RANI CHANNAMMA UNIVERSITY BELAGAVI

THE COURSE STRUCTURE & SYLLABUS OF UNDER GRADUATE

BACHELOR OF SCIENCE

BOTANY

1ST TO 6TH Semesters

w.e.f.

Academic Year 2020-21 and Onwards
Under

CHOICE BASED CREDIT SYSTEM (CBCS)

CHOICE BASED CREDIT SYSTEM [CBCS]
B.Sc. Program with Optional Subject: BOTANY

B.Sc., BOTANY Syllabus under CBCS scheme (With effect from the academic year 2020-21 onwards)								
Sem	**Part**	**Paper Code**	**Title of the Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
I	**Part – 1 DSC**	BOTDSCT1.1	Biodiversity (Microbes, Algae, Fungi and Archegoniate)	4	20	80	100	3
		BOTDSCP1.1	Practical I	3	10	40	50	1
		Total : Hours / Credits		**7**			**150**	**4**
II	**Part – 1 DSC**	BOTDSCT2.1	Plant Ecology and Diversity of angiosperms	4	20	80	100	3
		BOTDSCP2.1	Practical II	3	10	40	50	1
		Total : Hours / Credits		**7**			**150**	**4**

B.Sc., BOTANY Syllabus under CBCS scheme (With effect from the academic year 2021-22 onwards)								
Sem	**Part**	**Paper Code**	**Title of the Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
III	**Part – 1 DSC**	BOTDSCT3.1	Plant Anatomy and Embryology	4	20	80	100	3
		BOTDSCP3.1	Practical III	3	10	40	50	1
	Part – 2 SEC	BOTSECT3.2	Herbal technology	2	10	40	50	2
		Total : Hours / Credits		**9**			**200**	**6**
IV	**Part – 1 DSC**	BOTDSCT4.1	Plant Physiology and Biochemistry	4	20	80	100	3
		BOTDSCP4.1	Practical IV	3	10	40	50	1
	Part – 2 SEC	BOTSECT4.2	Nursery and Gardening	2	10	40	50	2
		Total : Hours / Credits		**9**			**200**	**6**

CHOICE BASED CREDIT SYSTEM [CBCS]
B.Sc. Program with Optional Subject: BOTANY

B.Sc., BOTANY Syllabus under CBCS scheme (With effect from the academic year 2022-23 onwards)								
Sem	**Part**	**Paper Code**	**Title of Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
V	**Part – 1 DSE**	BOTDSET5.1	Economic Botany and Biotechnology	4	20	80	100	3
		BOTDSEP5.1	Practical V	3	10	40	50	1
		BOTDSET5.2A (**Elective I)**	Cell and Molecular Biology	4	20	80	100	3
		BOTDSEP5.2A **(Elective I)**	Practical VIA	3	10	40	50	1
		BOTDSET5.2B **(Elective II)**	Genetics, Plant Breeding and Evolution	4	20	80	100	3
		BOTDSEP5.2B **(Elective II)**	Practical VIB	3	10	40	50	1
	Part – 2 SEC	BOTSECT5.3	Medicinal Botany	2	10	40	50	2
		Total : Hours / Credits		**16**			**350**	**10**
Note: Students have to choose either Elective-I or Elective-II								
VI	**Part – 1 DSE**	BOTDSET6.1	Analytical Techniques in Plants.	4	20	80	100	3
		BOTDSEP6.1	Practical VII	3	10	40	50	1
		BOTDSET6.2A (**Elective III)**	Research Methodology	4	20	80	100	3
		BOTDSEP6.2A (**Elective III)**	Practical VIIIA	3	10	40	50	1
		BOTDSET6.2B (**Elective IV)**	Biofertilizers and Organic Farming	4	20	80	100	3
		BOTDSEP6.2B (**Elective IV)**	Practical VIIIB	3	10	40	50	1
	Part – 2 SEC	BOTSECT6.3	Ethnobotany	2	10	40	50	2
		Total : Hours / Credits		**16**			**350**	**10**
Note: Students have to choose either Elective-III or Elective-IV								

T: Theory, P: Practical, CC/EA: Co-curricular/Extension Activities. AECC: Ability Enhancement Compulsory Course, DSC: Discipline Specific Course. DSE: Discipline Specific Elective, SEC: Skill Enhancement Course)

Note: Duration of examinations is 03 Hrs for 80 Marks theory and 02 hrs for 40 marks theory. For practical's duration of examination is 03 Hrs.

First Semester B.Sc. (Botany)

Paper Code: BOTDSCT1.1 **Paper Title:** Biodiversity (Microbes, Algae, Fungi and Archegoniate)
Teaching Hours: 4 Hrs / Week **Marks:** Th-80+IA-20
Total hours: 60 **Credits: 3**

Unit1:

- **Viruses** : Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance;
- **Bacteria:** Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.
- **Viral Plant Diseases**: TMV. Vein clearing, Dwarfing, Yellowing and BBTV disease.
- **Bacterial Plant Disease**: Citrus canker, Bacterial blight and Crown gall disease.

15 hours

Unit2:

- **Algae**: General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae by smith; Morphology and life-cycles of the following: *Nostoc*, *Oedogonium*, *Vaucheria*, *Volvox*, *Ectocarpus & Batrachospermum*. Economic importance of algae.
- **Fungi**: Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota), *Penicillium* (Ascomycota), *cercospora (Deutoromycota), Puccinia, Agaricus* (Basidiomycota);
- **Fungal Diseases:** Late blight of potato, White rust of *Albugo candida*., Black rust of *Puccinia*, Powdery mildew and Early Blight of Tomato.
- **Symbiotic Associations-Lichens**: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance **15 hours**.

Unit 3:

- **Introduction to Archegoniate:** Unifying features of archegoniates, Transition to land habit, Alternation of generations.
- **Bryophytes:** General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Riccia*, *Marchantia, Anthoceros* and *Funaria* (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

15 hours

Unit 4:

- **Pteridophytes:** General characteristics, classification, Early land plants (*lepidodendron, Lepidocarpon, Calamites*). Classification (up family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.
- **Gymnosperms:** General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas, Gnetum* and *Pinus*. (Developmental details not to be included). Ecological and economical importance. **15 hours**

Practical

Paper Code: BOTDSCTP1.1 **Paper Title:** Biodiversity (Microbes, Algae, Fungi and Archegoniate)
Teaching Hours: 3 Hrs / Week **Marks:** Th-40+IA-10
Credits: 1

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Volvox, Nostoc,* (electron micrographs), *Oedogonium, Vaucheria, Ectocarpus and Batrachospermum* through temporary preparations and permanent slides.
5. *Rhizopus and Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Cercospora Specimens*/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ectomycorrhiza and endomycorrhiza (Photographs)
11. ***Marchantia***-morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides).
12. ***Funaria***- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L. S. capsule and protonema.
13. ***Selaginella***- morphology, w.m. leaf with ligule, T.S. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), L.S. strobilus (permanent slide).
14. ***Equisetum***- morphology, T.S. internode, L.S. strobilus, T.S. strobilus, w.m. sporangiophore, w.m. spores (wet and dry) (temporary slides); T.s rhizome (permanent slide).
15. ***Pteris***- morphology, T.S. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), T.S. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
16. ***Cycas***-morphology (coralloid roots, bulbil, leaf), T.S. coralloid root, T.S. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), L.S. ovule, T.S. root (permanent slide).
17. ***Pinus***- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, T.S. needle, T.S. stem, L.S./T.S. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), L S. female cone, T. L.S. & R. L.S. stem (permanent slide).
18. Study tour two days compulsory.

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, Mac Millan Publishers Pvt. Ltd.,Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi,India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

Second Semester B.Sc. (Botany)

Paper Code: BOTDSCT2.1 **Paper Title:** Plant Ecology and Diversity of angiosperms
Teaching Hours: 4 Hrs / Week **Marks:** Th-80+IA-20
Teaching hours: 60 **Credits:** 3

Unit1:

- **Atmosphere:** Atmosphere gaseous composition and Atmospheric layers.
- **Ecological factors:** Soil, weathering, composition, pedogenesis and soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

15 hours

Unit 2:

- **Plant Succession:** Characters; Ecotone and edge effect; Succession; Hydrosere and Xerosere.
- **Ecosystem:** Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycles; carbon, nitrogen and Phosphorous cycles.
- **Phytogeography:** Principle, biogeographical zones; Endemism.

15 hours

Unit3

- **Morphology of Angiosperms:** Root, Stem, leaf and its modifications: inflorescence, flower and fruit.

15 hours

Unit4:

- **Plant Taxonomy:** Introduction, Identication Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access
- **Classification**

  Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).
- **Taxonomic hierarchy**

  Ranks, categories and taxonomic groups, Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.
- **Botanical nomenclature**

  Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

15 hours

Practical

Paper Code: BOTDSCP2.1 **Paper Title:** Plant Ecology and Diversity of angiosperms
Teaching Hours: 3 Hrs / Week **Marks:** Th-40+IA-10
Credits: 1

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer /hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two fertile soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. (a) Study of morphological adaptations of hydrophytes (Submerged, Free floating, Amphibious and Rooted floating) and xerophytes (succulent and non succulent).
   (b)Study of biotic interactions of the following: Stem parasite (*Cuscuta),* Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
4. Morphology of Angiosperms: Root, Stem, leaf and its modifications: Inflorescence, Flower and Fruit.
5. Study of vegetative and floral characters of the following families (Description,V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Polypetalae: Magnoliaceae, Malvaceae, Rutaceae, Brassicaceae. Gamopetaleae– Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae. Apetalae-Euphorbiaceae. Monocot- Poaceae
6. Mounting of a properly dried and pressed specimen of any wild plant with herbarium Label (Herbarium any 10 to be submitted in the record book).
7. Study tour for minimum 3 days compulsory.

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). *Plant Systematics.* Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). *Plant Systematics:* Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

Third Semester B.Sc. (Botany)

Paper Code: BOTDSCT3.1 **Paper Title:** Plant Anatomy and Embryology
Teaching Hours: 4 Hrs / Week **Marks: Th-80+IA-20**
Teaching hours: 60 **Credits: 3**

Unit1:

- **Tissues**: Tunica carpous theory and apical theory, meristems and its types; Simple and complex tissues.
- **The tissue system:** Epidermal tissue system, Ground and fundamental tissue system and Vascular or conducting tissue system.
- **Organ:** Structure of dicot and monocot root stem and leaf.

15 hours

Unit 2:

- **Secondary Growth**: Stelar and Extrastelar Secondary growth in root and stem, Wood (heartwood and sapwood). Abnormal secondary growth in Bignonia, Dracaena and Beet root.
- **Leaf fall and healing of wounds**.
- **Special tissues**: Secretary.
- **Mechanical tissues in plants**

15 hours

Unit3:

- **Structural organization of flower:** Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultra structure of mature embryo sac.
- **Pollination and fertilization:** Pollination mechanisms and adaptations; Types of pollination: Anemophily, Entemophily, hydrophily. Double fertilization; Endosperm types, structure and functions.

15 hours

Unit 4:

- **Embryo and endosperm:** Dicot and Monocot seed-structure, appendages and dispersal mechanisms. Structure and development of Dicot and Monocot embryo; Embryo- endosperm relationship.
- **Apomixis and polyembryony:** Definition, Classification and practical applications.

15 hours

Practical

Paper Code: BOTDSCP3.1 **Paper Title:** Plant Anatomy and Embryology
Teaching Hours: 3 Hrs / Week **Marks:** Th-40+IA-10
Credits: 1

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary growth: *Helianthus* (Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary growth: *Helianthus* (Permanent slides).
5. Leaf: Dicot and Monocot leaf (Permanent slides).
6. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
7. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous / campylotropous.
8. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
9. Ultrastructure of mature egg apparatus cells through electron micrographs.
10. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs ands pecimens).
11. Dissection of embryo/endosperm from developing seeds.
12. Calculation of percentage of germinated pollen in a given medium.

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J. D. (1988).Plant Anatomy.The Benjamin/Cummings Publisher, USA.

Third Semester B.Sc. (Botany) Skill Enhancement Course

Paper Code: BOTSECT3.2 **Paper Title:** Herbal technology
Teaching Hours: 2Hrs / Week **Marks:** Th-40+IA-10
Teaching Hours: 30 **Credits :**2

Unit1:

- **Herbal medicines**: History and scope, definition of medical terms and role of medicinal plants in Siddha systems of medicine; cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants.
- **Pharmacognosy**: Systematic position medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Gooseberry and Ashoka.

15 hours

Unit2:

- **Phytochemistry**: Active principles and methods of their testing, identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

- **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** micropropagation of important species (*Withania somnifera*, neem and tulsi, Herbal foods and future of pharmacognosy.)

15 hours

Suggested Readings

1. Glossary of Indian medicinal plants, R. N. Chopra, S. L. Nayarand I. C. Chopra, 1956. C.S.I.R, New Delhi.

2. The indigenous drugs of India, Kanny, Lall, Deyand Raj Bahadur, 1984. International Book Distributors.

3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.

4. Ayurvedic drugs and their plant source. V. V. Sivarajan and Balachandran Indra1994. Oxford IBH publishing Co.

5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsi dass, Delhi.

6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.

7. Pharmacognosy, Dr. C. K. Kokate et al. 1999. Nirali Prakashan.

Fourth Semester B.Sc. (Botany)

Paper Code: BOTDSCT4.1 **Paper Title:** Plant Physiology and Biochemistry
Teaching Hours: 4 Hrs / Week **Marks:** Th-80+IA-20
Teaching Hours: 60 **Credits:** 3

Unit 1:

- **Plant-water relations:** Solutions, Suspensions, colloids, True solutions, Molarity, Molar, Buffer, Molal, pH, Emulsion and Gel. Permeability, Diffusion, Osmosis, Imbibition, membranes, Endoosmosis, Exoosmosis, osmotic pressure, Turger pressure, Wall pressure, Relation between O.P, D.P.D and T.P. Importance of water, water potential and its components;
- **Transpiration**: Transpiration types, Structure of stomata, Types of stomata, stomatal Movment, Starch sugure Interconversion theory and K^+ ion pump theory. significance of transpiration; Factors affecting transpiration; guttation,
- **Pathways of water movment:** Apoplast and symplast.
- **Mineral nutrition:** Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

15 hours

Unit 2:

- **Ascent of sap, translocation of solutes:** Theories on Ascent of sap: Root pressure theory and transpiration pull theory. Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.
- **Photosynthesis:** Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C_3, C_4 and CAM pathways of carbon fixation; Photorespiration, Blackmen's law of Limiting factor and factors affecting photosynthesis.

15 hours

Unit3:

- **Respiration:** Aerobic cellular respiration: Glycolysis, TCA cycle, Oxidative phosphorylation & Pentose Phosphate Pathway. Anaerobic respiration: Alcoholic lactic acid and acetic acid fermentation amphibolic pathway. Respiratory quotient of carbohydrate, protein and organic acid.
- **Enzymes:** Structure and properties, Classification, Mechanism of enzyme catalysis Lock and key model and induced fit model, enzyme inhibition and factors affecting enzyme activity.
- **Nitrogen metabolism:** Nitrogen cycle, Biological nitrogen fixation; Nitrate and ammonia assimilation.

15 hours

Unit 4:

- **Plant growth regulators:** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. Application of Phytoharmones.
- **Plant Movements:** Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.
- Structure and classification of Proteins, carbohydrates and Lipids. **15 hours**

Practical

Paper Code: BOTDSCP4.1 **Paper Title:** Plant Physiology and Biochemistry
Teaching Hours: 3 Hrs / Week **Marks:** Th-40+IA-10
Credits: 1

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Demonstration of rate of transpiration by Ganong's photometer / Farmer's photometer
4. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
5. To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.
6. Comparison of the rate of respiration.
7. Separation of Chlorophyll pigments by paper chromatography.
8. Qualitative test for proteins, carbohydrate and lipids.
9. Demonstration experiments
   - Bolting.
   - Effect of auxins on rooting.
   - Suction due to transpiration.
   - R.Q. (Ganong's respirometer.)
   - Phototropism.
   - Seismonastic movements.
   - Nyctinastic movements.

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

Fourth Semester B.Sc. (Botany) Skill Enhancement Course

Paper Code: BOTSECT4.2 **Paper Title :**Nursery and Gardening
Teaching Hours: 2Hrs / Week **Marks:** Th-40+IA-10
Teaching Hours: 30 **Credits :**2

Unit 1:

- **Nursery:** Definition, objectives and scope, building up of infrastructure for nursery, planning and seasonal activities. Planting, direct seeding and transplants.

- **Seed:** Structure and types. Seed dormancy; causes and methods of breaking dormancy, Seed storage: Seed banks, factors affecting seed viability, genetic erosion, Seed production technology, seed testing and certification.

- **Vegetative propagation**: Air layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants, green house, mist chamber, shed root, shade house and glass house.

15 hours

Unit2:

- **Gardening:** Definition, objectives and scope. Different types of gardening: Landscape and home gardening, parks and its components. Plant materials and design. Computer applications in landscaping. Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.
- **Sowing/raising of seeds and seedlings - Transplanting of seedlings:** Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots-Storage and marketing procedures**.**

15 hours

Suggested Readings

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M. K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, Mc Graw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

Fifth Semester B.Sc. (Botany)

Paper Code: BOTDSET5.1 **Paper Title :**Economic Botany and Biotechnology
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Teaching Hours:60 **Credits :**3

Unit1:

- **Origin of Cultivated Plants:** Concept of centers of origin, their importance with reference to Vavilov's work.
- **Cereals:** Origin, morphology and uses of Wheat, Jowar and Rice
- **Legumes:** General account with special reference to Gram and Soybean
- **Pulses**: Origin, morphology and uses of Chick pea, Cow pea and Lentil.

15 hours

Unit2:

- **Spices:** General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)
- **Beverages:** Tea (morphology, processing, uses)
- **Oils and Fats:** General description with special reference to groundnut.
- **Rubber:** General description with special reference to Hevea sp.
- **Fiber Yielding Plants:** General description with special reference to Cotton (Botanical name, family, part used morphology and uses).

15 hours

Unit 3:

- **Microbial genetic manipulation**: Bacterial transformation, selection of recombinant and trasformants, genetic improvement of industrial microbes, nitrogen fixers and fermentation technology.
- **Immunology:** Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.
- **Plant tissue culture:** Micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

15 hours

Unit4:

- **Recombinant DNA Techniques**: Biotechnology scope, tools of genetic engineering, gene cloning techniques, gel electrophoreses, Bioreactor, transgenic plants. Agro bacterium and retroviruses as natural genetic engineer. Intellectual property rights and possible ethical risks.
- **Blotting techniques:** Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR.

15 hours

Practical

Paper Code: BOTDSEP5.1 **Paper Title :**Economic Botany and Biotechnology
Teaching Hours: 3Hrs / Week **Marks:** Th-40+IA-10
Credits :1

1. Study of economically important plants: Wheat, Jowar, Rice, Gram, Soybean, Black pepper, Clove, Tea, Cotton, Groundnut through specimens.
2. Study of economically important plants: chick pea, cowpea, Clove, Tea, Cotton, Groundnut and rubber through specimens.
3. Familiarization with basic equipments in tissue culture.
4. Study through photographs: Anther culture and somatic embryogenesis
5. Study through photographs: endosperm and embryo culture; micropropagation.
6. Study of molecular techniques: PCR and Blotting techniques.
7. Demonstration of Gel electrophoresis.
8. Demonstration and comparison of genetically modified plants.(Bt Cotton, Bt Brinjal and Bt, Tomato)

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4thedition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

Fifth Semester B.Sc. (Botany) Elective I

Paper Code: BOTDSET5.2A **Paper Title :** Cell and Molecular Biology
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Teaching Hours:60 **Credits :**3

Unit 1:

- **Techniques in Biology**
  Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.
- **Cell as a unit of Life**
  The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.
- **Cell Membrane and Cell Wall**
  The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall.

15 Hours

Unit 2:

- **Mitochondria:** Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA.
- **Chloroplast:** Structure, marker enzymes, composition; semi autonomous nature, chloroplast DNA.
- **ER, Golgi body & Lysosomes:** Structures and roles.
- **Peroxisomes and Glyoxisomes:** Structures, composition, functions in animals and plants and biogenesis.
- **Nucleus:** Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

15 Hours

Unit 3:

- **Cell Cycle**
  Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.
- **Genetic material**
  Gene concept: DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material.
- **DNA replication (Prokaryotes and eukaryotes):** bidirectional replication, semi–conservative, semi discontinuous RNA priming, Ǿ (theta) mode of replication, replication of linear, ds- DNA, replicating the 5́ end of linear chromosome including replication enzymes.

15 Hours

Unit4:

- **Transcription (Prokaryotes and Eukaryotes)**
  Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Protein synthesis in Prokaryotes and eukaryotes, genetic code.
- **Regulation of gene expression**
  Gene concept and protein synthesis, Prokaryotes: Lac operon and Tryptophan operon; and in Eukaryotes.

15 Hours

Practical: Elective I

Paper Code: BOTDSE P5.2A **Paper Title :** Cell and Molecular Biology
Teaching Hours: 3Hrs / Week **Marks:** Th-40+IA-10
Credits :3

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. Study of mitosis and meiosis (temporary mounts and permanent slides).
5. Measure the cell size (either length or breadth/diameter) by micrometry.
6. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
7. Preparation of the Karyotype and ideogram from given photograph of somatic metaphase chromosome.
8. Isolation of DNA from plants.

Suggested Readings

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F.2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E.2009.The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W. M., Kleinsmith, L.J., Hardin.J. and Bertoni,G.P.2009.TheWorld of the Cell.7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Fifth Semester B.Sc. (Botany) Elective II

Paper Code: BOTDSET 5.2B **Paper Title :** Genetics, Plant Breeding and evolution
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Teaching Hours:60 **Credits :**3

Unit1: Heredity

1. Brief life history of Mendel
2. Terminologies
3. Laws of Inheritance
4. Modified Mandelian Ratios: 2:1-lethal Genes; 1:2:1-Co-dominance,incomplete dominance; 9:7; 9:4:3; 13:3;12:3:1.
5. Chi Square
6. Pedigree Analysis
7. Cytoplasmic Inheritance: Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in Mirabilis jalapa, Male sterility.
8. Multiple allelism
9. Pleiotropism
10. Chromosome theory of Inheritance.

15 Hours

Unit2:

- **Sex-determination and Sex-linked Inheritance**
- **Linkage and Crossing over:** Linkage: concept & history complete & incomplete linkage, bridges experiment, coupling& repulsion, recombination frequency, linkage maps based on two and three factor crosses. Crossing over: concept and significance, cytological proof of crossing over.
- **Mutations and Chromosomal Aberrations:** Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy; Structural chromosomal changes: Deletions, Duplications, Inversions &Translocations. **15 Hours**

Unit 3:

- **Plant Breeding:** Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.
- **Methods of crop improvement:** Introduction, Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.
- **Crop improvement and breeding:** Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement. **15 Hours**

Unit 4:

- **Evolution;** Origin of life: Special creation theory, Theories of spontaneous generation or abiogenesis. Theory of chemical evolution and spontaneous origine of life at molecular level Oparin's hypothesis Miller's experiment, Protenoid microsphere.
- **Process of origin of life**:Structure of cosmos, primitive earth, Prebiotic synthesis, Evolution of progenote, Origine and evolution of protein RNA, DNA, Plasma membrane,
- Origin of prokaryotes and eukaryotes (endo symbiotic hypothesis)
- **Theories of organic evolution:** Lamarkism, Darwinism, Mutational and Modern concept of Evolution. **15 Hours**

Practical: Elective II

Paper Code: BOTDSEP5.2B	**Paper Title :** Genetics, Plant Breeding and evolution
Teaching Hours: 3Hrs / Week	**Marks:** Th-40+IA-10
	Credits :1

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
7. Hybridization techniques - Emasculation, Bagging (For demonstration only).
8. Induction of polyploidy conditions in plants (For demonstration only).
9. Genetic problems.
10. Genetic problems.

Suggested Readings

1. Gardner E J, Simmons M J, Snustad D P (2008).Principles of Genetics. 8th Ed. Wiley- India.
2. Snustad, D. P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug W S, Cummings MR, Spencer, C, Palladino, M (2011).Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freemanand Co., U.S.A.10th edition.
5. Pierce B A (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B. D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007).Principles of Plant Genetics & Breeding. Blackwell Publishing.

Fifth Semester B.Sc. (Botany) Skill Enhancement Course

Paper Code: BOTSEC5.3 **Paper Title :** Medicinal Botany
Teaching Hours: 2Hrs / Week **Marks:** Th-40+IA-10
Credits :2

Unit1:

- History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, pancha mahabhutas, sapta dhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha:Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/therapy, polyherbal formulations.
- Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacredgroves, National Parks; Exsitu conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

15 Hours

Unit 2:

- **Propagation of Medicinal Plants**: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.
- **Ethnobotany and Folk medicines. Definition**; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure andskindiseases. **15 Hours**

Suggested Readings

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.

2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

Sixth Semester B.Sc. (Botany)

Paper Code: BOTDSE6.1 **Paper Title :** Analytical Techniques in Plants
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Credits :3

Unit1:

- **Imaging and related techniques**

  Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freez eetching.

15 Hours

Unit 2:

- **Cell fractionation**

  Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.
- **Radioisotopes**

  Use in biological research, auto-radiography, pulse chase experiment.
- **Spectrophotometry**

  Principle and its application in biological research.

15 Hours

Unit3:

- **Chromatography**

  Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion- exchange chromatography; Molecular sieve chromatography; Affinity chromatography.
- **Characterization of proteins and nucleic acids**

  Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

15 Hours

Unit4:

- **Biostatistics**

  Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

15 Hours

Practical

Paper Code: BOTDSEP 6.1 **Paper Title :** Analytical Techniques in Plants
Teaching Hours: 3Hrs / Week **Marks:** Th-80+IA-20
Credits :3

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.

2. To separate Amino acids by paper chromatography.

3. To separate chlorophyll pigments by paper chromatography.

4. To estimate protein concentration through Lowry's methods.

5. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).

6. Preparation of permanent slides (double staining).

7. Calculation of central tendencies (Mean, Mode and Median)

8. Calculation of standard deviation.

9. Calculation of ANOVA (Analysis of variance- one way ANOVA)

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata Mc Graw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.

2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.

3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

Sixth Semester B.Sc. (Botany) Elective III

Paper Code: BOTDSET6.2A **Paper Title :**Research Methodology
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Credits :3

Unit1:

- **Basic concepts of research**
  Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

15 hours

Unit2:

- **General laboratory practices**
  Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.
- **Data collection and documentation of observations**
  Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.

15 hours

Unit3:

- **Overview of Biological Problems**
  History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics-Transcriptional regulatory network.
- **Methods to study plant cell/tissue structure**
  Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non- coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

15 hours

Unit 4:

- **Plant microtechniques**
  Staining procedures, classification and chemistry of stains.Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.
- **The art of scientific writing and its presentation**
  Numbers, units, abbreviations and nomenclature used in scientific writing. Writingre ferences. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

15 hours

Practical: Elective III

Paper Code: BOTDSE P 6.2A **Paper Title :**Research Methodology
Teaching Hours: 3Hrs / Week **Marks:** Th-40+IA-10
Credits :1

1. Basic introduction to laboratory safety.
2. Research techniques.
   a. Microscopic techniques.
   b. Chromatography technique.
   c. Separation technique.
3. Experimental design.
4. Sampling techniques.
5. Introduction to research methodology.
6. Introduction to research ethics.
7. Introduction to Intellectual property rights.
8. Skill of writing Scientific/research paper.
9. Research paper communication.
10. Search engines and research databases.
11. Academic misconduct and plagiarism

Suggested Readings

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.

2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.

3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

Sixth Semester B.Sc. (Botany) Elective IV

Paper Code: BOTDSET6.2B **Paper Title : Biofertilizers and Organic Farming**
Teaching Hours: 4Hrs / Week **Marks:** Th-80+IA-20
Teaching Hours:60 **Credits :**3

Unit 1:

- **Manures and Biofertilizers:** Need for fertilizers, manures. Manure composition. Manures for crop productivity.

Differences between fertilizers and biofertilizers: pH changes and water contamination.

- **Organic Farming:** Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable

municipal, agricultural and industrial wastes, Biocompost making- types, method of vermicomposting, Panchakavya. Biological pest control (neem)

15 Hours

Unit 2:

- **Bacterial Biofertilizers:** General account on the microbes used as bio fertilizer. *Azotobacter*: classification,

characteristics– crop response to *Azotobacter* inoculum, maintenance and mass multiplication. *Rhizobium* – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

15 Hours

Unit 3:

- **Algal Biofertilizers;** *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, *Azolla* in rice cultivation.

15 Hours

Unit 4:

- **Fungal Biofertilizers:** Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and

distribution, phosphorus nutrition, growth and yield, colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

15 Hours

Practical: Elective IV

Paper Code: BOTDSE P 6.2B **Paper Title : Biofertilizers and Organic Farming**
Teaching Hours: 4Hrs / Week **Marks:** Th-40+IA-10
Credits :1

PRACTICAL

1. Isolation and culture of *Rhizobium* and Algae.
2. Anatomy of *Azolla* leaf and identification of *Anabaena azollae*.
3. Mass cultivation of *Azolla*.
4. Isolation and culture of VAM.
5. Compost preparation- green manure, vermicompost.
6. Estimation of mineral content of biomass from vermicompost manure(pH, Nitrate,Nitrite, sulphate, Calcium, magnesium, Ammonia, Silica)
7. Isolation of cyanobacteria from soil.
8. Isolation of Fungi from soil
9. Isolation of Bacteria from soil

Suggested Readings

1. Dubey R.C. 2005. A Text book of Biotechnology. S.Chand & Co. New Delhi.
2. Kumaresan V. 2005. Biotechnology. Saras Publications. New Delhi.
3. John Jothi Prakash E. 2004. Outlines of Plant Biotechnology. Emkay Publication. New Delhi.
4. Sathe T.V. 2004. Vermiculture and Organic Farming. Daya Publishers. New Delhi.
5. Subha Rao N.S. 2000. Soil Microbiology, Oxford & IBH Publishers. New Delhi.
6. Vayas S.C, Vayas S. and Modi H.A. 1998.Bio-fertilizers and organic Farming Akta Prakashan. Nadiad.

Sixth Semester B.Sc. (Botany) Skill Enhancement Course

Paper Code: BOTSEC6.3 **Paper Title :** Ethnobotany
Teaching Hours: 2 Hrs / Week **Marks:** Th-40+IA-10
Teaching Hours:30 **Credits :**2

Unit1:

- **Introduction to Ethnobotany:** Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a)Food plants b)intoxicants and beverages c)Resins and oils and miscellaneous uses.
- **Ethnobotany and legal aspects**

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

15 Hours

Unit 2:

- **Methodology of Ethnobotanical studies**

Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) Temples and sacred places.

- **Role of ethnobotany in modern Medicine**

Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba*e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia sepentina, Trichopus zeylanicus, Artemisia, Withania*.

Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management). **15 Hours**

Suggested Readings

1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2) S. K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxfordand IBH, New Delhi–1981
3) Lone et al,.Palaeoethnobotany
4) S. K. Jain (ed.)1989.Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
5) S. K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah. 8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine–INA–SHREE Publishers, Jaipur-19969)

Question Paper pattern
First Semester B.Sc. Degree Examination, December 2020
(CBCS Scheme-2020-21: Regular)
BOTANY
BOTDSC T11: Biodiversity (Microbes, Algae, Fungi and Archegoniate)

Time: 3 hours Max. Marks: 80

1.		**Answer any 10 sub question**	**10 x 2 = 20**
	i.		
	ii.		
	iii.		
	iv.		
	v.		
	vi.		
	vii.		
	viii.		
	ix.		
	x.		
	xi.		
	xii.		
2.			
	(a)	5 marks	
	(b)		10 marks
		OR	
3.	(a)	5 marks	
	(b)		10 marks
4	(a)	5 marks	
	(b)		10 marks
		OR	
5	(a)	5 marks	
	(b)		10 marks
6.	(a)	5 marks	
	(b)		10 marks
		OR	
7.	(a)		

		5 marks
	(b)	10 marks
8.	(a)	5 marks
	(b)	10 marks
	OR	
9.	(a)	5 marks
	(b)	10 marks

****

Instruction to set the question paper.

1. Question number 1 has 12 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any ten questions.
2. Question number 2 and 3 are from unit I.
3. Question number 4 and 5 are from unit II.
4. Question number 6 and 7 are from unit III
5. Question number 8 and 9 are from unit IV.
6. Student has to answer either question number 2 or 3, 4 or 5, 6 or 7 and 8 or 9.

Note: In case student answered both the questions from the same unit in full or part, highest marks from any one choice has to be considered.

Question paper pattern for skill enhancement course, SEC

Third Semester B.Sc. Degree Examination, December 2021
(CBCS Scheme-2020-21: Regular)
Botany
BOTSEC T32: Skill Enhancement Course

Time: 2 hours Max. Marks: 40

1.		**Answer any 5 sub question**	**5 x 2 = 10**
	i.		
	ii.		
	iii.		
	iv.		
	v.		
	vi.		
2.			
	(a)	5 marks	
	(b)		10 marks
		OR	
3.	(a)	5 marks	
	(b)		10 marks
4	(a)	5 marks	
	(b)		10 marks
		OR	
5	(a)	5 marks	
	(b)		10 marks

Instruction to set the question paper.

7. Question number 1 has 6 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any five questions.
8. Question number 2 and 3 is from unit I.
9. Question number 4 and 5 is from unit II.
10. Student has to answer either question number 2 or 3, 4 or 5.

Note: In case student answered both the question from the same unit in full or part, highest marks from any one choice has to be considered.