

RAJ RISHI GOVT. (AUTONOMOUS) COLLEGE, ALWAR (RAJ.)



(An Autonomous Institute Affiliated to RRBMU, Alwar)



THREE/FOUR YEAR UNDERGRADUATE

PROGRAMME

FACULTY OF SCIENCE

Programme : Bachelor of Science (Botany)

Programme Code: UG0103 Bachelor of Science (Botany)

Subject/Course/Discipline-Botany

Medium of Instruction : Hindi / English

(Syllabus as per NEP-2020 and Choice Based Credit System)

(Academic Year 2023-24 Onwards)

Director

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]

Name of College	Raj Rishi Govt. (Autonomous) College Alwar (Rajasthan)
Name of Faculty	Science
Name of Programme	Three/Four Year Bachelor of Science (Botany)
Name of Discipline	Botany

SEMESTER - WISE PAPER TITLES WITH DETAILS

Three/Four Year Bachelor of Science (Botany)										
S. No.	Level	Semester	Type	Botany		Title	Credits			Total
				Programme Code	Course Code		L	T	P	
1.	5	I	MJR	UG0103	BOT-51T-101	Cell Biology, Genetics and Plant Breeding	4	0	0	4
2	5	I	MJR	UG0103	BOT -51T-102	Diversity of Plant Kingdom	4	0	0	4
3	5	I	MJR	UG0103	BOT -51P-103	Botany Lab-I	0	0	2	2
4	5	I	MJR	UG0103	BOT -51P-104	Botany Lab-II	0	0	2	2
5	5	II	MJR	UG0103	BOT -52T-105	Plant Biochemistry and Physiology	4	0	0	4
6	5	II	MJR	UG0103	BOT -52T-106	Ecology and Plant Resource Utilization	4	0	0	4
7	5	II	MJR	UG0103	BOT -52P-107	Botany Lab-III	0	0	2	2
8	5	II	MJR	UG0103	BOT -52P-108	Botany Lab-IV	0	0	2	2

BOTANY
Semester -I

B.Sc. Part I (Hons)

Maximum Marks: 300

SEMESTER-I

Paper-I BOT-51T-101 Cell Biology, Genetics and Plant breeding	100 marks
Paper-II BOT-51T-102 Diversity of Plant Kingdom	100 marks
Practical 1 BOT-51P-103 (6 hrs.)	50 marks
Practical 2 BOT-51P-104 (6 hrs.)	50 marks

SEMESTER-II

Maximum Marks: 300

Paper-III BOT-52T-105 Plant Biochemistry and Physiology	100 marks
Paper-IV BOT-52T-106 Ecology and Plant Resource Utilization	100 marks
Practical 1 BOT-52P-107 (6 hrs.)	50 marks
Practical 2 BOT-52P-108 (6 hrs.)	50 marks

Handwritten signatures and scribbles in blue ink, including names like Divyata, Archan, and others.

Scheme of Examination (Common for all theory papers)

Continuous assessment (20% weightage)

(End of Semester Examination) EoSE (80% weightage)

Each theory paper shall have two parts A & B.

Part A: 20 marks

Part A will be compulsory having 10 or 20 very short answer type questions (with a limit of 20 words) of two or one marks respectively.

Part B: 60 marks

Part B of question paper shall be divided into four units comprising question numbers 2-5. There will be two questions from each unit with internal choice. Each question will carry 15 marks.

Bachelor of Science

	Continuous assessment (C A)	End of Semester Examination (EoSE)	Total
Theory Time	1:00 Hours	3:00 Hours	
Marks (Max Marks)	20	80	100
Minimum Marks	8	32	40
Practical Time	2:00 Hours	4:00 Hours	
Marks (Max Marks)	10	40	50
Minimum Marks	4	16	20

Handwritten signatures and notes in blue ink:
A large signature at the top left.
A signature in the middle with the name "Dnyata" written below it.
A signature on the right with the name "Alubana" written below it.
Other illegible signatures and scribbles are present at the bottom.

SEMESTER-I

Paper I- BOT-51T-101 Cell Biology, Genetics and Plant breeding

Objectives

- To understand the structural organization of cells.
- To understand structure and functions of different organelles in the cell.
- To understand the concept of cell division, mutations and chromosomal aberrations.
- To understand basic laws of inheritance and variations.
- To understand various gene interactions.
- To understand basics of plant breeding methods and other crop improvement strategies.

Course Outcomes:

At the completion of the course, the student would be able to:

BOTANY	
Cognitive level	Course outcomes
1. Understanding	<ul style="list-style-type: none">➤ Learn, understand and develop skill and hands on training in basics of cell biology, genetics and plant breeding.➤ The functions and structural properties of different types of cells and their organelles.➤ Cycle of cell division, gene interactions, DNA damage and repair mechanisms.➤ Principles of crop improvement strategies.
2. Memorizing	<ul style="list-style-type: none">➤ The structural and functional aspects of cell and cellular organelles.➤ Various stages of cell cycle and cell division.➤ Inheritance and various types of gene interactions.➤ Basics methods of plant breeding and crop improvement.
3. Applying	<ul style="list-style-type: none">➤ Variations in functions of cell organelles.➤ Concept of cell cycle, functions of cell membrane, chromosomal alterations.➤ Possibilities of mutations and mutagens.➤ Role of gene interactions in phenotype development.➤ Implying of plant breeding methods for crop improvement.

2102
Diyata
3. On
Arkhara
AD

UNIT I

Ultrastructure of Cell and Cell Organelles: Eukaryotic and Prokaryotic cell structure; Ultrastructure and functions of different cell organelles (Cell wall, Plasma membrane, Nucleus, Mitochondria, Chloroplast, Ribosome, Peroxisomes, Lysosome, Golgi bodies and Endoplasmic Reticulum); Basic idea of Mitochondrial and Chloroplast genome. **Gene and DNA:** Genome, Gene, Double helical structure of DNA, DNA supercoiling, Gene structure. **Chromosome organization:** chromatin Structure and chromosome organization, Chromosome Morphology, Specialized types of chromosomes: Sex chromosomes, Lambrush and Polytene chromosomes.

15 hrs

UNIT II

Cell Division: Basic idea of Cell cycle; Different stages of mitosis; Different stages of Meiosis I and Meiosis II, synaptonemal complex, chiasmata formation and crossing over. **Structural and numerical aberrations in human chromosomes and ploidy in plants:** Deletion, Duplication, Translocation, Inversion, Aneuploidy and Polyploidy. **Genetic material:** DNA as genetic material (Griffith's transformation experiment and Hershey and Chase blender experiment); structure of DNA (Watson and Crick Model); Structure and function of different types of RNA (rRNA, m RNA, tRNA, sn RNA). **Mutations:** Types of Mutations, Spontaneous and induced Mutations, Physical and Chemical mutagens.

15 hrs

UNIT III

Genetic inheritance: Mendel's laws of inheritance and their exceptions; allelic (incomplete dominance, co-dominance, lethality) and non-allelic interactions (complementary genes, epistasis and duplicate genes); Multiple allelism (ABO blood groups in men); Quantitative inheritance (Grain color in wheat). **Cytoplasmic inheritance:** Plastid inheritance (different types of leaves in *Mirabilis jalapa*); Mitochondrial inheritance (Cytoplasmic male sterility in plants).

DNA damage and repair: Causes of DNA damage and molecular mechanisms of repair – excision repair system in bacteria, base excision, recombination repair systems and SOS repair.

Plant breeding: History and objectives of plant breeding. Types of plant reproduction (vegetative, asexual and sexual); Modes of pollination (Self and Cross); relevance of mode of reproduction to plant breeding; their effect on generating and fixing genotypic variation. Types

2702
Diyata
Bh
3.00
Archan
AD

of crop plants for plant breeding (self-pollinated, cross-pollinated and vegetatively propagated crop plants).

15 hrs

UNIT IV

Plant introduction and acclimatization: Purpose, Types (primary and secondary), Procedure, merits and demerits and achievements. Plant introduction agencies in India (NBPGR, FRI, BSI). Famous Indian and International plant breeders and their contributions. National and International agricultural research institutes. **Inbreeding:** Pure and inbred lines, methods of inbreeding, its genetic effects (inbreeding depression), its practical applications. **Hybridization:** Meaning, objectives, types, procedure, various methods of emasculation, genetic effects (hybrid vigor), its practical applications. Role of mutation and polyploidy in plant breeding (with examples).

Methods of plant improvement: Selection (Pureline and mass selection); hybridization methods in self-pollinated plants (Pedigree and Bulk method) and in cross-pollinated crops (single and double cross); Interspecific hybridization. Plant breeding work done on wheat and rice in India, Green revolution.

15 hrs

BOT-52P-103-Suggested Laboratory Exercises:

- Study of cell structure from Onion, *Hydrilla* and *Spirogyra*.
- Study of cyclosis in *Tradescantia* spp.
- Study of plastid for pigment distribution in *Lycopersicom*, *Cassia* and *Capsicum*.
- Study of electron microphotographs of eukaryotic cells for various cell organelles.
- Study of electron microphotographs of virus, bacteria and eukaryotic cells for comparative study of cellular organization.
- Study of different stages of mitosis and meiosis in root-tip cells and flower buds respectively of onion.
- To solve genetic problems based upon Mendel's laws of inheritance: Monohybrid, Dihybrid, Back cross and test cross.
- Permanent slides/photographs of different stages of mitosis and meiosis, sex chromosomes, polytene chromosome and salivary gland chromosomes,
- Emasculation, bagging & tagging techniques
- Permanent slides/photographs of different stages of mitosis and meiosis, sex chromosomes, Polytene chromosome and Lampbrush chromosomes.
- Genetic Problems on Monohybrid cross.
- Genetic Problems on Dihybrid cross.
- Genetic Problems on Non-Mendelian Interactions.
- Demonstration of Emasculation and hybridization.
- Study of Famous Indian and International plant breeders and their contributions.
- Study of National and International agricultural research institutes.

Divyata

Archan

Suggested Readings: -

1. Albert B., Johnson A., Lewis J., Raff M., Roberts K. and Walter P. 2014. Molecular biology of the cell. Garland Sciences, 6th edition.
2. Gupta P.K. 1999. A text book of cell and molecular biology, Rastogi publication, Meerut.
3. Lodish and Darnell J. 2000. Molecular cell (4th edition). W.H. Freeman & Co. New York, USA.
4. Cooper G. 2018. The Cell: A molecular approach. Sinauer Associates Inc, 8th edition.
5. De Roberts E. D. P. and De Roberts E. M. F. 2010. Cell and Molecular Biology. Walters Kluwer, 8 th edition.
6. Karp G., Iwasa J. and Marshall W. 2018. Cell Biology. Wiley publication., 8th edition.
7. Pollard. T. D. and Earnshaw, W.C. 2002. Cell Biology. Saunders, 3rd edition.
8. Pierce, B. A. (2012). Genetics: a conceptual approach. Macmillan publication.
9. Snustad, D. P., & Simmons, M. J. (2015). Principles of genetics. John Wiley & Sons.
10. Gupta, P.K. (2010). Cytogenetics. Rastogi Publications, Meerut, India.
11. Lewin, B., Krebs, J., Kilpatrick, S. T., & Goldstein, E. S. (2011). Lewin's genes X. Jones & Bartlett Learning.
12. Choudhary, H.K. Elementary Principles of Plant Breeding. Oxford and IBM Publishing Co., New Delhi, 1989.
13. Miglani, GS.: Advanced Genetics, Narosa Publishing House, New Delhi (2000).
14. Russel, PI Genetics. The Benjamins/Cummings Publishing Co., Inc. U.S.A. (1998).
15. Singh, B. D.: Plant Breeding-Principles and methods, Kalyani Publishers, New Delhi (1990)
16. Shukla, R.S. and Chandel, P.S.: Cytogenetics, Evolution and Plant Breeding, S. Chand & Co. Ltd., New Delhi (2000).
17. Singh, R. B.: Text Book of Plant Breeding, Kalyani Publishers, Ludhiana (1999).
18. Lodish, HF. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York.

Handwritten signatures and notes in blue ink at the bottom of the page, including names like 'Diyata', 'Shukla', and 'Sanghi'.

Semester- I

Paper-II BOT-51T-102 Diversity of Plant Kingdom

Objectives

- To understand microscopic to macroscopic view of the plants.
- To differentiate algal members from different class of the kingdom Algae
- To understand structure and reproduction in bryophytes.
- To understand difference between Hepaticopsida, Anthocerotopsida and Bryopsida.
- To interpret structure, reproduction, life cycle and economic importance of Lichens.

Course Outcomes:

At the completion of the course, the student would be able to:

BOTANY	
Cognitive level	Course outcomes
1. Understanding	<ul style="list-style-type: none">➤ To aware students, diversity of plants present on various habitats.➤ To understand microscopic to macroscopic view of the plants.➤ To interpret amphibious to symbiotic relationship of the plants.
2. Memorizing	<ul style="list-style-type: none">➤ Diagramatic representation of the algae, bryophytes and lichens.➤ Habit, habitat, thallus organization of various members.➤ Typical type of Life cycles found in algae and bryophytes.
3. Applying	<ul style="list-style-type: none">➤ Economic importance of algae, bryophytes and lichens.➤ Microscopic identification of algae, bryophytes and lichens.

Handwritten signatures and notes in blue ink:

- 2103
- Divyata
- 3.03
- Arshana
- मिर्जा
- संकाश

UNIT I

Algae: General characters, Classifications (Fritsch) upto classes. Diverse Habitat. Range of thallus structure. Reproduction (Vegetative, Asexual, Sexual). Types of the life cycle. *Type studies of: Chlorophyceae- Volvox, Chara; Xanthophyceae-Vaucheria; Phaeophyceae-Ectocarpus; Rhodophyceae-Polysiphonia.* Lichens- General characters, habitat, morphology and reproduction.

Fungi: General characteristics; Thallus organization; types of fruiting bodies, Cell wall composition; Heterokaryosis and parasexuality; Nutrition; Classification (*Alexopoulos*); reproduction, economic importance. Type studies: Oomycota: *Phytophthora*, Zygomycota: *Rhizopus*, Ascomycota: *Peziza*, Basidiomycota: *Agaricus*.

15 hrs

UNIT II

Bryophytes: General characters, Origin, and evolution of Bryophyta. Classification (*Rothmaler*), Habitat, Range of thallus structure, Reproduction (Vegetative and Sexual), Alternation of generations and Economic importance. Study of Morphology, Anatomy, Reproduction, Gametophytes and sporophytes of *Riccia*, *Marchantia* and *Funaria*.

15 hrs

UNIT III

Pteridophytes: General characters of pteridophytes, affinities with bryophytes & gymnosperms, classification, economic importance, study of life histories of fossil Pteridophytes – *Rhynia*. Type studies Life histories of *Selaginella*- (Heterospory and seed habit), *Equisetum*, *Pteris*, *Lycopodium*.

15 hrs

UNIT IV

Gymnosperms: General characters, classification, Gymnosperms: Type studies Life histories of *Cycas* & *Pinus*, economic importance of gymnosperms. Angiosperms: General characters, Differences between Monocotyledons and Dicotyledons, Typical life cycle of Angiosperm.

15 hrs



BOT-52P-104-Suggested Laboratory Exercises:

- Visit Local Garden /fieldstudy of plants
- Study of anatomy by making suitable temporary slides and study of permanent slides of *Volvox*, *Chara*, *Vaucheria*, *Ectocarpus*, *Polysiphnia* (vegetative and reproductive).
- Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
- *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides. *Peziza*: ascospores; *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*.
- **Bryophytes**- morphology of vegetative and reproductive stages of *Riccia*, *Marchantia*, and *Funaria*.
- **Pteridophytes**- study of vegetative and reproductive stages of *Selaginella*- (Heterospory and seed habit), *Equisetum*, *Pteris*, *Lycopodium*
- Study of Vegetative and reproductive stages of *Cycas* and *Pinus* using temporary and permanent slides.
- Study of monocot and dicot flowers and seeds.

Suggested Readings:

- Alexopoulos, C.J. and Mims, C.W.: *Introductory Mycology*, John Wiley and Sons, New York, 2000
- Dube, H.C. :*Fungi*, Rastogi Publication, Meerut, 1989.
- Vashihsta, B.R. **Botany for Degree Students -Fungi**, S. Chand & Co., New Delhi, 2001.
- Gilbert, M.Smith: *Crypogamic Botany*, Vol. I & II (2nd Ed.) Tata McGraw Hill. Publishing Co., Ltd., New Delhi, 1985.
- Kumar, H.D.: *Introductory Phycology*, Affiliated East—West Press, Ltd. New York, 1988.
- Puri. P.: *Bryophytes*, Atmaram& Sons. Delhi, Lucknow, 1985.
- Aneja, K.R.: *Experiments in Microbiology, Plant Pathology and Biotechnology* New Age International (P) Ltd., Publishers, New Delhi 2003.
- Pandey BP(2022) *Algae, Bryophytes and Lichens*, S Chand Publication.

Handwritten signatures and notes in blue ink:
Diyata
Aneja
S. Chand
10

Semester- II

Paper-III BOT-52T-105 Plant Biochemistry and Physiology

Objectives:

- Provide students with learning experiences that help instill deep interests in learning plant biochemistry and physiology.
- Develop broad and balanced knowledge and understanding of biomolecules, key biochemical concepts, principles and theories related to biochemistry.
- Equip students with appropriate tools of analysis and with theoretical, technical and analytical skills to tackle issues and problems in the field of biochemistry and plant physiology.
- Understand the plant nutrient uptake and translocation, photosynthesis, respiration and nitrogen metabolism.
- Understand the effects of various factors on the growth and development of plants.

Course Outcomes: At the completion of course, the student will be able to:

BOTANY	
Cognitive level	Course Outcomes
Understanding	<ul style="list-style-type: none">➤ Disciplinary knowledge and understanding of biochemistry, structure and function of biological molecules.➤ Students will be able to understand the various physiological life processes in plants
Memorizing	<ul style="list-style-type: none">➤ Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions.➤ Unique property of water as a universal solvent and its importance in biological system.➤ Understand the role of physiological and metabolic processes for plant growth and development.➤ They will also gain about the various uptake and transport mechanisms in plants and will be able to recognize the role of various plant hormones.
Applying	<ul style="list-style-type: none">➤ Curiosity and ability to formulate biochemistry related problems and using appropriate concepts and methods to solve them.➤ Applying the concepts of biochemistry in other discipline, to make significant contribution in interdisciplinary sciences.➤ Gained knowledge will help to identify mineral deficiency in the plants based on symptoms and their effective management.

Handwritten signatures and initials in blue ink, including "2103", "Dnyata", "B. C. S.", "Aruna", and "Surya".

Unit-1

Overview of Biochemistry: Definition, scope and significance of Biochemistry. Important discoveries in Biochemistry. An overview of elements, chemical reactions and biomolecules in living organisms. Properties of water: Molecular structure of water, physio-chemical properties of water. Its effect on biomolecules. importance to plant life, concept of water potential.

Proteins: Amino acids-structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, physical and chemical properties. Enzymes: Structure, nomenclature & classification of enzyme. Characteristics of enzymes, mechanism of action, multi-enzyme system, regulation of enzyme activity. 15 hrs

Unit-2

Carbohydrates: Introduction, importance, nomenclature, classification, molecular structure & function of mono, di and poly saccharides, their properties, glycosidic linkages and glycoprotein. **Lipids:** Introduction, nomenclature, classification, molecular structure & functions. Importance of fatty acids (saturated and unsaturated). Alpha and Beta oxidation.

Nucleic acids: DNA: Composition, Nucleosides and nucleotides. Chargaff's rule. Watson and Crick model of DNA. Melting of DNA (T_m). RNA: Composition, types (mRNA, tRNA and rRNA), secondary structures of tRNA – clover leaf model. Chemical reactions of RNA and DNA with acid and alkali. 15 hrs

Unit-3

Plant-water relations: Absorption and Transport of water; Ascent of sap, Transpiration and its significance; factors affecting transpiration; root pressure and guttation. Mineral nutrition: role of essential elements; transport of ions across cell membrane, active and passive transport, carriers, channels and Pumps. Transport of organic substances: Mechanisms of phloem transport, factors regulating the translocations of nutrients.

Photosynthesis: Pigments, Photosynthetic apparatus, light reaction, photo system I & II, Z scheme, photophosphorylation, C_3 (Calvin cycle), C_4 cycle, and factors affecting the photosynthesis.

Respiration: - Aerobic and anaerobic respiration; RQ (Respiratory Quotient), Kreb's cycle, electron transport system, oxidative phosphorylation, and factors affecting the process. Fermentation. 15 hrs

Unit-4

Nitrogen metabolism: Biological nitrogen fixation; nitrate and ammonia assimilation. Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Phases of growth and development: Seed dormancy and germination, plant movement, Biological clock-their regulatory factors.

Photoperiodism & vernalisation; physiology and mechanism of action, concept of florigen and phytochrome. 15 hrs

Handwritten signatures and scribbles in blue ink, including names like 'Dinyata', 'Arshana', and 'Surya'.

BOT-52P-107-Practical Exercises:

1. To separate amino acids in a mixture by paper chromatography.
2. To prepare the standard curve of protein.
3. To demonstrate the tests for proteins in the unknown samples.
4. To demonstrate the enzyme activity - Catalase, peroxidase and amylase.
5. To demonstrate the tests for different types of carbohydrates and lipids.
6. Conductometric titration of strong acid against strong base.
7. Conductometric titration of weak acid (amino acid) against strong base.
8. Carbohydrates –Molisch, Benedict's / Fehling's, picric acid, Barfoed's, Bial's, Seliwanoff's, osazone tests. Glucose, fructose, lactose, maltose and sucrose.
9. Proteins – Precipitation reactions of proteins, colour reactions of proteins, colour reactions of
10. Amino acids like tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine.
11. Colour reactions of proteins – Biuret, xanthoproteic, Millon's.
12. Lipids– solubility, acrolein test, Salkowski test, Lieberman-Burchard test.
13. Qualitative tests for nucleic acid.
14. To determine the osmotic potential of vacuolar sap by plasmolytic method.
15. To study the permeability of plasma membrane using different concentrations of organic solvents.
16. To study the effect of temperature of permeability of plasma membrane.
17. To separate chloroplast pigments by solvent method.
18. To separate chloroplast pigments using paper chromatography.
19. Bioassay of growth hormone (auxin, cytokinin, gibberellin).
20. Demonstration of phenomenon of osmosis by use of potato osmometer.
21. To demonstrate root pressure.
22. To demonstrate rate of transpiration by use of potometers.
23. Photosynthesis by inverted funnel method, Moll's experiment.
24. To demonstrate anaerobic and aerobic respiration.
25. R.Q. by Ganong's respirometer.
26. Measurement of growth using auxanometer.

Handwritten notes and signatures in blue ink:
21/02
Dingata
B. am
Aurang
H. H. H.

Suggested Readings:

1. Buchanan, B., Gruissem, G. and Jones, R. (2000). Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA.
2. Davies P J. (2004). Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands.
3. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley and Sons, U.S.A. 4th Edition.
4. Nelson, D.L., and Cox, M.M. (2008). Lehninger Principles of Biochemistry (5th ed.).
5. W.H. Freeman & Co., New York. Parashar, A. N. and Bhatia, K. N.: Plant physiology. Trueman Book Company, 1985.
6. Verma, S. K. and Verma, M.: A textbook of plant physiology, biochemistry and biotechnology. S. Chand Ltd., 2000.
7. Biochemistry by U. Sathyanarayana Books and Allied (P) Ltd. Kolkata, ISBN 0-87893-214-3, (2014).
8. Text book of Biochemistry by J.L Jain (2016). Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
9. Taiz, L., Zeiger, E., (2014). Plant Physiology. Sinauer Associates Inc., U.S.A. 6 th Edition. Verma, S.K.: Textbook of plant physiology. S. Chand & Company, 1999.
10. Parashar, A. N. and Bhatia, K. N.: Plant physiology. Trueman Book Company, 1985.
- 11 Jain, V. K.: Fundamentals of plant physiology. S. Chand & Company Ltd., 2013.
12. Verma, V.: Textbook of plant physiology. ANE Books India, 2007.
13. Malik, C. P. and Srivastava, A. K.: Textbook of plant physiology. Kalyani publication, 1982.

Handwritten signatures and scribbles in blue ink:

- Top right: *Arshana*
- Middle right: *Arshana*
- Bottom right: *Arshana*
- Bottom center: *Divyata*
- Bottom left: *2183*
- Bottom center: *Arshana*
- Bottom right: *Arshana*

Semester- II

Paper-IV BOT-52T-106 Ecology and Plant Resource Utilization

Objectives:

- To make students understand ecology and basic ecological concepts.
- To gain the knowledge on the economically important plants.
- To study interrelation between the living world and environment.
- To make aware about environmental issues.
- To understand plant part used of economic plants.
- To understand processing of plant part used as economic importance.
- To interpret the application of ethnobotany

Course Outcomes: At the completion of course, the student will able to:

BOTANY	
Cognitive level	Course Outcomes
Understanding	<ul style="list-style-type: none"> ➤ Understanding of ecology provides insights into the sustainable management of natural resources, including forests, fisheries, and water bodies. ➤ Understanding of morphology and processing and economic value of plant sources of cereals, legumes, spices, oil, rubber, timber and medicines.
Memorizing	<ul style="list-style-type: none"> ➤ Getting insights into the functioning of ecosystems and the relationships between organisms and their surroundings. ➤ Know and/or identify important plant species. ➤ Explain which parts of these plants are important for usage.
Applying	<ul style="list-style-type: none"> ➤ Application in assessing the value of ecosystem services, such as pollination, water purification, and carbon sequestration, and incorporating them into economic decision-making processes. ➤ Ecologists contribute to the development of conservation strategies and the management of protected areas. ➤ Domestic and industrial applications of plants. ➤ Learning about high value products from plants.

Unit-I

Environment and plant:

Ecological factors; Atmosphere (four distinct zone), light (photosynthetically active radiation, zonation in water bodies, photoperiodism, heliophytes and sciophytes), temperature (Raunkier's classification of plant: megatherm, mesotherm, microtherm, heikistotherm, thermoperiodicity and vernalisation), soil (development, soil profile, properties). Ecological adaptations of hydrophytes, xerophytes, epiphytes and halophytes. Population ecology: growth curve, ecotypes, ecads. Population interaction among organisms (neutralism, amensalism, alleliopathy), competition, predation, parasitism and mutualism.

Community characteristics and succession:

Frequency, density, cover, life forms, biological spectrum, ecological succession. Ecosystem: Structure, components, food chain, food web, energy flow, trophic levels and ecological pyramids, primary and secondary productivity, biogeochemical cycle of carbon and phosphorus.

15 Hrs.

Unit-II

Biogeographic regions and vegetation types of India:

Forest grassland with special reference to Rajasthan. Environmental pollution- air, water and soil, WWF, chipko movement, green house effect, ozone depletion loss of biodiversity and extinction of species, red data book.

Concept and principles of environmental management:

principle of optimized use and sustainable development, threats to sustainable development, ecological footprint, National Environmental Policy, management of forest and degraded lands, concepts and principles of environmental management, efforts to control these effects (Vienna Convention, Montreal Protocol, Earth summit, Kyoto Protocol, World Summit on sustainable development, 2002 Carbon trade); IPCC.

15 Hrs.

Unit-III

Origin of Cultivated Plants:

Concept of centres of origin, their importance with reference to Vavilov's work. History, origin, distribution, cultivation and processing of cereals: wheat, maize, rice and bajra. General account of pulses: chana and moong. Identification and medicinal value of locally available medicinal plants.

General account and identification of spices and condiments of Rajasthan:

Characteristics and uses of timber yielding plants teak and sal, dyes (*Indigo* and *Lawsonia*), beverages (tea and coffee), fumigators and masticatories, fat and oil yielding plants (*Brassica* and *Cocus*).

15 Hrs.

Unit-IV

Handwritten notes and signatures in blue ink, including the name "Diyata" and other illegible scribbles.

General account and identification of locally available fruits, vegetable and ornamental plant:

History, cultivation, processing and economic use of sugar and rubber, fiber yielding plants (cotton and jute).

Ethnobotany and its concepts and relevance:

Ethnobotanical areas of Rajasthan, ethnic groups in India and ethnobotanical study of any tribal area of Rajasthan. Ethical aspect of ethnobotany. 15 Hrs.

BOT-52P-108-Suggested Laboratory Exercises:

- Study of adaptive anatomical and morphological features of Hydrophytes, Epiphytes and Xerophytes using plant material.
- Study of soil pH, soil moisture in relation to depth, bulk density, porosity and water holding capacity of different soil samples.
- Determination of requisite size and number of quadrat for the study of plant community
- Study of structure of plant community by determining frequency, density and abundance of quadrat method.
- To study different statistical methods: mean, median and mode, standard error, standard deviation.
- Regression analysis and application of statistical tests in environmental problems.
- Study and Submission of economically important plants and plant products (cereals, pulses, spices, fibers, condiments, fat and oils, tea, coffee, wood, dyes, tobacco).
- Study following specimens with special reference to: Botany of the economically important part. Processing if any involved. Specimens of cereals, pulses, fibres, spices, beverage (tea, coffee), sugar, oil yielding plants and medicinal plants (mentioned in theory).
- Microchemical test for starch, sugar, oils, proteins, fat, carbohydrate, lignin using wheat, maize, soyabean. Chana, sweet potato, clove, ground nut, mustard and match sticks.
- Study of starch grains in potato and pea.
- Field trip to economically important place.
- Collection, description and submission of at least 5 plants of ethnobotanical importance.

Handwritten signatures and scribbles in blue ink, including names like 'Suryata', 'Abhang', and 'S. S. Sontak'.

Suggested Readings:

1. Koromondy, E.J.1996. Concepts of Ecology. 4th Edition Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Misra, K.C. 1988. Manuals of Plant Ecology. (3rd Edition) Oxford and IBH Publishing Co., New Delhi.
3. Odum, E.P. 1983. Basic Ecology. 5th Edition Thomson Business International Waldis Pvt. Ltd., Baricahd.
4. Odum, E.P. 2008. Ecology. Oxford and IBH Publisher.
5. Sharma, P.D. 2010. Ecology and Environment, (8th Edition) Rastogi Publications, Meerut.
6. Singh, J.S., Singh, S.P. and Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi.
7. Gupta, S.K. and Kaushik, M.P. 1973. An Introduction to Economic Botany. K.NathandCo., Meerut.
8. Hill, A.W. 1952. Economic Botany. McGraw Hill Book Co., New York.
9. Jain, S.K. 1981. Glimpses of Indian Ethnobotany. Oxford and IBH, New Delhi.
10. Jain, S.K. 1987. A Manual on Ethnobotany. Scientific Publisher, Jodhpur.
11. Prakash, G., Sharma, S.K. 1975. Introductory Economic Botany. JaiPrakahNathandCosec, Meerut.
12. Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi.
13. Sen, S. 1992. Economic botany. New Central Book Agency, Calcutta.
14. Singh, V., Pandey, P.C. and Jain, D.K. 1998. Economic Botany. Rastogi Publications, Meerut.
15. Verma, V. 1974. A Text Book of Economic Botany. Emkay Publications, New Delhi.

Handwritten signatures and scribbles in blue ink, including the name "Divyata" and other illegible marks.