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

Course Code	**US03MABOT01(T)**	Title of the Course	**ECONOMIC BOTANY**
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. Students will be able to understand basic knowledge about cereals, legumes, spices, beverages, rubber, timber and fiber yielding plants and their economic importance.

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction with their distribution, botanical name, family, parts used and economic importance of followings: **Cereals**: Wheat and Rice and Important Millets **Legumes**: Chick pea, Pigeon pea and brief account of fodder legumes	25%
2.	**Sources of sugars and starches:** Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses. **Spices:** Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper	25%
3.	**Beverages:** Tea, Coffee (morphology, processing & uses) **Natural Rubber:** Para-rubber: tapping, processing and uses. **Timber plants:** General account(List important timber plants with their botanical names and family) with special reference to teak . **Fibers:** Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).	25%
4.	**Sources of oils and fats:** General description, classification, extraction, their uses and health implications of groundnut, coconut, linseed, soybean, mustard, sesame and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.	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)

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

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.	Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2.	Kokate, Purohit and Gokhle, Pharmacognosy
3.	Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
4.	Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.

On-line resources to be used if available as reference material
https://www.biologydiscussion.com/biologyarticles
https://nlist.inflibnet.ac.in/ e books/e-journals

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

Course Code	**US03MABOT02 (T)**	Title of the Course	**PLANT MORPHOLOGY AND TAXONOMY**
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1.To study morphology of angiosperm plants. 2.To learn technical terms to describe morphological features. 3.To learn how to describe an angiosperm plant in a technical language.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to Plant Morphology**: Importance of plant morphology, Parts of an angiosperm plant. **Morphology of Root:** Characteristics of roots,Types of root system, Regions of the root, Modifications of root. **Morphology of Stem**: Characteristics of stem,Forms of stem, Bud and its modifications,Modifications of stem, Types of branching. **Habit of the plant:** parasitic, myco-heterotrophic and epiphytic plants.	25%
2.	**Morphology of Leaf:** 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. **The Inflorescence:** Definition, Classification of inflorescences,Racemose and its types, Cymose and its types and special types of inflorescence.	25%
3.	**The Flower:** **Flower** as a modified shoot, structure of flower, types of flower, thalamus, bracts, Symmetry of the flower, **Calyx and corolla**:its modifications and forms. **Androecium**:Parts of stamen, cohesion of stamens, adhesion of stamens, length of stamens, **Gynoecium**: Parts of carpel, simple and compound gynoecium, cohesion of carpels, placentation and its types. **The Fruit:**Definition, Parts of fruit, Classification of fruits, Dispersal of seeds and fruits. **The Seed:**Definition, Parts of dicotyledonous and monocotyledonous seeds,Seed germination and its types.	25%

4.	**Systematic Learning approach for Angiosperm:** General characteristics and Life cycle of an angiosperm plant. Outline Classificationof Bentham and Hooker, merits and demerits of B & H classification. Techniques for Herbarium preparation and Herbaria of the world and India. How to describe an angiosperm plant? -General characters with economic importance of the following families: **Dicotyledonae:** Polypetlae: Malvaceae, Meliaceae, Fabaceae, Cucurbitaceae Gamopetalae: Rubiaceae, Solanaceae Monochlamydeae: Euphorbiaceae **Monocotyledonae:** Gramineae (Poaceae)	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)

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

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

On-line resources to be used if available as reference material
https://www.biologydiscussion.com/biologyarticles
https://nlist.inflibnet.ac.in/ e books/e-journals

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

Course Code	**US03MABOT03**	Title of the Course	**Botany Practical**
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

	Course content (Equal Weightage % for all experiments)
No.	AIM
	SECTION-I CREDIT-2 PRACTICAL-4 HOUR
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.
11	**Taxonomical study of plants belongs to families which included in your theory syllabus.(** Malvaceae, Fabaceae, Cucurbitaceae, Rubiaceae, Solanaceae)
12	**Botanical excursion** (Students are expected to visit nearby forest area or area of botanical interest for field experience. Prepare the excursion report and submit
	SECTION-I I CREDIT-2 PRACTICAL-4 HOUR
1	Cereals: Wheat and Rice (habit sketch, study of starch grains, micro-chemical tests).
2	General study of Millets (habit sketch, study of starch grains and micro-chemical tests).
3	Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
4	Sources of sugars and starches: Sugarcane,Potato (habit sketch; starch grain- micro-chemical tests),
5	Spices: Black pepper, Fennel and Clove (habit and sections).
6	Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
7	Sources of oils and fats: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds
8	Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).
9	Rubber: specimen, photograph/model of tapping, samples of rubber products.
10	Woods: Specimen

11	Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).
12	To prepare checklist of plants of your own campus and submit during examination.
13	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.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination	50%
2.	University Examination	50%

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

On-line resources to be used if available as reference material
https://www.biologydiscussion.com/biologyarticles
https://nlist.inflibnet.ac.in/ e books/e-journals

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(Bachelor Of Science) (Botany)
(B.Sc.) (Botany-IDP) Semester (III)

Course Code	US03IDBOT01	Title of the Course	**Plant Diversity**
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	Build awareness about the different groups of plants and their roles in nature.

Course Content		
Unit	Description	Weightage* (%)
1.	• Introduction to Plant Diversity • Diversity Based on Habitat:Hydrophytes,Halophyles,Mesophytes,Xerophytes • Diversity Based on Habit:Herbs,Shrubs and Trees • Angiosperm Diversity Based on Stem Nature • Diversity Based on Size • Diversity Based on Life Span:Ephemerals,Annuals,Biennials and Periennials • Diversity Based on Nutrition:Autotrophs and Heterotrophs	50
2.	• Plant Kingdom – Members of Kingdom Plantae,Characteristics of Kingdom Plantae • Classification of Kingdom Plantae and Brief introduction to each class of plants with examples.(Thallophyta,Bryophyta,Pteridophyta,Gymnosperms and Angiosperms)Cryptogams and Phanerogams.	50

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)

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand outlines of plant diversity and its importance.
2.	Understand about basic role of each class of plants.

Suggested References:	
Sr. No.	References
1.	Botany for Degree Students, A.C.Dutta, Oxford University Press
2.	Taxonomy of Angiosperms, V. Singh and D. K. Jain, Rastogi Publications
3.	A Text Book of Botany- Angiosperms, B. P. Pandey, S. Chand and Comp. Ltd

On-line resources to be used if available as reference material
Shodhganga
https://onlinelibrary.wiley.com/doi/book/10.1002/9781444313383

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(Bachelor Of Sciences) (BOTANY)
(B.Sc.) (BOTANY-IDP) Semester (III)

Course Code	US03IDBOT02	Title of the Course	Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	1. To get hands on training to use various plants. 2. To do experiment as per the given syllabus through fresh/preserved specimen/slides/models/charts etc

Unit	Description
1.	To study local plant diversity (common Algae, Bryophytes, Pteridophytes, in and around the campus; and understand their ecological and economic importance
2	To study local plant diversity (common Gymnosperms angiosperms in and around the campus; and understand their ecological and economic importance)
3.	To study (any three) commonly found tree species in the vicinity and understand their role in human welfare.
4.	To prepare an inventory of common medicinal plants in your campus (identify to the family level, list their uses in Indian System of Medicines)
5.	To prepare an inventory of common timber plants in your campus (identify to the family level, list their uses in Indian System of Medicines)
6.	To study commonly found flowering species in the vicinity and understand their role in human welfare
7.	To visit the local parks and list the trees planted. Also assess some for their dust pollution mitigation capacity using standard procedures.
8.	Industrial visit to see how the drugs are extracted from plants (report to be submitted for evaluation).
9.	Field trip/Submission/ Project report

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.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand botanical name ,family,important morphological characters and uses of cereals,millets,legumes and vegatables.

Suggested References:	
Sr. No.	References
1.	A text book of Practical Botany(vol I&II) by Bendre and Kumar
2.	Modern Practical Botany(vol I&II)byPandey B.P.

On-line resources to be used if available as reference material
On-line Resources
The virtual library of Botany
https://www.wiziq.com/tutorials/practical

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(Bachelor Of Sciences) (Botany)
(B.Sc.) (Botany-SEC) Semester (III)

Course Code	US03SEBOT01	Title of the Course	Hydroponics-I
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	1. Basic knowledge on Hydroponic systems ; aware on Hydroponic materials (media, etc.) 2. Working with Hydroponic equipments. 3. Basic knowledge on Nutrition management. 4. Hydroponic greenhouse management; basic knowledge on Hydroponic crops.

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction to Soilless culture of plants: History and origin of Soilless culture, Present status of hydroponics-Contrasts with soil-based culture, Applications & Future developments	50
2.	Plant Nutrition: Essential, mineral elements-Functions and effects on plants, Deficiency Symptoms of the following Essential Minerals-N, P , Ca, Mg, K, S, Fe , Mn, Cu, Zn , B ,Mo. Environmental & Chemical Factors: Light (quality, ener, Photoperiodism & systems), Temperature (heating & cooling), Humidity and CO2., pH, PPM/TDS.	50

Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation/Garden visit 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)

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Describe the advantages/disadvantages of controlled environment agriculture and hydroponic crop production in the agricultural production of various food crops.
2.	Demonstrate an understanding of basic principles of plant biology, entomology, plant nutrition and disorders, irrigation and fertilization, and environmental conditions necessary for growing greenhouse hydroponic vegetable crops.
3.	Understand plant cultivation, harvesting, pest management, and food safety techniques for growing hydroponic tomatoes; understand the considerations involved with different types of greenhouses and structural components, control systems, and site selection in order to grow a successful crop.
4.	Understand the knowledge base, food safety issues, marketing, and financial considerations needed to start a hydroponic crop production business.

Suggested References:	
Sr. No.	References
1.	Howard M. Resh. Hobby Hydroponics. CRC Press USA.
2.	Keith Roberto. How to Hydroponics. The future garden press New York. 4th Edition.
3.	Prasad S and Kumar U. Green House Management for Horticultural Crops. Agrobios India
4.	Dahama A K. Organic Farming for Sustainable Agriculture. Agrobios India.
On-line resources to be used if available as reference	
On-line Resources	
Google	

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