(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:	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. 2. Students will explore the knowledge of Nutraceutical botany and about functional foods. 3. Students will get basic knowledge of traditional ethnobotany.

Course Content		
Unit	Description	Weightage* (%)
1.	**Ethnobotany:** 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) *Azadiractha indica* (b) *Ocimum sanctum*(c) *Vitex negundo* (d) *Gloriosa superb* (e) *Tribulus terrestris* (f) *Pongamia pinnata* (g) *Cassia auriculata* (h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example- *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*.	25%
2.	**Economic Botany**: **Major crops:** Introduction with their distribution, botanical name, family, parts used and economic importance of followings: **Cereals**: Wheat and Rice. **Legumes**: Chick pea, Pigeon pea and brief account of fodder legumes. **Source of sugars:** Sugarcane; **Source of starch**: Potato. **Spices**: Fennel, Saffron, Clove, and Black Pepper. **Beverages**: Tea, Coffee. **Sources of oils and fats**: Groundnut, Coconut, Linseed, Soybean, Mustard. **Natural Rubber:** *Hevea sp.* **Drug-yielding plants:** *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*. **Timber plants**: *Teak* and *Pine*. **Fibres**: Cotton, Coir and Jute. **Essential oilyielding plants:***Rosa*, *Vetiveria*, *Santalum* and *Eucalyptus.*	25%

3.	**Introduction and scope to Nutraceutical botany:** Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin Ornithine, alpha ketoglutarate. Use of grape products, flaxseed oil as Nutraceuticals.	25%
4.	**Functional Foods:** 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, *Capsicum annum*, mustards, Ginseng, garlic, grape, citrus fruits, fish oils, and sea foods.	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)	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 BahadurEthnobotany of India, 5-Volume Set

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 (IV)

Course Code	**US04CBOT52 (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 witheconomic 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)	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

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 (IV)

Course Code	**US04CBOT53**	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	**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-II CREDIT-2 PRACTICAL-4 HOUR
	Taxonomical study of plants belongs to following families
1	Malvaceae
2	Meliaceae
3	Fabaceae - Papilionaceae, Caesalpiniaceae (Leguminosae)
4	Cucurbitaceae
5	Rubiaceae
6	Solanaceae
7	Graminae (Poaceae)
8	Euphorbiaceae
9	Ethno botanical study of plants as per syllabus
10	Economical botany –study and submission per syllabus
9	To prepare checklist of plants of your own campus and submit.
10	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.

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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