

Government College for Women, Parade Ground, Jammu



DEPARTMENT OF BOTANY

Learning outcome based curriculum

B.Sc. Programme (CBCS)

WITH BOTANY AS A SUBJECT UNDERGRADUATE SEMESTER V AND VI

2022-2023

BOTANY

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BOTANY**(SEMESTER-V)****DISCIPLINE SPECIFIC ELECTIVE****Course Title: Cell Biology and Genetics (Theory)****Course No: UBO1103**

The course contents have been designed with the focus on following objectives/ student specific learning outcomes

1. The students shall understand the structural and functional diversities of prokaryotic and eukaryotic cells.
2. A proper understanding of the properties of bio-molecules (Micro and Macro), their relationships, functional attributes with regard to cellular activities and biological responses shall be achieved.
3. Understanding of cell metabolism, chemical composition, physiochemical and functional organization of cell organelles shall be attained.
4. The students shall be able to understand the genesis of variation and there by evolution in the biological systems.
5. Knowledge about the basic principles of inheritance of characters and the possible modifications associated shall be gained by students.

BOTANY**(SEMESTER-V)****DISCIPLINE SPECIFIC ELECTIVE****Course Title: Cell Biology and Genetics (Theory)****Course No: UBOTDSE 501****Credits: 04****Duration of Exam: 3hrs****Maximum Marks: 100****Internal Assessment: 20 Marks****External Examination: 80 Marks****UNIT-I Cell Structure**

- 1.1 Cell Wall; Primary cell wall, its structure, formation and function.
- 1.2 Plasma membrane; lipid bilayer structure, fluid mosaic model; functions of plasma membrane.
- 1.3 Cell organelles, structure and functions of endoplasmic reticulum, Golgi bodies, chloroplasts, mitochondria, cytoskeleton (microtubules/microfilaments)
- 1.4 Ultra structure of nuclear membrane, organization and function of nucleolus.

UNIT-II Chromosome structure and multiplication

- 2.1 Physical and chemical structure of chromosome; structure and importance of Centromere and telomere; concept of sex chromosomes
- 2.2 Reductional and equatorial divisions: Various stages; detailed structure of pairing and crossing over.
- 2.3 DNA: structure and replication; satellite and repetitive DNA.
- 2.4 Extra-nuclear genome: structure and function of mitochondrial and plastid DNA; Plasmids.

UNIT-III Genome Organization and function/Gene to protein

- 3.1 Organization of DNA in prokaryotic and eukaryotic genomes, role of proteins; nucleosome model.
- 3.2 Concept of gene; genetic code; structure and functions of mRNA and tRNA.
- 3.3 Protein synthesis; transcription; regulation of gene expression in prokaryotes (Operon concept) and eukaryotes (Britten and Davidson model).
- 3.4 Protein synthesis: translation; post-translational modifications of proteins (primary, secondary and tertiary structure of proteins).

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UNIT-IV Alterations of the genome

- 4.1 Structural alterations; types, effect and detection of intra-chromosomal alterations (deletions, duplications and inversions).
- 4.2 Translocations; Effect and translocation heterozygotes, and their effect.
- 4.3 Euploidy-types, origin, effect and their role in the evolution of Wheat and Cotton.
- 4.4 Aneuploidy-types, origin, effect and their role with suitable examples (*Datura*, Human syndromes).

UNIT- V Alterations in the basic unit of inheritance and inheritance patterns

- 5.1 Mutations-types, sources (spontaneous and induced), uses and mechanisms of induction.
- 5.2 Transposable elements in prokaryotes (IS and Tn) and eukaryotes (Ac-Ds). DNA damage and repair mechanisms.
- 5.3 Mendelism; laws of segregation and independent assortment; Incomplete dominance, Non Mendelian interactions,
- 5.4 Linkage and recombination, role of linkage in mapping of genes.

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Note for paper setters

External End Semester Examination (Total Marks: 80)

Time duration: 3 hrs.

The question paper will have 3 sections.

Section I. Five (5) short answer questions representing all units i.e. at least one from each unit (without detailed explanation having 70-80 words) of 3 marks each =15 marks (all compulsory).

Section II. Five (5) medium answer questions (With explanation having 250-300 words) of 7 marks each = 35 marks (All compulsory).

Section III. Five (5) long answer questions (with explanation of having 500-600 words) covering all the units. The candidate will be required to answer only two questions of 15 marks each= 30 marks.

Internal Assessment (Total Marks: 20)

Time duration: 1 hr.

The internal assessment under CBCS shall comprise of two parts

Part A: Total Weightage to this part shall be 10 marks. It will have eight short answer questions. Selecting at least two from each of the two/three units/50% of the syllabus covered. A candidate has to attempt any five questions of two marks each.

Part B: Total Weightage to this part shall be 5 marks. It will have two long answer questions, selecting one each from first two/three units/50% of the syllabus covered.

Attendance: 5 marks

Suggested Readings:

1. Karp G, Iwasa J, Marshall W. 2020. Karp's Cell and Molecular Biology. John Wiley & Sons.
2. Brown TA. 2018. Genomes 4. Garland science.
3. Waddington CH. 2016. An introduction to modern genetics. Routledge.
4. Pollard TD, Earnshaw WC, Lippincott-Schwartz J, Johnson G. 2016. Cell biology E-book. Elsevier Health Sciences;
5. Karp G, Iwasa J and Marshall W. 2015. Cell and molecular biology, Concepts and experiments. 8th Edn. Wiley Publications.
6. Brown TA. 2012. Introduction to genetics: a molecular approach. 1st Edn. Gerald Science New York, USA.
7. Albert B, Bray D, Raff M, Roberts, K and Watson JD. 2004. Molecular Biology of Cell. 3rd Edn. Garland Science. New York, USA
8. Lodish H, Berk A, Zipursky S.L, Matsudaria P, Baltimore D and Darnell J. 2000. Molecular Cell Biology. 5th Edn. WH. Freeman & Co. New York, USA.
9. Snustad D.P. and Simmons M.J. 2000. Principles of Genetics. John Wiley & sons, Inc. USA.

Handwritten notes in blue ink, including a large checkmark and the numbers 2, 3, and 4.

10. Atherly AG., Girton JR. and Mc.Donald, JF. 1999. The Science of Genetics. Diane Publishing. Co. Fort Worth, USA.
11. Gupta, PK. 1999. A Text Book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
12. Russell, P J. 1998. Genetics. The Benjamin Cummings Publishing Co. Inc., USA.

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(SEMESTER-V)

DISCIPLINE SPECIFIC ELECTIVE

Course Title: Cell Biology and Genetics (Practical)

Course No: UBOTDSE 501

Credits: 02

Duration of Exam: 3hrs

Maximum Marks: 50

Internal Assessment: 25 Marks

External Examination: 25 Marks

1. To study the structure from onion leaf peels and demonstrate staining and mounting.
2. Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*.
3. Study of cyclosis in *Tradescantia* petal cells.
4. Study of plastids to examine pigment distribution in plants (e.g. Cassia, Tomato and Capsicum).
5. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
6. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organisation.
7. Examination of various stages of mitosis and meiosis using appropriate plant material (onion root tips, onion flower buds)
8. Preparation of karyotypes from dividing root tip cells and pollen grains.
9. Cytological examination of special types of chromosomes; Barr body, lampbrush and polytene chromosomes.
10. Working out the laws of inheritance (monohybrid, dihybrid, gene interactions) using seed mixtures.
11. Working out the mode of inheritance of linked genes from test cross and / or F2 data.

Note for the distribution of 50 marks in practical Examination (50% internal and 50% external)

I.	Internal Assessment	25 marks
	1. Day to Day performance in the laboratory:	12 marks.
	2. Practical Test:	8 marks
	3. Regularity of Attendance:	5 marks
II.	External Assessment:	
	External practical examination:	p
	marks.....	25

BOTANY
(Semester-V)

SKILL ENHANCEMENT COURSE

Course title: Bio-fertilizers (Theory)

Course code: UBOTS-501

The course contents have been designed with the focus on following objectives/ Student specific learning outcomes:

1. Understand the role of bio-fertilizers in sustaining the productivity levels of all types of agricultural practices.
2. Understanding the importance in maintaining fertility and water retaining capabilities of soils.
3. Acquire knowledge to becoming entrepreneurs in the field of bio-fertilizer production.

BOTANY
(Semester-V)

SKILL ENHANCEMENT COURSE

Course title: Bio-fertilizers (Theory)

Course code: UBOTS-501

Credits: - 2Total

Marks 50 (external =40 Internal =10)

UNIT-I Introduction

- 1.1 Biofertilizers: definition, scope and importance.
- 1.2 Types of biofertilizers: nitrogen fixing biofertilizers, phosphorus mobilizing biofertilizers.
- 1.3 Method of biofertilizer inoculation, seed inoculation, soil application, self inoculation.
- 1.4 Manures: definition, types and their importance.

UNIT-II Introduction to characteristics of biofertilizer organisms

- 2.1. General account, culture, inoculation methods and importance of *Rhizobium*, *Azotobacter*, and *Azospirillum*.
- 2.2. General account, culture, inoculation methods and importance of Arbuscular Mycorrhizal Fungi (AM fungi).
- 2.3. Enriched compost: Preparation and advantages of biofertilizers enriched composts.
- 2.4. Vermicompost: Concept, methods of production, characteristics of Vermicompost, advantages of vVermicompost over commercial fertilizers.

Suggested Readings

- 1. Biofertilizers Technology, Scientific Publishers, Page 450, by S. Kannaiyan, K. Kumar, K. Govindrajan.
- 2. Biofertilizers Technology, 2019. N Ramanathan.
- 3. Biofertilizers: Botany, 2022, by Dr. K.N. Dhumai, Dr. V.B. Naikawadi, K. B. Landage.
- 4. W.S. Subbharao 1982. Biofertilizers in agriculture and forestry. Oxford and IBH Publishing Co., New Delhi.
- 5. H.L.S. Tandon. Fertilizers, Organic Manures, Recyclable Wastes and Biofertilizers.

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6. Subha Roa, N. 2002. Soil Microbiology, Oxford and IBH Publishers, New Delhi NIIR Board 2012. The complete Technology Book on Biofertilizers and Organic Farming (2nd Revised Edition).
7. ICAR . Handbook of Manures and fertilizers. Atlantic Publishers 2007.
8. S.k. Mukerjee. 2006. An Introduction to soil science. Tata Mcgraw Hills.
9. N. Mukerjee and T.K. Ghosh 1998. Agriculture Microbiology. Kalyani Publishers, New Delhi.
10. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya Publishers.



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(SKILL ENHANCEMENT COURSE)

BIOFERTILIZERS (Practicals)

Course code: UBOTS-501

Credits: 02

External Examination: 25 marks

Internal Examination: 25 Marks

Duration of Exam: 3hrs

Maximum marks: 50

List of laboratory experiments

1. To study the different types of organic manures and their characteristics.
2. Designing a vermicomposting unit and production of vVermicompost using locally available earthworm's species.
3. Techniques for extraction of Vermicompost and their benefits.
4. Learning the composting methods for the production of quality compost.
5. Observation of Arbuscular Mycorrhizal fungi in roots.
6. Maintenance of AM fungi in pot culture.
7. To grow plant saplings (in pots) using different biofertilizers and comparing their efficacy with chemical fertilizers.
8. Isolation of *Rhizobium* sp. from root nodules of legumes.
9. Isolation of phosphate solubilising bacteria from given soil sample and its application in the field.
10. Survey of biofertilizer products in market.



Botany
(SEMESTER- VI)

DISCIPLINE SPECIFIC ELECTIVE

Course Title: Economic Botany and Biotechnology (Theory)
Course No. UBOTDSE 601

The course contents have been designed with the focus on following objectives/ Student specific learning outcomes:

1. The students shall get a thorough understanding of the relevance of plants in the welfare of humans and sustenance of the biosphere.
2. Understand methods of cultivation and commercial uses of various plant species.
3. A proper understanding of the relationship between human settlements their cultural evolution and plant life shall be attained by students.

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Botany
(SEMESTER- VI)

DISCIPLINE SPECIFIC ELECTIVE

Course Title: Economic Botany and Biotechnology (Theory)

Course No. UBOTDSE 601

Credits: 04

Duration of exam: 3 hrs

Maximum marks: 100 Internal Examination: 20

Marks External Examination: 80 Marks

Unit-I Utilization of Plants- Cereals, beverages, Spices and condiments

- 1.1 Food plants: Origin of wheat, maize and rice and their cultivation in India.
- 1.2 Fibres: cultivation and processing of cotton and Jute.
- 1.3 Non- alcoholic beverages: tea and coffee; botany, plant part used and processing.
- 1.4 Spices and condiments: asafoetida, Cumin, fennel, Coriander, cloves, cinnamon, Ginger, Turmeric and cardamom; Botany and plant part used.

Unit- II Utilization of Plants- oil crops, timber yielding and medicinal plants

- 2.1 Vegetables oils: Botany, cultivation and utilization of groundnut, mustard and coconut.
- 2.2 Major firewood and timber yielding plants of J&K and their utilization.
- 2.3 Medicinal plants of J&K: wild and cultivated, a general account.
- 2.4 Botany, cultivation and processing of saffron and lavender.

Unit- III Utilization of plants- Pulses, Fruits and Vegetables

- 3.1 Pulses (Rajmash, pea and urd) - their cultivation and utilization.
- 3.2 Vegetables (Tomato, Potato, onion, fenugreek, ladyfinger and spinach) – their cultivation and utilization.
- 3.3 Fruits and nuts (apple, almond, apricot, walnut and mango) – their cultivation and utilization.
- 3.4 Indoor and outdoor ornamental plants; cultivation of *tagetes* and *gladiolus*.

Unit- IV Plant tissue culture

- 4.1 Basic concepts of plant tissue culture, cellular totipotency, differentiation and Morphogenesis, protoplast fusion.
- 4.2 Micropropagation- concept and techniques; haploid production through androgenesis and gynogenesis.
- 4.3 Somatic embryogenesis; methods of formation of somatic embryos and factors affecting their production; synthetic seeds.
- 4.4 Somaclonal variations and factors underlying their generation; advantages of somaclonal variants.

Unit –V Plant Biotechnology

- 5.1 Concept of biotechnology, recombinant DNA technology and gene cloning; restriction endonucleases, Agarose gel electrophoresis, southern blotting; genomic cDNA libraries.
- 5.2 Salient features of cloning vectors-plasmids; pBR, Lamba phage. *Agrobacterium*-mediated gene transfer.
- 5.3 Polymerase chain reaction; mechanism and applications.
- 5.4 Salient achievements in crop biotechnology; transgenic plants- a general account.

Note for paper setters

External End Semester Examination (Total Marks: 80)

Time duration: 3 hrs.

The question paper will have 3 sections.

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Section II. Five (5) medium answer questions (With explanation having 250-300 words) of 7 marks each = 35 marks (All compulsory).

Section III. Five (5) long answer questions (with explanation of having 500-600 words) covering all the units. The candidate will be required to answer only two questions of 15 marks each= 30 marks.

Internal Assessment (Total Marks: 20)

Time duration: 1 hr.

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Part A: Total Weightage to this part shall be 10 marks. It will have eight short answer questions. Selecting at least two from each of the two/three units/50% of the syllabus covered. A candidate has to attempt any five questions of two marks each.

Part B: Total Weightage to this part shall be 5 marks. It will have two long answer questions, selecting one each from first two/three units/50% of the syllabus covered.

Attendance: 5 marks

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Suggested readings

1. Kochhar SL. 2016. Economic botany. Cambridge University Press.
2. Trigiano RN, Gray DJ. 2016. Plant tissue culture, development, and biotechnology. CRC Press.
3. Bhatnagar SP, Dantu PK. 2015. The embryology of Angiosperms. Vikas Publishing House;
4. Bhatia S, Sharma K, Dahiya R, Bera T. Plant tissue culture. Modern applications of plant biotechnology in pharmaceutical sciences. 2015 Jul 22:31-107.
5. Bhojwani SS, Dantu PK. 2013. Plant tissue culture: an introductory text. India: Springer.
6. Johri BM, Ambegaokar KB, Srivastava PS. 2013. Comparative embryology of angiosperms vol. 1/2. Springer Science & Business Media.
7. Smith RH. 2012 Plant tissue culture: techniques and experiments. Academic Press;
8. Raghavan V. 2012. Developmental biology of flowering plants. Springer Science & Business Media.
9. Paul Jr F, 2012. Tissue culture: methods and applications. Elsevier.
10. Brown, T.A. 2010. Genomes. John Wiley and Sons (Asia) Pvt. Ltd.
11. Glick B.R., Pastenak J.J and Patten CL 2010. Molecular biotechnology: Principles and Applications of Recombinant DNA. 4th Edn. ASM Press Washington, DC.
12. Bhojwani, S.S. and Razdan, M.K. 2005. Plant Tissue Culture: Theory and Practice. Revised Edn. Elsevier Science Publication, The Netherlands.
13. Sharma O.P. 1996. Hills Economic Botany. (Late Dr. A.F Hill, Adapted by Dr. O.P Sharma), Tata McGraw Hill Co, Ltd. New Delhi.
14. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations, Elsevier Science Publishers, New York, USA.
15. Hartmann, H.T and Kestler, D.E. 1976. Plant Propagation: Principles and Practices. 3rd Edn., Prentice Hall of India Pvt. Ltd. New Delhi.

(SEMESTER-V)**DISCIPLINE SPECIFIC ELECTIVE****Course Title: Economic Botany and Biotechnology (Practical)****Course No. UBOTDSE-601****Credits: 02****Duration of Exam: 3hrs****Maximum Marks: 50****Internal Assessment: 25 Marks****External Examination: 25 Marks**

1. Study of the morphology, structure and simple micro chemical tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (except sugarcane).
2. Study of cotton flowers, sectioning of cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic study of cotton and test for cellulose. Sectioning and staining of Jute stem to show the location and development of fibres, microscopic structures. Test for lingo-cellulose.
3. Study of hand section of ground nut, mustard and coconut, and staining of oil droplets by Sudan III and Sudan Black.
4. To study sources of firewood yielding trees (10) and bamboos. A list to be prepared mentioning special features.
5. Examine black peppers, cloves, cinnamon, (hand sections) and opened fruits of cardamom and describe them briefly.
6. Preparation of an illustrated inventory of 10 wild and locally available medicinal plants used in indigenous system of medicine or allopathy. Write their botanical and common names, part used and diseases/ disorders for which they are described.
7. Section various pulses and from temporary mounts work out the various cellular inclusions.
8. Study the structure of various types of fruits and vegetables.
9. Demonstrate media preparation for culturing plant tissues.
10. Demonstration of the technique of micropropagation by using different explants e.g. axillary buds, shoot meristem.
11. Demonstration of the technique of anther culture.



Note for the distribution of 50 marks in practical Examination (50% internal and 50% external)

- I. Internal Assessment** **25 marks**
 - 1. Day to Day performance in the laboratory: 12 marks.
 - 2. Practical Test: 8 marks
 - 3. Regularity of Attendance: 5 marks

- II. External Assessment:**
External practical examination: 25 marks



BOTANY
(Semester-VI)

SKILL ENHANCEMENT COURSE

Course title: Ethnobotany (Theory)
Course code UBOTS-601

The course contents have been designed with the focus on following objectives/ Student specific learning outcomes:

1. Develop an understanding in the students that association of plants with different ethnic groups in different geographical regions could be diverse.
2. Understand proper methodology to harness correct information about the uses, part used and method of usage of entire or a part of a plant by a tribal group.
3. Understanding the usefulness of creating a repository of information of the reliance of various tribal groups on local plant life.



BOTANY
(Semester-VI)
SKILL ENHANCEMENT COURSE
Course title: Ethnobotany (Theory)

Course code UBOTS-601

Credits: - 2

Total marks 50 (external =40 Internal =10)

UNIT- I Ethnobotany; survey and issues

- 1.1 Concept of ethnobotany, ethnobotany as an interdisciplinary science and its importance.
- 1.2 Major ethnic communities/tribals of India with special reference to J&K; major issues related to ethnobotanical surveys (ethical, cultural and social)
- 1.3 Role of ethnic communities and sacred groves in conservation of plant resources.
- 1.4 Field work, collection of data, source of data, fossils and archeological resources, ancient literature, methods of study.

UNIT II- Legal Aspects in Ethnobotany

- 2.1 Concept of Rare, Endemic and Threatened (RET) taxa and Red data book.
- 2.2 Role of IUCN and BSI in conservation of plants.
- 2.3 Biopiracy. Intellectual property rights (IPRs) and Traditional knowledge (TKDL).
- 2.4 Biodiversity laws in India with special reference to Biodiversity Act 2002; Concept of Peoples Biodiversity Register (PBRs).

Suggested Readings:

1. Jain V, Jain SK. 2017. Dictionary of local-botanical names in Indian folk life. Scientific publishers.
2. Pullaiah T, Krishnamurthy KV, Bahadur B, 2017. Ethnobotany of India, Volume 4: Western and Central Himalayas. CRC Press.
3. Jain SK. 2010. Manual of ethnobotany. Scientific publishers.
4. Cotton CM. 1996. Ethnobotany: principles and applications. John Wiley & Sons.
5. Jain SK, Mudgal V. 1999. A handbook of ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun, India.
6. Jain SK (1995) Manual of Ethnobotany, Scientific Publishers, Jodhpur.



7. Rao N, Henry AN 1996. The ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India.
8. Jain SK 1989. Methods and Approaches in ethnobotany. Society of ethnobotanist, Lucknow, India.
9. Martin GJ. 2010. Ethnobotany: a methods manual. Routledge.
10. Kandari LS, Bisht VK, Bhardwaj M, Thakur AK. 2014. Conservation and management of sacred groves, myths and beliefs of tribal communities: a case study from north-India. Environmental Systems Research. 1-10.
11. Vartika Jain, SK Jain 2015. Compendium of Indian Folk Medicine and Ethnobotany Bio-Green (Publisher)



BOTANY
(Semester-VI)
SKILL ENHANCEMENT COURSE
Course title: Ethnobotany (Practicals)

Course code UBOTS-601

Credits: - 2

Duration of Exam: 3hrs

Maximum Marks: 50

External Examination: 25 Marks

Internal Examination: 25 Marks

1. To study the tribal distribution of Jammu and Kashmir and Ladakh with the help of map.
2. Field work & collection of data regarding major ethnic groups of J&K.
3. To visit herbal garden /medicinal plants repository for identification of ethno-medicinal plants.
4. To study the various tools used in the preparation of herbarium.
5. Methods of preparation of herbarium.
6. Documenting the traditional use of plants in your area.
7. Enlist the medicinal plants from your area (mentioned the part used, procedure of use and uses).
8. Ethnobotanical account of wild plants used for cultural and religious practices in J&K.
9. Botanical trips.
10. Morphology, part used and ethnobotanical uses of *Azadiracta indica*, *Oscimum sanctum*, *Vitex negundo*, *Gloriosa superba*, *Tribulus terrestris*, *Millettia pinnata*.

