DEPARTMENT OF BOTANY

J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)

B.Sc. I Semester (CBCS)

Session 2020-21

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	**Max. marks**		
1	BSC-110	CC	Biodiversity (Microbes, Algae, Fungi, Archegoniate)	4	30	70	100	4
2	BSC-111	Practical-CC	Practical	4	-	50	50	2

Note:

CC - Core Course

B.Sc. I SEMESTER

Biodiversity (Microbes, Algae, Fungi and Archegoniate) (BSC-110)

THEORY

Unit 1

Microbes

Viruses – Discovery, general structure, replication (general account), Lytic and lysogenic cycle, Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2

Algae

General characteristics; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas, Oedogonium*, *Vaucheria, Fucus, Polysiphonia*. Economic importance of algae.

Unit 3

Fungi

Introduction- General characteristics and classification; life cycle of *Rhizopus* (Zygomycota) *Penicillium, Alternaria* (Ascomycota), *Puccinia, Agaricus* (Basidiomycota); Symbiotic Associations-Lichens:

General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Unit 4

Bryophytes

General characteristics and Classification, Range of thallus organization. Morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Economic importance of bryophytes.

Unit 5

Pteridophytes and Gymnosperms

General characteristics and classification of Pteridophytes, morphology, anatomy and reproduction of *Rhynia*, *Lycopodium*, *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution.

Gymnosperms: General characteristics and classification, morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Economical importance.

Recommended Books

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, MacMillan 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.

B.Sc. I SEMESTER – BOTANY PRACTICAL (BSC-111)

Biodiversity (Microbes, Algae, Fungi and Archegoniate)

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 *Nostoc, Chlamydomonas* (electron micrographs)*, Oedogonium, Vaucheria, Fucus* and Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides)
5. *Rhizopus and Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria:* 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

a. *Agaricus*.

9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: Ecto mycorrhiza and endo mycorrhiza (Photographs)
11. ***Marchantia***- Morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup,

a. 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
17. Microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
18. ***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).

DEPARTMENT OF BOTANY

J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)

B.Sc. II Semester (CBCS)

Session 2020-21 onwards

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	Max. marks		
1	BSC-210	CC	Plant Ecology and Taxonomy	4	30	70	100	4
2	BSC-211	Practical-CC	Practical	4	-	50	50	2

Note:

CC - Core Course

B.Sc. II SEMESTER

Plant Ecology and Taxonomy (BSC-210)

THEORY

Unit 1

Ecological factors

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Plant communities:Characters; Ecotone and edge effect; Succession; Adaptation of hydrophytes and xerophytes.

Unit 2

Ecosystem

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous,Phytogeography: Introduction, Principle biogeographical zones of World, India and Rajasthan ;Endemism.

Unit 3

Plant taxonomy

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series). Taxonomic hierarchy: Ranks, categories and taxonomic groups. **Nomenclature:** Principles and rules (ICN); Herbarium techniques, important herbaria and botanical gardens of the world and India.

Unit 4

Taxonomic evidences, Biometrics, numerical taxonomy and cladistics:Characters; variation:

Taxonomic evidences from palynology, cytology, phytochemistry and molecular data. **Biometrics, numerical taxonomy and cladistics:** Characters; variation: OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

Unit 5

Study of Angiosperm families: Brassicaceae -*Brassica, Alyssum / Iberis* **Asteraceae** - *Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax;* **Solanaceae** –*Solanum nigrum, Withania;* **Lamiaceae** -*Salvia, Ocimum*; **Liliaceae** - *Asphodelus / Lilium / Allium.*

Recommended Books

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.

B.Sc. II SEMESTER

PRACTICAL (BSC-211)

Plant Ecology and Taxonomy

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 soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
   (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).
   (b) Study of biotic interactions of the following: Stem parasite (*Cuscuta)*, Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
4. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
5. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
6. 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):Brassicaceae -*Brassica, Alyssum / Iberis;* Asteraceae -*Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax;* Solanaceae -*Solanum nigrum, Withania;* Lamiaceae -*Salvia, Ocimum*; Liliaceae - *Asphodelus / Lilium / Allium.*
7. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

DEPARTMENT OF BOTANY

J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)

B.Sc. III Semester (CBCS)

Session 2021-22

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	Max. marks		
1	BSC-310	CC	Plant Anatomy and Embryology	4	30	70	100	4
2	BSC-311	Practical-CC	Practical	4	-	50	50	2
3	BSC-319	SEC	Herbal Technology	4	-	100	100	4

Note:

CC - Core Course SEC - Skill Enhancement Course

B.Sc. III SEMESTER

Plant Anatomy and Embryology (BSC-310)

THEORY

Unit 1

Meristematic, Permanent Tissues and Organs

Root and shoot apical meristems; Simple and complex tissues. Structure of dicot and monocot root stem and leaf and their modifications.

Unit 2

Secondary Growth

Secondary growth in root and stem, Wood (heartwood and sapwood).Epidermis, cuticle, stomata; Anomalous secondary growth, General account of adaptations in xerophytes and hydrophytes.

Unit 3

Plant Reproduction

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac. Pollination and fertilization: **Pollination mechanisms and adaptations; Double fertilization;**

Unit 4

Embryo and endosperm: Endosperm types, structure and functions; Dicot and monocot embryo; Embryo- endosperm relationship

Unit 5

Seed, Apomixis and Polyembryony

Seed: mature monocot and dicot seed structure, seed dispersal mechanism. Apomixis and polyembryony: Definition, types and practical applications.

Recommended Books

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.

B.Sc. III SEMESTER

PRACTICAL (BSC-311)

Plant Anatomy and Embryology

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: *Helianthus* (only Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.

B.Sc. III SEMESTER

SKILL ENHANCEMENT COURSE

Herbal Technology (BSC-319)

1. Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

2. Pharmacognosy - systematic position medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

3. 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).
4. 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)

5. Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy)

Recommended Books

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

2. The indigenous drugs of India, Kanny, Lall, Dey and 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 Indra 1994. Oxford IBH publishing Co.

5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.

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

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

DEPARTMENT OF BOTANY

J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)

B.Sc. IV Semester (CBCS)

Session 2021-22

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	Max. marks		
1	BSC-410	CC	Plant Physiology and Metabolism	4	30	70	100	4
2	BSC-411	Practical - CC	Practical	4	-	50	50	2
3	BSC-419	SEC	Medicinal Botany	4	-	100	100	4

Note:

CC - Core Course SEC - Skill Enhancement Course

B.Sc. IV SEMESTER

Plant Physiology and Metabolism (BSC-410)

THEORY

Unit 1

Plant-water relations and Mineral nutrition

Water potential, Diffusion and Osmosis.Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. Essential elements, macro and micronutrients;
Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 2

Translocation in phloem and photosynthesis

Pressure flow model; Phloem loading and unloading,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.

Unit 3

Respiration and Enzymes

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway. Enzymes: Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Unit 4

Nitrogen metabolism and Plant growth regulators

Biological nitrogen fixation; Nitrate and ammonia assimilation. Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit 5

Plant response to light and temperature

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

Recommended Books

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.

B.Sc. IV SEMESTER

PRACTICAL (BSC-411)

Plant Physiology and Metabolism

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

Demonstration experiments (any four)

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.

B.SC. IV SEMESTER

SKILL ENHANCEMENT COURSE

Medicinal Botany (BSC-419)

1. History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments.

2. 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.

3. Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

4. 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.

5. 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 and skin diseases.

Recommended Books

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.

DEPARTMENT OF BOTANY

J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)

B.Sc. V Semester (CBCS)

Session 2022-23

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	Max. marks		
1	BSC-519	DSE 1	Economic Botany and Biotechnology	4	30	70	100	4
2	BSC-521	Practical-DSE-1	Practical	4	-	50	50	2
3	BSC-520	DSE 2	Bioinformatics	4	30	70	100	4
4	BSC-522	Practical-DSE- 2	Practical	4	-	50	50	2
5	BSC-532	SEC	Nursery and Gardening	4	-	100	100	4

Note:

(1) DSE - Discipline Specific Elective Courses SEC - Skill Enhancement Course

(2) Students will opt any one Discipline Specific Elective Courses (DSE) out of given options.

B.Sc. V Semester

Economic Botany and Biotechnology (BSC-519)

THEORY

Unit 1

Origin of Cultivated Plants, Cereals, Legumes and Fibers

Concept of centers of origin, their importance with reference to Vavilov's work

Wheat -Origin, morphology, uses; Legumes: General account with special reference to Gram and soybean, General description of fibres with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 2

Spices, Beverages, Oils and Fats

General account of spices with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses, Tea and Coffee (morphology, processing, uses),

General description of oils and fats with special reference to groundnut and sunflower.

Unit 3

Biotechnology

History and general information, Genomic DNA extraction, Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR, DNA sequencing**,** Gel electrophoresis, gene cloning.

Unit 4

Plant tissue culture and Bioinformatics

Plant Tissue culture techniques and methods, Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications, bioinformatics for analysis of genes and the annotated sequences of PCR products.

Unit 5

Recombinant DNA Techniques:

Recombinant DNA methods, C-DNA, Genomic tools, Gene Bank, Restriction Enzymes, plasmids, vectors, ligation of DNA sequence fragments, gene libraries, Applications of recombinant DNA.

Recommended Books

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
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.

B.Sc. V Semester

Practical-I (BSC-521)

Economic Botany and Biotechnology

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

B.Sc. V Semester

Bioinformatics (BSC-520)

THEORY

Unit 1

Introduction to Bioinformatics

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.
Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

Unit 2

Biological Sequence Databases

National Center for Biotechnology Information (NCBI), Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database.

EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools.

DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ.

Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR.

Swiss-Prot: Introduction and Salient Features.

Unit 3

Sequence Alignments

Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

Unit 4

Molecular Phylogeny

Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

Unit 5

Applications of Bioinformatics

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement.

Recommended Books

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley- Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

B.Sc. V Semester

Practical-II (BSC-522)

Bioinformatics

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

B.Sc. V Semester

Skill Enhancement Course

Nursery and Gardening (BSC-532)

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

2. 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.

3. 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.

4. 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.

5. 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.

Recommended Books

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, McGraw 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.

DEPARTMENT OF BOTANY
J.R.N. Rajasthan Vidyapeeth (Deemed to be University), Udaipur (Raj.)
B.Sc. VI Semester (CBCS)
Session 2022-23

S. No.	Paper Code	CC/DSE / SEC	Title	Hrs./ week	Internal Exam.	External Exam.	Total	Credit
					Max. marks	Max. marks		
1	BSC-619	DSE 1	Cell and Molecular Biology	4	30	70	100	4
2	BSC-621	Practical-DSE 1	Practical	4	-	50	50	2
3	BSC-620	DSE 2	Analytical Techniques in Plant Sciences	4	30	70	100	4
4	BSC-622	Practical-DSE 2	Practical	4	-	50	50	2
5	BSC-632	SEC	Floriculture	4	-	100	100	4

Note:

(1) DSE - Discipline Specific Elective Courses
SEC - Skill Enhancement Course

(2) Students will opt any one Discipline Specific Elective Courses (DSE) out of given options.

B.Sc. VI Semester

Cell and Molecular Biology (BSC-619)

THEORY

Unit 1

Techniques in Biology

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); X-ray diffraction analysis.

Cell: The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape.

Unit 2

Cell Organelles: Structure and Functions:

Cell Membrane and Cell Wall: Structure, composition and functions

Mitochondria: Structure, composition and functions, marker enzymes, Symbiont hypothesis; mitochondrial DNA.

Chloroplast: Structure, composition and functions,marker enzymes, chloroplast DNA.

ER, Golgi body, Lysosome, Peroxisomes and Glyoxisomes : Structure, composition and functions

Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

Unit 3

Genetic material and cell cycle

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. Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.

Unit 4

Replication and Transcription

DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi–conservative, semi discontinuous, **:** Transcription (Prokaryotes and Eukaryotes),Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes). genetic code.

Unit 5

Transcription, Genetic Code and Regulation of gene expression

Translation (Prokaryotes and Eukaryotes),Genetic Code, Regulation of gene expression in Prokaryotes: Lac operon and Tryptophan operon ; Regulation of gene expression in Eukaryotes.

Recommended Books

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. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

B.Sc. VI Semester

Practical-I (BSC-621)

Cell and Molecular Biology

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. To study the structure of animal cells by temporary mounts-squamous epithelial cell and nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells
7. /cheek epithelial cells using vital stain Janus green.
8. Study of mitosis and meiosis (temporary mounts and permanent slides).
9. Study the effect of temperature, organic solvent on semi permeable membrane.
10. Demonstration of dialysis of starch and simple sugar.
11. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
12. Measure the cell size (either length or breadth/diameter) by micrometry.
13. Study the structure of nuclear pore complex by photograph (from Gerald Karp)Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
14. Study DNA packaging by micrographs.
15. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

B.Sc. VI Semester

Analytical Techniques in Plant Sciences (BSC-620)

THEORY

Unit 1

Imaging and related techniques

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy,Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit 2

Cell fractionation and Radioisotopes

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.

Unit 3

Spectrophotometry and Chromatography

Spectrophotometry: Principle and its application in biological research. Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion- exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Unit 4

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

Unit 5

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.

Recommended Books

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw- 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.

B.Sc. VI Semester

Practical-II (BSC-622)

Analytical Techniques in Plant Sciences

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

B.Sc. VI Semester

Skill Enhancement Course

Floriculture (BSC-632)

1. Introduction: History of gardening; Importance and scope of floriculture and landscape gardening,Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

2. Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

3. Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

4. Landscaping Places of Public Importance: Landscaping highways and Educational institutions. Diseases and Pests of Ornamental Plants.

5. Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids).

Recommended Books

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

REMARKS:

Signatures:

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