



JAI HIND COLLEGE

Basantsing Institute of Science & J. T. Lalvani College of Commerce
and Sheila Gopal Raheja College of Management.

Empowered Autonomous

"A" Road, Churchgate, Mumbai - 400 020, India

**Affiliated to
University of Mumbai**

Bachelor of Science

Program: B.Sc. in Botany

**Choice Based Credit System (CBCS) under NEP-2020
with effect from the academic year 2023-2024**

Syllabus as approved by Statutory Committees

LOCF Document

Dabholkar
**PRINCIPAL
JAI HIND COLLEGE**



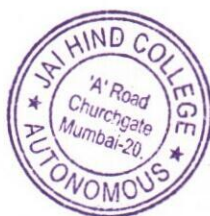
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Preamble

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of Choice Based Credit System (CBCS) which further expects learning outcome based curriculum in order to maximize the benefits of the newly designed curriculum. The learning outcome based curriculum in general and in Botany in particular will definitely help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. It is pertinent to mention here that the purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this. The template as developed has the provision of ensuring the integrated personality of the students in terms of providing opportunity for exposure to the students towards core courses, discipline specific courses, generic elective courses, ability enhancement courses and skill enhancement courses with special focus on technical, communication and subject specific skills through practical and other innovative transactional modes to develop their employability skills. The template of learning outcome based curriculum has categorically mentioned very well defined expected outcomes for the programme like core competency, communication skills, critical thinking, affective skills, problem-solving, analytical, reasoning, research-skills, teamwork, digital literacy, moral and ethical awareness, leadership readiness and so on along with very specific learning course outcomes at the starting of each course. Therefore, this template on Learning Outcomes based Curriculum Framework (LOCF) for B.Sc. with Botany/ Botany Honours will definitely be a landmark in the field of outcome based curriculum construction.



Credit Framework

Types of Courses

Sr. No	Type of Course	Learner Category
1	Major	Botany Major
2	Minor	Botany Minor
3	OE	Commerce / Arts Stream
4	SEC	Botany Major
4	VSC	Science Stream

Number of Courses and Credits

Type of Course	Number offered of each	Credits of each (Theory + Practical)
Major/Minor	02	4 (3 + 1)
OE	02	2 (2 + 0)
SEC	01	2 (Practical)
VSC	01	2 (Practical)



Semester-wise Courses

Semester	Course Code	Course Title	Type of Course	No of Credits
I	JUJUSBOT-DSC101/ JUSBOT-MIN101	CLASSICAL BOTANY I	Major/Minor	3
I	JUJUSBOT-DSC PR101/ JUSBOT-MIN PR101	BOTANY PRACTICAL I	Major/Minor	1
I/II	JUSBOT-OE101/ JUSBOT-OE201	GARDEN MANAGEMENT	OE	2
I/II	JUSBOT-OE102/ JUSBOT-OE202	LANDSCAPING	OE	2
I/II	JUSBOT-SEC101/ JUSBOT-SEC201	PHYTOCHEMISTRY I	SEC	2
I/II	JUSBOT-VSC101/ JUSBOT-VSC201	PRESERVATION TECHNIQUES - I	VSC	2
II	JUSBOT-DSC201/ JUSBOT-MIN201	CYTOGENETICS	Major/Minor	3
II	JUSBOT-DSC PR 201/ JUSBOT-MIN PR 201	BOTNAY PARACTICAL I	Major/Minor	1



Learning Outcome Based Approach

Curriculum is the heart of any educational system. It can be focused either to achieve the objectives of each course of the programme or on the expected learning outcomes from each course. The objective based curriculum refers to the overall targets to be achieved through curriculum which may be long term or immediate. On the other hand, the learning outcome based curriculum is very specific in nature in terms of changes in the cognitive, affective and psychomotor behaviour of the students as a result of their exposure to the curriculum. The outcome based curriculum provides the teacher very specific targets which he can achieve through the selected instructional process as compared to the objective based curriculum which provides general outcomes. The learning outcome based curriculum has a very close relationship with the learning of the students whereas the objective based curriculum focuses on only providing knowledge to the students. In other words, higher cognitive skills are developed through learning outcome based curriculum. Hence, it is preferred to develop a learning outcome based curriculum which will provide specific directions to the teacher with respect to the transaction process and expected changes in the behaviour of the students as well.

a. Nature and extent of the B.Sc. Botany Programme: Botany is the broad discipline encompassing various subjects involved with the study of plants. Emphasis has been shifted to modern science at the cost of traditional botany. This shift is discussed at various forums. There is a need to balance the traditional botany and upcoming modern computational and applied approach. In view of above, adequate balance of topics is proposed displaying latest APG IV based phylogenetic systematics of plants covering higher plants, lower plants, aquatic (fresh and marine water) plants, nature/ field study, functional aspects of various cellular processes of plants, molecular genetics and modern tools i.e. tissue culture, genetic engineering and computational studies are required to be introduced at undergraduate level. This modified syllabus has been drafted to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/introduced in this framework, including Chemistry, Mathematics and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Botany graduates are given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the



employability of graduates, a number of skill development courses are also introduced in this framework.

Graduate Attributes

The Department envisions that a graduate with a BSc. in Botany from Jai Hind College (Autonomous) would be an individual who is able to:

- Identify and differentiate between different classes/groups of plants.
- Display a knowledge and understanding of key concepts and theories in Molecular biology and Plant Physiology
- Read, write and present research papers / projects with the application of Phytochemistry, Physiology, Genetics etc
- Effectively communicate and articulate ideas in academic and industry settings
- Produce an original creative work that reflects the knowledge and values inculcated through the programme
- Exhibit a value system that is inclusive, and sensitive to different sections of society.

b. Aims of Bachelor's degree programme in Botany The broad aims of bachelors degree programme in Botany are:

1. To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects
2. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
3. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
4. To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination



Programme Objectives

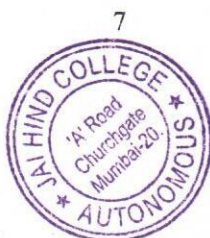
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Pedagogy

Teaching is student-centric and enables various kinds of learning such as Collaborative Learning, Participative Learning, Experiential Learning, and ICT based e-learning. The Pedagogy and teaching aids we use to facilitate these various kinds of learning are as follows:

- **Collaborative Learning:** Interactive teaching, guest lectures, workshops
- **Participative Learning:** Quizzes, Puzzles, Group Discussions and Debates, Class Presentations and Role Plays
- **Experiential Learning:** Field visits to forests, gardens, training institutes, industries, research institutes.
- **ICT based e-learning:** Audio-visual aids such as PPTs, films, documentaries, videos; e-learning resources such as Crossword Maker on TheTeachersCorner.net, Menti polls, Jam boards, virtual whiteboards, G-suite apps (Google docs, slides and sheets) and Google Classroom; sharing and use of e-books, pdfs, open-access journal publications; use of free and open-source messaging application Telegram, Whatsapp etc.



Assessment Methods / Evaluation Scheme:

Assessment pattern of the Major & Minor Courses:

Each Major / Minor Course of 4 credits will be divided into 3 credits for theory and 1 credit for practical. The assessment pattern will be as follows:

- Theory - 75 marks, Practical - 25 marks
- The theory component will comprise of 50 marks as Semester End Examination (SEE) of 2 hours; and 25 marks Continuous Assessment (CA)
- The Practical Component will comprise of 25 marks Semester End Examination (SEE) Practical of 1.5 hour; and 25 marks of continuous assessment (CA). The latter will consist of 20 marks based on continuous assessment of practical conducted during regular turns and 5 marks for VIVA. Completion of Journal is a requirement to appear for Semester-end Practical exam.
- Total of Internal Assessment + SEE for Practical = 50 marks which will be converted to out of 25

Assessment for Open Elective (OE) across all streams will be assessed on Theory Component which will be as follows:

- The theory component will comprise of 25 marks as Semester End Examination (SEE) of 1 hour; and 25 marks Continuous Assessment (CA)

Assessment for Vocational Skill Course (VSC) and Skill Enhancement Course (SEC) across all streams will be assessed as a practical component of 50 marks which will be as follows:

- The practical component will comprise of 25 marks as Semester End Examination (SEE) of 1.5 hour; and 25 marks Continuous assessment (CA); the evaluation pattern to be experiment/task based/ case study or any other similar.



Discipline Specific Core Courses – Major/Minor Core Courses

JUSBOT- DSC101/ JUSBOT- MIN101	Course Title: CLASSICAL BOTANY I	Credits: 03 Lectures/Week: 03
Course description	Students will gain knowledge on the vascular and non-vascular cryptogams placed under the plant kingdom. They will be able to identify and differentiate these based on their morphological and anatomical characteristics studied. They will also understand the economic importance of plants belonging to all the divisions.	
Learning objectives	<ul style="list-style-type: none"> • Learn the morphology, structure, Life-cycle and importance of the organisms and differentiate between classes of various groups of Algae, Fungi, Lichens, Bryophytes and Pteridophytes. • Classify lichens on the basis of their habitat, internal structure, fungal partner and thallus morphology. • Learn the economic importance and ecological significance of lichens. • Study the diseases and parasites on lichens. 	
Course Outcomes	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Differentiate and compare between different classes of Algae, Fungi, Bryophyta and Pteridophyta from their syllabus. • Discuss life cycles and systematic position, as well as understand the economic importance of Algae, Fungi, Bryophyta and Pteridophyta prescribed in the syllabus • Differentiate between types of lichen thallus on the basis of their internal and external structure as well as assess and understand the economic importance of lichens especially in food and medicine. • Grasp the basic understanding of the ecological significance of the presence of lichens and appreciate their role in the environment. 	
	THEORY	(4 5 L)
	Unit – I: Algae	10 le ct ur es
	<ul style="list-style-type: none"> • Classification by G. M. Smith and the economic importance of algae 	
	<ul style="list-style-type: none"> • General characteristics and life cycle of: 	



	Cyanophyta - <i>Nostoc</i> Chlorophyta - <i>Chlamydomonas</i> Euglenophyta - <i>Euglena</i>	
	Unit – II: Fungi	10 lect ures
	<ul style="list-style-type: none"> • Classification by G. M. Smith and the economic importance of fungi. 	
	<ul style="list-style-type: none"> • General characteristics and life cycle of: Phycomycetes :<i>Rhizopus</i> Ascomycetes :<i>Aspergillus</i> Basidiomycetes: <i>Puccinia</i> Deuteromycetes: <i>Alternaria</i> 	
	Unit – III: Lichens	05 lect ures
	<ul style="list-style-type: none"> • Nature of lichen thallus (external and internal structure – Foliose, crustose, fruticose) 	
	<ul style="list-style-type: none"> • Distribution of Lichen, Habit and Habitat 	
	<ul style="list-style-type: none"> • Reproduction in lichens 	
	<ul style="list-style-type: none"> • Economic importance: Lichens in Medicine Lichens in Dyes 	
	<ul style="list-style-type: none"> • Ecology of lichens 	
	Unit – IV: Bryophyta	10 lect ures
	<ul style="list-style-type: none"> • Classification by G. M. Smith and economic importance of bryophytes. 	



	<ul style="list-style-type: none"> • General characteristics and life cycle of: Hepaticae: <i>Riccia</i> Anthocerotae: <i>Anthoceros</i> Musci: <i>Funaria</i> 	
	Unit – V: Pteridophyta	10 le ct ur es
	<ul style="list-style-type: none"> • Classification by G. M. Smith and the economic importance of Pteridophytes. 	
	<ul style="list-style-type: none"> • General characteristics and life cycle of: Lycopsida - <i>Selaginella</i> Sphenopsida - <i>Equisetum</i> Pteropsida - <i>Adiantum</i> 	
	<p>Evaluation Scheme</p> <p>75 Marks</p> <p>(a) 50 Marks Semester End Exam (SEE) of 2 hours</p> <p>(b) 25 Marks Internal Assessment:</p> <p>10 marks CA-I (Test with Objective Questions)</p> <p>15 Marks CA-II (Assignment like Poster/model making, video making, presentation, etc.)</p>	



% Application of Bloom's Taxonomy					
Thinking Skills	Weightage of Marks				
	Unit I & II	Unit II & V	Unit III & IV	Total	%
Remembering / Knowledge	8	6	6	20	40
Understanding	6	6	4	16	32
Applying, Analyzing, Evaluating, Creative	4	4	6	14	28
Total Marks	18	16	16	50	100

References:	<ol style="list-style-type: none"> 1. Gangulee, Das & Datta, College Botany, Volume II, New Central Book Agency, 2006 2. Vashishta B. R. & Sinha, A. K., Botany for degree students - Algae, S. Chand, 1st Edition, 2010 3. Vashishta B. R. & Sinha, A. K., Botany for degree students - Fungi, S. Chand, 1st Edition, 2010 4. Smith G. M., Cryptogamic Botany – Algae and Fungi, Vol. I, McGraw Hill Publications, 1955 5. Vashishta B. R. & Sinha, A. K., Botany for degree students - Bryophyta, S. Chand, Chand, 1st Edition, 2010 6. Vashishta B. R., Sinha, A. K. & Kumar A., Botany for degree students Pteridophyta, S. Chand, 1st Edition, 2010
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Course Code: JUSBOT- DSCPR101/J USBOT- MINPR101	Botany Practical - I	Credits: 01 Practical/ Week: 01
Course description	Students will gain knowledge on the vascular and non-vascular cryptogams placed under the plant kingdom. They will be able to identify and differentiate these based on their morphological and anatomical characteristics studied. They will also understand the economic importance of plants belonging to all the divisions.	
	PRACTICAL	
Learning Objectives	<ul style="list-style-type: none"> ● To use bright field microscopy for observing Algae, Fungi, Lichens, Bryophytes and Pteridophytes. ● To study the morphology and anatomy of specimens mentioned above. ● To understand the economic importance of members belonging to classes of Algae, Fungi, Lichens, Bryophytes and Pteridophytes. 	
Course outcomes	Student will be able to: <ul style="list-style-type: none"> ● Focus and mount specimens mentioned above on a light microscope. ● Identify and Differentiate between the different specimens. ● Give Control measures of harmful fungi. ● Ecological and economic significance of all species. 	
1.	Study of stages in the life cycle of <i>Nostoc</i> from fresh/ preserved material and permanent slides.	
2.	Study of stages in the life cycle of <i>Chlamydomonas</i> from fresh/ preserved material and permanent slides.	
3.	Study of stages in the life cycle of <i>Euglena</i> from fresh/ preserved material and permanent slides.	
4.	Study of stages in the life cycle of <i>Rhizopus</i> from fresh/ preserved material and permanent slides.	
5.	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material and permanent slides.	
6.	Study of stages in the life cycle of <i>Puccinia</i> from fresh/ preserved material and permanent slides.	
7.	Study of stages in the life cycle of <i>Alternaria</i> from fresh/ preserved material and permanent slides.	



8.	Study of stages in the life cycle of <i>Riccia</i> from fresh/ preserved material and permanent slides.	
9.	Study of stages in the life cycle of <i>Anthoceros</i> from fresh/ preserved material and permanent slides.	
10.	Study of stages in the life cycle of <i>Funaria</i> from fresh/ preserved material and permanent slides.	
11.	Study of stages in the life cycle of <i>Selaginella</i> from fresh/ preserved material and permanent slides.	
12.	Study of stages in the life cycle of <i>Equisetum</i> from fresh/ preserved material and permanent slides.	
13.	Study of stages in the life cycle of <i>Adiantum</i> from fresh/ preserved material and permanent slides.	
14.	Identification of Lichens (Permanent slides and specimens) – based on morphology.	
15.	Economic importance of algae, fungi, bryophytes and pteridophytes.	
<p>Evaluation Scheme</p> <p>(a) 25 Marks Continuous Assessment during regular practical turns + Worksheets</p> <p>(b) 25 Marks SEE Practical Exam: Experiment, Identification, Viva. Total of Internal assessment + SEE Practical exam = 50 marks which is to be as 50/2 out of 25 Marks</p>		
References:	<ul style="list-style-type: none"> ● Gangulee, Das & Datta, College Botany, Volume II, New Central Book Agency, 2006 ● Vashishta B. R. & Sinha, A. K., Botany for degree students - Algae, S. Chand, 1st Edition, 2010 ● Vashishta B. R. & Sinha, A. K., Botany for degree students - Fungi, S. Chand, 1st Edition, 2010 ● Smith G. M., Cryptogamic Botany – Algae and Fungi, Vol. I, McGraw Hill Publications, 1955 ● Vashishta B. R. & Sinha, A. K., Botany for degree students - Bryophyta, S. Chand ● Vashishta B. R. & Sinha, A. K., Botany for degree students - Pteridophyta, S. Chand 	



Course Code: JUSBOT- DSC201/ JUSBOT- MIN201	Course Title: CYTOGENETICS	Credits: 03 Lectures/Week: 03
Course description	This Course is designed to make students understand the basic principles underlying Genetics. It aims at giving students conceptual understanding of inheritance patterns, and modifications of the same often caused due to gene interaction and environmental influence.	
Learning objectives	Students will learn the <ul style="list-style-type: none"> ● Basic principles of Mendelian Genetics and extensions of Mendelian principles. ● Concept of multiple alleles and Gene interactions ● Concept of penetrance and expressivity of genes 	
Course Outcomes	Students will be able to <ul style="list-style-type: none"> ● Understand how genes function to determine the phenotypic characteristics. ● Understand the concept of gene interaction and the influence of non-allelic genes on the phenotype of the organism. ● Conceptually understand penetrance and expressivity of a gene under study and that multiple internal and external environmental factors influence the expressivity of many genes. 	
	THEORY	(45 L)
	Unit – I: MENDELIAN GENETICS:	15 lectures
	<ul style="list-style-type: none"> ● Monohybrid ratio and their modifications- Complete dominance, Incomplete dominance, co-dominance and concept of essential and lethal genes. Test cross, back cross ratios, ● Di-hybrid ratios and their modifications ● Gene interactions ● Epistasis: Recessive, Dominant and Duplicate Recessive and Duplicate Dominant, additive action and inhibition ratio. ● Gene expression and environment: penetrance and expressivity, effects of environment (Age, Sex, Temperature and chemicals). ● Concept of multiple alleles. 	



	Unit – II: SEX LINKED AND EXTRA CHROMOSOMAL INHERITANCE	15 lectures
	<ul style="list-style-type: none"> ● Sex linked inheritance (eye colour in Drosophila, Haemophilia, colour blindness), sex influenced and sex-limited traits. ● Sex determination- Chromosomal Methods: heterogametic males and heterogametic females. Sex determination in monoecious and dioecious plants. ● Genic Balance Theory of sex determination in Drosophila. ● Lyon’s Hypothesis of X chromosome inactivation. 	
	Unit – III: EXTRA CHROMOSOMAL INHERITANCE	15 lectures
	<ul style="list-style-type: none"> ● Chloroplast determines heredity - Plastid transmission in plants, Streptomycin resistance in Chlamydomonas. ● Male sterility in maize ● Structure and function of Eukaryotic Chromosome ● Variation in Chromosome structure (Chromosomal Aberrations) : Definition, Origin, Cytological and Genetic Effects of the following: Deletions, Duplications, Inversions and Translocations. ● Numerical changes in chromosomes: <ul style="list-style-type: none"> ● Changes in one or few chromosomes (Aneuploidy): Generation and types of aneuploidy. ● Changes in complete sets of chromosomes(Euploidy): Monoploidy, polyploidy (autopolyploidy and allopolyploidy); Applications of polyploidy in plant breeding. ● Point mutations : Meaning, types and significance. 	
	<p>Evaluation Scheme</p> <p>75 Marks</p> <p>(a) 50 Marks Semester End Exam (SEE) of 2 hours</p> <p>(b) 25 Marks Internal Assessment:</p> <p>10 marks CA-I (Test with Objective Questions)</p> <p>15 Marks CA-II (Assignment like solving numerical problems in genetics, Article writing and powerpoint presentations on related topics, etc.)</p>	



% Application of Bloom's Taxonomy					
Thinking Skills	Weightage of Marks				
	Unit I	Unit II	Unit III	Total	%
Remembering / Knowledge	2	6	7	15	30
Understanding	2	6	7	15	30
Applying, Analyzing, Evaluating, Creative	12	4	4	20	40
Total Marks	16	16	18	50	100

References:	<ol style="list-style-type: none"> 1. Winchester, A. M., Heredity an Introduction to Genetics 2. Russell P., I-Genetics: A Molecular Approach, Pearson/Benjamin Cummings, 2nd Edition, 2006 3. Russell P., I-Genetics: A Molecular Approach, Pearson Education, 3rd Edition, 2011
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Open Elective Courses

Course Code: JUSBOT- OE101/ JUSBOT- OE201	Course Title: GARDEN MANAGEMENT	Credits: 02 Lectures/Week: 02
Course description	Students will gain knowledge about different horticultural branches. They will learn techniques related to natural and artificial propagation of plants and also develop entrepreneurial skills for nursery management.	
Learning objectives	<ul style="list-style-type: none"> ● Study the various branches of horticulture ● Understand the scope of branches of horticulture. ● Learn about different natural and artificial propagation techniques for mass and commercial production of horticultural plants. 	
Course Outcomes	Students will be able to: <ul style="list-style-type: none"> ● Gain entrepreneurship skills in various branches of horticulture. ● Manage and operate nurseries as well as fruit and vegetable gardens in a profitable way. ● Understand and suggest different methods for natural and artificial propagation of plants. 	
	THEORY	(30 L)
	Unit – I: INTRODUCTION TO HORTICULTURE:	15 lect ures
	<ul style="list-style-type: none"> ● Definition, importance and objectives of Horticulture and different branches of Horticulture 	
	<ul style="list-style-type: none"> ● Allied branches – Apiculture and Sericulture. 	
	<ul style="list-style-type: none"> ● Global and national scenario of horticulture. 	
	Unit – II: PLANT PROPAGATION PRACTICES:	15 lect ures
	<ul style="list-style-type: none"> ● Natural method of propagation: <ul style="list-style-type: none"> ○ By specialised Vegetative structures: Bulbs, Tubers, Corms, Rhizomes, Root stock, runners, Offsets and suckers. ○ By Seeds: Advantages and disadvantages, method of seed 	



	Sowing, Transplanting of seedlings and Hardening.	
	<ul style="list-style-type: none"> ● Artificial methods of propagation: Definitions, methods and advantages of: <ul style="list-style-type: none"> ○ Cutting– Root cutting, Stem cuttings, and leaf cuttings. ○ Layering – Simple and compound layering; Air Layering. ○ Grafting- Basic types of grafting: Detached, Attached, and Repair grafting, ○ Budding – T-budding (or shield budding), patch and ring budding. ○ Plant tissue culture 	



Evaluation Scheme

Total: 50 marks

(a) 25 marks SEE for 1 hr

(b) 25 Marks Internal Assessment:

10 marks CA-I (Test with Objective Questions)

15 Marks CA-II (Assignments/ Project, Article writing and powerpoint presentations on related topics, etc.).

% Application of Bloom's Taxonomy

Thinking Skills	Weightage of Marks			
	Unit I	Unit II	Total	%
Remembering / Knowledge	4	4	08	32
Understanding	4	5	09	36
Applying, Analyzing, Evaluating, Creative	4	4	08	32
Total Marks	12	13	25	100

References:

1. A TextBook of Horticulture with Practicals By Dr B.A. Patil , Dr S.K. Aher; Prof G. M. Bansude; Prof. S.L. Laware and Prof. S.G. Auti; GAAJ Prakashan.
2. J. S. Arora, Introductory ornamental horticulture, Kalyani Publishers.
3. Jitendra Singh, Basic horticulture, Kalyani Publishers, 2021
4. Rachandra N. Sabale, Horticulture, Anmol Prakashan, Pune.
5. Randhawa Gurcharan Singh & Mukhopadhyay, Amitabha, Floriculture in India, Allied Publishers, 1986
6. Timir Baran Jha and Biswajit Ghosh, Plant Tissue Culture: Basic and Applied, 2005.



7. <https://www.biotecharticles.com/Agriculture-Article/Growth-Regulation-Practices-in-Important-Fruit-Crops-3508.html>.



Course Code: JUSBOT- OE102/ JUSBOT- OE202	Course Title: LANDSCAPING	Credits: 02 Lectures/Week: 02
Course description	Students will understand principles of landscape designing. They will also learn the various techniques involved in indoor and outdoor beautification using plants.	
Learning objectives	<ul style="list-style-type: none"> ● Learn the principles of Landscape designing. ● Learn the use of plants for indoor and outdoor beautification. ● Learn use of various gardening implements. ● Study the significance of different garden operations. 	
Course Outcomes	Students will be able to: <ul style="list-style-type: none"> ● Design and plan gardens for both public areas and private properties. ● Suggest appropriate garden tools and practise suitable operations for the management of plants. ● Design beautiful indoor exhibits. 	
	THEORY	(30 L)
	Unit – I: Landscape designing and gardening	15 lectures
	<ul style="list-style-type: none"> ● Principles of landscaping & garden design. ● Purpose, Method of preparation and management of Important garden features and types of plants used- Paths & Avenues, Hedges & Edges, Lawn, Flowerbeds, Arches & Pergolas, Fencing, Water bodies & Rock garden. ● Urban gardening: Traffic islands, beautification of buildings, terrace gardens, Vertical walls. ● Indoor plants & Indoor gardens- Hydroponics, Terrarium/ Bottle garden, Dish garden, hanging baskets, bonsai, kokedama, cultivation of microgreens. 	
	Unit – II: Garden operations	15 lectures
	<ul style="list-style-type: none"> ● Garden implements and their uses. 	



	<ul style="list-style-type: none"> • Different types of pots & Potting medium, Potting and repotting • Use of soil testing Kit; Soil pH and organic carbon content. • Preparation of soil for garden • Tree Transplantation. • Irrigation ,Weeding and Pruning. 																														
	<p>Evaluation Scheme Total: 50 marks (a) 25 marks SEE for 1 hr (b) 25 Marks Internal Assessment: 10 marks CA-I (Test with Objective Questions) 15 Marks CA-II (Assignments/ Project, Article writing and powerpoint presentations on related topics, etc.).</p> <p style="text-align: center;">% Application of Bloom's Taxonomy</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Thinking Skills</th> <th colspan="4" style="text-align: center;">Weightage of Marks</th> </tr> <tr> <th style="text-align: center;">Unit I</th> <th style="text-align: center;">Unit II</th> <th style="text-align: center;">Total</th> <th style="text-align: center;">%</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Remembering / Knowledge</td> <td style="text-align: center;">5</td> <td style="text-align: center;">5</td> <td style="text-align: center;">10</td> <td style="text-align: center;">40</td> </tr> <tr> <td style="text-align: center;">Understanding</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> <td style="text-align: center;">09</td> <td style="text-align: center;">36</td> </tr> <tr> <td style="text-align: center;">Applying, Analyzing, Evaluating, Creative</td> <td style="text-align: center;">4</td> <td style="text-align: center;">2</td> <td style="text-align: center;">06</td> <td style="text-align: center;">24</td> </tr> <tr> <td style="text-align: center;">Total Marks</td> <td style="text-align: center;">13</td> <td style="text-align: center;">12</td> <td style="text-align: center;">25</td> <td style="text-align: center;">100</td> </tr> </tbody> </table>	Thinking Skills	Weightage of Marks				Unit I	Unit II	Total	%	Remembering / Knowledge	5	5	10	40	Understanding	4	5	09	36	Applying, Analyzing, Evaluating, Creative	4	2	06	24	Total Marks	13	12	25	100	
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and local food production: scenarios from Mumbai metropolitan region (MMR), India, 2014, International Journal of Food, Agriculture and Veterinary sciences, Vol.4 (2).



Skill Enhancement Course

Course Code: JUSBOT- SEC101/ JUSBOT- SEC201	Course Title: PHYTOCHEMISTRY I	Credits: 02
Course description	This Course is designed to bridge the gap between Pharma companies and Education. It aims at Various methods of extraction, isolation and detection of plant constituents.	
Learning objectives	Students will be able to <ul style="list-style-type: none"> ● Learn the principles and concepts of phytochemistry. ● Learn the concept of cold and hot solvent extraction. ● Learn the concept of using appropriate solvents as per plant metabolites. ● Understand the concept of solvent fractionation. 	
Course Outcomes	At the end of the course the students will be able to: <ul style="list-style-type: none"> ● Enlist the fundamental concepts of phytochemistry ● Design the methods for cold and hot solvent extraction suitable for plants. ● Analyze the obtained solvent fractions by various qualitative and quantitative techniques. ● Devise the process of screening crude extracts against plant pathogens or human pathogens. 	
PRACTICAL		
1	Collection & Processing of herbal drugs,	
2	Concept of solvent extraction for plant based compounds and Study of Soxhlet apparatus and its applications	
3 - 4.	Extraction of phytochemicals from <i>Curcuma</i> using cold extraction and Soxhlet.	
5 - 6.	Extraction of phytochemicals from <i>Lawsonia</i> using cold extraction and Soxhlet.	
7 - 8	Extraction of phytochemicals from <i>Vinca</i> using cold extraction and Soxhlet.	
9 - 11	Principle and Working of Rotary Evaporator, Concentration of extract (Rotary evaporation/ air drying) and retrieving of solvent for	



12 - 13.	Solvent fractionation using separating funnels.	
14 - 19.	Determination of each fraction for secondary metabolite.	
20 - 21	Demonstration of collected fractions for antimicrobial activity.	
22 - 30.	Analysis of extracts using biochemical tests and chromatography techniques for detection of: <ul style="list-style-type: none"> ● Phenolic compounds ● Terpenes ● Nitrogen containing compounds 	
	<p>Evaluation Scheme</p> <p>Assessment for Skill Enhancement Course (SEC) across all streams will be assessed as a practical component of 50 marks which will be as follows:</p> <ul style="list-style-type: none"> ● The practical component will comprise of 25 marks as Semester End Examination (SEE) of 1.5 hour; and 25 marks Continuous assessment (CA); the evaluation pattern to be experiment/task based/ case study or any other similar. 	
References:	<ol style="list-style-type: none"> 1. Harborne. J.B. (1998). Phytochemical methods. A guide to modern techniques of Plant Analysis. Chapman and Hall publication, London 2. Plumber, D. T. (2006). An introduction to practical biochemistry TATA-McGraw- Hill Publication, New Delhi 3. Shah, B.N. (2005). Text book of Pharmacognosy and phytochemistry. Cbs Publishers & Distributors-New Delhi 4. Egbuna, C., Chinenye, J. Stanley I. and Udedi, C. (2018). Phytochemistry: Fundamental, modern techniques and applications. Apple Academic Press. 5. CRC press. 	



Vocational Skill Course

Course Code: JUSBOT- VSC101/ JUSBOT- VSC201	Course Title: Preservation Techniques-I	Credits: 02
Course description	This Course aims at teaching Dry and wet preservation of plants and hands on training for techniques of fruits and vegetable preservation	
Learning objectives	<ul style="list-style-type: none"> • Identify different types of Fossils • Use the techniques of dry and wet preservation for plants • Understand the concept of Minimum Inhibitory Concentration for fruits and vegetable preservation 	
Course Outcomes	<ul style="list-style-type: none"> • Comment on different types of fossils • Demonstrate the technique of Herbarium making • Prepare fruit/vegetable preserves using different techniques 	
	PRACTICAL	
1.	To study the Process involved in formation of Fossils	
2 - 3.	To Study of Different fossils from preserved specimens/ photomicrographs.	
4 - 5.	To study Dry preservation techniques for plantstudying Herberia of India and World,	
6.	To study the Role of herbarium in Botany	
7 - 9	Preparation of Herbarium using suitable material	
10 - 14.	Demonstration of Wet preservation methods for Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms	
15.	Preparation of Jam using seasonal fruits	
16 - 17.	Preparation of Squash and Syrup using seasonal fruits	



18.	Preparation of Jelly using seasonal fruits	
19.	Preparation of Sauce using tomatoes	
20 - 21.	Preparation of pickle from raw mangoes	
22 - 23.	Preparation of Aamchur powder from Raw mangoes and Brining of Fresh vegetables/Rhizomes	
24 - 25.	Drying of fresh flowers using sand/ Silica	
26 - 27.	Demonstration of Microwave drying for flowers/ fruits / vegetables	
28 - 29	Demonstration of Oven drying using suitable material.	
30	To understand the concept of Seed banks	
	<p>Evaluation scheme: Assessment for Vocational Skill Course (VSC) across all streams will be assessed as a practical component of 50 marks which will be as follows:</p> <ul style="list-style-type: none"> The practical component will comprise of 25 marks as Semester End Examination (SEE) of 1.5 hour; and 25 marks Continuous assessment (CA); the evaluation pattern to be experiment/task based/ case study or any other similar. 	
References:	<ol style="list-style-type: none"> Randhawa G.S. & Mukhopadhyay A., Floriculture in India, Allied Publishers 1986 Rao, Manibhushan K., Textbook of Horticulture, MacMillan Publication, Second edition, 2005 Singh Jitendra, Basic Horticulture, Kalyani Publishers, 2011 Chadha, K. L., Handbook of Horticulture, Indian Council of Agricultural research, Kisan Forum Pvt. Ltd. 2014 Kokate C.K. , Purohit A.P and Gokhale S.B; Pharmacognosy, Nirali Publication, 2011. 	

