



Date :- 01/08/2023

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Botany (Sem. I & II)

Ref. :- Decision of the Academic Council at its meeting held on 26/07/2023.

The Syllabi of B. Sc. in Botany (First and Second Semesters) as per **NATIONAL EDUCATION POLICY - 2020** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2023-24.

Copy of the Syllabi Shall be downloaded from the College Website
(www.kcesmjcollege.in)

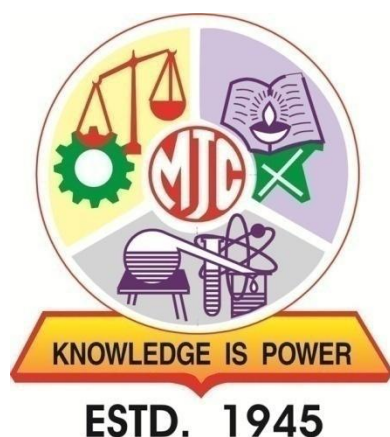
Sd/-
Chairman,
Board of Studies

To :

- 1) The Head of the Dept., M. J. College, Jalgaon.
- 2) The office of the COE, M. J. College, Jalgaon.
- 3) The office of the Registrar, M. J. College, Jalgaon.

Knowledge is Power

Khandesh College Education Society's
Moolji Jaitha College, Jalgaon
An "Autonomous College"
Affiliated to KBC North Maharashtra University, Jalgaon



SYLLABUS

F.Y.B.Sc. Botany

**Under Choice Based Credit System (CBCS)
and
as per NEP-2020 Guidelines**

[w. e. f. Academic Year:2023-24]

Preface

Skilled human resource is a prerequisite in higher education, and it is to be acquired through thorough knowledge of theoretical concepts and hands-on laboratory methods of the subject. The Moolji Jaitha College (Autonomous) has adopted a department-specific model as per the guidelines of UGC, NEP-2020 and the Government of Maharashtra. The Board of Studies in Botany of the college has prepared the syllabus for the first-year undergraduate of Botany. The syllabus cultivates theoretical and practical know-how of different fields of Botany. The contents of the syllabus have been prepared to accommodate the fundamental aspects of various disciplines of Botany and to build the foundation for various applied sectors of Botany. Besides this, in the first year, the students will be enlightened with the skill related to microbial identification and testing, which will enhance students' employability.

The overall curriculum of three / four-year covers all major classical and applied branches of Botany. and also covers papers of student interests like forensic Botany , Food Science, Commercial Forestry and others. Furthermore, the syllabus is structured to cater to botany's present and future needs in the research field, Industrial Sector, Environmental Sector, Entrepreneurship etc., emphasizing imparting hands-on skills. Hence, the curriculum is endowed with more experiments that shall run hand-in-hand with theory. The detailed syllabus of each paper is appended with a list of suggested readings.

Program Outcomes (PO) for B.Sc. Program:

Upon successful completion of the B.Sc. program, student will be able to:

PO No.	PO
PO 1	Understand the basic concepts and fundamental principles related to various science branches
PO 2	Aquaint the skills in handling scientific instruments and performing in laboratory experiments
PO 3	Relate various scientific phenomena and their relevancies in the day-to-day life.
PO 4	Analyse experimental data critically and systematically to draw the objective conclusions.
PO 5	Develop various skills such as communication, leadership, teamwork, social, research etc., which will help in expressing ideas and views clearly
PO 6	Develop interdisciplinary approach for providing better solutions and sustainable developments.

Program Specific Outcome PSO (B.Sc. Botany):

After completion of this course, students are expected to learn/understand the:

PO No.	PSO
PSO 1	Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium
PSO 2	Classification of families with genetic basis of heterosis
PSO 3	Awareness and appreciation of plants and plant products encountered in everyday life
PSO 4	Apply techniques of harvesting, drying and storage of medicinal herbs
PSO 5	Evaluates the role of microorganisms in industry and in agriculture
PO6	Examine the internal Anatomy of plant system and organs

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit										
Level	Sem	Major (Core) Subjects		Minor Subjects (MIN)	GE/ OE	VSC, SEC (VESC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
4.5	I	DSC-1 (2T) DSC-2 (2T) DSC-3 (2P)	—	MIN-1 (2T) MIN-2 (2P)	OE-1 (2T)	SEC-1 (2T) SEC-2 (1P)	AEC-1 (2T) (ENG) VEC-1 (2T) (ES) IKS (1T)	CC-1 (2)	22	UG Certificate 44
	II	DSC-4 (2T) DSC-5 (2T) (IKS) DSC-6 (2P)	...	MIN-3 (2T) MIN-4 (2P)	OE-2 (2T)	SEC-3 (2T) SEC-4 (1P)	AEC-2 (2T) (ENG) VEC-2 (2T) (CI) IKS (1T)	CC-2 (2)	22	
	Cum. Cr	12	...	8	4	6	4+4+2	4	44	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.0	III	DSC-7 (2T) DSC-8 (2T) DSC-9 (2P) DSC-10 (2P)	...	MIN-5 (2T) MIN-6 (2P)	OE-3 (2T) OE-4 (2P)		AEC-3 (2T) (MIL)	CC-3 (2) CEP (2)	22	UG Diploma 88
	IV	DSC-11 (2T) DSC-12 (2T) DSC-13 (2P) DSC-14 (2P)	...	MIN-7 (2T) MIN-8 (2P)	OE- 5 (2T) OE-6 (2P)		AEC-4 (2T) (MIL)	CC-4 (2) FP (2)	22	
	Cum. Cr	28	...	16	10	6	8+4+2	8+2+2	88	
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.5	V	DSC-15 (2T) DSC-16 (2T) DSC-17 (2T) DSC-18 (2P) DSC-19 (2P)	DSE-1 (2T) A/B DSE-2 (2P) A/B	MIN-9 (2T/P)	...	VSC-1 (2T) VSC-2 (2P)	...	OJT/Int(2)	22	UG Degree 132
	VI	DSC-20 (2T) DSC-21 (2T) DSC-22 (2T) DSC-23 (2P) DSC-24 (2P)	DSE-3 (2T) A/B DSE-4 (2P) A/B	MIN-10(2T/P)	—	VSC-3 (2T) VSC-4 (2P)	...	OJT/Int(2)	22	
	Cum. Cr.	48	08	20	10	8+6	8+4+2	8+2+2+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-28 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6(2P) A/B	RM (2T)	—	...	...	OJT/Int (2)	22	UG Honors Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-32 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8(2P) A/B	RM (2T)	—	...	...	OJT/Int (2)	22	
	Cum. Cr.	76	16	20+4	10	8+6	8+4+2	8+2+2+8	176	
Four Year UG Honors Degree in Major and Minor with 176 credits										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6 (2P) A/B	RM (2T)	...	...	...	RP (6)	22	UG Honors with Research Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8 (2P) A/B	RM (2T)	...	...	...	RP (6)	22	
	Cum. Cr.	68	16	20+4	10	8+6	8+4+2	8+2+2+8+12	176	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC-** Department Specific Course, **DSE-** Department Specific Elective, **T-** Theory, **P-** Practical, **CC-**Cocurricular **RM-**

Multiple Entry and Multiple Exit options:

The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Year Bachelor's Degree	120	132	6	3
6.0	Bachelor's Degree- Honours Or Bachelor's Degree- Honours with Research	160	176	8	4

F. Y. B. Sc. Botany Course Structure

Semester	Course Module	Credit	Hours/ week	TH/ PR	Code	Title
I	DSC	2	2	TH	BOT-DSC-111	Economic Botany and Plant Resource Utilization
	DSC	2	2	TH	BOT-DSC-112	Plant Systematics
	DSC	2	4	PR	BOT-DSC-113	Practical's Based on Economic Botany and Plant Systematics
	MIN	2	2	TH	BOT-MIN-111	Medicinal Botany
	MIN	2	4	PR	BOT-MIN-112	Practical's Based on Medicinal Botany
	OE/GE	2	2	TH	BOT-OE-111	Mushroom Culture Technology
	SEC	2	2	TH	BOT-SEC-111	Industrial and Environmental Microbiology
	SEC	1	2	PR	BOT-SEC-112	Practical's Based on Industrial and Environmental Microbiology
	AEC	2	2	TH	ENGS-AEC-111	English
	VEC	2	2	TH	ES -VEC-111	Environmental studies
	IKS	1	1	TH	IKS-111	Indian knowledge system
			2		NCC-CC-111 NSS-CC-111 SPT-CC-111 CUL-CC-111	NCC NSS Sports Cultural
	CC	2		CC		
II	DSC	2	2	TH	BOT-DSC-121	Anatomy of Angiosperms
	DSC	2	2	TH	BOT-DSC-122	Elements of Plant Breeding
	DSC	2	4	PR	BOT-DSC-123	Practical's Based on Anatomy of Angiosperms & Elements of Plant Breeding
	MIN	2	2	TH	BOT-MIN-121	Phytochemistry
	MIN	2	4	PR	BOT-MIN-122	Practical based on Phytochemistry
	OE/GE	2	2	TH	BOT-OE-121	Food Science
	SEC	2	2	TH	BOT-SEC-121	Commercial Forestry
	SEC	1	2	PR	BOT-SEC-122	Practical based on Commercial Forestry
	AEC	2	2	TH	ENGS-AEC-121	English
	VEC	2	2	TH	CI-VEC-121	Constitution of India
	IKS	1	1	TH	IKS-121	Indian knowledge system
			2		NCC-CC-121 NSS-CC-121 SPT-CC-121 CUL-CC-121	NCC NSS Sports Cultural
	CC	2		CC		

DSC : Department-Specific Core course
DSE : Department-Specific elective
GE/OE : Generic/ Open elective
SEC : Skill Enhancement Course
MIN : Minor course
AEC : Ability Enhancement Course
VEC : Value Education Courses

ENG : English
ES : Environmental studies
CI : Constitution of India
IKS : Indian Knowledge System
CC : Co-curricular course
TH : Theory
PR : Practical

Exam Pattern

- Each theory and practical course will be of 50 marks comprising of 10 marks internal and 40 marks external examination.

External Theory Examination (30 marks)

- External examination will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks (10 marks each) while the tentative pattern of question papers shall be as follows;
- Q1 (A), Q2 (A) and Q3 (A), each will be of 6 marks (attempt any 2 out of 3 sub-questions).
- Q1 (B), Q2 (B) and Q3 (B), each will be of 4 marks (attempt any 1 out of 2 sub-questions).
- Q4 will be of 10 marks (attempt any 2 out of 3 sub-questions).

External Practical Examination (30 marks):

- Practical examination shall be conducted by the respective department at the end of the semester. Practical examination will be of minimum 3 hours duration and shall be conducted as per schedule. There shall be 05 marks for journal, 10 marks for viva-voce. Certified journal is compulsory to appear for practical examination.

Internal Theory/ Practical Examination (20 marks):

- Internal theory assessment of the student by respective teacher will be comprehensive and continuous, based on written test/ assignment. The written test may comprise of both objective and subjective type questions.
- Internal practical examination should be conducted by respective department as per schedule given. For internal practical examination student should perform at least one major and one minor experiment and should have completed journal.

F. Y. B. Sc
Semester-I
BOT-DSC-111- Economic Botany and Plant Resource Utilization

Total Hours: 30

Credits: 2

Learning objectives	- To understand core concepts of Economic Botany and relate with environment, communities, and ecosystems. - To develop critical understanding on the evolution of concept of organization of new crops/varieties importance of germplasm diversity. - To develop a basic knowledge of taxonomic diversity and important families of economically useful plants. - To increase the awareness and importance of plants & plant products encountered in everyday life.	
Course outcomes	After studying this course the students will be able to : - Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems - Develop critical understanding on the evolution of concept of organization of new crops/varieties, importance of germplasm diversity. - Develop a basic knowledge of taxonomic diversity and important families of economically useful plants - Students get awareness and importance of plants and plant products encountered in everyday life.	
Unit	Topic Particular	Hours
Unit I	Origin and conservation of Cultivated Plants Origin, Importance and domestication: Origin of Agriculture and ancient economic Botany, Vavilov's Centres of Origin and diversity of crop plants, domestication, evaluation, bioprospection, Major plant introductions; Crop domestication and loss of genetic diversity; Germplasm augmentation and conservation: History and importance of germplasm collection. Overview of: Ecogeographical distribution of diversity. General account of : Biotechnology in plant germplasm acquisition, Plant Tissue Culture in disease elimination, in vitro conservation and exchange, cryopreservation.	7
Unit II	Botany, Utilization of Plant Wealth (Cereals, Pulses and Legumes, and Starches) Origin, evolution and biosystematics, morphology, and uses of some selected crops: Cereals: Wheat, Rice. Pluses: Origin, morphology, uses, Importance to man and ecosystem of pulses (Pigeon pea, Chickpea) and Legumes (lab-lab bean, Rice bean,). Morphology, propagation and uses of Sugarcane(for sugar), Potato(for starch).	7
Unit III	Botany, Utilization of Plant Wealth (Spices, Beverages, Oil seeds fats and Essential oils) Spices: Listing of important spices Cloves, Cardamom,(Their botanical name, family and part used. Origin, distribution, ecology, botany, cultivation practices, processing of economic	8

	plant part / product , main chemical constituents, and economic Importance of the Major spices, namely Turmeric, Capsicum. Beverages: Tea and Coffee: Botanical name, family, botanical description, plant part used, chemical constituents and uses. Oil seeds and fats: General description, classification, extraction and uses of groundnut, coconut.	
Unit IV	Botany, Utilization and Processing of Plant Wealth (Medicinal plants, Timber plants). Drug-yielding and Medicinal plants: Major Medicinal Plants : Botany, Uses, Cultivation and Processing of major medicinal plants, namely : Ghrith Kumari (Aloe vera), Gillo (Tinospora), Natural Rubber: Para rubber: tapping, processing and uses Timber plants and Fibres: Introduction, Botanical name, family, common name, plant part used, center of origin, morphology, characteristics and uses of Teak and Shisam. General account of the Fibre yielding plants, Extraction, processing, morphology and uses of fibres, with special reference to Cotton, Coir.	8
References	1. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett Publishers. 2. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). Aush Gyanya : Handbook of Medicinal and Aromatic Plant Cultivation. 3. Kochhar, S.L. (2016). Economic Botany: A Comprehensive Study. 5th Edition. Cambridge 4. Samba Murty, AVSS and Subrahmanyam, N.S. (1989). a text book of Economic Botany. Wiley Eastern Ltd., New Delhi 5. Sambamurty, AVSS and Subrahmanyam, N.S. (2008). A Textbook of Modern Economic Botany. 1st Edition, Paperback . CBS Publishers & Distributors Pvt.Ltd.; 1st edition (4 September 2008) 6. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands. 7. Any local/state/regional flora published by BSI or any other agency.	

F. Y. B. Sc
Semester-I
BOT-DSC-112-Plant Systematics

Total Hours: 30

Credits: 2

Learning objectives	- To classify Plant systematics and recognize the importance of herbarium and Virtual herbarium - To evaluate the Important herbaria and botanical gardens - To interpret the rules of ICN in botanical nomenclature - To assess terms and concepts related to Phylogenetic Systematic - To generalize the characters of the families according to Bentham & Hooker's system of classification.	
Course outcomes	After successful completion of this course, students are expected to: - Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium - Evaluate the Important herbaria and botanical gardens - Interpret the rules of ICN in botanical nomenclature - Assess terms and concepts related to Phylogenetic Systematics - Generalize the characters of the families according to Bentham & Hooker's system of classification.	
Unit	Topic Particular	Hours
Unit I	Significance of Plant systematics and Taxonomic hierarchy Introduction to systematics; Plant Identification, Classification, Nomenclature. Evidences from Palynology, Embryology, Cytology, Phytochemistry and molecular data.	6
Unit II	Botanical Nomenclature and Systems of Classification Principles and rules (ICN); Ranks of classification; author citation, rejection of names, Generic name, species name Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy Systems of classification: Natural, Artificial and Phyllogenetic system of classification , Bentham and Hooker's system of classification with reasons for each class Phyllogenetic system: Engler and Prantle's system	9
Unit III	Field inventory: Importance of Herbarium; Steps involved in herbarium Preparation, botanical gardens : Royal Botanical Garden(Kew), National Botanical Garden(Lucknow), Indian Botanical Garden (Kolkata); Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: intended (yolked) and bracketed keys.,;	6
Unit IV	Families of flowering plants: Morphological characters, Systematic position, Distinguishing characters and Economic importance of families: Malvaceae, Solanaceae, Lamiaceae, Euphorbiaceae and Cannaceae	9
References	- Singh, (2012). <i>Plant Systematics: Theory and Practice</i> Oxford & IBH Pvt. Ltd., NewDelhi.3rdedition. - Jeffrey, C. (1982). <i>An Introduction to Plant Taxonomy</i>. Cambridge University Press,Cambridge.	

	3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). <i>Plant Systematics-A Phylogenetic Approach</i>. Sinauer Associates Inc., U.S.A. 2nd edition. 4. Radford, A.E. (1986). <i>Fundamentals of Plant Systematics</i>. Harper and Row, New York. 5. Sambamurty A.V.S.S. (2005). <i>Taxonomy of Angiosperms</i>. I. K. International Pvt. Ltd., New Delhi. Singh, V., Pande, P. C. & Jain, D. K. (2008). <i>Taxonomy and Economic Botany</i>. Rastogi Publications, Meerut. 6. Pandey, B. P. (2009). <i>A Textbook of Botany Angiosperms</i>. S. Chand and Company Ltd., New Delhi. 7. Hall, B.G. (2011). <i>Phylogenetic Trees Made Easy: A How-To Manual</i>. Sinauer Associates, Inc. USA 8. Any local/state/regional flora published by BSI or any other agency	
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F. Y. B. Sc**Semester-I****BOT-DSC-113: Practical course based on BOT-DSC-111 and BOT-DSC-112****Total Hours: 60****Credits: 2**

Learning Objectives	- To classify Plant systematics and recognize the importance of herbarium and Virtual herbarium - To generalize the characters of the families according to Bentham & Hooker's system of classification - To develop a basic knowledge of taxonomic diversity and important families of economically useful plants. - To increase the awareness and appreciation of plants & plant products encountered in everyday life	
Course Outcomes	After successful completion of this course, students are expected to: - Classify Plant systematics and recognize the importance of herbarium and Virtual herbarium - Generalize the characters of the families according to Bentham & Hooker's system of classification. - Develop a basic knowledge of taxonomic diversity and important families of useful plants - Students get awareness and appreciation of plants and plant products encountered in everyday life	
Sr. No.		
1	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Malvaceae,	4
2	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Solanaceae	4
3	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Euphorbiaceae	4
4	Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Cannaceae	4
5	Field visit (local or outside depending on situation)	4
6	Mounting of a properly dried and pressed specimen of any 10 wild plant with Herbarium label (to be submitted in the record book).	4
7	Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).	4
8	Legumes: chick pea and pigeon pea (habit, fruit, seed structure, micro-chemical tests).	4

9	Sources of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato(habit sketch,tuber morphology, T.S. tuber to show localization of starch grains,	4
10	Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).	4
11	T.S. Sources of oils and fats: Coconut, Groundnut.	4
12	Rubber: specimen, photograph/model of tapping, samples of rubber products.	4
13	Woods: Tectona and Shisam: Specimen.	4
14	Fibre-yielding plants: Cotton and Coir (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre)	4
15	Drug-yielding plants: Specimens of Turmeric and Capsicum.	4
References	1. Sambamurty, AVSS and Subrahmanyam, N.S. (2008). A Textbook of Modern Economic Botany. 1st Edition, Paperback . CBS Publishers & Distributors Pvt.Ltd.; 1st edition (4 September 2008) 2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands. 3. Singh, (2012). <i>Plant Systematics: Theory and Practice</i> Oxford & IBH Pvt. Ltd., NewDelhi.3rdedition. 4. Jeffrey, C. (1982). An Introduction to <i>Plant Taxonomy</i>. Cambridge University Press,Cambridge. 5. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition. 6. Radford, A.E. (1986). Fundamentals of <i>Plant Systematics</i>. Harper and Row, New York. 7. Any local/state/regional flora published by BSI or any other agency. 8. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett Publishers. 9. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). Aush Gyanya : Handbook of Medicinal and Aromatic Plant Cultivation. 10. Kochhar, S.L. (2016). Economic Botany: A Comprehensive Study. 5th Edition. Cambridge	

F. Y. B. Sc
Semester-I
BOT-MIN-111- Medicinal Botany

Total Hours: 30

Credits: 2

Learning objectives	- To recognize the basic medicinal plants - To apply techniques of conservation and propagation of medicinal plants. - To setup process of harvesting, drying and storage of medicinal herbs - To propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India	
Course outcomes	After successful completion of this course, students are expected to: - Recognize the basic medicinal plants - Apply techniques of conservation and propagation of medicinal plants. - Setup process of harvesting, drying and storage of medicinal herbs - Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India	
Unit	Topic Particular	Hours
Unit I	History and Traditional Systems of Medicine History, Scope and Importance of Medicinal Plants; Traditional systems of medicine; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments. <u>Unani</u> : History, concept: Al Umoor al tabiyyah, tumors treatments/therapy, polyherbal formulations.	7
Unit II	Conservation and Augmentation Conservation of Endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens..	8
Unit III	Ethnobotany and Folk Medicine Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, ethnomedicine,	7
Unit IV	Brief description of selected plants and derived drugs, namely Guggul (<i>Commiphora</i>) Arjuna (<i>Terminalia arjuna</i>) for cardioprotection, turmeric (<i>Curcuma longa</i>) for wound healing, antioxidant and anticancer properties, Cincona and Artemisia for Malaria, Rauwolfia as tranquilizer,	8
References	- Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press. - AYUSH (www.indianmedicine.nic.in). <i>About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy</i>. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India. - CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). <i>Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation</i>. - Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. <i>Current Science</i> 73:909–928.	

	5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16th edn. Philadelphia, PA: Elsevier Saunders Ltd. 6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi 7. Kapoor, L. D. (2001). <i>Handbook of Ayurvedic medicinal plants</i>. Boca Raton, FL: CRC Press. 8. Saroya, A.S. (2017). Ethnobotany. ICAR publication. 9. Sharma, R. (2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House. 10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi. 11. Thakur, R. S., H. S. Puri, and Husain, A. (1989). <i>Major medicinal plants of India</i>. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.	
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F. Y. B. Sc
Semester-I
BOT-MIN-112: Practical based on BOT-MIN-111

Total Hours: 60

Credits: 2

Learning Objectives	To demonstration and practice cultural practices for seed / vegetative / clonally propagated medicinal plants (Mentha arvensis, Satavari, Aloe vera etc.)	
Course Outcomes	After successful completion of this course, students are expected to: • Demonstration and practice of cultural practices for seed / vegetative / clonally propagated medicinal plants (Mentha arvensis, Satava, Aloe vera etc.)	
Sr. No.		
1	Harvesting, drying, storage (Stevia, Kalmegh and Satavar)	4
2	Harvesting, drying, storage (Stevia, Kalmegh and Satavar)	4
3	Harvesting, drying, storage (Stevia, Kalmegh and Satavar)	4
4	Harvesting of Mints, Basil	4
5	Distillation of Mints	4
6	Distillation of Basil	4
7	Extraction of alkaloids form Ashwagandha	4
8	Extraction of Withanaloids from Ashwagandha	4
9	To study harvesting, drying grading, and value addition techniques for medicinal plants.	4
10	To study storage, processing for medicinal plants.	4

11	To study value addition techniques for medicinal plants.	4
12	To study harvesting techniques of aromatic plants.	4
13	To study drying grading of aromatic	4
14	To study storage and processing of aromatic plants	4
15	To study value addition techniques of aromatic plants	4
References	1. AYUSH (www.indianmedicine.nic.in). <i>About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy</i>. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India. 2. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). <i>Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation</i>. 3. Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. <i>Current Science</i> 73:909–928. 4. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16th edn. Philadelphia, PA: Elsevier Saunders Ltd. 5. Jain, S.K. and Jain, Vartika. (eds.) (2017). <i>Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects</i>. Deep Publications, Delhi 6. Sharma, R. (2003). <i>Medicinal Plants of India-An Encyclopaedia</i>. Delhi: Daya Publishing House.	

F. Y. B. Sc
Semester-I
BOT-OE-111-Mushroom Culture Technology

Total Hours: 30

Credits: 2

Learning objectives	• To study various types and categories of mushrooms. • To demonstrate various types of mushroom cultivation technologies. • To examine various types of food technologies associated with mushroom industry. • To know the value of economic factors associated with mushroom cultivation • To device new methods and strategies to contribute to mushroom production
Course outcomes	After successful completion of this course, students are expected to: • Recall various types and categories of mushrooms. • Demonstrate various types of mushroom cultivating technologies. • Examine various types of food technologies associated with mushroom industry. • Value the economic factors associated with mushroom cultivation • Device new methods and strategies to contribute to mushroom production.

Unit	Topic Particular	Hours
Unit I	Introduction, History. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - <i>Volvariella volvacea</i> , <i>Pleurotus citrinopileatus</i> , <i>Agaricus bisporus</i> .	7
Unit II	Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparations of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation- Low cost technology; Composting technology in mushroom production.	8
Unit III	Storage and nutrition: Short-term storage (Refrigeration – up to 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.	8
Unit IV	Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.	7
References	1. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore. 2. Swaminathan, M. (1990). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018. 3. Tewari, P. and Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi. 4. Bahl, N. (1984-1988). Hand book of Mushrooms, II Edition, Vol. I & Vol. II.	

F. Y. B. Sc
Semester-I
BOT-SEC-111-Industrial and Environmental Microbiology

Total Hours: 30

Credits: 2

Learning objectives	• To understand the concept and role of microbes in industry and environment. • To critically analyze the types of bioreactors and the fermentation process. • To evaluate the role of microorganisms in industry and microbes in agriculture. • To reflect upon different Landscaping practices and garden design • To develop skills on the remediation process of contaminated soils
Course outcomes	After successful completion of this course, students are expected to: • Understand the concept and role of microbes in industry and environment. • Critically analyze the types of bioreactors and the fermentation process. • Evaluate the role of microorganisms in industry and microbes in agriculture. • Reflect upon different Landscaping practices and garden design • Develop skills on the remediation process of contaminated soils

Unit	Topic Particular	Hours
Unit I	Scope & Use of Fermentation and Bioreactor Technology An introduction to fermentation process; History, scope, range, equipment, kinetics of growth and product formation. Solid-state and liquid-state (stationary and submerged) fermentations; Batch, Fed-batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilot-scale and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. Isolation, preservation and improvement of industrially important microorganisms, Media for Industrial Process, Sterilization, Development of inoculums for industrial process, aeration.	7
Unit II	Microbial Production of Industrial Products and Important Enzymes Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol), antibiotic (Penicillin), vinegar and microbial cells.	8
Unit III	Micro-Organisms for Fermentation Microorganisms for industrial applications and hands-on-screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).	8
Unit IV	Microbes and Role in Environment for Agriculture and Remediation of Contaminated Soils. Microbiology of air (Aeromicrobiology), nature of bioaerosol, launching and control of bioaerosol, Aeromicrobiology of building, hospital and waste deposition site, aeroallergens, pollen allergy, Soil surface and sub-surface soil microbiology, distribution of microbes in air; Isolation of microorganisms from soil, air and water, biogeochemical cycle (nitrogen). Aquatic microbiology-Freshwater, brackish water, estuaries and marine. Water pollution, role of microbes in sewage and domestic waste water treatment systems. Secondary treatment of waste water, Activated sludge, Microorganisms as indicators of water quality, coliform and fecal coliform in water samples. Determination of BOD, COD, TDS and TOC of water samples. Biological N ₂ -fixation; Phosphate solubilization, plant growth promoting rhizobacteria (PGPR), Mycorrhizae; Bioremediation of contaminated soils, arbuscular mycorrhizal colonization in plant roots <i>Rhizobium</i> –legume symbiosis, Biocontrol.	7
References	1. Pelzar, M.J. Jr., Chen E.C. S. and Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi. 2. Tortora, G.J., Funke, B.R. and Case, C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition. 3. Casia, J.R.L.E (2009) Industrial Microbiology. New Age International (P) Ltd. Publisher, New Delhi 4. Stanbury, P. F., Whitaker, A. and Hall, S.J. (1979). Principles of Fermentation Technology. Aditya Books (P) Ltd., New Delhi. 5. Atlas and Bartha (2000). Microbial Ecology. Benjamin Cummings.	

F. Y. B. Sc
Semester-I
BOT-SEC-112: Practical course based on BOT-SEC-111

Total Hours: 30

Credits: 1

Learning Objectives	- To teach the students about instrument handling and laboratory safety measures - To provide the practical knowledge of sterilization techniques and production of acids	
Course Outcomes	After successful completion of this course, students are expected to: - Handle instruments safely and also learn laboratory safety measures - Acquire the knowledge of sterilization techniques and acid production	
Sr. No.		
1	Principles of instruments in microbiology laboratory	4
2	Functioning of instruments in microbiology laboratory	4
3	Hands on sterilization techniques	4
4	Preparation of different culture media.	4
5	Preparation of different culture media.	4
7	Serial dilution, pour plate technique,	4
8	Streak plate technique.	4
9	Microbial production of citric acid I	4
10	Microbial production of citric acid II.	4
11	Microbial production of cellulase enzyme I	4
12	Microbial production of cellulase enzyme II	4
13	Microbial production of ethanol.	4
14	Microbial production of penicillin.	4
15	A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.	4
Referances:	1. Practical Microbiology, R. K. Dubey, D. K. Maheshwari. S. Chand Publication. 2. Industrial exploitation of micro-organisms R. C. Dubey, D. K. Maheshwari. I K International publishing house. 3. Microbiology practical manual Amita Jain. Elsevier publisher.	

F. Y. B. Sc
Semester-II
BOT-DSC-121-Anatomy of Angiosperms

Total Hours: 30

Credits: 2

Learning objectives	•To develop an understanding of concepts and fundamentals of plant anatomy •To examine the internal anatomy of plant systems and organs •To develop critical understanding on the evolution of concept of organization of shoot and root apex. •To evaluate the adaptive and protective systems of plants	
Course outcomes	After successful completion of this course, students are expected to: •Develop an understanding of concepts and fundamentals of plant anatomy •Examine the internal anatomy of plant systems and organs •Develop critical understanding on the evolution of concept of organization of shoot and root apex. •Evaluate the adaptive and protective systems of plants	
Unit	Topic Particular	Hours
Unit I	Introduction to plant anatomy and plant body Internal organization of plant body: tissue system, types of cells and tissues. Classification of tissues; Simple and complex tissues, Hydathodes, cavities, lithocysts and laticifers	7
Unit II	Apical meristems Evolution of concept of organization of shoot apex continuing meristematic tissues, types of vascular bundles; Structure of dicot and monocot stem. Structure of dicot and monocot leaf, . Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.	8
Unit III	Adaptive and Protective Systems Introduction to Epidermal tissue system, cuticle, trichomes, stomata (structure, function and classification);Secretory tissue sytem, Anatomical adaptations of xerophytes, mesophytes and hydrophytes.	8
Unit IV	Vascular Cambium and Wood Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Anomalous secondary growth; Sapwood and heartwood;	7
References	1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA. 2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA. 3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA. 4. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. 5. Any local/state/regional flora published by BSI or any other agency	

F. Y. B. Sc
Semester-II
BOT-DSC-122-Elements of Plant Breeding

Total Hours: 30

Credits: 2

Learning objectives	- To develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool. - To familiarize with genetic basis of heterosis. - To classify Sexual and Asexual modes of reproduction. - To Reflect upon the role of various non- conventional methods used in crop improvement.	
Course outcomes	After successful completion of this course, students are expected to: - Develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool. - Familiarize with genetic basis of heterosis. - Classify Sexual and Asexual modes of reproduction in plants. - Reflect upon the role of various non- conventional methods used in crop improvement.	
Unit	Topic Particular	Hours
Unit I	Nature and Scope of Plant Breeding Introduction and objectives of Plant Breeding, Intertype Concept, Major International and National Plant Breeding Institutes / Centers, Some reputed Indian and International Plant Breeders, Significant achievements of plant breeding (Semi-dwarf wheat and rice, Mobilization of Indian Canes, Hybrid Millets, Hybrid Cotton, Disease resistance and Transgenic varieties), Crop Genetic Resources and Centers of Diversity, Exploration and Collection, Origin and domestication of major crop plants; Basics of Gene Banks.	7
Unit II	Methods of Crop Improvement Reproduction, Pollination and Mating Systems: Mitosis and Meiosis, Modes of Reproduction (vegetative, asexual, apomixes, sexual), Pollination and mating systems, Male Sterility: Genetic, Cytoplasmic and Cytoplasmic Genetic male sterility, Chemically induced male sterility; Methods of Plant Breeding: Introduction, Acclimatization; Domestication; Selection methods for : Self-pollinated, Cross-pollinated and vegetative and clonal propagation; Hybridization: For self, cross and vegetatively propagated plants – Basics of Procedure, advantages and limitations; Procedure for Release of varieties and IPR rights.	8
Unit III	Quantitative Inheritance, Heterosis and Inbreeding Depression Concept of quantitative characters: Monogenic vs polygenic Inheritance; Multiple factor hypothesis, heritability and Examples of inheritance of Kernel colour in wheat, Skin colour in human beings. Heterosis and Inbreeding depression: History, Genetic basis of Heterosis and Inbreeding Depression (Dominance, Over-dominance and Epistasis hypothesis); Application of Heterosis	8
Unit IV	Non-conventional Methods in Crop improvement and Biotechnology Mutations: Spontaneous and Induced Mutations; Artificial Induction of Mutations, Role of mutations in Plant breeding; Polyploidy: Autopolyploidy and Allopolyploidy and their role in Evolution and crop improvement, Induction of Polyploidy, Biotechnology in crop improvement: Scope and	7

	Importance of Biotechnology in India; Cell, Tissue and Organ Culture, Elements of Somatic Hybridization; Molecular markers; Transgenics – scope and limitations; Bt-Cotton.	
References	1. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition. 2. Das, L.D. Vijendra (2006) Plant Breeding. New Age International Publishers, New Delhi. 3. Sharma, J.R.(1994) : Principles and practices of Plant Breeding. Tata McGraw-Hill Publishing Company Ltd. , New Delhi 4. Singh, B.D. (2012). Plant Breeding: Principles and Methods. Kalyani Publishers. 9th edition. 5. Singh, Phundan (1996): Essentials of Plant Breeding. Kalyani Publishers, New Delhi-2.	

F. Y. B. Sc

Semester-II

BOT-DSC-123 - Practical course based on BOT-DSC-121 and 122

Total Hours: 60

Credits: 2

Learning Objectives	• To develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool. • To familiarize with plant tissues. • To understand effect of chemical mutagenes on seed germination. • To familiarize with the stem of monocot and dicot plant	
Course Outcomes	After successful completion of this course, students are expected to: • Understand plant genetic resources, plant breeding, gene bank and gene pool. • Familiarize with plant tissues. • Understand effect of chemical mutagenes on seed germination. • Familiarize with the stem of monocot and dicot plant	
Sr. No.		
1	Study of anatomical details through permanent slides/temporary stain mounts/ macerations/museum specimens with the help of suitable examples or experimentally	
2	Study of meristem (Permanent slides/ Photographs)	4
3	Study of Simple Tissues: Parenchyma, Collenchyma and Sclerenchyma (Permanent Slides/ Photographs)	4
4	Study of Macerated xylem and phloem elements (Permanent slides/ Photographs).	4
5	Study of structure of Stem: monocot, dicot - primary structure	4
6	Study of primary structure of dicot root (Sunflower) and monocot root (Maize) (Permanent slides).	4
7	Study of anatomy of Dicot leaf , monocot leaf (Permanent slide)	4
8	Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials	4

9	Adaptive Anatomy: xerophytes, hydrophytes	4
10	Secretory tissues: cavities, lithocysts and laticifers.	4
11	Methods of emasculation , bagging, tagging(Wheat, Barley, Mustard, Pigeon pea, Cotton)	4
12	Pollen viability test	4
13	Seed viability test	4
14	Effect of radiation and chemical mutagens on seed germination, seedling growth and cell division (mitotic index).	4
15	More Practical may be added depending on the local habitats and available facilities	4
References:	1. Practical Botany Vol II B. P. Pandey. S. Chand publications 2. Practical Botany, Bendre Kumar., Rastogi publication. 3. Practical Handbook of Plant Breeding, Vikas Pali. Kalyani publications.	

F. Y. B. Sc
Semester-II
BOT-MIN-121-Phytochemistry

Total Hours: 30

Credits: 2

Learning objectives	- To give the knowledge of fundamental concepts of phytochemistry - To develop the skills of cold and hot solvent extraction. - To examine the solvent fractionation. - To evaluate the process of screening each fraction for plant pathogens or human pathogens	
Course outcomes	After successful completion of this course, students are expected to: - Understand the fundamental concepts of phytochemistry - Develop the skills of cold and hot solvent extraction. - Examine the solvent fractionation. - Evaluate the process of screening each fraction for plant pathogens or human pathogens	
Unit	Topic Particular	Hours
Unit I	Introduction and scope of photochemistry. Screening of phytochemicals by different chemical methods (general account). Laboratory safety and basic laboratory operation. Extraction methods - All the techniques and apparatuses that will be used to extract the active constituents of the plants (Solvent extraction methods, maceration method, distillation unit, soxhlet apparatus and chromatography)	7
Unit II	Extraction of tannins - Review the meaning of tannins and its classification - List the part and scientific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	7

Unit III	Identification of flavonoids - Review the meaning of flavonoid glycoside and its classification - List the part and scientific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	8
Unit IV	Volatile oils: - Review the meaning of volatile oils and its classification - List the part and ific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	8
References	1. Harborne. J.B. (1998).Phytochemical methods. A guide to modern techniques of Plant Anlysis. 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. CRC press. 5. ‘Phytochemical methods’ A guide to modern techniques of plant analysis 3rd edition, J. B. Harborne. 6. ‘An Introduction to Phytochemical Analysis’, Adheena Elza Johns. Notion press. 7. ‘Practicals in commercial Botany and phytochemical analysis’, O. P. Sharma.. Pragati publishers.	

F. Y. B. Sc
Semester-II
BOT-MIN-122- Practical based on BOT-MIN-121

Total Hours: 60

Credits: 2

Learning objectives	- To give the understanding of the fundamental concepts of phytochemistry - To develop the skills of cold and hot solvent extraction. - To examine the solvent fractionation. - To evaluate the process of screening each fraction for plant pathogens or human pathogens	
Course outcomes	After successful completion of this course, students are expected to: - Understand the fundamental concepts of phytochemistry - Develop the skills of cold and hot solvent extraction. - Examine the solvent fractionation. - Evaluate the process of screening each fraction for plant pathogens or human pathogens	
Unit	Topic Particular	Hours
1-2	Laboratory safety and basic laboratory operation.	08
3-5	Extraction methods - Explain all the techniques and apparatuses that will be used to extract the active constituents of the plants	12
6-9	Extraction of tannins - Review the meaning of tannins and its classification - List the part and scientific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	16
10-12	Identification of flavonoids - Review the meaning of flavonoid glycoside and its classification - List the part and scientific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	12
13-15	Volatile oils: - Review the meaning of volatile oils and its classification - List the part and scientific plant name - List the solvents used in extraction - Discuss tests used for identification - Analyze and evaluate the result of work - Perform good laboratory report writing	12
References	- Harborne. J.B. (1998). Phytochemical methods. A guide to modern techniques of Plant Analysis. Chapman and Hall publication, London - 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. CRC press. 5. 'Phytochemical methods' A guide to modern techniques of plant analysis 3rd edition, J. B. Harborne. 6. 'An Introduction to Phytochemical Analysis', Adheena Elza Johns. Notion press. 7. 'Practicals in commercial Botany and phytochemical analysis', O. P. Sharma.. Pragati publishers.	
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F. Y. B. Sc
Semester-II
BOT-OE-121-Food Science

Total Hours: 30

Credits: 2

Learning objectives	•To classify the proteins, lipids and Minerals in food chemistry •To recognize Sources of microorganisms and food borne illness •To evaluate the food Processing industries and preservation techniques •To comprehend the interrelationships among different components of beverages technology and Check Food Packaging	
Course outcomes	After successful completion of this course, students are expected to: •Classify the proteins, lipids and Minerals in food chemistry •Recognize Sources of microorganisms and food borne illness •Evaluate the food Processing industries and preservation techniques •Comprehend the interrelationships among different components of beverages technology and Check Food Packaging	
Unit	Topic Particular	Hours
Unit I	Food Chemistry: Sources and Classification of Carbohydrates, proteins, lipids and Minerals. Participation in metabolic pathways.	7
Unit II	Food Microbiology: Sources of microorganisms in food, Principles of food spoilage, food borne illness. Food Processing: Dairy industry, Fruit processing, meat industry, processing and preservation. Beverages technology: Coffee, beer and wine etc.	8
Unit III	Nutrition, Nutraceuticals and functional foods: Classification and characteristics of functional foods. Processing technology and incorporation. Food Toxins: Natural, microbial and chemical toxins in food processing. Food Packaging: Aseptic and Packaging of specific foods, fruits, vegetables, dairy products, cereals snacks etc.	8
Unit IV	Food laws and quality control: Food safety and standard act (2006) and other Indian and International standards. Food Biotechnology: Biotechnology in food industry, production of biocolours, flavours, vitamins, biopreservatives, antibiotics and industrial alcohol. Genetically modified foods.	7

References	1. Damodaran, S., Parkin, K.L. and Owen, R. (2008). Fennema's Food Chemistry . CRC Press. 2. Chopra, H. K. and Penesor, P.S. (2010). Food Chemistry. Narosa Publishing (2010). 3. Pelczar, M.J. and Michael, J. (1999). Microbiology. McGraw-Hill. 4. Jay, J.M. (2005). Modern Food Microbiology (7th edition) by Golden Food Science Text Series. 5. Frazier, W.C. and Weshoff, D.C. (2015). Food Microbiology (5th edition) McGraw- Hill. 6. Kumari, S. (2012). Basics of Food Biochemistry and Microbiology. Koros Press. 7. Whitaker. J.R. (2016). Handbook of Food Enzymology. CRC press 8. Shewfelt, R.L.(2013). Introducing Food Science. CRC Press. 9. Smith, J.S. and Hui, Y.H.(2014) Food Processing. Wiley. 10. Varzakas, T. and Tzia, C. (2016). Handbook of Food Processing. CRC Press. 11. Potter, N. N.(2007). Food Science. CBS Publishers.	
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F. Y. B. Sc
Semester-II
BOT-SEC-121- Commercial Forestry

Total Hours: 30

Credits: 2

Learning objectives	• To give the knowledge of basic facts about forests and recognize diseases of commercial forestry • To evaluate the Marketing channels, costs, margins and price spread and its applications. • To explain the role of public and private agencies in marketing of forest • To interpret Total and Relative Growth rate of forests and assess international trade in timber and non-timber forestry	
Course outcomes	After the end of the course, the students will be able to: • Know the basic facts about forests and recognize diseases of commercial forestry • Evaluate the Marketing channels, costs, margins and price spread and its applications. • Explain the role of public and private agencies in marketing of forest • Interpret Total and Relative Growth rate of forests and assess international trade in timber and non-timber forestry	
Unit	Topic Particular	Hours
Unit I	Basics of forests, Forestry, Characteristics, Types of forest, Production and Commercial Forestry techniques, commercial growing of forest plants and forest nursery, Trees for commercial forestry, Growth rate- Total and Relative Growth rate, History of commercial forestry in India, Diseases of commercial forestry, maintenance of forests, Protection from fire, illicit felling, Measurement of Trees- Height, girth, wood density, wood quality, clear and selective felling.	8

Unit II	Nature and scope of marketing: Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets. Marketing channels, costs, margins and price spread - concepts and applications.	8
Unit III	Concepts of market integration and marketing efficiency: Role of public and private agencies in marketing of forest produce. Market inefficiencies in the trade of forest produce and measures to check the same.	7
Unit IV	Fundamentals of international trade: Domestic and international trade in timber and non- timber forestry output, Demand forecasts - concept and methods: WTO - background, structure, functions and decision making process. IPRs and their implications for forestry and allied sectors in the country.	7
References	1. Belcher, B.M. (1998). A production-to-consumption systems approach: Lessons from the bamboo and rattan sectors in Asia. In: Wollenberg, E and A. Ingles (eds.). Incomes from the forest: methods for the development and conservation of forest products for local communities. Center for International Forestry Research (CIFOR), Bogor, Indonesia. 2. Chomitz, K.M., with P. Buys, G. De Luca, T. S. Thomas, and S. Wertz-Kanounnikoff. (2007). Incentives and constraints shape forest outcomes. In: At loggerheads? Agricultural expansion, poverty reduction and environment in tropical forests. The World Bank, Washington, DC. Available at: http://www.wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2006/10/19/0001012742_20061019150049/Rendered/PDF/367890Loggerheads0Report.pdf. 3. FAO (1986). Guidelines to Practical Project Appraisal. Natraj Pub. Kerr JM, Marothia DK, Singh K, Ramaswamy C and Beritley WR. 1997. Natural Resource Economics : Theory and Applications in India. Oxford & IBH. 4. Nautiyal, J.C. (1988). Forest Economics – Principles and Applications. Natraj Publications, Dehra Dun. 5. Sagreiya, K.P. (1979). Forests and Forestry. National Book Trust, India, New Delhi, P1-307. 6. Sharma, L.C. (1980). Forest Economics, Planning and Management. International Book Distributors, Dehra Dun.	

F. Y. B. Sc

Semester-II

BOT-SEC-122-Practical based on BOT-SEC-121

Total Hours: 30

Credits: 1

Learning objectives	• To give the knowledge of basic facts about forests and recognize diseases of commercial forestry • To evaluate the Marketing channels, costs, margins and price spread and its applications. • To explain the role of public and private agencies in marketing of forest • To interpret Total and Relative Growth rate of forests and assess international trade in timber and non-timber forestry
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Course outcomes	After the end of the course, the students will be able to: • Know the basic facts about forests and recognize diseases of commercial forestry • Evaluate the Marketing channels, costs, margins and price spread and its applications. • Explain the role of public and private agencies in marketing of forest • Interpret Total and Relative Growth rate of forests and assess international trade in timber and non-timber forestry	
Practical	Topic Particular	Hours
1	Identification of tree-species of the Campus and its classification according to uses and preparation of herbarium	4
2	Measurements of diameter-girth and basal area of trees using Calipers, Tape, Ruler, Pentaprism Tree Caliper etc and height using non instrumental method and Instrumental methods like Hypsometer, Ravi Multimeter, Abney level	4
3	Volume estimation of logs and standing trees using Quarter girth formula	4
4	Study of Natural regeneration in forest area and mode of regeneration	4
5	Planning and layout of forest plantations, Choice of species, methods of planting and after care	4
6	Exercise on tree nursery practice- seed collection, seed pre-treatment, bed preparation and sowing	4
7	Field exercise on various tending operations in forest/plantations like thinning, pruning, climber removal etc.	4
8	Study of Traditional agroforestry systems in the region and visits to some of the local agroforestry systems and recording its components.	4
9	Study of Tree Architecture, structure and growth of trees, crown and root architecture	4
10	Identification of trees suitable for Windbreaks & Shelterbelts, Fodder etc.	4
11	Cultivation practices of two important fast growing tree species of the region.	4
12	Practicals based on Silviculture : To study different developmental stages of tree growth and its structure.	4
13	To study different planting methods/techniques.	4
14	To execute the field preparation by marking, alignment and stacking in planting site.	4
15	Visit to forest plantation and study of its growth and general condition of plantation	4
	References: 1. 'Handbook of Practical Forestry', Pankaj Panwar, S. D. Bharadwaj 2. 'Indian Forestry' 8th edition K Manikandan, S Prabhu. Jain Brothers. 3. 'Textbook of An Introduction to Forestry' , Nirakar Bhol, V K Mishra Sanjeev Kumar Chauhan. Kalyani Publishers. 4. 'Introduction to Forestry', S. R Reddy, C. Nagamani. Kalyani publishers	