JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program :BSc.

Proposed Course: Botany

Semester V

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2020-2021

T.Y.B.Sc. BOTANY Syllabus

Academic year 2020-2021

Semester V			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SBOT501	Microbiology, Algae, Fungi and Plant Pathology	4	4
SBOT502	Palaeobotany, Angiosperms, Anatomy, Palynology	4	4
SBOT503	Cytology and Molecular Biology, Physiology, Environmental Botany, Plant Tissue Culture	4	4
SBOT504	Ethnobotany& Mushroom Industry, Biotechnology I, Instrumentation, Pharmacognosy& Medicinal Botany	4	4
SBOT5PR1	Practical I and II	4	8
SBOT5PR2	Practical III and IV	4	8

Semester V – Theory

Course code: SBOT501	**Microbiology, Algae, Fungi and Plant Pathology (Credits : 4 Lectures/Week:4)**	**60 L**
	Learning Objectives: • Study types of micro-organisms, culturing techniques and their applications • Study a comparative account of different classes of marine and fresh water algae. • Learn about life cycles of fungi, plant pathogenic fungi and different control measures. **Learning Outcomes:** Students will be able to: • Identify the different types of organisms and their growth characteristics. • Master culturing techniques of microbes • Grasp the concept of fermentation using appropriate examples. • Differentiate between marine and fresh water algae • Understand life cycles of algal and fungal specimens [as per the syllabus] and classify the same • Apply the knowledge gained to identify pathological symptoms on plants and suggest appropriate prophylactic measures for the same	
Unit I	**MICROBIOLOGY:** • Types of microbes • Culturing: Sterilization, media, staining, colony characters • Pure cultures • Role of microbes in fermentation: Alcohol and Antibiotics	**15 L**
Unit II	**ALGAE:** • Division Rhodophyta: Classification(According to G.M. Smith)and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance o Structure, life cycle and systematic position of *Polysiphonia; Batrachospermum* • Division Xanthophyta:Classification (According to G.M. Smith) and General Characters, Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance o Structure, life cycle and systematic position of *Vaucheria* • Division: Bacillariophyta:Classification (According to G.M. Smith) and General Characters, Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance o Structure, life cycle and systematic position of *Pinnularia*	**15 L**

Unit III	**FUNGI:** • Basidiomycetes: Classification (According to G.M. Smith)General characters, life cycles and economic importance of: o *Agaricus* o *Puccinia* • Deuteromycetes: Classification (According to G.M. Smith) General Characters, life cycles and economic importance of: o *Alternaria*	**15 L**
Unit IV	**PLANT PATHOLOGY** • Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle and control measures of the following. o White Rust – *Albugo sp.* o Tikka disease of ground nut: *Cercospora* o Damping off disease: *Pythium* o Citrus canker – *Xanthomonas* sp. o Leaf curl – leaf curl virus	**15 L**

References:

1. Rao A. S., Introduction to Microbiology, Prentice Hall of India Pvt. Ltd., 2006
2. Gangulee H.C., Das K.S., &Datta C., College Botany, Volume I, New Central Book Agency, 2006
3. Vashishta B. R., & Sinha A. K., Botany for degree students Algae, S. Chand, 1st Edition, 2010
4. Vashishta B. R., & Sinha A. K., Botany for degree students Fungi, S. Chand, 1st Edition, 2010
5. Reed G., Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, 2004
6. Casida L. E. J.R., Industrial Microbiology, New Age International Publishers, 2007.
7. Smith G. M., Cryptogamic Botany – Algae and Fungi, Vol. I, McGraw Hill publications, 1955.

Course code: SBOT502	**Palaeobotany, Angiosperms, Anatomy, Palynology (Credits :04/ Lectures/Week:04)**	**60 L**
	Learning Objectives: • Learn about the process of fossilization and different fossils. • Morphology of flower and fruits will help the students, understand the classification in an effective manner. • Learn about abnormal secondary growth and importance of the same in identification of plants • Study of palynology and its application will help the students to understand importance of pollen study. **Learning Outcomes:** Students will be able to: • Construct various form genera on the basis of internal structures observed in fossilized specimens prescribed in the syllabus. • Identify and differentiate between types of flowers and fruits. • Apply the knowledge of morphology in identification of plants as per Bentham and Hooker's (Natural) system of classification. • Enumerate plants of economic importance from the prescribed families. • Compare and differentiate amongst various types of anomalous anatomical structures in plants. • Identify pollen grains based on morphology using NPC system of classification. • Apply the knowledge of palynology in various fields prescribed in syllabus and Suggest a few measures to cure or control pollen allergy.	
Unit I	**PALAEOBOTANY:** • All form genera Stem, leaf, male and female fructification - *Calamites* • All form genera root, stem, bark, leaf, male andfemale fructification - *Lepidodendron* • All form genera root, stem, leaf, male and femalefructification - *Lyginopteris* • All form genera - *Pentoxylon* • Contribution of BirbalSahni&BirbalSahni Institute of Palaeobotany, Lucknow	**15 L**
Unit II	**ANGIOSPERMS:** • Morphology of flower and fruit • Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of the families o Capparidaceae o Umbelliferae o Cucurbitaceae o Rubiaceae o Solanaceae	**15 L**

	○ Commelinaceae ○ Zingiberaceae ○ Marantaceae	
Unit III	**ANATOMY:** • Anomalous secondary growth in the Stems of ○ *Bignonia* ○ *Salvadora* ○ *Achyranthes* ○ *Aristolochia* ○ *Dracaena*. • Anomalous secondary growth in storage roots ofBeet, Radish • Root stem transition • Types of Stomata ○ Anomocytic ○ Anisocytic ○ Diacytic ○ Paracytic ○ Graminaceous ○ Tetracytic ○ Cyclocytic	**15 L**
Unit IV	**PALYNOLOGY:** • Pollen morphology • Pollen viability – storage • Germination and growth of pollen • Application of Palynology in honey industry, coal and oil exploration, forensic science(Case studies) • Aerobiology and pollen allergies (Case studies)	**15 L**

References:

1. Gangulee H.C., Das K.S., &Datta C., College Botany, Volume II, New Central Book Agency, 2006
2. Chopra G. L., Angiosperms: Systematic & Life cycle, Nagin & Co. 1964
3. Sharma O. P., Plant Taxonomy, Tata McGraw – Hill Publishing Co. Ltd., 2009
4. Gurcharan S., Plant systematics, Oxford &IBH publishing Co. Pvt. Ltd., 3rd edition, 2012
5. Davis P. H., & Heywood V. H., Principles of Angiosperm Taxonomy, Scientific Publishers, 2011
6. Pandey B. P., Plant anatomy, S. Chand & Co. Ltd., 2012
7. Fahn A., Plant anatomy, Pergamon Press,1967
8. Esau K., Plant anatomy, John Wiley & Sons, 1953
9. Pijush R., Plant anatomy, New Central Book Agency, 2006
10. Sivanna K.R., &Johri B.M., Angiosperm Pollen: Structure and Function, John Wiley & Sons (Asia), Pvt. Ltd , 1986
11. Bhattacharya K., Majumdar M. R., & Bhattacharya S.G., A textbook of Palynology, New Central Book Agency, 3rd edition, 2011
12. Agashe S. N., Palaeobotany: Plants of the past, their evolution, Palaeoenvironment and application in exploration of fossil fuels, Science Publishers, 1997.
13. Biswas C. and Johri B.M. - The Gymnosperms Springer publication.

Course code: SBOT503	**Cytology and Molecular Biology, Physiology, Environmental Botany, Plant Tissue Culture (Credits :4 Lectures/Week:4)**	**60 L**
	Learning Objectives: • Learn about different cell organelles and important processes within the cell. • Learn about some more cell organelles like nucleus and vacuoles in depth. They will also study important processes within the cell which are involved in protein synthesis in prokaryotes and eukaryotes. • Study various plant physiological processes involved in solute and water uptake and translocation. • Study in detail the various anatomical structures and tissues involved in transportation of solutes and water. • Learn about different bioremediation techniques and also change in landforms due to gradual changes in their surroundings and environment. • Plant tissue culture aims to acquaint the students with applied aspects of plant tissue culture, especially in agriculture and crop improvement. • Understand the actual working of a fermentation process and how it can be applied commercially. **Learning Outcomes:** Students will be able to: • Understand the detailed structure and role of important cell organelles like nucleus and vacuoles. Function and ultrastructure of normal and giant chromosomes will also be understood • Understand the detail process of protein synthesis (transcription and translation) along with post transcriptional modifications occurring in eukaryotic cells during protein synthesis • Understand principle involved behind important physiological processes like transpiration, osmosis, water potential and imbibition. • Understand the role and presence of variable types of anatomical structures involved in water movement in different types of plants. • Understand the principle involved in transportation of water and solutes within plants. • Understand and comment on different methods of bioremediation to combat the major current day problem i.e. pollution. • Learn the transition of landform over the period of years due to environmental impact. • Understand commercial productions of secondary metabolitesfrom plants and their scale ups	
Unit I	**CYTOLOGY AND MOLECULAR BIOLOGY** • Structure and function of nucleus • Structure and function of vacuole • Structure and function of giant chromosomes • The genetic code: Characteristics of the genetic code • Transcription and Translation in Prokaryotes &Eukaryotes	**15 L**

Unit II	**PHYSIOLOGY** • Water relations: Potential, osmosis, transpiration, imbibition • Solute transport: Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps • Translocation of solutes: Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading, anatomy of sieve tube elements, mechanisms of sieve tube translocation, Munch's hypothesis	**15 L**
Unit III	**ENVIRONMENTAL BOTANY** • Bioremediation: Principles, factors responsible and microbial population in bioremediation • Phytoremediation: Metals, Organic pollutants • Plant succession: Hydrosere and Xerosere – Formation of barren space, succession on the land citing different seres leading upto the climax, succession in water, ecesis, poly and monoclimax theories	**15 L**
Unit IV	**PLANT TISSUE CULTURE** • Aspects of micropropagation with reference to Floriculture: Detailed study of Orchid cultivation • Plant cell suspension cultures for the production of secondary metabolites: with special reference to Shikonin production • Somatic embryogenesis and artificial seeds • Protoplast fusion and Somatic hybridization: o Concept, definition, and various methods of protoplast fusion o Applications of somatic hybridization in agriculture	**15 L**

References:

1. De Robertis E. D. P., Cell Biology and Molecular Biology, 8th edition, Lea and Febinger, 1987.
2. Russell P. J., i-Genetics: A Mendelian Approach, 3rd edition, Pearson Education India, 2009.
3. Russel P. J., Genetics, 5th edition, Harper Collins Publishers, 1990.
4. Odum E. P., Barrett G. W., Principles of Ecology, Brooks and Cole, 2004.
5. Verma P. S., Agarwal V.K., Textbook of Environmental Biology, S. Chand , 2000.
6. Taiz L., Zeiger E., Plant Physiology, 5th edition, Sinauer associates Inc., 2010.
7. Verma V., Plant Physiology, ANE books, 2009.
8. Jha T. B., Ghosh B., Plant tissue culture- Basic and Applied, Universities Press, 2005.
9. Ignacimuthu S., Plant Biotechnology, 2nd edition, Narosa Publishing HsePvt. L 2012.
10. Gamborg O. L., Phillips G. C., Plant cell tissue and organ culture- Fundamental methods, Narosa publishing house, 2004.
11. Pearson- Ecology: New International Publication
12. Reinert J., Bajaj Y. P. S., Applied and fundamental aspects of Plant cell, Tissue and organculture, Springer- Verlag, 1989.
13. Buchanan, B. B.,Gruissem, W. & Russell L. J.: Biochemistry and molecular biology of plants 2nd Edition, Chichester, West Sussex: John Wiley & sons, Ltd, 2015.

Course: SBOT504	**Ethnobotany& Mushroom Industry, Biotechnology I, Instrumentation, Pharmacognosy& Medicinal Botany (Credits :04/ Lectures/Week:4)**	**60 L**

Learning Objectives:

- Learn the concept of Ethnobotany and its importance.
- Learn different medicinal plants used to treat various ailments.
- Learn the concept of cultivation and harvesting of different mushroom species.
- Learn the nutritional value and importance of Mushroom in daily diet.
- Study the construction and analysis of genomic, chromosomal and c-DNA libraries and analysis of genes and gene transcripts.
- Learn the working, principle and parts of a regular colorimeter and spectrophotometer. They will also study the applications of both instruments in all areas of biological sciences.
- Study general principle involved in column chromatography. They will study in detail the parts of any column chromatography unit along with principle involved in separation of analytes using column chromatography technique.
- Study in detail the principle involved, bedding material used and specific applications of adsorption and partition chromatography, ion exchange and molecular sieve chromatography.
- Learn about different medicinal plants and their pharmacopoeia standards along with their pharmacological properties of the same.

Learning Outcomes:

Student will be able to:

- Appreciate the importance of ancient medicines and its application in current scenario.
- Understand mushroom cultivation practices and can further utilize this knowledge for entrepreneurship development.
- Understand the significance and construction of genomic, chromosomal and c- DNA libraries and will be able to differentiate between these.
- Understand the various ways in which DNA molecules are analysed in molecular biology experiments. They will be familiar with methods and principle involved in identification and analysis of cloned DNA or its transcripts using colony hybridisation, antibody probes, southern hybridisation, Autoradiography, as well as restriction mapping.
- Master the technique of column chromatography and will be able to distinguish between various types of column chromatographic separation procedures.
- Pack the bedding material in small columns for chromatographic separation of plant metabolites.
- Know the applications of all types of column chromatographic techniques and therefore be able to correctly decide the type of method i.e. adsorption and partition chromatography, ion exchange or molecular sieve chromatography to be implemented for separation of specific plant metabolites depending on its properties.
- Comment upon geographical source, chemical constituents and uses of various plants prescribed in their syllabus.
- Understand the importance of macroscopic and microscopic

	characters/phytoconstituents in identification of adulterants and common varieties for the plants from their syllabus.	
Unit I	**ETHNOBOTANY AND MUSHROOM INDUSTRY** • Ethnobotany - Definition, history, sources of data and methods of study Applications of ethnobotany: o Ethnomedicines o Agriculture o Edible plants o Famine related plants o Poisonous plants and Antidotes • Traditional remedies used by tribals in Maharashtra for o Skin problems: *Rubiacordifolia, Santalum album* o Liver problems : *Phyllanthus , Andrographis* o Wound healing and ageing: *Centella, Typha, Terminalia, Tridax* o Fever : *Vitexnegundo, Tinosporacordifolia* leaves o Diabetes: *Momordicacharantia, Syzygiumcuminii* • Mushroom Industry: General account of production of mushrooms with respect to methods of Composting, spawning, casing and harvesting of mushroom. Cultivation of *Pleurotus, Agaricus, Volvariella* Mushroom in detail • General account of mushrooms: Nutritional value, picking and packaging, economic importance.	**15 L**
Unit II	**BIOTECHNOLOGY I** • Construction of genomic DNA libraries, Chromosome libraries and c- DNA libraries • Identification of specific cloned sequences in c DNA libraries and Genomic libraries • Analysis of gene and gene transcripts – Restriction enzyme, analysis of cloned DNA sequences, Hybridization (Southern Hybridization)	**15 L**
Unit III	**INSTRUMENTATION** • Colorimetry and Spectrophotometry (Visible, UV and IR) - Instrumentation, working, principle and applications • Chromatography: General account of Column chromatography. Principle and bedding material and applications ofadsorption and partition chromatography, ion exchange chromatography, molecular sieve chromatography. Brief account & applications of HPLC & HPTLC technique • Centrifugation: Principle, working and application of centrifuge, types of centrifuge.	**15 L**

Unit IV	**PHARMACOGNOSY AND MEDICINAL BOTANY** • Monographs of drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants - o *Trigonellafoenum-graecum* (Methiseeds) o *Cassia angustifolia* (Senna leaves) o *Syzygiumaromaticum (* Clove buds) o *Allium sativum*(Garlic cloves) o *Curcuma longa* (Turmeric Rhizome) o *Syzygiumcuminii*(JamunStem bark) o *Raphanussativus*(RadishRoot) o *Micheliachampaca*(Champakaflower)	**15 L**

References:

1. Sanjeev Kumar, Recent Advances In Ethnobotany, Deep publication 2015
2. Jain S. K. &Mudgal V., A Handbook Of Ethnobotany, Bishen Singh Mahendra Pal Singh, Debra Dun, 1999
3. Chaudhuri, Rai H.N. & D.C. Pal 1981. Plants in folk religion and mythology. In: S.K. Jain (ed.), Glimpses of Indian Ethnobotany. Oxfords IBH, New Delhi. 59- 68.
4. Ayurvedic Pharmacopoeia of India, AYUSH, Government of India.
5. Biswas S., Datta M., Mushroom: A Manual for Cultivation, College of Agriculture, Phi learning Pvt. ltd., 2011.
6. Kokate C. K., Purohit A. P., Pharmacognosy, NiraliPrakashan, 2011.
7. Khandelwal K.R., Practical Pharmacognosy- techniques and experiments, NiraliPrakashan, 2008.
8. Evans W. C., Trease and Evans Pharmacognosy, 16th edition, Saunders ltd., 2009.
9. Wilson K., Walker J., Principles and techniques of Biochemistry and molecular Biology, 7th edition, Cambridge University Press, 2010.
10. Russell P. J., Genetics: A Mendelian Approach, 3rd edition, Pearson Education India, 2009.
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12. Glick, B. R., Pasternak, J. J. & Patten C. L.: Molecular Biotechnology Principles and applications of Recombinant DNA 4thEdition Wiley Publishers 2010
13. A.K Gupta and Neeraj Tandon- Reviews on Indian Medicinal Plants Indian Council of Medical Research (ICMR) 2004.

Semester V – Practical

Course: SBOT5PR1	**PRACTICAL I & II** **(Credits :4 Practical/Week:8)**

Learning objectives :

- Learn the techniques of isolation and culturing of microorganisms like bacteria, fungi, etc. They will also learn to study the effect of various chemicals on the growth of microorganisms.
- Study the morphological differences and structures of different classes of marine and fresh water algae
- Study the morphological and features of different classes of pathogenic fungi
- Observe the various fossil specimens and slides.
- Observe minute morphological details of plants under study with reference to its habitat, leaf, flower and fruit morphological peculiarities and distinctive features.
- Take anatomical sections of plant parts and understand normal as well as secondary growth occurring in plants.
- Observe various types of pollen grains and classify the same based on pollen morphology. They will also perform techniques to extract and isolate pollen grains from various naturally occurring samples of honey and coal. Practical ways to perform, observe and study in vitro pollen germination along with effects of various metabolites on pollen germination and growth of pollen tube growth will be studied.

Learning outcome:

- Students will be able to
- Master the technique of isolation, identification and culturing of microbes and will be able to design the various experimental models to study effect of metabolites on the growth of microbes.
- Differentiate and classify the various forms of algae and understand their importance to the environment
- Differentiate and classify the various forms of fungal species, understand life cycles of pathogenic fungi and will also be able to suggest measures to protect the plants from pathogenic fungi.
- Understand the importance of fossil study.
- Understand the basis of plant classification by Morphological study of distinctive features of floral parts, fruits, leaves, etc.
- Relate study of anatomy with respect to plant growth, evolution and classification.
- Isolate and morphologically identify and classify pollen grains from any given sample. They will be able to design experiments involving study of pollen grain germination and effects of environmental parameters and constituents on pollen germination.

Microbiology

- Study of aeromicrobiota by petriplate exposed method :
  - Fungal
  - Bacterial
- Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected micro organism
- Study of antimicrobial activity by the disc diffusion method

Algae

- Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides
  - *Polysiphonia*
  - *Batrachospermum*
  - *Vaucheria*
  - *Pinnularia*

Fungi

- Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides
  - *Agaricus*
  - *Puccinia*
  - *Alternaria*

Plant Pathology

- Study of the following plant diseases:
  - White rust
  - Tikka disease in Groundnut
  - Damping off disease
  - Citrus canker
  - Leaf curl

Palaeobotany

- Study of the following form genera with the help of permanent slides/ photomicrographs.
  - *Calamites*
  - *Lepidodendron*
  - *Lyginopteris*
  - *Pentoxylon*

Angiosperms

- Morphology of Flower
- Morphology of fruit
- Study of one plant from each of the following Angiosperm families
  - Capparidaceae
  - Umbelliferae
  - Cucurbitaceae
  - Rubiaceae
  - Solanaceae
  - Commelinaceae
  - Zingiberaceae
  - Marantaceae

- Morphological peculiarities and economic importance of the members of the above mentioned Angiosperm families
- Identifying the genus and species of a plant with the help of Flora

Anatomy

- Study of anomalous secondary growth in the stems of the following plants using double staining technique:
  - *Bignonia*
  - *Salvadora*
  - *Achyranthes*
  - *Aristolochia*
  - *Dracaena*
- Study of anomalous secondary growth in the roots of
  - Beet
  - Radish
- Types of Stomata
  - Anomocytic
  - Anisocytic
  - Diacytic
  - Paracytic
  - Graminaceous
  - Tetracytic
  - Cyclocytic

Palynology

- Study of pollen morphology (NPC Analysis) of the following by Chitale's Method
  - *Hibiscus*
  - *Datura*
  - *Ocimum*
  - *Ipomoea*
  - *Pancratium*
  - *Canna*
- Determination of pollen viability by TTC method
- Pollen analysis from honey sample – unifloral and multifloral honey
- Effect of varying concentration of sucrose on *In vitro* Pollen germination

Course: SBOT5PR2	**PRACTICAL III & IV** **(Credits :4 Practical/Week:8)**
	Learning objectives : • Learn to perform staining techniques to observe nuclear chromosomes and various stages of cell division in somatic as well as gametic cells of plants. • Learn the technique of analysing the sequence of codons to correctly determine the sequence of amino acids in any given prokaryotic or eukaryotic mRNA strand. • Learn to run various biochemical assays and quantitatively estimate various plant constituents like phosphorus and iron. They will understand the concept and importance of running a standard graph with known quantities of element under analysis while simultaneously extracting, quantitatively estimating and comparing the same element actually present in plant samples. • Study the ways to determine the various ecological parameters like DO, BOD, hardiness, salinity and chlorinity levels of water samples for performing ecological study of a particular sample area. • Learn to accurately calculate and prepare various chemical solutions and growth culture media as required for plant tissue culture experiments. They will learn to aseptically grow and transfer explants as a regular operation for maintaining and growing cells and tissues during plant tissue culture. • Observe and study the morphology of some economically important ancient plants and understand their importance to mankind. • Learn the technique of mushroom cultivation and be able to distinguish between various stages of growth of mushrooms. • Study the growth curve of bacterial cells and determine their generation time. They will also relate the same to the changes in growth pattern or generation time, while exposing the organisms under study to variable growth parameters. • Learn to perform the technique of isolation of plasmid DNA and load and run the same on agarose gels. They will also be able to learn the technique of southern blotting to transfer the DNA from the agarose gels on to the nitrocellulose papers for further analysis. They will also understand to solve the problems on restriction mapping to determine the possible sites of restriction enzymes on the given DNA fragment that is to be analysed. • Learn to perform the techniques of colorimetry, and spectroscopy this will include the analysis of coloured samples to demonstrate beer lamberts law. • Learn the method of preparation of various silica or alumina columns to demonstrate adsorption chromatography and use it for separation of plant pigments. They will also learn to prepare and use ion exchange resin columns to demonstrate the separation of amino acids by ion exchange chromatography.

	• Observe macroscopic and microscopic structures of parts of different medicinal plants and also perform various chemical tests to identify their active ingredients. **Learning Outcomes:** Students will be able to • Master staining techniques for staining of nuclear matter as well as dividing cells. • Evaluate data involving reading of mRNA transcript to form translation products. • Carry out accurate biochemical assays and relate their skill and knowledge to carry out plant analysis. • Carry out Ecological projects and analyse various ecological parameters in specific ecological localities. • Conceptually understand the principle involved in separation of plasmid DNA from cell. They will also understand the principle of separation of DNA by technique of electrophoresis. • Understand the importance of aseptic ways of working in tissue culture and molecular biology labs. • Apply their theoretical knowledge for developing protocols for embryogenesis of plants *in vitro* • Learn the concept of Mushroom cultivation and entrepreneurship • Apply techniques like chromatography, spectroscopy and electrophoresis to characterise plant based compounds. • Understand use of plants in medicine, their analysis and their applications
	CYTOLOGY AND MOLECULAR BIOLOGY • Mounting of Giant chromosomes from Chironomous larva • Smear preparation from *Tradescantia* buds • Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation (Prokaryotic &Eukaryotic) **PHYSIOLOGY** • Estimation of Phosphate phosphorus (Plant acid extract) • Estimation of Iron (Plant acid extract) Note: Preparation of a standard graph and determination of the multiplication factor for Phosphate / Iron estimation using a given standard phosphate / Standard Iron solution should be done in regular practical. This will also be put as a question in practical exam **ENVIRONMENTAL BOTANY** • Estimation of the following in given water sample o Dissolved oxygen demand o Biological oxygen demand o Hardness o Salinity and Chlorinity • Estimation of heavy metals from polluted and remediated water /soil sample

MICROPROPOGATION

- Plant Tissue culture:
  - Identification – Multiple shoot culture, hairy root culture, somatic embryogenesis
  - Sterilization of seed/explant
  - *In vitro* callus induction
- Preparation of stock solutions for preparation of MS medium

(Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).

ETHNOBOTANY AND MUSHROOM INDUSTRY

- Study of plants mentioned in theory for Ethnobotany
- Mushroom cultivation (To be demonstrated)
- Identification of various stages involved in mushroom cultivation – spawn, pin head stage, mature/ harvest stage of *Agaricus, Pleurotus, Volvariella*

BIOTECHNOLOGY I

- Growth curve of *E. coli*
- Plasmid DNA isolation and Separation of plasmid DNA using AGE
- Restriction mapping (problems), Southern blotting

INSTRUMENTATION

- Verification of Beer Lambert's Law and determination of λ_{max}.
- Experiment based on ion exchange chromatography for demonstration
- Experiment based on separation of dyes/ plant pigments using silica gel column.
- Isolation of chloroplast using Sucrose density gradient centrifugation

PHARMACOGNOSY

- Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants
  - *Trigonellafoenum-graecum* (Methi seeds)
  - *Cassia angustifolia* (Senna leaves)
  - *Syzygiumaromaticum (C*love buds)
  - *Allium sativum*(Garlic cloves)
  - *Curcuma longa* (Turmeric Rhizome)
  - *Syzygiumcuminii*(Jamun Stem bark)
  - *Raphanussativus*(Radish Root)
  - *Michelia champaca*(Champaka flower)

Evaluation Scheme:

[A] Evaluation scheme for Theory courses:

I. Continuous Assessment (C.A.) - 40 Marks

(i) C.A.-I: Test – 20 Marks of 40 mins. Duration/ continuous evaluation in given time frame with Surprise test

(ii) C.A.-II: Assignment/project/quiz/continuous evaluation in given time frame with Surprise test

II. Semester End Examination (SEE)- 60 Marks

[B] Evaluation scheme for Practical courses: (SEE – 100 marks)

NOTE:

A minimum of TWO field excursions forhabitat studies is compulsory.
