



(Bachelor of Sciences) (BOTANY)  
(B.Sc.) (Botany) Semester III

Course Code	<b>US03CBOT51 (T)</b>	Title of the Course	<b>PHYCOLOGY, MYCOLOGY AND PHYTOPATHOLOGY</b>
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. To make acquainted with the basic characteristic features of lower group of plants such as Algae and Fungi with suitable examples of each sub categories.</li><li>2. To give exposure for applied role and importance of such lower groups of plants.</li><li>3. To make aware for various plant pathological features of our important agricultural crops.</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Phycology: General characteristics</b> of Cyanophyta, Xanthophyta, Chlorophyta, Charophyta, Phaeophyta and Rhodophyta. <b>Type study:</b> <i>Nostoc, Vaucheria, Chlamydomonas, Chara, Ectocarpus</i> and <i>Polysiphonia</i> . (Classification (as per G. M. Smith), Occurrence, Morphology, thallus organization, Cell structure, Reproduction and life-cycle). Significant contributions of renowned Phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). <b>Role of algae</b> in the environment, agriculture, biotechnology and industry.	25%
2.	<b>Introduction to true fungi</b> General characteristics; Affinities with plants and animals; <b>Mycology: General Characteristic</b> features of Chytridiomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota. <b>Type study:</b> <i>Synchytrium, Phytophthora, Albugo, Aspergillus, Neurospora, Agaricus, Alternaria</i> . (Classification (as per G. C. Ainsworth, 1973), Occurrence, Morphology, thallus organization, Cell structure, Reproduction and life-cycle).	25%
3.	<b>Symbiotic association and Applied mycology:</b> Symbiotic associations: Lichen - Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction. Symbiotic associations: Mycorrhiza - Ectomycorrhiza, Endomycorrhiza and their significance. <b>Applied Mycology:</b> Role of fungi in biotechnology; Application of	25%





	fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes); Secondary metabolites	
4.	<p><b>Phytopathology:</b>  <b>Major Plant Diseases:</b> Differentiation between bacterial, viral and fungal diseases using morphological symptoms.            Study of the following diseases (symptoms, causal organism, disease cycle and disease control).  <b>Bacterial diseases</b> – Citrus Canker, Angular leaf spot of cotton.  <b>Viral diseases</b> -Leaf curl of papaya, Yellow vein mosaic in bhindi.  <b>Fungal diseases</b>- White rust of crucifers, Red rot of sugarcane, Tikka disease of groundnut, and Stripe rust of wheat.  <b>Phytoplasma diseases:</b> Little leaf of brinjal.            Significant contributions of Prof.Karam Chand Mehta.</p>	25%

Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Student's assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
2.	Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology





3.	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies
4.	Identify the common plant diseases according to geographical locations and device control measures

Suggested References:

Sr. No.	References
1.	A TEXT BOOK OF BOTANY, SINGH, PANDE AND JAIN
2.	Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
3.	Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996).
4.	R.S. Mehrotra, Plant Pathology
5.	B. R. Vashistha, Fungi
6.	Gangulee and Kar, College Botany Vol 2
7.	John Wiley & Sons, Introductory Mycology, (Asia) Singapore. 4th edition.
8.	Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
9.	Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India. Kumar, H.D. (1999).
10.	Singh R. S. Plant Pathology
11.	Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

On-line resources to be used if available as reference material

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(Bachelor of Sciences) (Botany)  
(B.Sc.) (Botany) Semester (III)

Course Code	US03CBOT52(T)	Title of the Course	GENETICS AND BIOINFORMATICS
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. To learn life cycles of genetically important organisms</li><li>2. To know about mendelism and its extension</li><li>3. To have an idea about linkage, crossing over and Cytoplasmic inheritance</li><li>4. A student completing shall be able to apply: knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics. existing software effectively to extract information from large databases and to use this information in computer modelling</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Genetics:</b> Introduction: Definition, scope, branches and application of genetics, selection of genetic material, Profiles of some geneticists and molecular biologists, Life cycle of some genetically important organisms like Bacteriophage, E. Coli, Yeast, Neurospora, Chlamydomonas, Maize and Arabidopsis.	25%
2.	<b>Mendelian genetics and its extension</b> Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Polygenic inheritance.	25%
3.	Genetics: Linkage-Definition, History, Kinds, Linkage groups and significance. Crossing Over-Definition, Types, Mechanism, Kinds and significance. Maternal effects and cytoplasmic inheritance: Maternal effects in snails, Streptomycin resistance in Chlamydomonas, mitochondrial mutations in yeast, Kappa particles in <i>Paramecium</i> , plastid inheritance in <i>Mirabilis jalapa</i> , male sterility in plants.	25%
4.	<b>Introduction to Bioinformatics:</b> <b>Introduction:</b> What is bioinformatics? Definition, A multidisciplinary approach, Branches of Bioinformatics, History, Aim, Scope and Research areas	25%





	of Bioinformatics, applications of bioinformatics. Bioinformatics in India-the flourishing approach. <b>Databases in Bioinformatics:</b> Introduction, Biological Databases, Classification, format of Biological Databases, Biological Database Retrieval System.	
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Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students' assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Have conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
2.	Develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.
3.	Basic concept and life cycle of genetically important organisms.
4.	Learn about Introductory Bioinformatics and its databases.





Suggested References:

Sr. No.	References
1.	Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
2.	Verma and Agarwal, 9th edition GENETICS
3.	Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition
4.	Watson J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
5.	Sharma, Munjal and Shankar, A Text book of Bioinformatics (Rastogi publication)

On-line resources to be used if available as reference material

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**(Bachelor of Sciences) (Botany)**  
**(B.Sc.) (Botany) Semester (III)**

Course Code	<b>US03CBOT53 (P)</b>	Title of the Course	<b>BOTANY PRACTICAL</b>
Total Credits of the Course	<b>04</b>	Hours per Week	<b>08</b>

Course Objectives:	<ol style="list-style-type: none"> <li>1. To get hands on training to use various botany laboratory equipment.</li> <li>2. To do experiment as per the given syllabus through fresh/preserved specimen/slides/models/charts etc</li> </ol>
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<b>Course content [equal Weightage (%) for each practical]</b>	
No.	AIM
1.	Meiosis through temporary squash preparation/permanent slides/photographs.
2.	Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
3.	Study of <i>Nostoc</i> and <i>Vaucheria</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
4.	Study of <i>Chlamydomonas</i> and <i>Chara</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
5.	Study of <i>Ectocarpus</i> and <i>Polysiphonia</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
6.	Study of <i>Synchytrium</i> , <i>Aspergillus</i> and <i>Neurospora</i> , <i>Alternaria</i> . Classification, Thallus morphology, and reproduction (through mounting/permanent slides/charts/photographs).
7.	Study of types of Lichens. (through specimen/ charts/slides)
8.	Study of white rust of crucifers (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
9.	Study of early blight of potato (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
10.	Study of late blight of potato (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs)
11.	Study of Rust of wheat (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
12.	Study of Tikka disease of ground nut (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
13.	Preparation of potato dextrose culture medium and slants and To enumerate the steps involved for Culturing of fungi.
14.	To study life cycle of genetically important organisms as per syllabus
15.	Nucleic acid and protein databases.
16.	Sequence retrieval from databases.
17.	Sequence alignment.





18	Field visit.
19	Submission of disease specimens.
20	Field activity related to syllabus.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	University Examination	100%

Course Outcomes: Having completed this course, the learner in the laboratory course, will be able to	
1.	Gain hands-on experience of using various optical instruments and making temporary mountings.
2.	Identifying various pathogens for plant diseases.
3.	Study the characteristics of algae, fungi and lichens.
4.	Study the characteristics of some selected plant families and their economic role through specimens/charts/field specimens.
5.	Carried out field visits to explore ecological understanding and learn range of biodiversity.

Suggested References:	
Sr. No.	References
1.	Practical botany Vol 1 and 2 Ashok KumarBendre

On-line resources to be used if available as reference material
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(Bachelor of Science) (Botany)  
(B.Sc.) (Botany) Semester (IV)

Course Code	US04CBOT51(T)	Title of the Course	ETHNO,ECONOMIC AND NUTRACEUTICAL BOTANY
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. Students will be able to understand basic knowledge about cereals, legumes, spices, beverages, drugs, rubber, timber and fiber yielding plants and their economic importance.</li><li>2. Students will explore the knowledge of Nutraceutical botany and about functional foods.</li><li>3. Students will get basic knowledge of traditional ethnobotany.</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Ethnobotany:</b> Introduction, concept, scope and objectives; Medico-ethnobotanical sources in India; Significance of the following plants in ethnobotanical practices (along with their habitat and morphology) (a) <i>Azadiractha indica</i> (b) <i>Ocimum sanctum</i> (c) <i>Vitex negundo</i> (d) <i>Gloriosa superb</i> (e) <i>Tribulus terrestris</i> (f) <i>Pongamia pinnata</i> (g) <i>Cassia auriculata</i> (h) <i>Indigofera tinctoria</i> . Role of ethnobotany in modern medicine with special example- <i>Rauvolfia serpentina</i> , <i>Trichopus zeylanicus</i> , <i>Artemisia</i> , <i>Withania</i> .	25%
2.	<b>Economic Botany:</b> <b>Major crops:</b> Introduction with their distribution, botanical name, family, parts used and economic importance of followings: <b>Cereals:</b> Wheat and Rice. <b>Legumes:</b> Chick pea, Pigeon pea and brief account of fodder legumes. <b>Source of sugars:</b> Sugarcane; <b>Source of starch:</b> Potato. <b>Spices:</b> Fennel, Saffron, Clove, and Black Pepper. <b>Beverages:</b> Tea, Coffee. <b>Sources of oils and fats:</b> Groundnut, Coconut, Linseed, Soybean, Mustard. <b>Natural Rubber:</b> <i>Hevea sp.</i> <b>Drug-yielding plants:</b> <i>Cinchona</i> , <i>Digitalis</i> , <i>Papaver</i> and <i>Cannabis</i> . <b>Timber plants:</b> <i>Teak</i> and <i>Pine</i> .	25%





	<p><b>Fibres:</b> Cotton, Coir and Jute.  <b>Essential oilyielding plants:</b> <i>Rosa, Vetiveria, Santalum</i> and <i>Eucalyptus</i>.</p>	
3.	<p><b>Introduction and scope to Nutraceutical botany:</b>          Properties, structure and functions of various Nutraceuticals:          Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin Ornithine, alpha ketoglutarate.          Use of grape products, flaxseed oil as Nutraceuticals.</p>	25%
4.	<p><b>Functional Foods:</b>          Sources and role of Isoprenoids, Isoflavones, Flavonoids, Carotenoids, Tocotrienols, Polyunsaturated fatty acids, Sphingolipids, Lecithin, Choline, Terpenoids.          Vegetables, Cereals, milk and dairy products as Functional foods.          Health effects of common beans, <i>Capsicum annum</i>, mustards, Ginseng, garlic, grape, citrus fruits, fish oils, and sea foods.</p>	25%

Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students' assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%





Course Outcomes: Having completed this course, the learner will be able to

1.	Increase the awareness and appreciation of plants & plant products encountered in everyday life
2.	Get brief idea about traditional botany.
3.	Explore the economic importance of major crops.
4.	Aware about Brief idea on some Nutraceutical rich supplements, with applications of Nutraceutical in daily life.
5.	Appreciate the diversity of plants and the plant products in human use

Suggested References:

Sr. No.	References
1.	Robert E.C.Wildman, Handbook of Nutraceuticals and Functional foods
2.	Yashwant Pathak, Handbook of Nutraceuticals Volume I: Ingredients, Formulations, and Applications; CRC Press, 2009
3.	Kokate, Purohit and Gokhle, Pharmacognosy
4.	S. L. Kochhar Economic botany in the tropics
5.	S. K. Jain, Ethnobotany and Research on Medicinal Plants in India
6.	S. K. Jain and V. Mudgal. Handbook of ethnobotany
7.	T. Pullaiah, K. V. Krishnamurthy, Bir Bahadur Ethnobotany of India, 5-Volume Set

On-line resources to be used if available as reference material

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**(Bachelor of Science) (Botany)**  
**(B.Sc.) (Botany) Semester (IV)**

Course Code	<b>US04CBOT52</b> (T)	Title of the Course	<b>PLANT MORPHOLOGY AND TAXONOMY</b>
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<p>1.To study morphology of angiosperm plants.</p> <p>2.To learn technical terms to describe morphological features.</p> <p>3.To learn how to describe an angiosperm plant in a technical language.</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	<p><b>Introduction to Plant Morphology:</b> Importance of plant morphology, Parts of an angiosperm plant.</p> <p><b>Morphology of Root:</b> Characteristics of roots,Types of root system, Regions of the root, Modifications of root.</p> <p><b>Morphology of Stem:</b> Characteristics of stem,Forms of stem, Bud and its modifications,Modifications of stem, Types of branching.</p> <p><b>Habit of the plant:</b> parasitic, myco-heterotrophic and epiphytic plants.</p>	25%
2.	<p><b>Morphology of Leaf:</b> Parts of a leaf, types of leaves, types of stipules and their modifications, leaf blade with ref. to apex, margin, and shape. Venation, Simple and compound leaves,Modifications of leaves, Phyllotaxy,Functions of leaves.</p> <p><b>The Inflorescence:</b> Definition, Classification of inflorescences,Racemose and its types, Cymose and its types and special types of inflorescence.</p>	25%
3.	<p><b>The Flower:</b> <b>Flower</b> as a modified shoot, structure of flower, types of flower, thalamus, bracts, Symmetry of the flower, <b>Calyx and corolla:</b>its modifications and forms. <b>Androecium:</b>Parts of stamen, cohesion of stamens, adhesion of stamens, length of stamens, <b>Gynoecium:</b> Parts of carpel, simple and compound gynoecium, cohesion of carpels, placentation and its types. <b>The Fruit:</b>Definition, Parts of fruit, Classification of fruits, Dispersal of seeds and fruits. <b>The Seed:</b>Definition, Parts of dicotyledonous and monocotyledonous seeds,Seed germination and its types.</p>	25%





4.	<p><b>Systematic Learning approach for Angiosperm:</b>            General characteristics and Life cycle of an angiosperm plant.            Outline Classification of Bentham and Hooker, merits and demerits of B &amp; H classification. Techniques for Herbarium preparation and Herbaria of the world and India.            How to describe an angiosperm plant? -General characters with the economic importance of the following families:  <b>Dicotyledonae:</b>  <u>Polypetalae:</u> Malvaceae, Meliaceae, Fabaceae, Cucurbitaceae  <u>Gamopetalae:</u> Rubiaceae, Solanaceae  <u>Monochlamydeae:</u> Euphorbiaceae  <b>Monocotyledonae:</b> Gramineae (Poaceae)</p>	25%
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Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students' assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand plant morphology
2.	Understand basics of floral morphology





3.	Understand how plant morphology relates to plant reproduction
4.	Understand significance of morphological modifications of plant parts
5.	Have foundation for a course on Plant Systematics

Suggested References:

Sr. No.	References
1.	Botany for Degree Students, A.C.Dutta, Oxford University Press
2.	Morphology and Economic Botany of Angiosperms, S SundararRajan, Anmol Publications Pvt Ltd
3.	Morphology of Vascular Plants, E.J.Eames, Standard University Press
4.	Taxonomy of Angiosperms, V. N. Naik, Tata Mc GrawHill Publishing Comp
5.	Taxonomy of Angiosperms, V. Singh and D. K. Jain, Rastogi Publications
6.	A Text Book of Botany- Angiosperms, B. P. Pandey, S. Chand and Comp. Ltd
7.	A Text Book of Practical Botany II, Ashok Bendreand Ashok Kumar, Rastogi Publication
8.	Taxonomy of Vascular Plants, GHM Lawrence, Scientific Publishers

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**(Bachelor of Science) (Botany)**  
**(B. Sc.) (Botany) Semester (IV)**

Course Code	<b>US04CBOT53</b>	Title of the Course	<b>Botany Practical</b>
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	1. To get hands on training to use various botany laboratory equipment. 2. To do experiment as per the given syllabus through fresh/preserved specimen/slides/models/charts etc
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<b>Course content (Equal Weightage % for all experiments)</b>	
No.	AIM
1	Study of root and its modifications.
2	Study of stem and its modifications.
3	Study of leaf and its modifications (stipules, venation, simple leaf and types of compound leaves, leaf shapes, leaf margins, leaf apices)
4	Study of Phyllotaxy (Distichous, tristichous, penta-stichous, opposite decussate, opposite superposed, whorled)
5	Study of Inflorescences (Racemose, cymose, special types)
6	Study of flowers (Bract and bracteoles, attachment of flower, presence of floral whorls, symmetry, presence of reproductive organs, number of floral parts, position of floral organs on thalamus, perianth, tepals, aestivation)
7	Study of Androecium, Gynoecium and placentation.
8	Study of fruits (simple, aggregate and composite)
9	Study of seed parts (dicot, monocot) and types of germination.
10	Study the Signs and symbols to construct floral formula and draw floral diagram.
	<b>Taxonomical study of plants belongs to following families</b>
11	Malvaceae
12	Meliaceae
13	Fabaceae - Papilionaceae, Caesalpinaceae (Leguminosae)
14	Cucurbitaceae
15	Rubiaceae
16	Solanaceae
17	Graminae (Poaceae)
18	Euphorbiaceae
19	To prepare checklist of plants of your own campus and submit.
20	<b>Botanical excursion</b> (Students are expected to visit nearby forest area or area of botanical interest for field experience. Prepare the excursion report and submit during examination)
21	Learn to prepare herbarium sheets and digital submission.





Teaching-Learning Methodology	Observation of specimen Handling of specimen Using student's microscope Using certain required chemical for test Dissection of specimen Preparing journal though drawing various figures with description Learn through charts/model Field visits for live experience. Preparing field visit note.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
3.	University Examination	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand morphology of all plant parts.
2.	Describe vegetative and floral characters of an angiosperm plants

Suggested References:	
Sr. No.	References
1.	Practical botany Vol 1 and 2 Ashok KumarBendre

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