counselling - Definition - Process - Goals - Coping with Family Problem.

Unit V:

Counselor - Meaning - Characteristics - Assumption ship of the Helping Relation -Barriers to Good Listening - Guidelines to Listening - Problem Solving Process - Principles in Problem Solving.

Text Book:

Marie Mignon Mascarenhas, *Family Life Education*, A Publication of All India Association for Christian Higher Education, Bangalore.

Semester - IV

Self-Learning Course – Biology for Competitive Exam – II

Course Code: PB20S2

No. of credits	Marks
2	100

Objectives

1. To have a brief knowledge on biotechnology and biostatistics.
2. To motivate the students to write competitive examinations.

Course outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	analyze the relationship between different ecological groups	PSO – 2	An
CO - 2	understand the importance of biotechnology and in various fields	PSO – 4	U
CO - 3	evaluate the origin and development of different meristems	PSO – 5	E
CO - 4	apply the conceptual knowledge to operate biotechnological equipments	PSO – 6	Ap
CO - 5	formulate and perform statistical problems	PSO – 1	E

Unit I

Biotic and abiotic interactions; Concept of habitat and niche; population growth curves; structure and function of some Indian ecosystems- terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Environmental pollution; global environmental changes.

Unit II

DNA replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination of DNA.

Unit III

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis.

Unit IV

Isolation and purification of RNA, DNA and proteins; Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis; Generation of genomic and cDNA libraries; plasmid, phage, cosmid, BAC and YAC vectors. RFLP, RAPD and AFLP techniques.

Unit V

Measures of central tendency and dispersal; probability distributions, Regression and Correlation; t-test; Analysis of variance; Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells.

Reference Books

1. Bernard R. Glick and Jack J. Pasteunack. (1996). *Molecular Biotechnology : Principles and Manipulation of Recombinant DNA* (4th Edition). New Delhi Panima Publishing Corporation.
2. Bernard Rosner. (2006). *Fundamental of Biostatistics* (7th Edtn). Cengage Learning Inc.
3. Freifelder. (1990). *Molecular Biology*. New Delhi: Narosa publishing house.
4. Hall, D.O and K.K. Rao. (1994). *Photosynthesis* (Fifth Edition). U.K: Cambridge University Press.
5. Jain, V.K. (2004). *Fundamentals of Plant Physiology*. New Delhi: S. Chand and Co. Ltd.
6. Noggle, G.R and Fritz G.J. (2002). *Introductory Plant Physiology*. New Delhi: Prentice Hall India.
7. Sharma A.K. (2005). *Text Book of Biostatistics*. New Delhi: Discovery Publishing House.