Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),

Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India,

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: M.Sc. I Botany

Course: CRYPTOGAMS I

SPERMATOPHYTA I

PLANT PHYSIOLOGY

CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Semester I

Choice Based Credit System (CBCS) with effect from the Academic year 2019-20

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Preamble

As Autonomy has been granted to the college, the syllabus has been restructured. Keeping in tune with the revised syllabi of F.Y.B.Sc., S.Y.B.Sc. and T.Y.B.Sc., the committee has taken utmost care to maintain the continuity in the flow of information of higher level at M.Sc. Hence some of the modules of the earlier syllabus of M.Sc. part I in semester I and II, have been upgraded with the new modules in order to make the learners aware about the details and recent developments in various branches of Botany (like Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms taxonomy, Genetics, Molecular Biology, Anatomy, Physiology, Biotechnology) with an objective to raise the students awareness in interdisciplinary courses such as Biostatistics, Biophysics, Bioinformatics , Computational Biochemistry, Bioinstrumentation, Palynology, Embryology, Medicinal Botany.

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Presentation	15 marks
Component 2 (CA-2)	Test	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Sub-part	Description	Marks	Total Marks
Q1 A)	i) to ii)	Answer any 1 of 2 questions	10marks	10 Marks
Q1 B)		Compulsory	5 marks	5 marks
Q 2 to Q 4		Same as above		
		TOTAL OF 4 QUESTIONS		**60 Marks**
Q5)	i) to iv)	Short notes Answer 3 out of 4	05 marks	15 Marks
			TOTAL	**15 Marks**
			NET TOTAL	**75 Marks**

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Signature Signature Signature

HOD Approved by Vice –Principal Approved by Principal

Program: M.Sc. I (2019-20)					**Semester:** I
BOTANY PAPER I CRYPTOGAMS I					**Course Code:** PSMABO101
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

Plant diversity, Algae, Applied Phycology, Fungi and Plant pathology that deals with both conceptual and practical tools for identifying, classifying & studying microbes, the life cycles of algae and fungi, and plant diseases. It develops knowledge of life cycle, economic importance & outline of their classification in general. Identifying them based on their morphological features. This course will also help students to build on the basic skills regarding methods of controlling plant diseases and understand the integrated management of plant diseases.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Learn microbiological culturing techniques and Isolate algae and fungi

CO2: Understand Xanthophyta and Bacillariophyta among algae along with the life-cycles of related algae and their economic importance

CO3: Understand the life cycles of the related fungi and their systematic positions

CO4: To identify diseased conditions in plants and effective methods to control the plant diseases

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Algae	1hr
2	Applied Phycology	1hr
3	Fungi	1hr
4	Plant Pathology	1hr
	Total	
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**Algae** • Classification and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Classification and General Characters of Xanthophyta: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Classification and General Characters of Bacillariophyta: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • General account of the chloroplasts and chromatophores in different groups of algae. • Domains & kingdom systems • Outline classification of algae by F.E. Fritsch 1935; F.E. Round 1973 & Chapman & Chapman 1973	**Credit 1**
Module 2	**Applied Phycology** • Culturing of algae and preservation • Cultivation of algae with special reference to *Chlorella* and *Arthospira sps*.(Spirulina) • Economic importance of algae with reference to: Food, Agriculture - Fodder, Biofuel, Biofertilizers, Industry: Agar agar, Medicine, Sewage disposal, Water pollution, Energy production. • Contributions of Eminent Algologists in India: M. O. P. Iyengar and T. V. Desikachary.	**Credit 1**
Module 3	**Fungi**	**Credit 1**

	• Classification of fungi upto orders, according to the system proposed by Alexopoulos (1962). • General account of vegetative structure of unicellular and multicellular Mycelia, Septa, Hyphal modifications in various groups of fungi • General account of spore bearing organs and their arrangements in various groups of fungi. • Spore release and dispersal – with special reference to Basidiomycotina, Deuteromycotina • Life cycle of *Stemonitis*, *Phytophthora* and *Peziza.* • Mycorrhiza: type, distribution and significance with reference to agriculture and forestry	
Module 4	**Plant Pathology** • Integrated management of diseases • Study of the following diseases with reference to occurrence, symptoms, causal organism, disease cycle, predisposing factors and control measures of the following diseases: a. Red rot of Sugarcane (*Colletotrichum falcatum*) b. Blast of Rice (*Pyricularia oryzae*) c. Wilt of Arhar/ Tur (*Fusarium oxysporum*) d. Green ear of Bajra (*Sclerospora graminicola*) e. Angular leaf spot of Cotton (*Xanthomonas axonopodis*)	**Credit 1**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

- Study of following type with reference to their systematic position, thallus and reproductive structures: *Scytonema, Lyngbya, Anabaena, Volvox, Scenedesmus, Ulva, Enteromorpha, Pithophora, Closterium, Nitella, Padina and Gracilaria.*
- Extraction of algal pigments and their separation by paper chromatography.
- Culturing of *Chlorella* and Spirulina algae
- Culturing of *Penicillium* by streak method

- Study of the following types with reference to their systematic position, thallus and reproductive structures: *Stemonitis, Saprolegnia, Phytophthora, Penicillium, Peziza, Polyporus, Daedalea, Fusarium and Trichoderma*.
- Study of the disease mentioned in the syllabus (theory) with reference to the symptoms, Causal organisms, Disease cycle and Control measures.

Suggested Readings

1. Dinabandhu Sahoo, Joseph Seckbach, (2015). The Algae World. Springer Publication
2. Smith, Gilbert M. (1955). Cryptogamic Botany Algae & Fungi Volume 1; 2nd edition; McGraw Hill Book Comp. Tokyo.
3. Gangulee, Das and Dutta (2011). College Botany Volume I and II. Central Education enterprises.
4. Peter Roberts, Shelley Evans (2014). The Book of Fungi: A Life-Size Guide to Six Hundred Species from around the world.
5. Mishra, S.R. (2005). Morphology of Fungi. Discovery Publishing House.
6. Sharma, O.P. (1989). A text book on Fungi. Tata McGraw-Hill Publications, New Delhi.
7. Michael J. Carlile, Sarah C. Watkinson, G. W. Gooday (2008). The Fungi. Elsevier Publications.
8. Kevin Kavanagh (2005). Fungi: Biology and Applications, John Wiley and sons Ltd.
9. Ingold, C.T. & Hudson H.J. (1993). The Biology of Fungi**,** Chapman & Hall.
10. Mukerji, K.G., Manoharachary, C. (2010). Taxonomy and Ecology of Indian Fungi, I.K International.
11. Deacon, J. W. (2006). Fungal biology. (4th Ed.) Blackwell publishing.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. I (2019-20)				**Semester:** I	
Course: BOTANY PAPER II SPERMATOPHYTA I				**Course Code:** PSMABO102	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

This paper deals with study of Gymnosperms and Angiosperms. It expose the students to evolutionary hist morphology, biology of living and fossil Gymnosperms, economic importance & outline of Benthar Hooker's classification of angiosperm families and Nomenclature. The lessons also give students hand competence for studying families in nature & identifying them based on their morphological features.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Understand Fossilisation of plants and their anatomy

CO2: Understand how to identify and classify plants based on Bentham & Hooker's classification. Also to relate the morphology of flowers and fruits to animal interaction.

CO3: Corelate the characteristics of various parts of the plant to the habit of the plants for nomenclature

CO4: Understand the economic importance of the pollen and pollen morphology as criteria for taxonomic classification.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Gymnosperms I	1hr
2	Gymnosperms II	1hr
3	Angiosperms I	1hr
4	Angiosperms II	1hr
	Total	
PRACTICALS		4hr

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Unit	Topic	No. of Hours/Credits
Module 1	**Gymnosperms I** • Classification of Gymnosperms upto orders according to the system proposed by C. J. Chamberlain. • Characters of Gymnosperms which resemble and differ from Pteridophytes, Angiosperms. • General characters; affinities and interrelationships of • Cycadofilicales, Bennettitales and Cycadales. • Life cycle of *Zamia* and *Araucaria*	**Credit 1**
Module 2	**Unit II: Gymnosperms- II** • Classification of Coniferophyta upto orders. • General Characters of Cordaitales, Ginkgoales, Coniferales & Gnetales. • Life cycle of *Ginkgo.* • Life cycle of *Podocarpus*	**Credit 1**
Module 3	**III Angiosperms I** • Study of following families with reference to its systematic position, distribution, floral formula, floral diagram, affinities, morphological peculiarities, economic important plants and their uses. Menispermaceae, Passifloraceae, Portulacaceae, Sterculiaceae, Meliaceae, Celastraceae, Sapindaceae, Crassulaceae, Lythraceae, Gentianaceae, Boraginaceae, Chenopodiaceae, Cyperaceae	**Credit 1**

Module 4	**Angiosperms II**
	• International Code of Nomenclature for Algae, Fungi and Plants (I.C.N.) Principles and Rules and reccomendation.
	• Principles for assessment of relationships, delimitation of taxa & attribution of rank: a) Criteria b) Guidelines c) Practical consideration d) Use of Categories
	• Systems of classification
	  o Introduction to Artificial, Natural and Phylogenetic System of classification
	  o Introduction to A. P. G. systems.
		Credit 1

	• Evolution, variation & speciation, Biosynthetic categories, biotypes & ecotypes.	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL II

Gymnosperms: A study of following types

- *Cycadeoidea* (Fossil)
- *Williamsonia* (Fossil)
- *Araucaria*
- *Cupressus*
- *Podocarpus*
- *Zamia*
- *Ginkgo* – (from slides/photomicrographs if no material available)

Angiosperms:

- A study of the angiosperm families mentioned in theory with reference to their morphological peculiarities and economic importance of its members.
- Identification of genus and species with the help of flora (In addition to the above mentioned families, all families studied in undergraduate classes are included)

Suggested Readings

GYMNOSPERM

1 Gymnosperms Structure And Evolution by Chamberlain C.J.

2 A textbook of Gymnosperms by Vyas, Purohit and Garg. Ramesh book depot, Jaipur.

3 Gymnosperms, by P.C.. Vashishta. 1983. VAS g. Publisher, New Dehli.

4 Charles Joseph Chamberlain and John Merle Coulter, 1910, Morphology of Gymnosperms. K. R. Sporne. The morphology of gymnosperms

PLANT TAXONOMY

1. A.K. Mondal (2005). Advanced plant taxonomy, New Central book agency (p) Ltd, London.

2. A.N. Henry and M. Chandrabose, 1980, An aid to ICBN, Today tomorrow printers and publishers

3. Cole A. J. 1969, Numerical Taxonomy, Academic Press, London.
4. Cronquist A. 1981, An integrated system of classification of flowering

plants, Columbia University Press, N.Y.
5. Davis, P. Hand V.H. Heywood, 1963, Principles of angiosperm taxonomy, Oliver and Boyd, Edinburgh.
6. Gurucharan Singh, 1999, Plant Systematics, Oxford and IBH publishers.
7. Heywood, V.H. 1967, Plant Taxonomy, Edward Arnold publishers, London.
8. Jeffery, C. 1973. Biological Nomenclature,Edward Arnold publishers, London.
9. Lawrence George H.M. 1967, Taxonomy of Vascular plants, Oxford and IBH publishers.
10. Naik V.N. 1999. Taxonomy of Angiosperms, Tata-MacGraw Hill Publishers, Co. Ltd.
11. Sharma O.P. 1988. Plant Taxonomy.
12. Samuel Jones 1987. Plant systematics, Tata-MacGraw Hill Publishers, Co. Ltd.
13. Sivarajan V.V. 1991, Introduction to principles of plant taxonomy, Oxford and IBH publishers, New Delhi.
14. Sneath R.H.A. & R.R. Sokal, 1973. Numerical Taxonomy, W.H. Freeman and Company, Sanfransisco.
15. Vasudevan Nair R. 1997. Plant systematics, Oxford and IBH publishers.
16. V.V. Sivarajan, 1991. Introduction to Principles of plant Taxonomy, Oxford and IBH publishers.

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Program: M.Sc. I (2019-20)				**Semester:** I	
Course: BOTANY PAPER III PLANT PHYSIOLOGY				**Course Code:** PSMABO103	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

This paper includes Physiology. This course deals with both conceptual and practical tools about var physiological processes at cellular and organ level in plants. The course also imparts knowledge of proteins plant growth hormones.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: The students will learn about how plant cell responds to various biotic and abiotic stresses, photosynthetic mechanism in plants, events of seed and fruit development and various physiological r of plant hormones.

CO2: Learn the basic techniques of Plant physiology and its applications in propogation of commercially important plants.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Photosynthesis I	1hr
2	Photosynthesis II	1hr
3	Proteins	1hr
4	Plant Growth Regulators	1hr
	Total	
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**Photosynthesis I (Eukaryotes)** • ATP synthesis in chloroplasts (chemiosmotic hypothesis) • Regulation of C_3, C_4 and CAM pathways of photosynthesis: o **C_3 plants:** Role of light, regulation of RUBISCO o **C_4 plants:** Role of light, regulation of PEPcase, transport of metabolites, carbonic anhydrase, NADP-MDH and PPDK o Regulation of CAM through transport of metabolites. • **Pentose Phosphate Pathway** and its importance, effect of glucose-6-phosphate dehydrogenase deficiency.	**Credit 1**
Module 2	**Photosynthesis II (Prokaryotes)** • Photosynthesis of prokaryotes: • Classification of photosynthetic bacteria**,** • Pigment systems, CO_2 fixation in bacteria and cyanobacteria, • Structure and mechanism of light harvesting complex, • Reductive TCA cycle.	**Credit 1**
Module 3	**Proteins** Primary, secondary, tertiary and quaternary structural features and their analysis – Theoretical and experimental; protein folding – biophysical and cellular aspects, Role of chaperons in protein folding.	**Credit 1**
Module 4	**Plant Growth Regulators**	**Credit 1**

	Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Brassinosteroids and Jasmonic acid; Biosynthesis, storage, breakdown, transport and their physiological responses.	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

Major experiments

- Enzyme kinetics: Determination of Km and Vmax of the enzyme amylase (purified amylase).
- Extraction of cellulase from a suitable fungal culture and study of enzyme activity by DNSA method.
- Immobilisation of yeast cells and study of invertase activity.
- Quantitative study of diurnal fluctuation in Titratable Acid Number (TAN) in a CAM plant.
- Extraction and estimation of GOT and GPT from suitable plant material.
- Estimation of the total nitrogen content of a plant using Kjeldahl's method.

Minor experiment

- Separation of organic acids by paper chromatography.
- Separation of sugars by paper chromatography.
- A study of the enzyme polyphenol oxidase, from potato peels.
- Solvent extraction of chlorophyll a/b, xanthophylls and study of absorption pattern.
- Determine the Chl a/Chl b ratio in C_3 & C_4 plants.

Suggested Readings

1. Plant physiology by Lincoln Taiz and Eduardo Zeiger
2. Introduction to plant biochemistry by T W Goodwin and E I Mercer
3. Fundamentals of biochemistry by Donald Voet and Judith G Voe
4. Biochemistry by Zubay
5. Advanced Plant Physiology – Noggle& Fritz – Prantice – Hall of India.
6. Introductory Plant Physiology – Malcom Wilkins, Pitman Publication Ltd, 1984.
7. Plant Physiology – Pandey and Sinha, Vikas Publishing House, 1987.
8. Outlines of Biochemistry – Conn &Stumpf, John Willey and Co., 1987.
9. Plant Physiology, Biochemistry and Molecular Biology – Dennis and Turnip, longman
10. Scientific and Technical, 1990.
11. Plant Physiology – Taiz and Zeiger, Sinauer association Inc.

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Program: M.Sc. I (2019-20)				**Semester:** I	
BOTANY PAPER IV CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY				**Course Code:** PSMABO104	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

This paper includes Cytogenetics, Molecular Biology and Biotechnology.

To acquaint the students, about the hereditary basis of life, prokaryotic and eukaryotic genome organization and its functions.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Get an insight into the structure and functions of choromosomes, chromosome mapping, polyploidy and cytogenetic aspects of crop evolution.
CO2: Acquire the knowledge of importance of chromosomal variations in structure and number.
CO3: Understand, what forms the basis of evolution in living organisms.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Cytogenetics	1hr
2	Molecular Biology	1hr
3	Recombinant DNA technology	1hr
4	Applications of R-DNA technology	1hr
	Total	
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**Cytogenetics** Cell division and cell cycle: Steps in cell cycle and control of cell cycle. • Check points during cell cycle-G_1 to S, progression of S phase, G_2 to M phase, Anaphase check points and components involved as regulators of check points, role of cyclins and CDKs, synthesis and degradation of cyclins, structural features of CDKs and cyclins, activation and inactivation of cyclin dependent kinases; role of E2Fs, and DP proteins, P53, different types of Cyclin dependent CDKs, CDC25, CAKs, Wee1 proteins, nim-proteins, SCFs, Anaphase Promoting Complexes APC (cyclosomes), licensing factors, replication origin and replication initiation complexes. • Centrosome activation- structure, duplication of centrosomes, Role of nucleophosmins, organization of mitotic apparatus, binding of tractile fibers to kinetochore complexes, molecular motors involved in movement of chromosomes to equatorial plate and in anaphase movement; cytokinesis by cleavage and phragmoplast formation- different gene products and structures involved and the mechanisms of cytokinesis.	**Credit 1**
Module 2	**Molecular Biology** • Microbial Genetics: Molecular basis of transformation, transduction, Conjugation; fine structure of the gene, T4 Phage, complementation analysis, deletion mapping, cis-trans tests. • Tetrad analysis in *Neurospora:* Linkage detection (2 genes and centromere)	**Credit 1**
Module 3	**Recombinant DNA Technology**	**Credit 1**

	• General information on SV-40, Vaccinia, Baculovirus & retroviral vectors. • Use of YAC or YEp of yeast (*Saccharomyces cervisiae*) as effective cloning vectors because of their high copy numbers in production of HBsAg vaccine. • Use of BAC and its advantages. • Strategies to create Transgenic plants with herbicide resistance: Following strategies to be studied in detail with reference to herbicide Glyphosate resistance: a) Overexpression of the target protein by using a strong promoter. b) Improved plant detoxification resulting in a more and faster conversion of toxic herbicide to non toxic or less toxic compound. c) Detoxification of herbicide by using a foreign gene. d) Mutation of target protein • Methods of modifying the Diazotrophs (N_2 fixing bacteria) by Gene alterations in *Rhizobium* sp. to a) Improve nitrogen fixing efficiency and bacteria host plant interaction. b) Induce symbiotic relationship with non-leguminous plants such as wheat, rice and corn c) Transfer of gene for nitrogen fixation from *Rhizobium* sps. to other bacteria such as *Agrobacterium tumefaciens.*	
Module 4	**Applications of Recombinant DNA technology** • **Resistance to biotic stress:** a) Transgenic plants with insect resistance: Resistance genes from microbes: Gene from *Bacillus thuringenesis*, Cholesterol oxidase of *Streptomyces* culture filtrate, Isopentenyl transferase gene from *Agrobacterium tumefaciens* Resistance genes from higher plants: Genes for Proteinase inhibitors: eg. Cowpea trypsin inhibitor gene (CpTi), Genes for alpha amylase inhibitors. b) Transgenic plants with viral resistance: Employing virus encoded genes or virus coat proteins; e.g. Transgenic tobacco plants expressing tobacco mosaic virus coat protein gene were developed which express high level of resistance to TMV • **Improvement of nutritional content and Quality:**	**Credit 1**

	a) Increase in sweetness and flavor in fruits and vegetables for e.g. Monellin gene from African plant (*Dioscorephyllum cumminsii*)- introduction in tomato and lettuce b) Increase and change in the quality oils in *Brassica* species (increase in medium chain fatty acids and converting unsaturated fatty acid to saturated fatty acids). c) Increase in starch content (potato). • Transgenics for delayed fruit ripening and extended shelf life-Tomato. • Transgenic plants: Plantibodies, vaccines, Biopolymers and vitamins. • Transgenic plants in floriculture: Increase in the shelf life of cut flowers - (Carnation flowers), Genetic engineering of Orchids, Genetic manipulation of flower pigmentation. • Genetic engineering for inducing Male Sterility in plants. • Transgenic plants for enhancing phytoremediation**.**	

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PRACTICAL I

1. Preparation of cytological stains, fixatives and pretreatment agents.
2. Squash preparation from pre-treated root tips (colchicines/ Paradichlorobenzene/ Aesculin.
3. Squash preparation from mutagen treated root tips for study of aberrations.
4. Smear preparation from any suitable plant material.
5. Problems based on:
   a. Restriction map analysis and construction of restriction maps,
   b. Tetrad analysis in *Neurospora* – two genes and centromere.
   c. Deletion mapping in Bacteriophage.

Suggested Readings

1. Daneil J.H and Lodish D. (1995). Molecular Cell Biology. Baltimore Scientific American Book
2. De Robertis and De Robertis. Cell and Molecular Biology

3. Eduardo Diego Patricio De Robertis, EMF De Robertis (1988), Cell and molecular biology, International Ed. Inst. Med. Ltd
4. Hyde David R, Genetics and Molecular Biology, Mcgraw Hill
5. Lewin Benjamin. Genes, Oxford University Press.
6. Lewis R. Human Genetics, Concepts and applications
7. Molecular Biology W.H Freeman G Co. 47
8. Russell PJ (2001) iGenetics: A molecular Approach Pearson
9. Simmons M.J. Principles of Genetics, John Wiley and Sons.
10. Watson James D. Molecular Biology of the Gene, Pearson
11. Elliot and Elliot. (2001). Biochemistry and Molecular Biology. Oxford University Press.
12. Gerald Karp. (1996). Cell and Molecular Biology. John Wiley and Sons. Inc
13. Glick B. and J. Pasternak, , (2003) Molecular Biotechnology: Principles and Applications of Recombinant DNA , 3rd Edition, American Society of Microbiology
14. Lodish,H., Ber, A., Zipuoskry, L.S., Matsudaira, P., Bahimore, D and Damell J. (2001) Molecular Biology W.H Freeman G Co. 47
15. Pollard J.P. and W.C. Earnshaw. (2002). Cell Biology, Sunders

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Program: M.Sc. I

Course: PLANT DIVERSITY CRYPTOGAMS II

PLANT DIVERSITY: SPERMATOPHYTA II

PLANT PHYSIOLOGY & ENVIRONMENTAL BOTANY

MEDICINAL BOTANY & DIETETICS

Semester II

Choice Based Credit System (CBCS) with effect from the Academic year 2020-2021

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Preamble

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		TOTAL OF 4 QUESTIONS		**60 Marks**
Q5)	i) to iv)	Short notes -Answer 3 out of 4	05 marks	15 Marks
			TOTAL	**15 Marks**
			NET TOTAL	**75 Marks**

Signature
HOD

Signature
Approved by Vice –Principal

Signature
Approved by Principal

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. I (2019-20)				**Semester:** II	
PLANT DIVERSITY : CRYPTOGAMS II				**Course Code:** PSMABO201	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

This paper includes the students understand and conceptualize the classification and life cycle of members belonging to bryophytes, and Pteridophytes. The course also offers to make students learn and understand certain applied aspects of both bryophytes & pteridophytes viz. their evolution, diversity, distribution, their ecology, economic importance and their use as pollution indicators. Besides, the course also caters to making the learners understand their economic importance. Practically, the learners will be studying these members from preserved and fresh material. One crucial aspect that adds to comprehensive learning about these groups of plants is through regular field visits, which reinforces classroom-learning objectives about the variety of plant groups.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Identify the members belonging to bryophytes and pteridophytes in their natural habitat and their evolutionary trends.

CO2: Experience the natural environment where these plant groups grow and comprehend their life cycle and their role in ecology.

CO3: Understand the applied aspects related to plant diversity, distribution and their economic importance

CO4: Understand the economic and ecological of bryophytes and pteridophytes.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Bryophyta I**	1hr
2	**Bryophyta II**	1hr
3	**Pteridophyta I**	1hr
4	**Pteridophyta II**	1hr
	Total	
PRACTICALS		4hr

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Unit	Topic	No. of Hours/Credits
Module 1	**Bryophyta I** • Classification of Bryophyta, upto orders, according to the system proposed by G. M. Smith. • Alternation of generation in Bryophyta. • Contribution of Shiv Ram Kashyap and S. C. Srivastava in Bryology. • Type study of *Plagiochasma* and *Pogonatum*	**Credit 1**
Module 2	**Bryophyta II** • Origin and evolution of Bryophyta with reference to habitat and form. • Evolution of the Sporophyte in Bryophyta • Study of gametophytes in Bryophyta. • Bryophytes as bioindicators. • Alternation of generations in Bryophytes.	**Credit 1**
Module 3	**Pteridophyta I** • Classification of Pteridophyta, upto orders, according to the system proposed by G.M.Smith. • Classification & general characters of Pterophyta • Heterospory and seed habit • Life cycle of *Psilotum*, *Pteris* and *Salvinia*	**Credit 1**
Module 4	**Pteridophyta II** • The geological time scale and a study of fossil Pteridophytes *Horneophyton, Cladoxylon, Sphenophyllum, Coenopteris*) • Cultivation and maintenance of ornamental Ferns. • Abnormalities in the life cycle - Apogamy and Apospory • Ethnomedicinal uses of Pteridophytes	**Credit 1**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

- Study of vegetative and reproductive structures in *Plagiochasma*, *Fimbraria*, and *Pogonatum*.
- Study of vegetative and reproductive structures in : *Isoetes*, *Ophioglossum*, *Pteris*, *Angiopteris*, *Lygodium* and *Salvinia*
- Study of fossils :*Horneophyton, Cladoxylon, Sphenophyllum, Coenopteris*
- Ethnomedicinally important Pteridophytes

Suggested Readings

- College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
- Cryptogamic Botany Vol I and II by G M Smith, Mcg raw Hill
- Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part I - Algae.* S ChandPubl.
- Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part II - Fungi* S ChandPubl.
- Vashishtha B R, Vashi Sinha AK and Anil Kumar *Botany for Degree Students Part III - Bryophyta* S ChandPubl.
- Rashid A (1999) An introduction to Pteridophyta. Vikas Publishing house Pvt.Ltd. New Delhi.
- Sharma OP (1990) textbook of Pteridophyta. Mac Millan India Ltd. Delhi.
- Smith GM (1955) Cryptogamic Botany Vol. II Mc Grew Hill.
- Sporne KR (1986) The morphology of Pteridophytes. Hutchinson University Press. London.
- Stewart WN and Rothwell GW (2005) Paleobotany and the Evolution of plants, 2nd Edn. Cambridge University Press.
- Sundara Rajan S. (1999) Introduction to Pteridophyta. New Age International Publishers, New Delhi.
- Surange KR (1966) Indian fossil Pteridophytes. Council of Scientific and Industrial research.
- Parihar NS (1976) Biology and morphology of the Pteridophytes. Central Book Depot.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. I (2019-20)				**Semester:** II	
Course: PLANT DIVERSITY: SPERMATOPHYTA II				**Course Code:** PSMABO202	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

To enable the students to understand the various aspects of plant development and sexual reproduction, to learn about plant tissue systems, development botany and seed development and fruit growth.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Understand the structural elements of plants meristems, organogenesis and embryology .

CO2: Understand the micro and mega sporogenesis; sexual incompatibility, types of endosperm and biology of fruit development and maturation.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Anatomy I	1hr
2	Anatomy II	1hr
3	Developmental Botany	1hr
4	Palynology	1hr
	Total	
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**<u>Anatomy I</u>** • Meristems: Definition type of meristems, apical cell theory, histogen theory and Tunica corpus theory • Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristems; shoot and root development, leaf development and phyllotaxy; transition of flowering, floral meristems and floral development in *Arabidopsi*s and *Antirrhinum*	**Credit 1**
Module 2	**<u>Anatomy II</u>** • **Study of Tissue system:** o **Sensory and tactile tissue system**: Tactile sense organs, gravitational and optical sense organs. o **Secretory Tissues:** Introduction, Glands, Digestive glands, Nectaries, Resin ducts and oils ducts, Laticiferous ducts. • **Wood Anatomy:** Coniferous and Angiosperm wood o Parenchyma: Storied and non-storied wood parenchyma, Distribution of axial parenchyma o Distribution of vessels o Structure of rays Characters used in identification of wood.	**Credit 1**
Module 3	**<u>Developmental Botany</u>** • Male gametophyte: Pollen development and gene expression male sterility sperm dimorphism and hybrid seed production; pollen tube growth and guidance. • Female gametophyte; Types of embryo sacs; structure of embryo sac cells. • Fertilization: heterospermy, differential behavior of	**Credit 1**

	male gametes, discharge and movement of sperms; syngamy and triple fusion, post-fertilization metabolic & structural changes in embryo-sac. • Seed development and fruit growth; endosperm development during Early Maturation and Desiccation stages; embryogenesis, ultrastructure and nucellar cytology; cell lineage during late embryo development; storage proteins of endosperm and embryo; apomixis; embryo culture; dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.	
Module 4	**<u>Palynology</u>** • Special relationships of pollen grain in pollen tetrads. • Pollen Chemistry: Introduction, Chemical constituents of pollen-Major metabolites (Carbohydrates, Mineral content, Callose, Organic acids, Amino acids, Pigments, Vitamins, Hormones and steroids), Chemistry of pollen wall, Pollen wall proteins. • Pollen wall morphogenesis, ultrastructure & primexin formation. • Utilization of pollen: Pollen as health food, Pollen as medicine, Pollen allergens for diagnosis and therapy.	**Credit 1**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

- Study of wood elements in *Annona, Michelia, Sterculia* and *Thuja* & *Araucaria* using the maceration technique.
- Study of the following leaves with respect to leaf surface characters (wax, cuticle, epidermis, stomata, epidermal outgrowth): *Pistia, Ficus, Avicennia* and *Peperomia.*
- Study of vessels, parenchyma: Axial & Ray Parenchyma – Apotracheal: Terminal, Diffuse, Banded, Reticulate; Paratracheal: Vasicentric, Aliform, Confluent, Abaxial.
- Ray Parenchyma &Rays: Homogenous & Heterogenous
- Wood Fibres from dicotyledonous wood by temporary preparation.
- (Topic 3 for identification only)
- Mounting of Glands- salt glands of halophytes- *Avicennia, Ipomoea biloba, Sesuvium/Suaeda*
- Nectaries- Euphorbiaceae & Combretaceae (at least 3 examples from each family)
- Resin ducts- Pinus

- Oils ducts- *Citrus, Eucalyptus, Murraya*
- Laticiferous ducts Apocynaceae & Asclepiadaceae.
- Digestive glands- From permanent slides/ photomicrograph
- Microtomy- Processing of material, Block making & staining- 5 slides- (only for submission).
- Camera lucida sketches of parenchyma/ rays.(only for submission)
- A study of Microsporogenesis, Megasorogenesis, ovules & types of embryo sacs with the help of permanent sides/photomicrographs. (Topic 7 for identification only)
- *In vitro* germination of pollen grains, effect of temperature on pollen viability and short-*term* storage.
- Detection of amino-acids, sugars and lipids by paper/ Thin layer chromatography from pollen grains.
- Study of the morphology of the pollen (using Chitale's and acetolysis method) from the families; studied in sem I & II

Suggested Readings

1. KashinathBhattacharya etc; 2011, A text Book of Palynology(Basic and Applied)New Central Book Agency (P)Ltd,London.
2. Nair.P.K.K. 1970, Pollen Morphology of Angiosperms, Scholar Publ.House, Lucknow.
3. Shivanna K.R.,2003, Pollen Biology and Biotechnology-Special Indian Edition, Oxford and IBH Publ.CoPvt.Ltd,New Delhi.
4. Shivanna.K.R.&Johri.B.M, 1985,The Angiosperm Pollen:Structure and Function,Wiley Eastern Ltd, New delhi.
5. Tilak.S.T,1982,Aerobiology,VaijayanthiPrakashan,Aurangabad,India.
6. Plant Anatomy by Chandurkar P J, , Plant Anatomy Oxford and IBH publication Co. New Delhi 1971
7. Plant Anatomy, By P Pandey, S Chand and Co. Ltd, New Delhi 1978
8. An introduction to Modern Biology By Greulach V A and Adams J E Plant-, Toppen Co. Ltd, Tokyo,
9. An Introduction to Plant Anatomy, By Eams and Mc Daniel,McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan
10. Practical Plant Anatomy, By Adriance S Foster D Van Nostrand Co. INC, Newyork
11. Plant Anatomy, By Esau,Wiley Toppan Co. California, USA
12. Plant Anatomy, By Pijush Roy New Central Book Agency Ltd, Kolkata
13. Plant Anatomy and Embryology, By Pandey S N and Ajanta Chadha, Vikas Publishing House,Pvt, Ltd, New Delhi

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. I (2019-20)				**Semester:** II	
Course: PLANT PHYSIOLOGY & ENVIRONMENTAL BOTANY				**Course Code:** PSMABO203	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

The course offers to make students understand various metabolic processes pertaining to seed and stress physiology, To enable them to understand the physiological mechanism of plants, to understand the various biochemical pathways of plants, to create knowledge on different biochemical pathways, physiology and developmental aspects of plants and help them understand the physiology and biochemistry of seed germination, Environment, Biogeography and Population Ecology

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Describe the physiological phenomena of plants in terms of mechanisms, will know the overview of biorhythms; stress physiology of plants.

CO2: Understand the concept of environment, biogeography and population ecology.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Seed Physiology	1hr
2	Stress Physiology	1hr
3	The Environment	1hr
4	Climate Change	1hr
	Total	4hr
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**Seed physiology:** • Physiology and Biochemistry of seed germination, Mobilization of food reserves, Germination and growth factors. • Seed dormancy, Control and release of seed dormancy. • Factors in control for the long term storage of seeds, seed proteins.	**Credit 1**
Module 2	**Stress Physiology:** • Biotic and abiotic stress, Response of plants to Biotic (pathogenic and insects) stress, Adaptations to eliminate and tolerate the infection, Hypersensitive reaction. • Response of plants to abiotic stress - Drought stress, Heat stress - Heat shock proteins, Chilling, and freezing, Salinity stress • Signaling pathways activated during stress	**Credit 1**
Module 3	**The Environment, Biogeography and Population Ecology**: • Environment: Components, Major components of physical environment, biotic and abiotic interactions, • Biogeography: Major terrestrial biomes, Theory of island bio-geography, Bio-geographical zones of India. • Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection).	**Credit 1**
Module 4	**Climate Change:** • Global warming, carbon credits, Kyoto mechanism. • Factors responsible for climate change, Climate change in relation to the changes in patterns of temperature, precipitation and sea level rise, Impacts of Climate Change on various sectors –	**Credit 1**

	Agriculture, Forestry and Ecosystem. The Montreal Protocol, Paris Agreement, UNFCCC, IPCC. • Adaptation Strategy/ Mitigation Measures, Blue carbon initiative.	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

Practical exercises are planned for better understanding of the state of environment, rather than 5-hour units. Field exercises are expected to be completed during excursion and field diaries maintained for submission during tests. Other practical work can be carried out in the laboratorywith help of plant and soil samples collect from the field.

Major experiments

- Breaking of seed dormancy by Physical and Chemical methods
- Assessing seed viability by TTC method
- Determination of Nygard index of algae in a water body.
- Determination of dust load on lives of roadside plant.
- Comparison of two population of a species collected from two areas.
- Determination of primary production of an area by harvest method.
- Determination of primary production of an area by chlorophyll method.
- Determination of primary aquatic production by harvest method.
- Determination of mechanical composition of soil by international pipette method.

Minor experiments

- Effect of water and salinity stress on chlorophyll content of leaves.
- Effect of water and salinity stress on Proline content of leaves.
- Determination of Stomatal Index of leaves
- Determination of epidermal architecture of leaves.
- Determination of LAI of different types of trees.
- Assessment of pollution in ambient air, on the basis of injured leaf area.

Field exercises

- Assessment of erosion status of land along a 'stream' on a slope or on flat land.
- Assessment of status of waste land, on the basis of its appearance and visible plant growth.
- 3Assessment of degradation of a forest on the basis of its canopy cover and height, strata and species diversity.

Suggested Readings

1. Gupta, P.K. (2011). Cell-biology, Genetics, Evolution and Ecology.
2. Odum, E .P. and Barrett, G .W. (2005). Fundamentals of Ecology by Thompson Asia Pvt Ltd. Singapore Vol 87
3. Chapman, J.L. and Reiss M.J. (2005). Ecology Principles and Applications, Cambridge University Press London.
4. Dash, M.C. (1994). Fundamentals of Ecology, Tata McGraw Hill, New Delhi.
5. Introduction to Biomes Book by Susan L. Woodward Vol 8 (Pb 2009)
6. Santra SC. (2011). Environmental Science, New Central book agency
7. Subrahmanyam, N.S.;Sambamurty, A.V.S.S.; (2000) Ecology; 1st edition; New Delhi : Narosa Publishing House
8. Fundamentals of Ecology. By E.P. Odum. 1996. Natraj Publishing, Dehradun.
9. Plants and Environment- A Text Book of Plant Ecology (3rd edition). By Daubenmire R.F. 1974. John Wiley & Sons. New York.
10. Ecology with Special Reference to Animals and Man. By Kendeigh S.C. 1980. Prentice Hall of India Pvt. Ltd., New Delhi.
11. Modern Concepts of Ecology (3rd edition). By Kumar H.D. 1996. Vikas Publishing House Pvt., Ltd. Delhi. 11.Kumar.H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
12. Concepts of Ecology. By Kermondy F.J. 1996. Prentice Hall of India Pvt. Ltd., New Delhi.
13. Ecology and Field Biology (5th edition). By Smith L.R. 1996. Harper Collins College Publishers, USA.
14. Plant Ecology. By Weaver. J.E. and Clements. S.E. 1966. Tata McGraw Publishing Co. Ltd. Bombay.
15. Elements of Ecology. (4th edition). By Smith L.R. and Mith T.M. 1998. An imprint of Addison Wesley, Longman ink., California.
16. Plant Physiology by S. N. Pandey and B. K. Sinha (2014)., Vikas Publishing House Pvt. Ltd., India. Buchanan B.B, Gruissem W. and Jones R.L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
17. Plant physiology by Salisbury F.B and Ross C.W (1992). (Fourth Edition) Wadsworth Publishing Company, California,USA.
18. Introduction to Plant Physiology by William G. Hopkins (1995), Published by – John Wiley and Sons, Inc.
19. Plant Physiology (3rd edition), by Lincoln Taiz and Eduardo Zeiger (2003). Published by – Panima Publishing Corporation R. G. S. Bidwell (revised edn.)-
20. Plant Physiology by Verma S.K. and Verma Mohit (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. I (2019-20)				**Semester:** II	
Course: MEDICINAL BOTANY & DIETETICS				**Course Code:** PSMABO204	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4		8	25	75

Learning Objectives:

The course offers to make students understand various aspects of Medicinal Botany and Dietetics To develop understanding of Indian and Ayurvedic pharmacopeia, to train students in the field of quality control of crude drugs, to focus and depth in the food science discipline, to introduce the future perspective of nutraceuticals and to acquaint the students with the concept of plant food as medicine

Course Outcomes:

After completion of the course, learners would be able to:

The students are expected to be able to get familiar with therapeutic uses of several plants, learning pharmacopeia both Indian and Ayurvedic and learn how plant food is used as medicine.

CO1: Familiarise with therapeutic uses of several plants..
CO2: learn pharmacopeia both Indian and Ayurvedic.
CO3: learn how plant food is used as medicine

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Medicinal Botany I**	1hr
2	**Medicinal Botany II**	1hr
3	**Dietetics I**	1hr
4	**Dietetics II**	1hr
	Total	4hr
PRACTICALS		4hr

Unit	Topic	No. of Hours/Credits
Module 1	**<u>Medicinal Botany I</u>** • Monograph of drugs with respect to Biological source, Geographical distribution, macro and microscopic characters, chemical constituents and therapeutic uses of the following drugs: • Root: *Withania somnifera* (Ashwagandha) • Rhizome: *Zingiber officinale* (Ginger). • Stem bark: *Cinnamom zeylanicum* (Cinnamom) and *Holarrhena antidysenterica* (Kurchi). • Leaf: *Azadirachta indica* (Neem). • *Fruit: Foeniculum vulgare* (Fennel) • Seed: *Plantago ovata* (Isabgol*)*	**Credit 1**
Module 2	**Medicinal Botany II** • Introduction to Pharmacopeia**:** Indian pharmacopeia and Ayurvedic pharmacopeia • Quality control of crude drugs: • Morphological examination – Exomorphic characters • Microscopical evaluation – Anatomical characters • Preliminary phytochemical tests. • Development of standardization parameters – Moisture content, Ash values, • Solvent extraction value, bitterness value, foaming index, swelling index and heavy metal.	**Credit 1**
Module 3	**Dietetics I** Nutraceuticals: • Definition and Introduction, classification (Dietary supplements, functional foods, Medicinal food, Pharmaceuticals) • Role of plant nutraceuticals in health benefits (onion, garlic, tomato, carrot, beet, turmeric). • Current trends and future prospective of nutraceuticals.	**Credit 1**

Module 4	**Dietetics II** Plant Food as medicine: • Plant food in the treatment of diseases – arthritis, constipation, diarrhoea, diabetes, , hypertension, cancer, jaundice, memory and piles • Concept of Antioxidants, their significance, Plants as a source of antioxidants.	**Credit 1**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL I

Medicinal Botany –I

A study of the macroscopic and microscopic characters and identification of active ingredients of drugs mentioned in the syllabus for theory by means of chemical tests.

- Root: *Withania somnifera* (Ashwagandha)
- Rhizome: *Zingiber officinale* (Ginger)
- Stem bark: *Cinnamom zeylanicum* (Cinnamom) and
    - *Holarrhena antidysenterica* (Kurchi)
- Leaf: *Azadirachta indica* (Neem)
- *Fruit: Foeniculum vulgare* (Fennel)
- Seed: *Plantago ovata* (Isabgol*)*

Medicinal Botany -II

- Determination of Moisture content of Ash values, Solvent extraction value of the given sample.
- Determination of foaming index of the given sample.
- Determination of swelling index of the given sample.

NUTRACEUTICALS

- Estimation of lycopene by TLC
- Amino acid profile of a plant/plant product
- Identification of plants Nutraceuticals for health benefits (As per theory topics)

Note:

1. A minimum of five field excursions (with at least one beyond the limits of Maharashtra) for habitat studies are compulsory. Field work of not less than 8 hours duration equivalent to 1 period per week for a batch of 15 students.
2. A candidate will be allowed to appear for the practical examinations only if he /she submits a certified journals of MSc Botany and field report.
3. Compulsory visit to Western Ghats for observation of plants (at least for three days).
4. Compulsory excursion for observation of plants (local, atleast 2 in each term). Same Field diary to be continued from Sem I and II & maintained for all four semesters.

Suggested Readings

1. Mukherjee P.K, (2002). Quality Control of Herbal Drugs-An approach to evaluation of Botanicals: Business Horizons Pharmaceutical Publishers, New Delhi.
2. Khandelwal KR. (2004). Practical Pharmacognosy. Nirali prakshan, 2004.
3. Anonymous, (1996) Pharmacopoeia of India, Ministry of health and family welfare, Govt. of India.
4. Trease & Evans (1996) Pharmacognosy. Sunders company ltd.
5. Wallis T.E. (1985) Textbook of Pharmacognosy. CBS PRESS.
6. Jain S.K. (1987). A manual of Ethnobotany. Sci. Publ. Jodhapur.
7. Jain S.K. & Mundal V. (1999). A hand book of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun.
8. Jain S.K. (1986). Ethnobotany Interdisciplinary Sci. Rev 11 (3) 285-292.
9. Jain A.K. (20160. I ndian Ethnobotany: Emerging Trends. Scientific Publishers
10. European Pharmacopoeia. 9th Edition. (2017). 3 Volume Set.
11. Evans W. C. (2009) Trease and Evans' Pharmacognosy. Elsevier Health Sciences.
12. Farooqi A. A. and Sreeramu B.S. (2004) Cultivation of Medicinal and Aromatic Crops. Revised Edition. Universities Press (India) Pvt. Ltd.
13. Harborne A. J. (1998) Phytochemical Methods A Guide to Modern Techniques of Plant Analysis. Third Edition. Chapman and Hall.
14. Indian Pharmacopoeia 7th Edition (2014). 4 Volume Set.
15. Jain S. M. and Saxena P. K. (2009) Protocols for in vitro Cultures and Secondary Metabolite Analysis of Aromatic and Medicinal Plants. Humana Press.
16. Rai M. and Carpinella M. C. (2006) Naturally Occurring Bioactive Compounds. Elsevier B. V.
17. Raman N. (2006) Phytochemical Techniques. New India Publishing Agency, New Delhi, India. Ramavat K. G. and Goyal Shaily (2009) Comprehensive Biotechnology. 1st Edition. S. Chand Publishing.
18. Schirmer, R.E., (2000), Modern Methods of Pharmaceutical Analysis, Vol. 1, 2. CRC Press, Boca Raton, Florida.
19. Wagner H. and Bladt S. (1996) Plant Drug Analysis A Thin Layer Chromatography Atlas. 2nd Edition. Springer.
20. Smith, P. M. (1976) The Chemotaxonomy of Plants. Edward Arnold, UK