Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Two Year Degree Program in Botany

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Botany) Part-II Semester -III

For Department of Botany

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2019 Pattern)

M.Sc. Botany

Program Outcomes (Pos) for M. Sc. Program

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the discipline that forms a part of a postgraduate programme. Execute strong theoretical and practical understanding generated from the specific programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. Identify the problem by observing the situation closely, take actions and apply lateral thinking and analytical skills to design the solutions.
PO3	**Social competence:** Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies. Elicit views of others, present complex information in a clear and concise way and help reach conclusions in group settings.
PO4	**Research-related skills and Scientific temper :** Infer scientific literature, build a sense of enquiry and able to formulate, test, analyse, interpret and establish hypothesis and research questions; and to identify and consult relevant sources to find answers. Plan and write a research paper/project while emphasizing on academics and research ethics, scientific conduct and creating awareness about intellectual property rights and issues of plagiarism.
PO5	**Trans-disciplinary knowledge:** Create new conceptual, theoretical and methodological understanding that integrates and transcends beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Perform independently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Course Structure for M. Sc. II (Botany)
SYLLABUS (CBCS) FOR M. Sc. Botany II (w. e. f. June, 2020)
Academic Year 2020-2021

Sem	Paper Code	Title of Paper	No. of Credits
III	BOT5301	Angiosperms and Evolution	4
	BOT5302	Developmental Botany	4
	BOT5303	Computational Botany	4
	BOT5304 (A) BOT 5304 (B) BOT 5304 (C) BOT 5304 (D)	Advances in Plant Physiology Advances in Mycology and Plant Pathology Bryology Angiosperm Taxonomy	4
	BOT5305	Practical's Based on BOT 5301,5302 and 5303	4
	BOT5306 (A) BOT5306 (B)	Practical's based on special paper Advances in Plant Physiology Practical's based on special paper Advances in Mycology and Plant Pathology Practical's based on special paper Bryology Practical's based on special paper Angiosperm Taxonomy	4
IV	BOT5401	Plant Pathology	4
	BOT5402	Industrial Botany	4
	BOT5403	Plant Biotechnology	4
	BOT5404 (A) BOT 5404 (B) BOT 5404 (C) BOT 5404 (D)	Advances in Plant Physiology Advances in Mycology and Plant Pathology Bryology Angiosperm Taxonomy	4
	BOT5405	Practical's Based on 5401, 5402 and 5403	4

	BOT5406	Research Projects, Review of Literature and Summer Training	4

Class : M.Sc. II (Semester- III)
Paper Code : BOT 5301
Paper : I Title of Paper: Angiosperms and Evolution
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To create awareness and inculcate knowledge of morphological and taxonomical awareness of local flora.
2. To give idea of economic importance of angiosperms and evolution.

B) Course Outcome:

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2.Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

TOPICS / CONTENTS:

Credit I - Systematics and Classification of Angiosperms (15L)

1. Systematics: A key science, importance, relevance to conservation, taxonomic structure - taxonomic hierarchy, the species concept, categories and ranks, alpha and omega taxonomy, taxonomy as synthetic discipline. **5L**
2. International Code of Botanical Nomenclature: Salient features-principles, important rules and recommendations, provisions for the governance of the code, appendices **3L**

3. Systems of Angiosperm classification: Brief history of pre-Darwinian and post-Darwinian classification systems (any four), phenetic versus phylogenetic systems, cladestics in taxonomy, angiosperm phylogeny group (APG). **4L**
4. Recent Systems of Classifications: By Armen L.Takhtajan, Authur Cronquist, R. M. T. Dahlgren and Robert F. Thorne. **3L**

Credit II -Taxonomic Aspects of Angiosperms (15L)

1. Morphological variations, systematic position, interrelationship, phylogeny and economic importance of following families: Magnoliaceae, Lauraceae, Piperaceae, Aristolochiaceae, Nymphaeaceae, Moraceae, Urticaeae, Casuarinaceae, Alismataceae, Hydrocharitaceae, Najadaceae, and Aponogetonaceae, Bignoniaceae, Passifloraceae, Aracaceae, Eichhorniaceae, Typhaceae, Amaranthacaeae **10L**

2. Phytogeography: Phytogeographic regions of India, endemism, hotspots and hottest

hotspots. Endemism in Western Ghats, plant explorations, invasions and introductions. **5L**

Credit III: Evolution = (15 Lectures)

1. Emergence of evolutionary thought: Steps and preview of evolution, Lamarkism, Darwinism- Concepts of variation, adaption, struggle for fitness and natural selection; Nerdarwinism, Spontaneity of mutations, The evolutionary synthesis, Fossils- Formation, Nature, Types, Geological time scale **3L**

2. Origin of cells and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of organic monomers and polymers, Concepts of Opairn and Halden, Experiment of Miller (1953), The first cell, evolution of prokaryote, origin of eukaryotic cells, evolution of unicellular eukaryotes, anaerobic metabolism, photosynthesis and aerobic metabolism, RNA world theory **4L**

3. Molecular Evolution: Concepts of natural evolution, molecular clocks, molecular tools in phylogeny, classification and identification, protein and nucleotide sequence analysis, origin of new genes and proteins, gene duplication and divergence **4L**

4. The mechanism of evolution: Population genetics- populations gene pool, gene frequency, Hardy-Weinberg law, Concepts and rate of change in gene frequency through natural selection, migration and random genetic drift, adaptive radiation and modification, isolation mechanism, speciation, allopatric and sympatricality, parapetric, convergent evolution, sexual selection, co-evolution **4L**

Credit IV : Modern techniques in angiosperm taxonomy 15 L

1.Anatomy in relation to taxonomy: Wood and floral anatomy, anatomical characters of taxonomic importance, use of anatomical data in understanding the interrelationships, evolution of angiosperms and solving taxonomic problems. **3L**

2. **Palynotaxonomy**: Pollen morphology-Polarity, symmetry, NPC of pollen, exine stratification, excrescences, L/O pattern, palynogram; pollen characters of taxonomic importance. **3L**

3.**Chemotaxonomy**, classes of compounds and their biological significance, stages in chemotaxonomic investigations. Techniques-Criteria for use of chemical in plant taxonomy; Proteins and taxonomy- seed proteins, techniques of protein electrophoresis, analysis of A. A. sequence and its significance in systematics. Serology and taxonomy- history, precipitation reaction, techniques, antigen, antisera, antibody, application of serological data in systematics. **6L**

4. **Ultrastructural Systematics**: SEM and TEM studies and plant systematics; SEM and plant surface structure, TEM and dilated cisterneae of endoplasmic reticulum and sieve element, plastids, applications of data in the classification of higher taxa. **3L**

References:

1. Blatter E and W.S Millard. 1929. Some Beautiful Indian Trees J.Bom. Nat Hist Soc. 33:624-635.
2. Bor N.L 1943. Manual of Indian Forest Botany. London.
3. Cliford H.T and W. Stephenson. 1975. An Introduction to Numerical Taxonomy. Academic Press, N.Y.
4. Cole A.J (Ed.) 1969. Numerical Taxonomy. Academic Press, N.Y.
5. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London.
6. Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
7. Heywood V.H 1967. Plant Taxonomy, London.
8. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.
9. Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.
10. Rendle A.B. 1925. The Classification of flowering plants. 2 Vols. London.
11. Santapau H. 1953. The Flora of Khandala on the Western Ghats of India.
12. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
13. Swingle D.B. 1946. A Text book of Systematic Botany. McGraw Hill Book Co. New York.
14. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
15. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand.
16. Vashishta P.C., A.R. Sinha, Anil Kumar. 2006. Gymnosperms. S.Chand.
17. Nair, P. K. K. 1966. Pollen morphology of Angiosperms. Periodical Expert Book Agency, New Delhi.
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19. Hutchison, J. 1959. Families of flowering plants.
20. Powar C. B. (2005) (3rd Edn). Cell Biology, Himalaya Publishing, Mumbai
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25. Evolution, Ecology. S. Chand and Company, New Delhi.
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29. Roy S.C and De K.K. (2005). (2ndEdition). Cell Biology, New central Book Agency Private Ltd., Kolkata.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Angiosperms and Evolution **Course Code**: BOT 5301

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3		2			1			3
CO 2	3		2			1			3
CO 3	3				2	1	1	1	1
CO 4		3	1	1			1		
CO 5					1				1
CO 6	3				1				1
CO 7		3				2			

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO6. Describe and identify the flowering plants.

PO2: Critical Thinking and Problem Solving

CO4. Know different methods of conservation of Phanerogams.
CO7. Understand the local flora with respect to Phanerogams.

PO 3: Social competence

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO4. Know different methods of conservation of Phanerogams.

PO 4: Research-related skills and Scientific temper

CO4. Know different methods of conservation of Phanerogams.

PO5: Trans-disciplinary Knowledge

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO5. Study the applications of Phanerogams.
CO6. Describe and identify the flowering plants.

PO6: Personal and Professional Competence

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO7. Understand the local flora with respect to Phanerogams.

PO 7: Effective Citizenship and Ethics

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO4. Know different methods of conservation of Phanerogams.

PO 8: Environment and Sustainability

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

PO 9: Self-directed and Life-long Learning

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO5. Study the applications of Phanerogams.
CO6. Describe and identify the flowering plants.

Class : M.Sc. II (Semester- III)
Paper Code : BOT 5302
Paper : I Title of Paper: Developmental Botany
Credit : 4 No. of lectures: 60

A) Learning Objectives:

1. To study structure of plant development process.
2. To pertain knowledge of different embryological techniques.

B) Course Outcome:

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2.Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

TOPICS/CONTENTS:

Credit I- Process of Plant Development (15L)

1. Plant development- concept, definitions and unique features. **1L**

2. Processes of development, cell growth, division and differentiation, competence, determination, commitment, specification, differentiation, redifferentiation and dedifferentiation. Polarity and symmetry, integration, organization of cells, tissues and tissue system to whole plant. Cell-cell interaction **6L**

3. Factors affecting for development- intrinsic and extrinsic **2L**

4. Vegetative development – structure and organization of seed embryo **1L**

5. Seed germination – Embryonal axis- meristems, establishment of seedling organ **1L**

6. Phenomenon of development, meristems as dynamic centers of cell regeneration, organ development, primordium to organ, juvenility – characteristics, transition to adult phase. Coordinated development **4L**

Credit II -Embryological Aspects of Development (15L)

1. Transition - vegetative to reproductive phase, morphological and histochemical changes in vegetative plant body **2L**

2. Gametophyte development, stamen and microsporogenesis, male gametophyte or male germ unit development, carpel and megasporogenesis, female gametophyte or female germ unit formation **4L**

3. Fertilization – Pollen tube growth and its path, its entry into embryo sac, gametic fusion, significance of double fertilization, abnormalities in fertilization **3L**

4. Embryo development - Development of embryo in dicots and monocot, unclassified or abnormal embryos, unorganized or reduced embryo **3L**

5. Polyembryony, apomictic phenomenon Polyembryony – concept and classification of polyembryony, special cases and causes of polyembryony, apomixis- concept, categories- agamospermy and vegetative reproduction apospory, parthenogenesis **3L**

Credit III -Physiology and Molecular Basis of Plant Development (15L)

1. Physiology of plant development – totipotency, light mediated development, hormonal control in development, light and hormonal signaling, cell lineages, cell fate mapping, positional informational techniques for studying development, specific gene expression . **6L**

2. Case study of organ culture, anther, pollen and protoplast culture and its role in understanding plant development **3L**

1. Molecular basis of plant development - Embryogenesis and seedling development, root, shoot and leaf development, gene expression during transition to flowering and flower development molecular genetics of gametophytes development, expression of cell incompatibility. **6L**

Credit IV - Economic Botany (15L)

Source, method of cultivation and economic uses of

1. Cereals- rice, wheat, maize, barley, oat

2**.** Millets – sorghum, pear millet, finger millet **2L**

3. Legumes and nuts- gram, pigeon pea, soybean, garden pea, black gram, moth bean, cowpea, peanut, almonds, green almonds, cashewnut, walnut **2L**

4. Vegetables- sweet potato, beet, carrot, radish, turnip, potato, brinjal, onion, garlic,

cabbage, cauliflower, tomato, jack fruit, cucurbits, bitter gourd **1L**

5. Fruits- mango, citrus, grapes, banana, guava, papaya, anjeer, pineapple, date, apple, pear, plum, peach, strawberry **2L**

6. Plant fibres- cotton, flax, sun-hemp, coir **1L**

7. Wood and Cork – babul, mulberry, willow, deodar, pinewood, red sandalwood, teak, salwood, veneers, plywood cork **2L**

8. Rubber and its products **1L**

9. Fatty oils- linseed oil, safflower oil, soybean oil, sunflower oil, sarson oil, castor oil, peanut oil **1L**

10. Essential oils- camphor oil, eucalyptus oil, jasmine oil, lavender oil, clove oil, rose oil, turpentine oil **1L**

11. (a)Sugar industry and its byproducts **2L**

(b)Spices- *Asafoetida*, turmeric, ginger, cinnamon, saffron, cardamom, nutmeg

Tea and coffee industry

REFERENCES:

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9. Hill. Economic Botany
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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Developmental Botany **Course Code**: BOT 5302

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3		2			1			3
CO 2	3		2			1			3
CO 3	3				2	1	1	1	1
CO 4		3	1	1			1		
CO 5					1				1
CO 6	3				1				1
CO 7		3				2			

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2. Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO6. Describe and identify the flowering plants.

PO2: Critical Thinking and Problem Solving

CO4. Know different methods of conservation of Phanerogams.

CO7. Understand the local flora with respect to Phanerogams.

PO 3: Social competence

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2. Identify, describe and study in detail life cycle of Phanerogams.

CO4. Know different methods of conservation of Phanerogams.

PO 4: Research-related skills and Scientific temper

CO4. Know different methods of conservation of Phanerogams.

PO5: Trans-disciplinary Knowledge

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO5. Study the applications of Phanerogams.
CO6. Describe and identify the flowering plants.

PO6: Personal and Professional Competence

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO7. Understand the local flora with respect to Phanerogams.

PO 7: Effective Citizenship and Ethics

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO4. Know different methods of conservation of Phanerogams.

PO 8: Environment and Sustainability

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

PO 9: Self-directed and Life-long Learning

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO5. Study the applications of Phanerogams.
CO6. Describe and identify the flowering plants.

Class : M.Sc. II (Semester- III)

Paper Code : BOT5303

Paper : III **Title of Paper: Computational Botany**

Credits : 4 **No. of lectures: 60**

A) Learning Objectives:

1. To inculcate knowledge of use of computer for biological data analysis.

2. To give idea of importance of different software's used in bioinformatics.

B) Course Outcome:

CO1. Students will be expert in use of computer to solve biological problems.
CO2. Students can be master in solving biological problems with the help of statistics.
CO3. Students will apply their knowledge in various branches of biology.
CO4. Students' expertise in microscopic techniques.
CO5. Expertise in different centrifugation techniques.
CO6. Train to use different electrochemical techniques.
CO7. Students will apply their knowledge in various branches of biology.

TOPICS / CONTENTS:

Credit I- Basic Biostatistics **(15 L)**

1. Introduction to Statistics

Population, Sample, variable, Attributes-Concepts **9L**

Measures of central tendency – arithmetic mean, trimmed mean mode, mode of median

Measures of dispersion range– variation, combined S. D. quartile deviation BOX plot standard deviation, coefficient of variance

Skewness and kurtosis

2. Correlation and regression **6L**

Bivariate correlation, positive correlation, negative correlation

Measures of correlation – Scatter diagram, Karl-Pearson's coefficient of correlation, Spearman's Rank correlation coefficient,

Regression – Equations of regression lines. Regression coefficient

Credit II- Experimental Statistics (15 L)

1. Design of experiments and analysis of variance **8L**

Sampling and sampling distributions – concept of sample and population.

Principles of design – randomization, replication, local control.

Guidelines for designing the experiments, size of plot, number of replications

Completely randomized design (CDR), Randomized block design (RBD), Latin Square Design (LSD)

Analysis of variance table (ANOVA), One way and Two way ANOVA

Tukey's test for pairwise comparison of treatments

Dunnet's test for comparison of treatment means with control

Duncan's multiple range test

Mann–Whitney U test

2. Testing of hypothesis **7L**

Hypothesis, statistical hypothesis, critical region, level of significance, p-value

T-test: t-test for mean, chi-square test: chi-square test for goodness of fit, F- test

NOTE – Emphasis be given on methodology and numerical problem solving rather than derivations and proofs.

Credit III - Bioinformatics **(15 L)**

Bioinformatics concept, Information resources NCBI (Functions), MGD **1L**

Types of databases (Primary, secondary, composite. flat file relational, hierarchial)**2L**

Sequences used in bioinformatics (genomic DNA, cDNA, organellar DNA, expressed sequence tags (EST). Gene Sequence Tags (GST) **3L**

Statistical analysis and evaluation of BLAST results. **3L**

b. Multiple sequence alignments (Dynamic programming, progressive methods, iterative methods) **3L**

c. Use of Bioinformatics tools in analysis **2L**

d. Protein structure prediction, motifs and domains, designing of primers. **1L**

Credit IV-Biomathematics (15L)

1. Types of measurement and their units **1L**
2. Making solutions – moles and molarity, stock solutions and dilutions **4L**
3. Ions and electrical potentials – Nerst and Goldman equations **1L**
4. Osmolarity and osmotic pressure measurements **1L**
5. Quantification of chemical reactions – equilibrium constant, reaction rates **1L**
6. pH measurements and preparation of buffers **2L**
7. Measuring concentrations using spectrophotometry **1L**
8. Measurement of enzyme activity **2L**

9. Specific activity of radioisotopes, making radioisotope solutions **1L**

10. Cell counting using serial dilutions, haemocytometry **1L**

References :

1. Lab Math – Adams, D.S. I.K. Internations Pvt Ltd. New Delhi, 2004

2. Statistical Methods – Snedecor G.W. and Cochran W.G. Affiliated East-West Press Pvt. Ltd.1989

3. Statistical methods in Agriculture and Experimental Biology – Mead, R. and Curnow, R.N. Chapman and Hall, 1983

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6. Bioinformatics – Sequence and genome analysis. D.W. Mount, CBS Publishers, New Delhi,2003

7. Bioinformatics and Molecular Evolution – Higgs PG and Attwood, TK

8. Fundamentals of Biostatistics By Irfan Ali Khan & Atiya Khanum, Ukaaz Publication, Hyderabad ISBN : 81-900441-0-9 : 2009.

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10. Advanced biotechnology, Dr. R. C. Dubey, S. Chand and Company Pvt. Ltd.New Delhi.

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Computational Botany **Course Code**: BOT 5303

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		3		3					
CO 2		3							
CO 3	3								
CO 4						3			
CO 5									3

CO 6	3								
CO 7					2				

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Students will apply their knowledge in various branches of biology.
CO6. Students will apply their knowledge in various branches of biology.

PO2: Critical Thinking and Problem Solving

CO1. Students will be expert in use of computer to solve biological problems.
CO2. Students can be master in solving biological problems with the help of statistics.

PO 4: Research-related skills and Scientific temper

CO1. Students will be expert in use of computer to solve biological problems.

PO5: Trans-disciplinary Knowledge

CO7. Students' expertise in microscopic techniques.

PO6: Personal and Professional Competence

CO4. Students will be expert in use of computer to solve biological problems.

PO 9: Self-directed and Life-long Learning

CO5. Students can be master in solving biological problems with the help of statistics.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5304 (A)

Paper : III **Title of Paper: Advances in Plant Physiology**

Credits : 4 **No. of lectures: 60**

A) Learning Objectives:

1. To train the students in instrumentation useful in physiological techniques.
2. To make technosavy students.

B) Course Outcome:

By the end of course students will be able to

CO1. Use knowledge for improvement of agricultural yield.
CO2. Students aware about the plant to response environmental conditions.
CO3. Students get knowledge of internal activities in plant.
CO4. Student will understand the basic properties of plant cell
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

TOPICS/CONTENTS:

Credit- I Germination (15L)

Concept, seed viability and dormancy, methods of breaking seed dormancy, factors affecting on seed germination **7L**

Physiological changes takes place during seed germination, methods of application of fertilizers before seed sowing. **8L**

Credit- II : Plant Growth and Development (15L)

- **Growth**, phases, measurement of growth, nature of growth curve and formulae for growth curve, Metabolism and allocation of resource during vegetative and reproductive growth, RGR and NAR. Factors affecting growth. Shoot Root ratio, C/ N ratio. **4L**
- **Plant hormones** – Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

(Auxins, GA, Cytokinins, ABA, Ethylene, Jasmonic acid, Brassinosteroides) **5L**

- Application of plant growth regulators in Agriculture. **1L**
- Physiology of flowering, circadian Rhythms, photoperiodism, vernalisation, **2L**
- Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. **3L**

Credit- III Senescence and Ageing (15L)

- **Senescence**: Concept, definition, patterns of cellular senescence –cell, tissue, organ, whole plant **7L**
- Physiological and chemical changes takes place during senescence (pigment, protein, photosynthesis, oxidative, nucleic acid), Effect of growth regulators on senescence. Control of plant senescence, PCD (Programmed Cell Death) in life cycle of plants. **8L**

Credit- IV: Biomolecules and Secondary metabolites (15L)

- Composition, structure and function of bimolecular (carbohydrates, lipids, proteins, nucleic acids and vitamins). **7L**
- Secondary metabolites - Biosynthesis of terpenes (IPP), Alkaloid (barberine) and Phenolics (Phenylpropanoid), flavonoides, Lignin. **8L**

References

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Advanced Physiology - I **Course Code**: BOT 5304 (A)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3	3							
CO 3				3					
CO 4									
CO 5	2			2					
CO 6	3			3					
CO 7	3			3					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Use knowledge for improvement of agricultural yield.
CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

PO2: Critical Thinking and Problem Solving

CO2. Students aware about the plant to response environmental conditions.

PO 3: Social competence

CO1. Use knowledge for improvement of agricultural yield.

PO 4: Research-related skills and Scientific temper

CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5304 (B)

Paper : III **Title of Paper: Advances in Mycology and Plant Pathology**

Credits : 4 **No. of lectures: 60**

A) Learning Objectives:

1. To study fungal habit and habitat diversity.
2. To pertain classification and taxonomy of fungi

B) Course Outcome:

CO1. Use knowledge for improvement of agricultural yield
CO2. Students aware about the plant to response environmental conditions.
CO3. Students get knowledge of internal activities in plant.
CO4. Development of expertise in plant physiology.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Credit - I : Fungi as Organism (15L)

1. Fungi and their significance (1L)
2. Relationship of fungi with plants and animals (1L)
3. Milestones in mycological and pathological studies (2L)
4. Fungal cell- structure and composition (1L)
5. Physiology of fungal growth (2L)
6. Fungal ecology (1L)
7. Palaeomycology and Ethnomycology (2L)
8. Outline classification of fungi - (2L)
   E. A. Bessey System (1950)
   Alexopoulos System (1962),
   L. E. Hawkers System (1966),
   Alexopoulos and Mims System (1979),
   Webster and Weber System (2007)
9. Molecular method of fungal taxonomy (1L)
10. Fungi as model organism for genetical studies (2L)

Credit - II : Allied Fungi (15L)

(With respect to general characters, classification, structure, variation and importance)

1. **Myxomycota** - Acrasiomycetes, Protosteliomycetes, Dictyosteliomycetes, Myxomycetes. (6L)
2. **Plasmodiophoromycota** (2L)
3. **Straminipila** - Hyphochytridiomycota, Labyrinthulomycota and Oomycota (7L)

Credit - III : True Fungi **(15L)**

(With respect to general characters, classification, structural variation and pathological importance, if any)

1. **Chytridiomycota -** Chytridiomycetes (1L)
2. **Zygomycota -** Zygomycetes and Trichomycetes (2L)
3. **Ascomycota -** Archiascomycetes, Hemiascomycetes, Plectomycetes, Pyrenomycetes, Loculoascomycetes (6L)
4. **Basidiomycota** – Hymenomycetes - Agarics and Polypores, Homobasidiomycetes – Gasteromycetes, Heterobasidiomycetes – Auriculariales, Dacrymycetales, Tremellales
5. **Teliomycetes** – Rust and Smut fungi (6L)

Credit - IV : Anamorphic Fungi and Allied Aspects **(15L)**

1. **Deuteromycota**- Classification, structural variations and importance (4L)
2. **Fungal Association**- Lichens,mycorrhizae (3L)
3. **Fungal ecology**- Colonization strategies among fungi (2L)
4. **Ecological services of fungi**- bioremediation, biohydrometallurgy, microbiological sensors (2L)
5. **Fungi as Human pathogens**- Dermatomycosis (Tinea), intermediate and systemic mycosis, its symptoms, clinical aspects and control measures (4L)

References:

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Advanced Mycology - I **Course Code**: BOT 5304 (B)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2		3							
CO 3			3						
CO 4	2								
CO 5			2						
CO 6								3	
CO 7									3

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.

CO4. Get knowledge about life history of algae, fungi bryophytes.

PO2: Critical Thinking and Problem Solving

CO2. Classify the cryptogams up to species level.

PO 3: Social competence

CO3. Get aware about the importance of Cryptogams.

CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.

PO 8: Environment and Sustainability

CO6. Aware about plant conservation in society.

PO 9: Self-directed and Life-long Learning

CO7. Analyze industrial applications of algae.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5304 (C)

Paper : IV Title of Paper: Bryology

Credits : 4 No. of Lectures: 60

A) Learning Objectives:

1. To understand deep knowledge of season, collection, identification and life-cycle.
2. To study reproductive structures and develop In-situ
3. To develop innovative Ex-situ conservation techniques.

B) Course Outcome:

By the end of course students will be able to

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Classify the cryptogams up to species level.
CO3. Get aware about the importance of Cryptogams.
CO4. Get knowledge about life history of algae, fungi bryophytes.
CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.
CO6. Aware about plant conservation in society.
CO7. Analyze industrial applications of algae.

Credit –I :

1. History, Classification, distribution, habitat, morphology, Taxonomy, anatomy, phylogeny, inter-relationship, origin and evolution and comparative discussions of Gametophytes and sporophytes in living members of Hepaticopsida (15 L)

Credit –II :

2. History, Classification, distribution, habitat, morphology, taxonomy, anatomy, phylogeny, inter-relationship, origin and evolution and comparative discussions of gametophytes and sporophytes in living members of Anthoceropsida. (15 L)

Credit –III :

History, Classification, distribution, habitat, morphology, Taxonomy, anatomy, phylogeny, inter-relationship, origin and evolution and comparative discussions of Gametophytes and sporophytes in living members of Bryopsida. (15 L)

Credit –IV :

3. Modern taxonomy of bryophytes with reference to epidermal tissue system, palynology and cytology w.r.t. Hepaticopsida, Anthoceropsida and Bryopsida. Innovative strategies for *In-situ* conservation. (15 L)

Recommended References :

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Websites :

Hattori Botanical Laboratory

https://www.google.com/search?q=Hattori+Boanical&rlz=1C1CHWL_enIN909IN909&oq=Hattori+Boanical&aqs=chrome..69i57.13143j0j8&sourceid=chrome&ie=UTF-8

Australian Bryological Research Journal.

https://www.researchgate.net/publication/317644372_AUSTRALASIAN_BRYOLOGICAL_NEWSLETTER_Participants_at_the_Xth_Australasian_Bryophyte

Bulletin of Bryology

https://www.jstor.org/stable/1221137?seq=1

Indian Bryological Society

https://www.google.com/search?q=Indian+Bryological+Society&rlz=1C1CHWL_enIN909IN909&sxsrf=ALeKk023HYYE2mATYEdgv6xi8Yfevl1t-Q:1594468636630&ei=HKkJX7D_Jcvez7sPwOmYqAU&start=10&sa=N&ved=2ahUKEwiw_cPFksXqAhVL73MBHcA0BlUQ8tMDegQICxAt&biw=1366&bih=657

World Bryological Society

https://www.google.com/search?q=Indian+Bryological+Society&rlz=1C1CHWL_enIN909IN909&sxsrf=ALeKk023HYYE2mATYEdgv6xi8Yfevl1t-Q:1594468636630&ei=HKkJX7D_Jcvez7sPwOmYqAU&start=10&sa=N&ved=2ahUKEwiw_cPFksXqAhVL73MBHcA0BlUQ8tMDegQICxAt&biw=1366&bih=657

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Bryology - I **Course Code**: BOT 5304 (C)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3								2	
CO 4	3			3					
CO 5	3								
CO 6						3			
CO 7	2								

Justification for the mapping

PO1: Disciplinary Knowledge

.CO1. Knowledge of bryophytes at different localities.
CO2. Understanding of practical applications of bryophytes.
CO4. Protocols for In-vitro general techniques of tissue culture in bryophytes.
CO5. Students are able to develop Ex-Situ conservation techniques of bryophytes.
CO7. Understanding the alternation of generations and evolution of bryophytes.

PO 4: Research-related skills and Scientific temper

CO4. Protocols for In-vitro general techniques of tissue culture in bryophytes.

PO6: Personal and Professional Competence

CO6. Understanding of economic importance of bryophytes.

PO 8: Environment and Sustainability

CO3. Development of Ex-situ conservation techniques.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5304 (D)

Paper : IV Title of Paper: Angiosperm Taxonomy

Credits : 4 No. of lectures: 60

A) Learning Objectives:

1. To pertain classification and taxonomy of Angiosperms.
2. To know the rules to name a new plant species.
3. To know the brief account of different systems of classification.

B) Course Outcome:

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2.Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

Credit I (15 lectures)

Plant taxonomy: Importance of Angiosperm taxonomy and need for classification, definitions and concepts, hierarchical classification, general and special purpose classifications. Principles of taxonomy.

Botanical Nomenclature: history, scientific names, International Code of Nomenclature for Algae, Bryophytes, Angiosperms (ICBN): Salient features-Principles, Important Rules and Recommendations, Provisions for the governance of the Code, Appendices.

Taxonomy tools: Floras, monographs, revisions, Journals, Herbarium and botanical gardens, their role in teaching, research and conservation, important herbaria and botanical gardens. (Ex. Kew Botanical garden, AJCB Indian Botanic Garden, Kolkata and LBG, Shivaji University Kolhapur)

Credit II: (15 lectures)

Systems of classification: Phenetic and Phylognetic systems. Critical account of the systems of classifications of a) Bentham and Hooker b) Takhtajan c) Engler and Prantl d) Cladestics in taxonomy, General account of Angiosperm phylogeny group (APG)

Taxonomic evidence and techniques used there in a) Morphology b) Cytology c) Biochemistry d) Palynology e) Anatomy f) Embryology g) DNA sequence

Modern trends of taxonomy: Cytotaxonomy, Chemotaxonomy, numerical taxonomy and molecular systematics.

Species concept: Concept of taxa, concept of species- Biological and alternative species concepts; concept of genus and family. Plant Speciation: Allopatric, Peripatric, Sympatric, Parapatric, Apomictic speciation, Isolating mechanisms.

Credit III: (15 lectures)

Conservation biology: Biodiversity, its importance, assessment, Centers of diversity, loss and conservation, ethical principles of conservation biology, World organization for conservation of biodiversity, Ecological differentiation.

Species diversity: Species Richness, Species abundance. Red List categories of IUCN, means and ways for conservation. In situ and ex situ conservation strategies.

Endemism: Concept of endemism, categories, biodiversity of India, mega-centers of endemism in India; Keystone and flagship species, endemic plants of India with special reference to Western Ghats and Maharashtra, sacred grooves and their importance.

Credit IV: (15 lectures)

Distinguishing features of the following families:

a) **Dicotyledons:** Ranunculaceae, Polygalaceae, Rutaceae, Asclepidaceae, Meliaceae, Rosaceae, Moraceae, Passifloraceae, Plumbaginaceae, Sapotaceae, Boraginaceae.

b) **Monocotyledons:** Orchidaceae, Commelinaceae, Araceae, Arecaceae, Cyperaceae.

References:

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Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Angiosperm Taxonomy - I **Course Code**: BOT 5304 (D)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3	3								
CO 4	3								
CO 5	3								
CO 6	3								
CO 7				2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Origin of Angiosperms.
CO2. Importance and need for classification, hierarchical classification.
CO3. Pre- and post- Darwinian systems of classification.
CO4. Fossil angiosperms of India.
CO5. Floral Biology.
CO6. Phytogeography.

PO 4: Research-related skills and Scientific temper

CO7. Dicotyledons and Monocotyledons families.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5305

Paper : III **Title of Paper: Practical's Based on BOT 5301, 5302 and 5303**

Credits : 4 **No. of lectures: 60**

A) Learning Objectives:

1. To pertain taxonomical, embryological, computational techniques.
2. To provide the knowledge of different local families

B) Course Outcome:

By the end of course students will be able to

CO1. Develop identification skill in cryptogams.
CO2. Train in cell biology techniques.
CO3. Understand basic knowledge about life cycle of cryptogams.
CO4. Internal and external structure of cryptogams.
CO5. Explain basic knowledge about evolution of lower cryptogams.
CO6. Discuss spore dispersal mechanism.
CO7. Understand variations in cryptogamic diversity.

TOPICS/CONTENTS:

Practical's based on BOT 5301 Angiosperm taxonomy (Any four)

1. Study of plant families (at least 5 locally available families- 3 of Dicotyledons and two of Monocotyledons. **4P**
2. Identification of genus and species of locally available wild plants (any four) **1P**
3. Preparation of vegetative and reproductive botanical keys of any six plants from different Families **1P**
4.Pollen preparations by Acetolysis method (Semi-permanent) and study of different pollen morphotypes. **1P**

Note:

1. Field trips of at least two days for collection and preparation of field notes and its submission.

Practicals based on BOT 5302 Developmental Botany (Any four)

1. Isolation of shoot apical meristems from seedling, young and mature vegetative plant and tracing the course of stomatal development and observations on stomatal types. **1P**
2. Histochemical analysis of secondary growth (primary to secondary axis) and comparison between vegetative SA and reproductively induced SA **1P**
3. Observations on **1P**

a. Microsporogenesis and development of male gametophyte (pollen)
b. Megasporogenesis and development of female gametophyte
c. Types of endosperm, dissection and isolation of endosperm **2P**

4. Observations on stages of embryo development, dissection and isolation of developing embryo (3 stages) and *in vitro* germination of spore/pollen **1P**

Practicals based on BOT 5303 Computational Botany (Any four)

1	t – test and F -test	**1P**
2	Correlation and Regression	**1P**
3	Chi-square test for goodness of fit and independent attributes.	**1P**
4	Analysis of variance on the given data (ANOVA)	**1P**
5	Tukey's test for pairwise comparison of treatments	**1P**
6	Databases and database searching and DNA and protein sequence comparisons	**1P**
7	Multiple sequence alignments, progressive methods, CLUSTAL	**1P**
8	Determining phylogenetic relationships using DNA and protein sequences	**1P**

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Practical based on BOT 5301, BOT 5302 and BOT 5303
Course Code: BOT 5305

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1				3					
CO 2						3			
CO 3	3								
CO 4	3								
CO 5	2								
CO 6								2	
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO3. Understand basic knowledge about life cycle of cryptogams.
CO4. Internal and external structure of cryptogams.
CO5. Explain basic knowledge about evolution of lower cryptogams.
CO7. Understand variations in cryptogamic diversity.

PO 4: Research-related skills and Scientific temper

CO1. Develop identification skill in cryptogams.

O6: Personal and Professional Competence

CO2. Train in cell biology techniques.

PO 8: Environment and Sustainability

CO6. Discuss spore dispersal mechanism.

Class : M.Sc. (Semester- III)

Paper Code : BOT 5306 (A)

Paper : III Title of Paper: Practical's based on BOT 5304 (A) Advanced Plant Physiology

Credits : 4 No. of lectures: 60

A) Learning Objectives:

1. Create hands on training on physiological techniques
2. To give idea of experimental methodologies for crop physiology

B) Course Outcome:

CO1. Use knowledge for improvement of agricultural yield
CO2. Students aware about the plant to response environmental conditions.
CO3. Students get knowledge of internal activities in plant.
CO4. Development of expertise in plant physiology.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Practical's based on BOT 5304 (A) Advanced Plant Physiology

1. Testing of seed viability by TTC. **1P**
2. Estimation of total alkaloids **1P**
3. Effect of various PGRs on seed germination. **2P**
4. Effect of various PGRs on seedling growth / enzymes. **2P**
5. Isolation of starch. **1P**
6. Extraction and isolation of caffeine from tea powder **1P**
7. Comparative studies of accumulation of superoxide dismutase in normal and salt Stressed plants. **2P**
8. Effect of weed extracts on seed germination **2P**
9. Studies on changes in acidity and TSS during grape/ guava ripening **1P**
10. Studies on changes in NR activity during leaf senescence **1P**
11. Estimation of Total flavonoids. **1P**

Note: Visit to advanced plant physiology laboratory and submission of report

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Practical – Advanced Physiology - I **Course Code**: BOT 5306 (B)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3	3							
CO 3				3					
CO 4									
CO 5	2			2					
CO 6	3			3					
CO 7	3			3					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Use knowledge for improvement of agricultural yield.
CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

PO2: Critical Thinking and Problem Solving

CO2. Students aware about the plant to response environmental conditions.

PO 3: Social competence

CO1. Use knowledge for improvement of agricultural yield.

PO 4: Research-related skills and Scientific temper

CO3. Students get knowledge of internal activities in plant.
CO5. Get knowledge of plant metabolism.
CO6. Students get knowledge of plant cycle.
CO7. Students get knowledge of biomolecules.

Class : M.Sc. (Semester- III)

Paper Code : BOT 5306 (B)

Paper : III Title of Paper: Practical's based on BOT 5304 (B)Advanced Mycology and Plant Pathology

Credits : 4 No. of lectures: 60

A) Learning Objectives:

1. To study the identification of fungi and preparation of their pure culture.
2. To identify soil, air and water borne fungal pathogens.

B) Learning Outcome:

By the end of course students will be able to

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Classify the cryptogams up to species level.
CO3. Get aware about the importance of Cryptogams.
CO4. Get knowledge about lifehistory of algae, fungi bryophytes.
CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.
CO6. Aware about plant conservation in society.
CO7. Analyze industrial applications of algae.

Practicals based on BOT 5304 (B) Advanced Mycology

1. Preparation of culture medium for fungi-PDA medium, CDA medium, Sabourard's medium (2P)
2. Isolation of aquatic and soil fungi by baiting method (2P)
3. Isolation of fungi from rhizosphere and non-rhizosphere soil (2P)
4. Isolation of plant pathogenic fungi from root, stem and fruits (2P)
5. Study of seed borne fungi of any six crops (2P)
6. Study of fungal disease- (any one from each) rots, Downy mildew, wart, ergot, white rust, Anthracnose, rust, smut, leaf spot w.r.t. symptoms, causal organism and control measures (3P)
7. Study of fungi from the following groups – (10P)
   - Myxomycetes- any four
   - Chytridiomycetes- any two
   - Oomycetes- any four
   - Pyrenomycetes- any four
   - Loculoascomycetes- any two
   - Discomycetes- any four
   - Teliomycetes – any eight
   - Gasteromycetes- any four
   - Hymenomycetes- any six
   - Deuteromycetes- any six
8. Preparation of stains and mounting media for study of fungi (1P)

Note: 1. Compulsory visit to Western Ghats for collection and observation of fungi (at least for three days).
2. Visit to any one Mycology Institute / Laboratory.

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Practical – Advanced Mycology - I **Course Code**: BOT 5306 (B)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2		3							
CO 3			3						
CO 4	2								
CO 5			2						
CO 6								3	
CO 7									3

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.
CO4. Get knowledge about life history of algae, fungi bryophytes.

PO2: Critical Thinking and Problem Solving

CO2. Classify the cryptogams up to species level.

PO 3: Social competence

CO3. Get aware about the importance of Cryptogams.
CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.

PO 8: Environment and Sustainability

CO6. Aware about plant conservation in society.

PO 9: Self-directed and Life-long Learning

CO7. Analyze industrial applications of algae.

Class : M.Sc. (Semester- III)

Paper Code : BOT 5306 (C)

Paper : III **Title of Paper: Practical's based on BOT 5304 (C) Bryology**

Credits : 4 **No. of lectures: 60 (11 Practical's)**

A) Learning Objectives:

1. To understand season, collection, identification, morphology, anatomy.
2. To study reproductive structures.
3. To develop innovative techniques for In-situ conservation.

B) Course Outcome:

By the end of course students will be able to

CO1. Get knowledge about cryptogams to conserve Cryptogamic diversity.
CO2. Classify the cryptogams up to species level.
CO3. Get aware about the importance of Cryptogams.
CO4. Get knowledge about life history of algae, fungi bryophytes.
CO5. Explain the role of Algae, Fungi and Bryophytes in human welfare.
CO6. Aware about plant conservation in society.
CO7. Analyze industrial applications of algae.

Practical's based on BOT 5304 (C) Bryology

1. Study of any **six** living genera of Hepaticae (thalloid) w.r.t. morphology, anatomy of gametophytes and sporophytes. (03)
2. Study of any **four** living genera of leafy Jungermanniales (Hepaticae) w.r.t. morphology, anatomy of gametophytes and sporophytes. (02)
3. Study of any **four** living genera of Anthocerotales w.r.t. morphology, anatomy of gametophytes and sporophytes. (02)
4. Study of any **Six** living genera of Bryopsida w.r.t. morphology, anatomy of gametophytes and sporophytes. (03)
5. *In-situ* conservation techniques of bryophytes. (any two) (01)

Choice Based Credit System Syllabus (2019 Pattern)

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Bryology - I **Course Code**: BOT 5306 (C)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3								2	
CO 4	3			3					
CO 5	3								
CO 6						3			
CO 7	2								

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Knowledge of bryophytes at different localities.
CO2. Uderstanding of practical applications of bryophytes.
CO4. Protocols for In-vitro general techniques of tissue culture in bryophytes.
CO5. Students are able to develop Ex-Situ conservation techniques of bryophytes.
CO7. Understanding the alternation of generations and evolution of bryophytes.

PO 4: Research-related skills and Scientific temper

CO4. Protocols for In-vitro general techniques of tissue culture in bryophytes.

PO6: Personal and Professional Competence

CO6. Understanding of economic importance of bryophytes.

PO 8: Environment and Sustainability

CO3. Development of Ex-situ conservation techniques.

Class : M.Sc. II (Semester- III)

Paper Code : BOT 5306 (D)

Paper : III Title of Paper: Practical's based on BOT 5304 (D) Angiosperm Taxonomy

Credits : 4 No. of Lectures: 60 (15 Practical's)

A) Learning Objectives:

1. To pertain classification and taxonomy of Angiosperms.
2. To know the rules to name a new plant species.
3. To know the brief account of different systems of classification.

B) Learning Outcome:

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2. Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

CO5. Study the applications of cryptogams.

CO6. Describe and identify flowering plants.

CO7. Understand the local flora with respect to Phanerogams.

Practical's based on BOT 5304 (D) Angiosperm Taxonomy

1. Study of at least 15 locally available families of flowering plants (8P)
2. Identification of genus and species of locally available wild plants (2P)
3. Preparation of botanical keys by using Flora's (1P)
4. Knowledge of at least 20 plant species from each of the following categories: A) Medicinal Plants. B) Exotic weeds C) Endemic plants. (2P)
5. Field tours within and around Campus, compilation of field notes and preparation of herbarium by using photographs of such plants. (2P)

Note: Botanical excursion of about one week duration to any botanically rich location preferable outside the State.

Mapping of Program Outcomes with Course Outcomes

Class: M. Sc. II (Sem. III) **Subject**: Botany

Course: Elective Papers – Angiosperm Taxonomy - I **Course Code**: BOT 5306 (D)

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3								
CO 3	3								
CO 4	3								
CO 5	3								
CO 6	3								
CO 7				2					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Origin of Angiosperms.
CO2. Importance and need for classification, hierarchical classification.
CO3. Pre- and post- Darwinian systems of classification.
CO4. Fossil angiosperms of India.
CO5. Floral Biology.
CO6. Phytogeography.

PO 4: Research-related skills and Scientific temper

CO7. Dicotyledons and Monocotyledons families.