Department of Undergraduate Botany

B.Sc. – Botany Programme (CBCS)

(With effect from June 2015)

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	I	***12XX	TAM/HIN/FRE	3	2	30
	II	ENG1201	Conversational Skills	3	2	30
	IIIC	BOT1531	Ecology	5	5	75
	IIIC	BOT1433	Learning Basic Skills In Biology(LBSB)	4	4	60
	IIIC	BOT1435	LAB I (Ecology and LBSB)	4	4	60
	IIIS	CHE13XX	Chemistry for Botanist -1(theory)	3	3	45
	IIIS	CHE11XX	Chemistry for Botanist -1(lab)	2	1	15
	IVE	***12XX	Basic Tamil/Adv.Tamil/Non-Major	3	2	30
	IVLS	***12XX	Life Skill -1	3	2	30
	V	***11XX	NCA/NCN/NSS/PED/SLP		-	
			Total	**30**	**25**	
2	I	***12XX	TAM/HIN/FRE	3	2	30
	II	ENG1202	Reading and Writing Skills	3	2	30
	IIIC	BOT1532	Economic Botany	5	5	75
	IIIC	BOT1434	Horticulture Practices and Post-Harvest Technology (HPPHT)	4	4	60
	IIIC	BOT1436	LAB II (Economic Botany and HPPHT)	4	4	60
	IIIS	CHE13XX	Chemistry for Botanist – 2(theory)	3	3	45
	IIIS	CHE11XX	Chemistry for Botanist – 2 (lab)	2	1	15
	IVE	***12XX	Basic Tamil/Adv.Tamil/Non-Major	3	2	30
	IVLS	***12XX	Life Skill -2	3	2	30
	V	***11XX	NCA/NCN/NSS/PED/SLP		1	
			Total	**30**	**25+1**	
3	I	***22XX	TAM/HIN/FRE	3	2	30
	II	ENG2201	Study Skills	3	2	30
	IIIC	BOT2531	Microbiology and Phycology	5	5	75
	IIIC	BOT2533	Archegoniatae	5	5	75
	IIIC	BOT2335	Genetics and Plant Breeding	3	3	45
	IIIC	BOT2637	LAB III (Micro+Arche +Genetics)	2+2+2	6	90
	IIIS	ZOO2349	General Zoology-I	3	3	45
	IIIS	ZOO2151	Lab in General Zoology-I	2	1	15
	V	***21XX	NCA/NCN/NSS/PED/SLP			
			Total	**30**	**27**	
4	I	***22XX	TAM/HIN/FRE	3	2	30
	II	ENG2202	Career Skills	3	2	30
	IIIC	BOT2552	Mycology and Pathology	5	5	75
	IIIC	BOT2444	Cell Biology	4	4	60

	IIIC	BOT2436	Anatomy and Reproductive Biology of Angiosperms (ARBA)	4	4	60
	IIIC	BOT2638	LAB IV (Myco+Cellbio+ARBA	6	6	90
	IIIS	ZOO2350	General Zoology II	3	3	45
	IIIS	ZOO2152	Lab in General Zoology II	2	1	15
	V	***21XX	NCA/NCN/NSS/PED/SLP		1	
			Total	**30**	**27+1**	

Semester	**Part**	**Course No.**	**Course Title**	**Hr.**	**Cr.**	**Marks**
5	IIIC	BOT 3631	Plant Systematics	6	6	90
	IIIC	BOT3633	Biochemistry	6	6	90
	IIIC	BOT3535	Analytical Techniques and Research Methodology	5	5	75
	IIIC	BOT3637	LAB – V (Systematics + Biochem)	3+3	6	90
	IVLS	***32XX	Life Skill - 3	3	2	30
	IVEVS	BOT 3200	Environmental Studies	4	2	30
				30	**27**	
6	IIIC	BOT3832	Plant Biotechnology (Lab cum Theory)	5+3L	8	75+45
	IIIC	BOT3434	Entrepreneurial Botany	4	4	60
	IIIC	BOT3536	Bioresource Management	5	5	75
		BOT3538	Botany Project			
	IIIC	BOT3642	Plant Physiology (Lab cum Theory)	4+2L	6	60+30
	IVLS	***32XX	Life Skill IV	3	2	30
	IVVE	VAL32XX	Value Education	4	2	30
			Total	**30**	**27**	

Supportive Courses

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	IIIS	BOT1341	Plant Biology I (theory)	3	3	45
1	IIIS	BOT1143	Plant Biology I (lab)	2	1	15
2	IIIS	BOT1342	Plant Biology II (theory)	3	3	45
2	IIIS	BOT1144	Plant Biology II (lab)	2	1	15
3	IIIS	BOT2345	Botany for Chemists- I (theory)	3	3	45
3	IIIS	BOT2147	Botany for Chemists – I (lab)	2	1	15
4	IIIS	BOT2346	Botany for Chemists- II(theory)	3	3	45
4	IIIS	BOT2148	Botany for Chemists – II (lab)	2	1	15

Life Skill Courses

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	IVLS	BOT1231	Mushroom Culture Technology	3	2	30
2	IVLS	BOT1236	Nursery and Gardening	3	2	30
5	IVLS	BOT3239	Medicinal Botany	3	2	30
6	IVLS	BOT3240	Biofertilizers and Bio-Pesticide	3	2	30

Non Major Courses

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	IVE	BOT1233	Food and Nutrition	3	2	30
2	IVE	BOT1238	Plant Wonders	3	2	30

Programme Specific Outcomes (PSOs) for Undergraduates

1. Identify the diversity of nature to pursue his own career opportunity without disturbing the ecological balances.

2. Subscribe to the idea of climate conscious approaches while dealing with development activities

3. Probe new avenues in plant biology and pursue research

4. Explore suitable biotechnological approaches to develop the bio-entrepreneurship

5. Employ themselves in bio-based industries that offer Green jobs.

6. Evaluate and manage bioresources without bias and profiteering motives

7. Get back to the community as leaders and do such things that will appreciate the diverseness and togetherness in harmony with nature.

8. Draw from biotic associations in nature insights on to manoeuvre positive and negative influences that are essential for communal co living and societal interferences.

9. Learn from plants the idea of adaptations and acclimatization to entrain themselves to remain steadfast rather than running away from difficult situations.

10. Translate the idea of grand unification of life to draw lessons of pluralism and inclusivity.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Total
PSO1	5	4	3	5	5	4	5	3	5	4	42
PSO2	4	4	3	4	4	5	4	3	4	5	40
PSO3	4	5	4	4	4	5	4	3	4	4	41
PSO4	4	4	3	3	4	4	4	3	4	5	38
PSO5	5	4	4	4	5	4	4	4	4	4	42
PSO6	5	5	4	4	5	5	5	4	4	4	45
PSO7	3	4	4	4	5	4	4	3	4	4	39
PSO8	5	5	4	3	3	5	3	2	5	5	40
PSO9	5	5	4	3	3	4	4	2	4	4	38
PSO10	5	5	4	4	4	4	3	3	4	4	40
Mean 405/100 =4.05											

BOT 1531 **ECOLOGY** **5Hr./5Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	75	60	-	10	5

PREAMBLE: This course is designed for a fresher who steps in to the world of plants with an intent of aesthetically appreciating it. The study material is prepared to introduce the basics of botany and also help to study environment with floristic perspective. The course is aimed at giving ample material on plant based interaction for better understanding of the surrounding. Further the content will focus on the local knowledge on agriculture and the natural resource management and traditional practices of the local community in their day today life. After the completion of this course the student will be able to understand and appreciate the traditional knowledge and natural resources around him.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: understand the climatological changes and apply his knowledge in taking suitable initiatives to protect and conserve life support systems	1	15
CO2: analyze the extent of degradation in the floristic components and the water resources and offer suitable and viable solutions to mitigate the damage.	2	15
CO3: connect himself as co-inhabitant in nature and realize the extent of anthropogenic damages done and offer solutions refurbish, conserve and manage the native and exotic resources through sustainable utilization.	3	15
CO4: assess the extent of environmental degradation in urban Madurai and join the initiatives of city administration in developing and ensuring a clean and green Madurai.	4	15
CO5: quantify the natural wealth and resources by using appropriate field methods to maintain the environmental serenity and take efforts to enhance the ecological elegance.	5	15

SYLLABUS

Unit 1: Climate and Geography

Global, regional and local climatic conditions- a overview- Basic elements of Maps and global contour- Landscape Mapping- Altitudinal Zonation and forest types of Taamilnadu- Coastal to Climax Types- Significance of Forests and Grasslands- Elements of Forest mapping and application. Global Climate Change and its Imapact on Landscape transformation.

Unit 2: Ecological History

Traditional classification of Landscapes and Landscape Elements- Sacred Grooves, Nandavanam and other Sacred elements- Sangam Literature and land use pattern- Plants and Animals of socio-religious importance in Madurai- Ecological History of western Ghats and Vaigai Delta- Cultural ecology of Madurai City.

Unit 3: Human Ecology

Ecology of Earth before and after the evolution of *Homo sapiens*- Introduction to Evolution (origin of life- Basics of evolution and coevolution- Origin of Species- Contributions of Darwin, Lamarck, Urey

and Miller- tree of life- Origin of human)- Anthropogenic Impacts- Human population explosion and demographic changes- Impact on Animal and Plant population- Impact of agriculture; Native, exotic, and invasive species- valvilovian centre of Origin- Green revolution- Genetically Modified Crops.

Unit 4: Urban Ecology(Madurai)

Impact of urbanization and Tourism- Cultural Eutrophication of Vaigai River- Irrigation practices in Madurai- Interlinking of Vaigai and Cauvery- Land use conflicts in urban and rural areas of Madurai- Agrobiodiversity and Monoculture in Madurai- Solid waste management and pollution Monitoring at Madurai.

Unit 5: Vegetation and Floristic Elements

Estimation of number of species and number of individuals of a species at a given geographical area- College/School/Hospital campus/Parks/temples- Distribution of trees and other aesthetically important species in Madurai – Field ecologicay: Quadrat (frequency, density and abundance) Transact (belt and line) – Visualization of Composition, Structure and Origin of Community.

REFERENCES

1. Anonymous, 2011. Handbook of Agriculture, Indian council of Agricultural Research KrishiAnusandhanBhavan-I Pusa, New Delhi- 110012 (ISBN NO: 81-7164-050-8)
2. Kaehana, P. K 2004. Agriculture Science " a complete study package" Arihant Publishers (ISBN- 13 ; 978-8183482875)
3. Krishnamurthy, K.V. 2003. A text Book on Biodiversity (principles and Practice), Science Punlishers, USA. (ISBN 1578083257, 9781578083251)
4. Prathipalsingh, 2010. Introduction to biodiversity. Ane books Pvt. Ltd. New Delhi. (ISBN 978-1-8052-185-0)

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	4	5	5	5	29
CO 2	5	5	4	5	3	3	25
CO 3	5	5	4	4	3	3	24
CO 4	5	5	5	5	5	5	30
CO 5	5	5	5	5	5	5	30
							118/30
							3.9

BOT 1433 LEARNING BASIC SKILLS IN BIOLOGY 4 Hr. /4Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	60	45	7	4	4

PREAMBLE:

This is a unique course which aims to equip students to develop a basic understanding in biology and self-learning skills to comprehend and communicate with clarity and authenticity. It will also teach soft skill to the fresher in Botany who will be mostly from semi urban background of Madurai and give them the confidence to maneuver their linguistic and cognitive limitation. The course will also provide a gateway to the students and open their thinking and sensitivities to learn and appreciate in science and help to harbour and nurture innovative ideas in day to day life.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: see the growth of botanical studies from a exploratory standpoint that they shall be entrained to appreciate the idea of conceptualizing a botanical thought that no less sooner they will acquire skills to build their own cognitive capabilities by resorting to perform appropriate and suitable experiments	1	12
CO2: acquaint themselves with the contours of communications and equip themselves adequately with the reading writing, listening skills and master the ability to make graphical and pictorial presentations of their ideas to get groomed as a budding botanist	2	12
CO3: familiarize themselves with the scientific conventions of making scientific measurements, data collections and data interpretations that a professional training needed to initiate original scientific discoveries and pursue career in leading scientific discourses later in life is provided	3	12
CO4: find themselves nurtured with personality development and leadership traits to set proper goals, develop problem solving abilities, plan and schedule events that they may eventually emerge as mangers and custodians of nature	4	12
CO5:turn confident in hiring the services of the emerging frontiers of computational technology and ICT tools to emerge as an updated, informed, tech-savvy, skilled learner and a technician that he shall be vested with a competitive edge to compete with his peers in effectively realizing their dreams and ambitions of life	5	12

SYLLABUS

Unit 1. History of Natural Sciences

Rudiments and insights on botanical edifer- Contributions of Indian Botanists- S.R. Kashyap (Bryology) – Birbalsahni (Paleobotany) – P.Maheswari (Embryology) M.S. Swaminathan (Plant Breeding) – Jagadish Chandra bose (Biophysics).

Contributions of Naturalists of International Acclaims – Charles Darwin (Evolution) GJ Mendel (Genetics) Louis Pasteur (Microbiology) Watsun and Crick (Cell Biology).

Unit 2. Communication in Biology

Observational Skills: Contours of inputs from Class lectures, Seminars, Field Visits; Serendipity in science (Penicillin Invention, Newton Law), Making notes while listening Communication and Presentation skills; Verbal and nonverbal- use of scientific words, photographs, cartoon diagrams, tables and graphs – common barriers and impediments in communication.

Reading and Comprehension skills: Importance of reading, academic reading tips, making notes while reading.

Writing Skills : Purpose of writing (Class room, Examination, Scientific Publication)- logical sequence- Art of forming sentence and paragraph- choice of appropriate botanical terminology, interpretation of results and inferences, experimental records- Mnemonics.

Unit 3: Quantitative Biology

An overview of units and measurement- International system of Units (SI), Seven basic units- Distance (Meter), Mass (Kilogram), Time (seconds), Electric Current (Ampere), Temperature (Kelvin) Quantity (Mole) & Luminous intensity (Candela). Fundamental measurement- Volumetric and gravimetric Measurements- Tool and Techniques- Consents and standards- Principles of Calibration and Minimizing error – Collection, Processing, preservation of data.

Unit 4 : Soft Skills

Personality and Leadership Traits- Intra personal skills, self confidence, Goal setting, Problem solving abilities, Reflective thinking and strategic planning, Time management and effective planning.

Unit 5: Computer in Biology

Basic Computing and Arithmetic logic skill- Computer- software & Hardware, Exploring MS office (Opening and saving file, MS word, Excel & power point) and other open source software- Basics of networking and Internet applications- Selected tailor made software and its application in biology- Smartphone and its application in biology.

REFERENCES

1. Adir j, (1997) Effective communication, Pan Book. ISBN 0330347861

2. Jones A., Reed R & Weyers (2012), J. Practical skills in Biology, Pearsons review. ISBN 978-1408245477.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	3	2	1	21
CO2	5	5	5	5	4	4	28
CO3	5	5	5	5	5	3	28
CO4	5	5	5	5	5	5	30
CO5	5	5	5	5	5	5	30
Total	25	25	25	23	21	18	137
							137/30 = 4.5

BOT 1435 **4Hr./4Cr.**

ECOLOGY AND LEARNING BASIC SKILLS IN BIOLOGY- LAB

This is a basic course for those who have freshly joined in the field oriented biology courses. The primary objective of this course is to inculcate quantitative thinking and critical analysis among students. It is designed to promote systematic observation skills to promote documentation of the facts that are observed in the field. While studying the basic field ecology concepts students will be given a chance catalog the field information and data with precision and accuracy. At the end of this course students will know to enumerate, tabulate, rank, measure, estimate both qualitative and quantitative information collected aat the study area. They will be also trained to present given information with clarity and accuracy to their class and any other relevant forums.

Students will
CO1: learnt to appreciate the college campus diversity
CO2: observe various ecological spots
CO3: experiment the use of measuring instruments and landscaping
CO4: have hands on training with the use of computer softwares
CO5: visit agricultural fields to appreciate ecology of irrigation field

1. Enumeration and Description of Trees at the American college campus.
2. Observation of structural modifications and adaptations of plants grown in different ecosystem.
3. Fundamentals of Measurement (Volumetic and Gravimetic Measurements).
4. Basic Landscape Mapping (application of GPS and GIS)
5. Raunkier's biological and leaf spectrum.
6. Report writing.
7. Floristic studies of our campus.
8. Vegetation mapping in a nearby forest area (quadrat study 1x1, 10x10m)
9. Exploring MS office (word and power point presentation).
10. Botanical elements of heritage (historical) sites and sacred groves in Madurai (any one site)
11. Importance of irrigation and traditional wager management in Madurai; traditional crops in Madurai.
12. Data mining – Scientific web sites.

REFERENCES

1. Bebdre, A.M.Kumar 2006. A text book of Practical Botany. (Vol I and II).Rastogi publication New Delhi. (ISBN 81-7133-852-6)
2. Jones A., Reed R & Weyers (2012), J . Practical skills in biology, Pearsons Review. ISBN978-1408254477.

3.Sundararajan, S. 2000. Practical manual of Angiosperm Taxonomy. Anmol publication New Delhi. (ISBN 81-261-0687-5)

BOT 1231 **Mushroom Culture Technology** **3Hr. /2Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS /TUTORIAL	ICT	Visit to industry/field visit
	45	25	3	8	2	7

PREAMBLE:

As a two credit course offered to the first year student of any major, it will be taught as life skill course. Skill development is being recognized as the priority of higher education in any said branch of science. This course is designed to motivate fresh students to learn the science of cultivating mushrooms. It is an introductory level course and designed to help the students to grow mushrooms in simple and cheap substrates like hay and organic debris and other locally available substratum. The nutritive and economic potential of mushrooms will be taught with illustration. Demonstration and field visit components may help the students to get hands on experience. At the end of the course the students will develop skills in commercial cultivation, harvest and marketing. It is taught as a lab cum theory course which will span 4 hours per week. This course is also designed to carter to the need of young entrepreneurs who would like to start a food based industry.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: List different varieties of mushroom, distinguish between edible and non edible, and classify them.	1	5
CO2: characterize, compare the cultivating mushroom and trace the lifecycle.	2	10
CO3: experiment the cultivation procedure, design new culture technique, analyze the pest and factors affecting growth of mushroom.	3	10
CO4: develop technologies for harvesting, packaging and acquire knowledge to avail loan from banks	4	10
CO5: Summarize uses of mushroom and create new recipes for marketing.	5	10

SYLLABUS

Unit 1. Introduction:

Mushroom a type of fungi –Characteristics features of fungi – Differences between fungi and other organisms. mushroom classification – History of mushroom cultivation – Naming of mushroom – Popular mushroom – Edible and poisonous mushrooms – Institutes cultivating mushroom – Varieties available in Tamilnadu

Unit 2. Morphology and Taxonomy of Mushroom:

Morphological characters and taxonomical position of Agaricus - Pleurotus – Volvariella – Shiitake – life cycle of any one species – Spore collection – fruiting body.

Unit 3. Cultivation of Mushroom:

Tray method for large cultivation – Packet method for small scale cultivation – outdoor mushroom

cultivation Pure culture of spores – compost making – spawn types and spawning – casing of soil – Time interval for water sprinkling – Pest identification and control – environmental control.

Unit 4. Harvesting and Packaging :

Manual harvesting method – Asepsis –Packing – Labeling –Marketing –Shelf life of mushrooms – Budget.

Unit 5. Uses of Mushroom:

Economic value of various mushrooms – Food and Dietary Component –Medicinal value – Mushroom recipes.

References:

1. Bahl N. 2000. Handbook of mushrooms, Oxford and IBH publishing co. pvt.Ltd.New Delhi. ISBN 81-204-1399-7.

2. Kaul T.N. 2002. Biology and conservation of mushrooms.Oxford and IBH publishing co.pvt.Ltd. New Delhi. ISBN 81-204-1513-2.

3. Stamets P and Chilton J. S 1983. The mushroom cultivator, Agarikan press.HomstetBook corporation. ISBN096-1079-80-0.

Text book:

Tripathy D.P 2005. Mushroom cultivation. Oxford and IBH publishing co. pvt.Ltd.New Delhi.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	4	1	25
CO2	5	5	4	4	4	4	26
CO3	5	5	5	5	5	5	30
CO4	5	5	5	5	5	5	30
CO5	5	5	5	3	3	5	30
							141/30=4.7

BOT 1233 **FOOD AND NUTRITION** **3Hr./ 2Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	40		3	2

PREAMBLE:

Human perspective towards food keeps changing, taking advantage of this, global marketers introduce food varieties in the market every year. In general, foods preferred by consumers is determined by the media and the advertisement agencies. Hence, Today's youth and children are attached towards a variety of packaged, preserved fast food. Enough cautions are posed by health advisors about these junk foods, but still awareness id poor about healthy foods among the educated too. There is a need for a scientific analysis of the food colorants and preservatives. They would be able to choose healthy foods and avoid junk foods and further they would be able to carry this knowledge to their family and friends.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: comprehend the idea of defining food as a concept, classify foods, identify palatable nutritious meal, traditional and ethnic food and get idea on dealing with food security and hunger	1	9
CO2: fortify the value of food by knowing the need and methods of coloring it with suitable colorants, adding flavor factor attributing and fixing desired physical and chemical properties that the art and procedure of coloring is mastered	2	9
UNIT 3 CO3: gain a knowledge on the types of food preservative used and understand the limitation in terms of the clinical impact, shelf life and expiry details besides evaluating the significance of sweeteners, emulsifiers and probiotics that the health and market issues of food preservation is clearly elucidated	3	9
UNIT 4 CO4: distinguish the types of food adulteration, know the methods of checking food quality in the light of legal implications and food laws that the flipside of consuming low quality food on human health is realized	4	9
CO 5: acquire the needed skills from the dietary point of view to classify food, define balanced diet, and do BMI calculations for carrying out comparative analysis of food types for securing gainful employment in food industry.	5	9

SYLLABUS

UNIT 1 Food facts:

Concept of food- definition of human food- Brief history of food and agriculture- Cuisines and culture- Gender and Age dependent food choice- Classification of foods-(Western foods, Indian food, continental foods, Ethnic foods)- Famous food recipes of Madurai- Hunger and Food security

UNIT 2 Food colourants

Food colorants- Types- recommended dose and methods of application- Role in food preparation food flavors- Types- physical and chemical properties- Procedures of choosing right food flavors.

UNIT 3. Food preservatives

Food preservatives- types- Determination of minimum and maximum shelf life of the food- expiry date- limitation and clinical impacts. Artificial sweeteners- emulsifiers-probiotics- microbes in food industry- advantages and limitations of natural colorants and flavors.

UNIT 4: Food Adulteration

Adulterants- types of adulteration- simple tests used in identifying adulterated in food stuffs- qualitative assessment of adulteration in food- Impact on health- case study. Food policies and laws- legal implications Food and Health.

UNIT 5 Know your food

Biochemical classification of food and nutrients – BMI calculation – Nutritional requirements based on age, body mass and gender- Master Health Checkup Programs and role of dieticians- Balance diet and choice of food – Comparative analysis of a junk food vs Raw food, b. Seasonal local food vs exotic food- vegetarian food vs. non vegetarian food- Safe minimum cooking temperature and prevention of loss of nutrients

REFERENCES

1. Srilakshmi, B. 2006. Nutrition science. New age international publishers 9 ii ed.) ISBN 81-224-1633-0
2. Sumathi R.M 2007. Fundamentals of food, Nutrition and Diet therapy, New age International Publication ISBN 81-22419828
3. Anita Tull 1996. Food and Nutrition Oxford University press ISBN: 01-98327668
4. Annie Fredrick 2006. TextBook of Food and Nutrition, Lotus Press ISBN: 8193820735
5. Snjeev R. 2014. Ayurvedic science of Food and Nutrition, Springer Publication ISBN: 978-1-9627-408245477.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	2	2	24
CO2	5	5	5	5	5	2	27
CO3	5	5	4	3	2	1	20
CO4	5	5	5	3	3	2	23
CO5	5	5	5	5	3	3	26
	25	25	24	21	15	10	120
							120/30=4

BOT 1341 **PLANT BIOLOGY I** **3Hr./3Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	35	5	3	2

PREAMBLE:

This course is designed for zoology major students as a supportive course to enable them to understand the world of plants. It gives an overall view on diversity in structure, organization and evolutionary trend in the plant kingdom. Plants are broadly divided into non-vascular and vascular plants and from each group a plant will be taken for a detailed study. The course also has a lab component, in which students will experiment and learn more about the type specimens. At the end of the course the students would have accomplished the basic understanding of the plant kingdom.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: look at plants on earth with a geological and geographical perspective and recognize their placing in the five kingdom classification, an arrangement in which algae can be shown as the progenitor of the plant world with a special emphasis on its own ecological and economic potential	1	10
CO2: describe the general characters of bryophytes, classify liverworts, hornworts and mosses as the structure and reproduction of *Riccia* and the alternation of generation in mosses are scrutinized in the process of highlighting the ecological and economic importance of the group	2	11
CO3: present pteridophytes as first land plants and explain their general character and life cycle with morphology and reproduction of *Pteris* as a case study to illustrate the nifty-gritty and diversity of ferns and explore their ecology and evolutionary significance	3	8
CO4: describe and characterize gymnosperms as the constituents of the early forests of planet earth keeping a closer watch on *Pinus,* explaining its external and internal morphology, reproduction and seed formation and use the study to find the feasibility of cashing on industrial and domestic utilities	4	6
CO5: trace the origin of flowering plants, defining a flower and a fruit and gain an overview on the Bentham and Hooker's classification to deal with floral biology and study the significance of fruits and seeds	5	10

SYLLABUS

UNIT I: Introduction: Geological timescale -Five kingdom classification – evolution of plants.Co-evolution-biological diversity.

UNIT II: Non – vascular plants: General characters of algae **–** occurrence, and structure of alga (*Caulerpa*) - economic importance of algae. General characters of Bryophytes and morphology of *Riccia*-economic importance of Bryophytes.

UNIT III: Lower Vascular plants: Non-flowering plants – General characters of Pteridophytes – morphology of ferns (*Pteridium aquilinum*).

UNIT IV: Primitive seed plants: General characters of Gymnosperms–morphology of *Pinus.*

UNIT V: Flowering plants: Bentham and Hookers classification (up to series level)
Diagnostic characters of Malvaceae (Polypetalae), Solanaceae (Gamopetalae), Euphorbiaceae (Monochalamydeae) and Poaceae (Monocotyledons) with a species from each family as an example.

REFERENCES

Pandey, B. P. 2005. *College Botany*, Vol I. (5th ed.) S. Chand & Company New Delhi. (ISBN 81-219-0593-1)
Pandey, B. P. 2009. *College Botany*, Vol II. (7^{th} ed.) S. Chand & Company New Delhi.(ISBN 81-219-0601-6)
Vashishta, P. C. 2001. *Pteridophyta* (Vascular Cryptogams). S. Chand & Company New Delhi. (ISBN 81-219-0828-0)
Vashishta, P. C. 2009. *Gymnosperms*. S. Chand & Company New Delhi. (ISBN 81-219-2618-1)
Vashishta, B.R., A. K. Sinha & A. Kumar 2005. *Bryophyta*. S. Chand & Company New Delhi.(ISBN 81-219-0463-3)
Bhattacharyya, B. 2005. *Systematic botany*. Narosa Publishing House, Chennai (ISBN 81-7319-542-0)

	K1 (Recall)	K2 (Understanding)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	4	5	5	3	2	1	20
CO2	4	5	5	3	2	1	20
CO3	4	5	3	3	2	1	19
CO4	4	5	4	3	2	1	19
CO5	3	4	5	4	4	2	22
Total	19	24	22	16	12	6	100
							100/30= 3.33

BOT 1143 PLANT BIOLOGY- I (LAB) 2Hr./1Cr.

The students will be able to

CO I : identify the diverseness of various plant forms in their own habitats in day to day life and do comparative study of structure and reproduction of thallus forms to higher plants.
CO II : to distinguish species in a selective ecosystem. with the knowledge he acquired about the anatomical variations among the lower plant forms which differentiates terrestrial plants from aquatic habitats.
CO III: categorize the tissue organization in thallophytes, pteridophytes and gymnosperms.
CO IV: classify the flowering plants by investigating the floral structures of the given plant and identify the family to which the particular plant belongs to.
CO V: describe the economic importance of plants with specific attention to the plant produces from which he is benefited in life.

1. Algae – *Caulerpa* as example vegetative and reproductive structure
2. Bryophytes – Riccia (gametophyte and sporophyte structure)
3. Pteridophytes – morphological and anatomical structure of sporophyte and sorus organization
4. Gymnosperms – Morphological features of Pinus (Stem, needle and cones)
5. Gymnosperms – Anatomical features of Pinus (male and female cones)
6. Angiosperms – Morphology of vegetative and reproductive structure of Malvaceae *(Hibiscus rosa-sinensis* as example)
7. Morphology of vegetative and reproductive structure of Solanaceae (*Datura metel* as example)
8. Morphology of vegetative and reproductive structure of Euphorbiaceae (*Euphorbia cyathophora* as example)
9. Morphology of vegetative and reproductive structure of Poaceae (*Oryza sativa* as example)
10. Economic botany – plants used as food and medicine
11. Field trip to nearby areas such as Alagar Hills and Sirumalai

REFERENCES

Sundararajan, S. 2003. Practical manual of plant morphology. Anmol publication New Delhi. (ISBN 81-261-1403-7)
Bendre, A. M., A. Kumar, 2006. A text book of practical botany. Vol I. Rastogi Publication New Delhi. (ISBN 81-7133-809-7)
Bendre, A. M., A. Kumar, 2006. A text book of practical botany. (Vol I and II) Rastogi Publication New Delhi. (ISBN 81-7133-852-6)Sundararajan, S. 2000. Practical manual of Angiosperm Taxonomy. Anmol publication New Delhi. (ISBN 81-261-0687-5)

BOT 1532 **Economic Botany** **4Hr./4Cr.**

Pedagogy	A	B	C	D	E	F
	Course Teacher's Contribution	Department Resources	Field / Industry/ Lab	Subject Experts	ICT Virtual Learning	Peer Teaching
	60	5	2	3	2	3

PREAMBLE: This course is an eye-opener for the students to recognize useful plants of their won locality and gain food knowledge on rich plant resources. It is designed to help students to know about few ethnic communities and learn about their involvement in trade of plants and plant based products. This will help to appreciate their contribution in conservation and sustainable utilization of local plant species. Students would be encouraged to interact with a cross section of rural farming and trading communities who are indirectly or directly benefited through commercialization of local biological diversity. Every student get an opportunity to analyze the logistics and networking of local market potential. At the end of the course students will get an idea of incorporating scientific inputs and promoting value addition of locally available plant resources.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: recognize and enlist economically important plant resources of Madurai market and those species that have applications as fodder, forage and feed and make an assessment on the scope of bioprospecting lesser known crops using their wild relatives	1	15
CO2: take home a comprehensive knowledge on organic farming and do case study at Madurai context focusing on soil and water management and pest control contemplating on Climate Smart Agriculture	2	15
CO3: realize the importance of folk and traditional medicine of the region, prepare an inventory of raw drugs and NTFP investigating the ethno botanical practices to probe the export potential of local plants under existing legal provisions	3	15
CO4: concentrate on fiber yielding plants to assess the commercial value of popular fibers, find innovations in coloring of fibers that value additions are made to harp on the assessment of export potential	4	15

CO5: locate natural sweeteners such as palm, sugarcane, *Stevia* and honey and also non-alcoholic as well as fermented plant beverages that are known traditionally in small time trade in local markets and use them in innovative entrepreneurial ventures.		15

SYLLABUS

UNIT 1. Crop cultivars and Animal Breeds

Plant resources of Madurai- market survey- checklist of locally used, underutilized and discontinued plants – Economic potential and Geographical distribution of Miner Millets, Cereals, Pulses, Vegetables, Flowers and Wild Edible Plant products. An overview of native breeds of Animals- Economical potential of Fodder and feeds – Commercialization Vs Conservation of Crops, fodders and Wild Relatives of Cultivated Crops.

UNIT 2: Organic Agriculture

Local and Global Demand for organic products – Organic certification – Basic principles of Organic Farming – Biofertilizer – Manures – Biopesticides and organic Growth Promoters Traditional water and soil management – case studies in Madurai – Success and Failure models- Climate smart Agriculture Practices.

UNIT 3: Herbal Medicine

A Glimpses of Folk and Indian Systems of Medicine Practices and Practitioners in Madurai – Checklist of Raw Drugs and NTFPs available at Madurai – Ethnobiology of commercially significant plants – conservation and commercialization on highly exploited plants – Local and Export Market Potential - Legal Environment of Entrepreneurship and Business development

UNIT 4: Natural fibre and Dyes

Types of Fibre- Market potential – Handmade cotton sarees and traditional weavers of Madurai – Cotton, coir. Agave, Jute, banana based Products – Natural dyes and locally available dye yielding plants – Classification of dyes and basic dying methods – Revitalization of eco friendly export oriented business modules – Legal and Environmental issues.

UNIT 5: Natural Sweeteners and Beverages

Classification of Sweeteners – Jaggary – Palm and Cane sugars – History – Stevia Differences between stimulating beverages and alcoholic beverages – Coffee, Tea and a range of Herbal Teas available at Madurai – Neera (Sweet Toddy/Palm Nectar) – Homemade wine and its market potential – Local communities and their traditional knowledge in cultivation, collection, processing and marketing – Scope for value addition.

REFERENCES

1. Chrispeels, M.J. and Sandava, D.E.(2003) Plants, Genes and crop biotechnology. Jones and Bartlett Publishers, ISBN 978-0763715861

2. Kochhar S.L. (2012) Economic Botany in Tropics, 4th edn. Macmilan and Co, New Delhi, India. ISBN 978-9350590676

3. Sammbamurty, A.V.S.S. (2008)Text book of Modern Economic Botany, Ist Edn. CBS Publishers. ISBN 978-8123906294.

4.Simpson B.B and Ogorzaly M.C.(2000) Economic Botany: Plants in Our world McGraw Hill,

USA. ISBN 978-0072909388.
5.Wickens, G.E (2007) Economic Botany: Principles and Practices. Panima publishing corporation, New Delhi. ISBN 978-8181285683.

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	4	4	5	2	3	3	21
CO 2	5	5	5	4	3	4	26
CO 3	4	4	5	3	1	3	20
CO 4	4	4	5	3	2	3	21
CO 5	4	4	5	4	2	2	21
	21	21	25	16	11	15	
							109/30
							3.6

BOT 1434 HORTICUTURE & POST HARVEST TECHNOLOGY 4Hr./4Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/ TUTORIAL	ICT	Visit to industry/field work
	60	35	2	10	3	10

PREAMBLE: A skill based course, exclusively designed for future plant biologists, to learn the basic art of growing plants and multiplying different kinds of propagules in large numbers. While learning this course students will touch and feel and also watch the behaviour of juvenile plants and appreciate their transformation in to adult plants. They will also explore the reproductive biology of the plants and understand the role of seeds and other kinds of propagules in lifecycles of a plant. This course will give them a confident to nurture plants with care and add on fine skills in propagation. At the end students will gain a professional skill and also they will have a competitive edge over their counterparts.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: Examine soil characteristics , understand suitability of crops for seasons , identify various fertilizers and manures for improving soil and to assess the soil.	1	10
CO2: acquire professional competency in culturing horticultural crops, experiment the procedures in cultivating crops	2	20
CO3: Apply knowledge to develop physical protections and growing structures in their own terrace and garden.	3	10
CO4: Examine harvested produce; evolve new technology for processing and storing the horticultural produce.	4	10
CO5: Apply knowledge to conserve native varieties and appraise the farmer's performance and rights.	5	10

SYLLABUS

Unit 1 Soil

Soil types(colour, fertility, porosity): Soil organism and fumigation: Soil map of Madurai – Sustainability of crop and Season; Hydroponics and other soil less techniques

Unit 2 Propagation and Maintenance

Sexual propagation: Seed dormancy, Seed treatment- Asexual propagation: Stem, Leaf, Root, Rhizome, Bulb & offsets; Cutting, Grafting, Budding, Layering, Pruning; Pest & Nutrient control (Organic vs Chemical) Pruning, trimming, thinning, mowing, Bonsai, etc.

Unit 3 Infrastructure/ Facilities

Feasibility assessment for horticulture; Physical protection (Fence, Shade House, Greenhouse); Fertigation (Irrigation & Nutrient); Humidity control (Misting) ; Terrace and Backyard garden

Unit 4 Harvest, Post Harvest & Market

Methods and Materials used in Harvesting and processing of a vegetables and fruits (Banana, Mango, Grapes, Jasmine, Marigold Tomato, Onion, Garlic, Potato & Drumstick) Seasons; Techniques; Storing (Cold, Dry, Traditional); Packing (Conventional and Pouch) Marketing & Value addition.

Unit 5 Conservation policies & Ethics

Collection and Cataloguing of native- gene varieties and cultural cultivars and land races vs Modern breeds; contribution of growers in Conservation and Farmer's rights; Participation of ethnic communities in conservation. Role of Government and Non-Governmental Agencies

REFERENCES:

1. Chadha, K.L. 2012. Specifications of Handbook of Horticulture Ist Edition, ICAR, ISBN-9788171640065.
2. Edmon J.B., Seen T.L., Andrews F.S. Halfacre R.G (1997) Fundamentals of Horticulture. Tata McGraw Hill pub. New Delhi. ISBN 0-07-099288-6.
3. George, A. 2009. Horticulture-Principles and practices, 4th Edition, Prentice hall of India, New Delhi. ISBN-10-8120338200.
4. Kamaljit S Bawa, Richars B. Primack, Meera Anna OOmen, (2012) Conservation Biology University Press India pvt. Ltd. Hyderabad.
5. Raven,P.H, Evert R.F and S.E. Eichhorn. 1986. Biology of plants, Worth Pub.NewYork. ISBN 0-87901-315-X.

Text Book:

Manibhushan Rao K 2005. Text book of Horticulture, McMillan India Ltd. Pub. New Delhi. ISBN 1403-9281.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	4	3	27
CO2	5	5	5	5	5	4	29
CO3	5	5	5	5	3	5	28
CO4	5	5	5	5	4	4	28
CO5	5	5	5	5	4	2	26
							4.6

BOT 1436 Lab II (Economic Botany and Horticulture) 4Hr./4 Cr.

Economic botany is taught as market based botany, students are given a chance to meet the local traders and farmers to understand the economic value of farm and forest produce available at the local Market. It is also couples with horticulture for skill development, where students will collect seeds and vegetative propagules from the local market and conduct independent study to understand the methods of propagation and multiplication of plants. Students are expected to get hands on experience in both Horticulture and economic botany.

The students will be able to

CO1: identify different variety of plants to create garden, testify the quality of seed, acquire knowledge on propagules, grow plants using seeding and vegetative propagation techniques

CO2: build different protection facility, construct plant growing structures, practice horticultural propagating techniques such as cutting, layering for multiplication of plants, prune the plants for effective growth.

CO3 : harvest of plant produce, process vegetables and fruits, Use flowers for decoration, collect and document native varieties of seeds

1. Plant identification and selection

2. Sexual propagation – seed treatment and seeding

3. Asexual propagation – propagules

4. vegetative propagation – cutting and layering

5. Techniques practices in trees – grafting, budding

6. Landscape designing & Bonsai

7. Plant growing chambers – model making

8. Pruning and thinning techniques

9. Designing various types of garden

10.Organic pesticide and manure production

11. Harvesting flowers & Ikabana

12.Vegetable harvesting and processing

13. Fruit harvesting and processing

13. Collection of native varieties of rice –submission

REFERENCES

1. Kochhar S.L.(2012)Economic Botany in Tropics, 4th edn. MacMilan and Co, New Delhi, India. ISBN 9789350590676

2.Sadhu, M.M.,(1989)Plant Propagation, New Age International (P) Limited Publishers, New Delhi, ISBN 8122400655

BOT 1236 **Nursery and Gardening** **3 Hr./2Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/ TUTORIAL	ICT	Visit to industry
	45	25	-	10	5	5

PREAMBLE:

This course is designed for students who have passion for collecting plants and adopting them at safe and protected areas. The course is envisaged in such a way to develop fine skills in planning for various types of gardens with specific theme ad purpose. Landscaping is also added in order to enhance the scope of the course. It is a course where there is no need any perquisites except love and passion for plants and intelligent special perception. At the end of this course student is expected to use the given space in an intelligent manner and transform it as a thematic garden

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: Identify the varieties of plants maintained in a nursery, forecast the risk of climatic factors affecting nursery plants, create facilities of his own.	1	9
CO2: Develop seed storage strategies, track the pest and evolve the right method to control them.	2	9
CO3: Specialize himself in cultivation technique and manage the nursery.	3	9
CO4: Categorize the plants, select right choice of the plant for different gardens and develop himself as a entrepreneur	4	9
CO5: Recognize the various types of parks and gardens in his locality, appreciate the role of parks in society thereby conserving it.	5	9

SYLLABUS

Unit 1: Nursery: Definition, Objectives and scope and building up of infrastructure for nursey, planning and seasonal activities- planting – direct seeding and transplants.

Unit 2: Seed: Structure and types – Seed dormancy; causes and methods of braking dormancy Sowing/raising of seeds and seedlings – Transplanting of seedlings – Seed storage; Seed banks, factors affecting seed viability, seed testing and certification.

Unit 3: Vegetative propagation: grafting, layering and cutting, selection of specimen, collecting season, treatment of cutting, rooting medium and planting of cuttings- hardening.

Unit 4: Gardening: Definition, objectives and scope – different types of garden and gardening – landscape, home and ornamental gardening – parks and their components – plant materials and design – computer applications in landscaping

Unit 5: Visit to parks and Gardens – Health and wellbeing- benefits of gardens – management of Gardens – People's perception and community participation- gardens as open book for Children and Education institutions.

REFERENCES:

1. Agarwal, P.K.1993, Hand Book of Seed Technology, Dept. Of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
2. Bose T.K.& Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Dehli.
3.Edmond Musser & Andres, Fundamentals of Horticulture, McGrawHill Book Co., New Delhi.
4.Janick jules. 1979. Horticultural Science. (3rd Ed), W>H>Freeman and Co., San Francisco, USA.
5.Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
6. Sadhu, M.K., 1989, Plant propagation, Wile Eastern Ltd., Bangalore, Madras.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	3	3	4	4	4	4	22
CO2	3	3	3	3	3	3	18
CO3	4	4	4	4	4	4	24
CO4	4	4	4	4	4	4	24
CO5	5	4	4	4	4	5	26
	19	18	19	19	19	20	114
							114/30=3.8

BOT 1238 **PLANT WONDERS** **3 Hr./2Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	Field work
	45	30	3	7	-	5

PREAMBLE:

This course is aimed to impart knowledge on plants to non science students. It introduces the microscopic to giant Angiosperms of the plant kingdom. Students will learn about different groups of plant, basic plant processes and their contributions to the human being. Uniqueness of plants in terms of size, shape, habitat and their associations will be highlighted. They will develop a desire to further explore the plant kingdom and also to conserve plants.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: relate plants and civilization, identify plants as source of food, fuel, energy.	1	9
CO2: acquire knowledge about various life forms of plant, able to benefit from the uses of plants	2	9
CO3: describe the amazing plants, utilize plants as fertilizer	3	9
CO4 rank the plants according to their magnitude, identify the indicators of pollution and minerals	4	9
CO5: discover plants in various extreme environment, discuss the plant's adaptation.	5	9

SYLLABUS

UNIT I Plant as resource: Plants and civilization: Difference between plants and animals – Plants and man- Plants as source of food, energy, fuel and medicine - Plants in protection of environment.

UNIT II Plant groups: Unique characters and Importance of - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

UNIT III Amazing plants: Epiphytes – Parasites - Insectivores –sensitive plants - Aromatic plants- fertilizing plants –camaouflage plants (*Corydalis hemidicentra*) – stinky plants(Titan arum)

UNIT IV Plants of curiosity:

Tallest, largest, oldest and smallest plants – magnitudes in size, flowers, leaves and fruits – Biolumenscing plants – model plant- dancing plants –pollution indicators-mineral indicators- seed dispersing plants - orchids

UNIT V Extreme plants and their adaptation: Plants thriving in space (chlorella) – volcanoes(hawaiian *argyroxiphium*)- ocean(-sea weed) – swamps(mangroves -*Avicennia*) –desert (*Saguaro cactusti*) – alpine (junipers) – tundra (arctic lichen) .

REFERENCES

Pandey B.P. 2005 Collage Botany : Vol I, 5th edn. S.Chand &Company LTD. New Delhi. ISBN -81-219-0593-1

Raven PH Evert RF and Eichhorn SE 2013. Biology of plants. VIIIth Ed. W.H. Freeman Publishers, 1464113513.

Santna, S.C..Chatterjee, T.P and A.P. Das 2004 Collage Botany Practical (Vol II) New Central Book Agency (P) KolKatta. ISBN -81-7381-320-5

Starr,C. 2007. Biology : concepts and applications. VI edn. ISBN 81-315-0284-8

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	4	5	5	3	3	4	24
CO2	5	5	5	5	3	2	25
CO3	5	5	5	3	2	2	22
CO4	5	5	3	3	2	2	20
CO5	5	5	5	2	2	2	21
							112/30=3.7

BOT 1342 **PLANT BIOLOGY II** **3Hr./3Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	35	5	3	2

PREAMBLE:

This course gives an overview of life process happening inside plants and this will broaden the understanding of the students on various functional events including water and mineral uptake, transport of photosynthates, growth & development and nitrogen fixation. The course also has a lab component to have a hand on experience of verifying the theory under natural setting. At the end of the course students will be able to appreciate the plant as the only system, which is equipped to capture light energy and convert it into chemical energy.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: look at plant as a functionally self-contained entity and use the understanding on mechanics and structures for water and mineral uptake, transport and utilization in their cells and tissues as model system to create and fabricate machines, filters and devices of human utility modeled on the inputs they have received from this course	1	9
CO2: understand the translocation of food and sap, regulation water and food transport , ventilating mechanism with a role for stomatal apparatus, and process of liquid loss from hydathodes and lenticels that the heat release and hydraulic components of plant function can be analyzed for adoption in designing relevant production and processing units required for industrial and environmental applications	2	6
CO3: look at chloroplast as photovoltaic battery involved in thermodynamic functions that the light trapping, transfer and transduction processes are elucidated as functions initiated by chlorophyll form from the biophysical viewpoint and the role of phytochromes and cryotochromes are interpreted as environmentally regulated switches with precision ad sensitivity.	3	10
CO4: critically look at the paradox of nitrogen as a common as well as scarce resource to plants and evaluate the nitrogen cycle and the prokaryotic process nitrogen fixation that serves as source of nitrogenous input and look at nitrate reduction and amino acid synthesis that form the hub of nitrogen metabolism.	4	10

CO5:gain an overview of plant growth & development in outline, study plant growth promotion and regulation by auxins, gibberellins and cytokinins besides ABA and ethylene that they may acquire the prowess of commercially manipulating plant development to their own advantage.	5	10

SYLLABUS

UNIT I Water relations:

Pipeline systems in plants: Water potential, Guttation, Imbibition, Osmosis, Active transport, Passive transport and Carrier mediated transport. Tissue organization – xylem, phloem and their physiology.

UNITII Ventilating systems: Stomata, hydathodes, transpiration, evaporation, convection and photorespiration.

UNIT III Photobiology: Photosynthetic pigments, Photosynthetic electron transport, exploring the path of carbon in photosynthesis, photoperiodism, phytochromes, cryptochromes and photomorphogenesis

UNITIV Nitrogen metabolism: Nitrogen fixation – symbiotic, asymbiotic, Nitrogen fixing Organisms.

UNITV Growth and development--Planthormones, growth promoters-auxin, gibberelin, cytokinins – growth inhibitors- ethylene, ABA- Plant Movements - nastic and tactic movements.

REFERENCES

Bidwell. R. G. S. 1975. *Plant physiology*. Macmillan Publishing Co. INC. New York. ISBN-0-02-309430-3

Williams. M. B. 1984. *Advanced Plant Physiology*. Pitman Publishing New Zealands Ltd. Wellington.ISBN-0-273-02306-3

Salisbury. F. B. & Ross C.W. 1992. *Plant Physiology*. Fourth Edition. Eastern Press. Bangalore. ISBN-981-243-853

Sinha. R. K. 2004. *Modern plant physiology*. Narosa Publishing house New Delhi. ISBN 81-7319-333-9

Srivastava. H. S. 2005. *Plant physiology* Rastogi Publications Meerut. ISBN 81-7133-785-6

Ghosh. M. S. 1996. *Plant physiology*. (Ist Central Edition) New Central Book Agency (P) Ltd. ISBN 81-7381-478-3

	K1 (Recall)	K2 (Understanding)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	4	5	4	3	2	1	19
CO2	4	5	3	3	1	1	17
CO3	4	4	4	5	3	2	22
CO4	4	4	4	5	3	1	21
CO5	4	4	4	5	5	2	24
Total	20	22	23	21	14	8	103
							103/30= 3.4

BOT 1144 PLANT BIOLOGY II (LAB) 2Hr./1Cr.

The student will be able to

CO 1: investigate the movement of food and water through the specialized tissues ,intercellular translocation in plants with the influence of environmental factors.
CO2: analyse the external factors which brings changes in the physiology of plants through live experiments**.**
CO3: equipped himself to calculate the duration,rate of reaction and measurements of various physiological reactions.

CO4: explore the movements in plants with response to different stimuli and analyse the role of microbes in fixing atmospheric nitrogen which the plants cannot able to do.

CO5: apply the knowledge of growing plants in soilless environment with the supplement of mineral nutrients.

1. Ascent of sap (Ringing and Girdling experiment)
2. Osmosis using potato osmometer
3. Plasmolysis using Onion peel & Tradescantia leaf.
4. Measurement of (DPD) Diffusion Pressure Deficit using potato tubers
5. Transpiration using potted plant & bell jar, cobalt chloride method to compare the transpirational rates
6. Demonstration on the loss of weight during transpiration (Ganongs potometer)
7. Evolution of O_2 during photosynthesis using Wilmott bubbler counter.
8. Effect of different wavelength of light during photosynthesis
9. Measurement of growth using auxanometer
10. Phototropism & Gravitropism using a potted plants
11. Methods of studying plants nutrition – Hydroponics
12. Symbiotic nitrogen fixation – sectioning of legume root nodule

REFERENCES

Kumar B. 2006. *A Text book of practical botany.* Rastogi Publication. Meerut. ISBN 81-7133-809-7

Santra. S.C.. Chatterjee.T. P.& Das A. P. 2005. *College Botany-Practical.* Vol-I. New Central Book Agency (P) Ltd. India ISBN-81-7381-357-4

BOT 2531 **Microbiology and Phycology** **5Hr./5Cr.**

Pedagogy	Hours	Lecture	Dept. resources	Field /Indus. /Lab	Subject experts	ICT Virtual learning	Peer teaching	Super special models
	75	65	6	2	-	2	-	-

PREAMBLE:

This course provides an overview of the diversity of microbial life forms to the students. Structure and functions of selected prokaryotic organisms and algae will be dealt in detail.

The course introduces students to monera and protista of the five kingdoms, and proceeds with the milestones in the history of microbiology and phycology and contributions of eminent scientists. Viruses will be dealt separately with emphasise on the diseases caused by them to plants and animals. The variations and pigmentation characteristics of prokaryotic, photosynthetic cyanobacteria will be dealt. Pitching discussions on selected forms in the cyanobacterial link between the heterotrophs and autotrophs will be explored.

Students will be able to comprehend the life and processes of prokaryotic organisms from viruses to algae the earliest photosynthetic forms. Besides evolution and conservation aspects, commercial aspects of members will add the utility value of the course.

COURSE OUTCOME At the end of the Semester Students will be able to	Unit	Hrs P/S
CO1: Analyze the origin and diversity of life forms through the contributions of pioneering scientists in order that the role played by microbes in day to day life is understood.	1	10
CO2: Assess the characteristics and classification of viruses and use the knowledge in identifying and interpreting the diseases	2	10
CO3: Distinguish the characteristics, classification, growth, reproduction of bacteria and Cyanobacteria and find out agronomic significance.	3	25
CO4: Recognize the major groups of algae as a unique entity of biota and to know their life cycle and affinities.	4	15
CO5: Catalogue harmful and beneficial microbes and find out ways of effective commercialization.	5	15

SYLLABUS

Unit I:Introduction

Classification of life forms: Five kingdom and 3 domain- the advent of microbiology, (A. V. Leeuwenhoek, L.Pasteur and Robert Koch) and phycology (F E *Fritsch* and MOP Iyengar) - diversity based on habitat.

Unit II:Viruses

Viruses: Discovery, DNA virus (T-phage), lytic and lysogenic cycle- RNA virus (HIV) - comparison of plant and animal viruses – common human viral diseases.

Unit III:Bacteria and Cyanobacterium

Prokaryotic organisation:morphotypes, structure; nutritional types. A brief Introduction to Bergeys system of classification. Growth curve and measurements, Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction).

Cyanobacteria - Exomorphic variations, pigmentation, biological nitrogen fixers, Reproduction and adaptations.

Unit IV: Algae

General characteristics, major groups of algae - life-cycles of Caulerpa (Chlorophyta), Sargassum (Phaeophyta) and Gracilaria (Rhodophyta).

Unit V: Economic Importance

Harmful and beneficial microbes: microbial products –antibiotics(Streptomycin), vaccines (Rabies) and fermentation products - food spoilage. Biofertilizers & biopesticides, Agar, Carrageenan - Diatomite – Biofuel - large scale cultivation of algae.

REFERENCES

Text books

1. Dubey,R C and Maheswari,D.K .(2013) A Textbook of Microbiology, S.Chand & Comp. ISBN 81-219-2620-3
2. Kumar, H.D.(1988).Introductory Phycology. East West press.ISBN: 81-859-3896-2
3. Sharma,O.P (2007).Textbook of algae. Tata McGraw Hill, India ISBN 0-07-451928.

Reference books

1. Pelczar, H.J. E.C.S. Chan and N.R. Kreig. (1993). Microbiology concepts and applications. Tata McGraw Hill Inc. ISBN 0-07-049234-4
2. Prescott, L.M., Harley J.P., Klein D. A. (2008). Microbiology.McGraw Hill, India.6th edition. ISBN 0071267271
3. Bold, H.C and Wyne. M.J. (1978). Introduction to the algae: Structure and reproduction. Prentice-Hall. ISBN 0134777867
4. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition. ISBN: 978-0-521-14144-4
5. Ion Morris. (1971). An Introduction to the Algae. Hutchinson University Library. London. ISBN: 0-090-80713-8

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	5	4	3	27
CO2	5	5	5	5	5	1	26
CO3	5	5	5	3	2	1	21
CO4	5	5	4	3	2	1	20
CO5	5	5	5	4	4	4	27
	25	25	24	20	17	10	121
							121/30 = 4.0

BOT 2335 **Genetics and Plant breeding** **3Hr./3Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	25	5	10	5

Preamble:

The course introduces the basics of genetics dealing with inheritance of characters, about principles pertaining to plant breeding and crop improvement.

Starting from the basic rules drawn from Mendel's experiments, the idea of chromosomal theory of inheritance will be introduced that will lay foundations and students will be able to study applied studies, with real time examples. It will help them to understand DNA as the genetic material. The unit on population genetics will brief about the mutations, genetic drift and chances for speciation. Basics of plant breeding and traditional methods in crop improvement will be discussed citing regional examples. Discussion on plant breeding and crop improvement will not be exhaustive, but the content would suffice the learner to apprentice the need for breeding, conservation and management of genomes of useful plant stocks.

Students should be able to understand the science of inheritance of characters and reasons behind the variations noticed in the population. He should be able to appreciate the importance of plant resources, need to develop hybrid varieties and conserve them for the future generation.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
UNIT 1 CO1: Conceptualize the laws governing our inheritance, Compare and contrast the allelic and genic and polygenic interaction.	1	9
UNIT 2 CO2: Acquire knowledge about chromosome organization and recognize sex and sex linked inheritance.	2	9
UNIT 3 CO3: Formulate hardy Weinberg law, assess the effect of mutagens and appreciate the traits in humans.	3	9
UNIT 4 CO4: distinguish between qualitative and quantitative traits, expertise in various methods of breeding.	4	9
UNIT 5 CO5:Represent the right of farmer and breeder, adapt strategies to develop resistant varieties and gain knowledge and practical experience in the activities of breeding and conservation centres.	5	9

SYLLABUS

Unit I: Fundamentals of genetics

Mendel's experiment, laws of inheritance. Allelic interaction -Gene interactions- (dominant epistatis, complementary gene), multiple allele inheritance (human blood group), and polygenic interactions (ear length in Maize). Sex linked inheritance (color blindness).

Unit II: Chromosomal structure and inheritance

Chromosome organization – types of chromosomes, sex chromosome, Sex determination in human,

animals and plants (*Melandrium*),sex linked inheritance, chromosomal aberrations, linkage and mechanism of crossing over.

Unit III: Population genetics

Hardy-Weinberg Law, penetrance and expressivity, spontaneous and induced mutation, mutagens, genetic drift and erosion. Introduction to speciation, human traits,Pedigree and family tree.

Unit IV: Plant breeding

Objectives - Qualitative and quantitative characters. Conventional methods of selection and hybridization . Traditional breeding programmes in Rice.

Unit V: Crop improvement issues

Farmer's and breeder's rights. Crop improvement for resistant, tolerant and high yielding varieties. Plant genetic resources of India- Germplasm centres.

References:

1. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition. ISBN 0470388250
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2007). Concepts of Genetics. Pearson Education. 7 th edition. ISBN 813170811X
3. Sinnott,E.W., Dunn,L.C. and Dobzhansky,T. (2004).Principles of Genetics. Tata Mc Graw Hill. ISBN : 0-07-099-413-7.
4. Singh,B.D. (2014). Plant Breeding- Principles and methods. Kalyani Publishers.
5. Ahluwalia,K.B. (2009). Genetics, 2edn. New Age International Publishers. ISBN 978-81- 224-2390-7
6. Chahal, G.C and Gosal,S.S (2002) Principles and Procedures of Plant Breeding. Narosa Publishing House. ISBN 81-7319-374-6

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	4	4	4	4	26
CO2	5	5	4	4	4	4	26
CO3	5	5	5	5	5	5	30
CO4	4	4	5	5	3	5	26
CO5	5	5	4	3	5	3	25
							133/30=4.4

BOT 2533 **ARCHEGONIATAE** **5Hr./5Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	75	60	-	10	5

PREAMBLE: This course will help the student to understand the evolutionary process in plant kingdoms which will commence from algal form. It seeks to give a account plants of plant adaptations from aquatic condition to a colonized terrestrial habitat. The changes in morphological, anatomical and reproductive structures that propel plant evolution will be investigated. In nutshell the course will trace evidences of plant evolution from extinct and extant plants.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: comprehend the evolution of morphology of various group of plants, their ever changing life cycle pattern and the sex organs in plants	1	15
CO2: understand the salient features of liverworts "the amphibious plants" on earth with their adaptive features of the three major groups and its ecological significance	2	15
CO3: evaluate the rise of vascular plants through learning the classification and features of primitive land plants which exhibit the important character of seed bearing nature called heterospory	3	15
CO4: correlate and analyze the relationship between the ferns and the true land plants "the gymnosperms" and which proceed to the study of angiosperms.	4	15
CO5: justify the rise of green plants from their single cell ancestors by studying the historical evidence of fossils through ages.	5	15

SYLLABUS

Unit I: Morphological and life-cycle changes of typical land plants: General adaptations to terrestrial habitats (morphological and anatomical characters for heterotrichous habit) - evolution of plant sex organs:- (Antheridium, Oogonium with respect to sterile protective covering, archegonium, ovule).

Unit II. Bryophytes: Classification and Salient features; Introduction to Hepaticopsida, Anthocertopsida and Bryopsida, Morphology, anatomy and reproduction of Riccia, Anthoceros and Funaria. Ecological importance.

Unit III. Pteridophytes: Classification and Salient features; Introduction to Lycopsida, Sphenopsida and Filicopsida, Heterospory and seed habit. Morphology, anatomy and reproduction of Lycopodium

Unit IV. Gymnosperms: Classification and Salient features; Introduction to Cycadopsida, Coniferopsida, Gnetopsida, Morphology, anatomy and reproduction of *Pinus* . Economic importance.

Unit V: Evolution of land plants: Paleoclimatic changes across the Geological time zones. Fossilization and fossil types (Impression, compression, Petrifaction, cast, coal ball) - mega extinction - Origin of angiosperm.

References:
1. Muller,W,H. (1979). Botany: A functional approach, Collier Mac Millan ISBN 0-02-979440-4
2. Rashid,A.(1998). An Introduction to Bryophytes, Vikas Publishers Co. New Delhi.
ISBN: 81-259-0569-3
3. Rashid,A.(1982). An Introduction to Pteridophyta, Vikas Publishers Co. New Delhi. ISBN: 81-259-0709-2
4. Vasishta, P. C. (2006). Gymnosperms. S. Chand & Company New Delhi. ISBN 81-219-2618-1
5. Willis,K.J and McElwain.J.C (2002). The Evolution of Plants. Oxford University Press. ISBN 0-19-850065-3
6. Pandey, B. P. (2005). College Botany, Vol I. 5th Edn., S. Chand & Company New Delhi. ISBN 81-219-0593-1
7. Pandey, B. P. (2009). College Botany, Vol II. 7th Edn., S. Chand & Company New Delhi. ISBN 81-219-0601-6

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	3	5	5	3	26
CO 2	5	5	3	5	4	2	24
CO 3	5	5	4	4	3	2	23
CO 4	5	5	3	3	5	3	24
CO 5	5	5	3	5	5	3	26
							123/30
							4.1

BOT2637 Lab III (Micro+Arche +Genetics) (2+2+2 Hrs)

The students will be able to

CO1 : The students will be able to carry out basic microbiological techniques like sterilization, media preparation and culture methods that they would be independently equipped to explore the microbial world by conducting appropriate experiments.
CO2 : The students will be able to the investigate the habitat of cyanobacteria and other higher algal forms during the field study and daily walk of life that they shall draw comparative analysis of thallus structure and life cycle patterns as when needed.
CO3 understand the algal world
CO4 verify mendel's laws, test the purity of gametes, identify the interaction between alleles and distinguish various gene interaction, identify different blood group in human, familiarize with polygenes which influences quantitative traits, determine sex of animals, categorize human traits as dominant and recessive and perform probability test for gene inheritance**.**
CO5 test viability of seed, experiment with emasculation techniques and familiarize with different hybridization techniques by visiting plant breeding stations.

Microbiology
1. Good laboratory practices and observation of ubiquitous presence of microbes
2. Microscope and Simple Staining techniques
3. Gram staining
4. Media preparation& sterilization techniques
5. Microbial isolation from natural habitat– Serial Dilution
6. Smear, spread and pour plate & streaking techniques
7. Microbial analysis of legume root nodules

Phycology
1. Observation of common Cyanobacteria and algae from field
2. Microscopic green algae - Volvox and Spirogyra
3. Macro Green algae - Caulerpa and Chara
4. Brown algae – Sargassum
5. Red algae : Batrachospermum and Gracilaria
6. Mass Cultivation of Algae – Spirulina

Outstation study:
1. Visit to Aavin dairy – food microbiology & industrial unit
2. Field trip to Rameswaram (CMFRI) – marine algal collection

References:
1. Gunasekaran, P. (2000). Laboratory manual in microbiology, New Delhi
2. Cappuccino, J.G. and Sherman, N.(2002). Microbiology: a laboratory manual 6th ed. Pearson Education Ltd. Singapore.

Archegoniatae
1. Panoramic view of archegoniates : whole mount and charts
2. Liver worts and thalloid bryophytes: vegetative and reproductive features of Riccia

3. A study on mosses based on Funaria /Polytrichum
4. Sudy of Lycopodium-sectional view of stem.
5. Study of Selaginella highlighting heterospory.
6. Ecological adaptations of Equisetum: Study of shoot and strobilus
7. Collection andstudy of locally available pteridophytes,
8. Morphology, rachis,pinna and sori of a fern.
9. Pinus-vegatative and reproductive structures
10. Plant evolution I –activity based learning with Geological time scale
11. Plant evolution II – study of fossils (preferably with a field visit to Ariyalur)
12. Visit to hill station

References:

Bendre, A. M., and Kumar, A. (2006). A text book of practical botany. (Vol I). Rastogi Publication New Delhi. ISBN 81-7133-809-7
Bendre, A. M. and Kumar,A. (2006). A text book of practical botany. (Vol II) Rastogi Publication New Delhi. ISBN 81-7133-852-6

Genetics

1. Verification of Mendel's law – I (Monohybrid ,test and back crosses)
2. Verification of Mendel's law - II (Dihybrid cross)
3. Gene interactions – problem solving
4. Study of Mendelian traits in human
5. Barr bodies & Giant chromosome - Chironema
6. Blood grouping- multiple alleles
7. Probability test – beads/coin/dice
8. Chromosome mapping
9. Drosophila experiment

Plant breeding

10. Collection and submission of local rice / vegetable cultivars
11. Determination of seed viability
12. Method of emasculation – pollen dusting and bagging
13. Visits - Cotton, millet, sugarcane research centres (Coimbatore),
Banana Research Centre (Trichy), National facilities - NBPGR, ICRISAT.

Reference

1. Gardner,E.J.,Simmon,M.J and Snustad .D.P. (1991) . Principles of Genetics. John Willey and Son (Asian) Ltd. Singapore. ISBN:0-471-50487-4
2. Stansfield,W.D. (1991). Theory and problems of Genetics. 3rd ed. McGraw Hill Inc. ISBN 0-07-060877-6
3. Chahal,G.C and Gosal,S.S (2002) Principles and procedures of Plant breeding. Narosa Publi. House. ISBN 81-7319-374-6

BOT 2345 **Botany for Chemists I** **3Hr./3Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	35	5	3	2

PREAMBLE: This course is designed for the chemistry students as a major supportive course, hence a basic understanding of plant forms and functions are dealt. A general understanding of the abuse of earth's natural resources particularly hazards that the plants face due to habitat destruction and global climate change will be taught. Chemical composition and the uses of plant nutrient are informed.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: recognize the variations between the plant groups from the lower forms to the higher plants that they would not only know to judiciously use them but also would come forward to save and conserve them subscribing the values they learn from this study	1	9
CO2: view cell as the basic living entity of life and look at it as a fundamental self contained and self regulated structural and functional unit of all organisms and dare venturing into next level learning in biochemistry	2	9
CO3: hold the nucleus as the control centre of the cell account for cytochemical events happening within that they would gain confidence to the perform tasks in molecular biology.	3	9
CO4: develop an comprehensive picture of plant as autotrophic life forms and bio machines performing the feat water cycling, food production, carbon turn over and oxygen replenishment making earth a living planet.	4	9
CO5:see the plant's ability to procure selective elements from their surroundings and use them effectively in making their metabolites so as to support their growth and development and draw inspiration for setting up their production units or industries contemplating on resource utilization and economy showcased in a plant of his or her choice	5	9

SYLLABUS

Unit I An overview of plant groups: Salient features of Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Unit II Cell as the basic entity: Prokaryotic and eukaryotic cells, endosymbiosis, chemistry of cell wall and plasma membrane, Structure and function of chloroplast and mitochondria.

Unit III Nucleus: Organization – nucleic acids and chromosome – functions of nucleus.

Unit IV Plant – water and plant - carbon relations: Biological significance of water molecule (uptake and conduction). Photosynthesis (light reaction and carbon assimilation). Respiration (Glycolysis, TCA cycle and ETS).

Unit V Plant growth and nutrition: Plant nutrients – NPK (organic and inorganic sources) - deficiency symptoms – plant growth regulators (auxins, cytokinins, gibberellins, ABA and ethylene).

References:

1. Berg, L.R. (1997). Introductory Botany: Plants, People & the Environment. ISBN-13: 978-

0030248443
2. Sheeler.P and Bianchi. E.D. (1987). Cell and Molecular Biology . 3rd ed. John . Willey and Son (Asian) Ltd. Singapore. ISBN: 9814-12-648-9
3. Devlin,R M and Witham,F.H. (1999). Plant Physiology, 4edn. CBS Publishers, New Delhi.
4. Pandey, B. P. (2005). College Botany, Vol I. 5th Edn., S. Chand & Company New Delhi. ISBN 81-219-0593-1
5. Pandey, B. P. (2009). College Botany, Vol II. 7th Edn., S. Chand & Company New Delhi. ISBN 81-219-0601-6
6. Sinha, R.K. (2004). Modern plant physiology. Narosa Publishing House New Delhi. ISBN 81-7319-333-9

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	5	5	3	28
CO2	5	5	5	4	3	2	24
CO3	5	5	5	4	2	2	23
CO4	5	5	5	5	5	5	30
CO5	5	5	5	4	3	2	24
Total	25	25	25	22	18	14	129
							129/30=4.3

BOT 2147 **Botany for Chemists – Lab I.** **2Hr./1Cr.**

Students will be able to

CO1 understand the diversity of plant kingdom
CO2 survey trees of the campus
CO3 learn the use instruments to study the basic biochemical parameters of soil
CO4 experience the physiology of plant system
CO5 identify symptoms in plant system

1. Morphology of *Sargassum, Riccia, Fern* and identification of cryptogams in field
2. Morphology of *Cycas*
3. Angiosperms – morphology of monocot and dicot plant
4. Survey of campus trees.
5. A study on plant cell - Onion peel/ *Tradescantia ,Hydrilla&Vernonia* (c.s. of stem)
6. Soil test – pH, temperature, EC, alkalinity, acidity.
7. Plant growth measurement and movement – auxanometer, phototropism.
8. Plant water relations: Potato osmoscope

9. Photosynthesis – DCPIP experiment, starch test
10. Transpiration – Cobalt Chloride paper test, stomatal index
11. Respiration –Kuhns tube, Ganongs respiroscope
12. Collection and submission of plants with mineral deficiency symptoms

References:

1. Bendre, A. M., and Kumar, A. (2006). A text book of practical botany. (Vol I). Rastogi Publication New Delhi. ISBN 81-7133-809-7
2. Bendre, A. M. and Kumar,A. (2006). A text book of practical botany. (Vol II) Rastogi Publication New Delhi. ISBN 81-7133-852-6

BOT 2552 MYCOLOGY & PATHOLOGY 5Hr./5Cr.

Pedagogy	Hours	Lecture	Dept. resources	Field/Indust./Lab	Subject experts	ICT Virtual learning	Peer teaching	Super special models
	75	61	2	7	-	5	-	-

PREAMBLE:

This course uncovers the eukaryotic and achlorophyllous world of fungal biology, its classification and its biotic interaction. Later part of the course deals with the concept of pathogenesis and host response, citing examples of local disease occurrence and finally deals with conventional and modern methods of disease management. As an outcome of this course student will understand and appreciate the diversity and uniqueness of fungal kingdom and students are expected to identify, diagnose and manage the common disease of important crops.

COURSE OUTCOME At the end of the Semester students will be able to	Unit	Hrs P/S
CO1: Understand the features of fungi and relate this knowledge to the daily walks of life.	1	14
CO2: gain an overview of classification based on structure, reproduction and life cycle patterns to distinguish the major groups of fungi.	2	15
CO3: recall the concepts in pathology to understand the mechanism of pathogenesis in delineating host pathogen interactions.	3	12
CO4: interpret the symptomatology to diagnose fungal, bacterial and viral disease to recommend suitable control measures.	4	16
CO5: understand epidemiology and forecast disease and employ suitable disease management strategies.	5	18

SYLLABUS

UNIT I. Basics of mycology: General features of fungi, reproductive biology, fruiting body and spore print, spore dispersal and dormancy – fungal habitats and mode of nutrition -Economic importance.

UNIT II. Classification of fungi: Alexopoulos and Mims (1979) classification salient features of Gymnomycota (cellular and slime moulds), Mastigomycota (Oomycetes), and Amastigomycota (Ascomycetes and Basidiomycetes) – Fungal associations (lichens, mycorrhiza and endophytes)

UNIT III. Introduction to Pathology: Concept of plant disease – Koch's postulates – Disease

tetrahedron – Pathogenesis (enzymes and toxins) –Structural and functional defense in plants. Plant diseases and human civilization.

UNIT IV. Plant diseases: Classification, symptoms and diagnosis – traditional and molecular methods. Case studies: Bacterial disease (Citrus canker), Fungal disease (Rice blast), Viral disease (TMV).

UNIT V. Disease Management: Epidemiology and forecasting – agrometeorology - Disease severity and estimation of crop loss - Plant Quarantine – chemical, cultural and biological methods of disease management (*Pseudomonas fluorescens* and *Trichoderma*) – Integrated disease management.

REFERENCES

Text books

1.Mehrotra RS and Agarwal A. 2003. Plant Pathology. 2nd Edn. Tata McGraw Hills Publi. Co. New Delhi ISBN 0-07-047399-4

2. Sumbali G. 2005. The Fungi. Narosa Publishng House. New Delhi. ISBN 81 -7319-512-9

Reference books

1.Alexopoulos CG and Blackwell M. 1996: Introduction to modern mycology, John Wiley. New York. ISBN 9814-12-612-8

Agrios GN. 2006: Plant pathology. 5th Edn. Elseviers Publication, Academic press. New Delhi. ISBN-13: 978-81-312-0639-3

Chaube HS and Pundir VS. 2005. Crop disease and their management. Prentice Hall of India Pvt. Ltd. New Delhi. ISBN 81-203-2674-1

Hull.R .2002. Plant Virology. Elsevier Publication. Academic Press. New Delhi. ISBN 0-12-361160-1

Singh RS. 2005. Plant disease. Oxford and IBH publishing. Co. Pvt. Ltd. New Delhi. ISBN 81-204-1658-9

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	4	5	4	4	2	2	21
CO2	4	4	4	4	5	3	24
CO3	5	4	4	4	3	3	23
CO4	3	3	4	5	5	2	22
CO5	4	4	4	4	4	5	25
	20	20	20	21	19	15	115
							115/30 = 3.8

BOT2444 **CELL BIOLOGY** **4Hr./4Cr.**

Pedagogy	**A**	**B**	**C**	**D**	**E**	**F**	**G**
	Course Teacher's Contribution	Department Resources	Field / Industry/ Lab	Subject Experts	ICT Virtual Learning	Peer Teaching	Super-Special method
	50	2	-	2	2	2	2

PREAMBLE:

This course is designed as an introductory course to understand and appreciate the living cells that serves as invisible backbones of all the life forms found in our earth. Architectural significance of organelles and other sub cellular components are highlighted for the students to explore and relate the structure and function of a typical cell. Various modes of cell multiplication mechanisms are also taught to motivate students to learn the basics of normal and abnormal cell division. A few tools and techniques commonly employed in cell biology are introduced to monitor and record the behaviour of a living cell. Students expected to get a holistic picture of life cycle pattern of a cell at the end of the course.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: write a brief resume of cell science, explain the organization of prokaryotic cell, fine structure of an eukaryotic cell and see it as product of endosymbiotic theory which with plastome and the plastids shall be establishing the uniqueness of plant cells	1	11
CO2: demarcate cell surface with cell wall and membranous envelope along with understanding on its molecular anatomy and the colloidal nature of protoplasm that draws a line between life and non-life	2	12
CO3: identify the structural and functional significance that endomembranes offer to the sub cellular compartments and see the vitality of GERL complex and the importance of vacuoles and microbodies as single membrane entities besides the chloroplast and mitochondrion the double membrane structures closely associated with energetic	3	13
CO4: fix cell duplication process in the spread of cell cycle events and distinguish direct, indirect ad reduction division as unique and discrete processes	4	14

and find a role for cytoskeleton and cytokinesis conferring meaning to multicellularity and development		
CO5:familiarize themselves with the theory and practice of using compound microscope, variants of LM and EM, cell fractionation and density gradient centrifugation that cell fractionation is done with precision for pursuing further studies	5	10

SYLLABUS

UNIT I

Cell as a basic unit of life: Cell- Discovery, theory - Organization of prokaryotic and eukaryotic cells, endosymbiotic theory - Unique features of plant cell.

UNIT II

Cell Surface and Matrix: Cell wall organization, plasmodesmata, pit fields, middle lamella- Plasma membrane structure (Unit membrane, Fluid-mosaic models) and functions- Properties of Cytoplasm.

UNIT III

Sub cellular components: Ultrastructure of Chloroplast - Mitochondria- Endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes, Micro bodies, cytoskeletons, Vacuoles and Ergastic substances (Crystals and raphides).

Nucleus – Membrane, nucleoplasm, chromatin reticulum, chromosome and nucleolus.

UNIT IV

Cell cycle and Cell Division: Cell division in lower forms- binary fission and budding.

Cell cycle, mitosis &meiosis- Abnormal cell cycle (Tumour and Cancer cells).

UNIT V

Microscopy and analytical procedures: Principle and working mechanism of compound and electron microscope – Sample preparation and Isolation of organelles (homogenisation, sub-cellular fractionation), Haemocytometry, Photomicrography.

REFERENCES

1.Gerald Karp (2003), Cell Biology 7 th Edn (international student version) John Willey ISBN :9781118318744

2.Geoffrey M. Cooper (2015), 7th Edn The Cell- A Molecular Approach, ASM publications Washington.

3.Albertis B,Johnson A,Lewis J Raff M, Roberts K and Walter P., 2002 Molecular Biology of cell, 4th Edn. Garland Science Publ. ISBN 0-8153-4072-9.

4.Singh and Tomer , (2015), 10th Edn Cell biology .Rastogi publications.Meerut.ISBN-978-81-7133-969-3

5.P.K.Gupta (2015) 4th Edn, A text book of cell and Molecular Biology. Rastogi publications ISBN-978-93-5078-072-5

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	2	2	2	1	17
CO 2	5	5	2	2	2	1	17
CO 3	5	5	1	2	2	1	16
CO 4	5	5	1	2	2	1	16
CO 5	5	5	5	4	4	2	25
	25	25	11	12	12	6	
							91/30
							3.03

BOT 2436 Anatomy and Reproductive Biology of Angiosperms (ARBA) 4Hr./4Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	35	5	3	2

Preamble : This course exposes students into the internal structure and organization of plants mostly angiosperms. Anatomy of vegetative and reproductive structure is given emphasis to know the complete changes in internal morphology that happens in the lifecycle of plants. Students will be trained to identify the tissue types and meristems which form the basis of growth. The reproductive organs which give rise to the gametes followed by the development of seed will be taught to the students to understand the essentials of reproduction. Students will also learn the applied part of anatomy and embryology which they can employ after learning the course in various field of their career such as making permanent slides, anatomical structures in printing technology, use of stains and mordant to print textiles, Induction of polyembryony and parthenocarpy in horticulture.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: recognize different types of cells and tissues in plant anatomy. Integrate the theories on meristem.	1	9
CO2: Conceptualize the primary structures in plant parts, Differentiate between secondary and anomalous structures.	2	10
CO3: Describe the structure of stamen and pistil, appreciate the development of pollen and embryo sac.	3	13
CO4: Identify the agents of pollination, examine the embryo and endosperm in a seed.	4	14
CO5: gain confidence in sectioning, effectively use stains for staining and utilize technology to develop parthenocarpy.	5	14

SYLLABUS

Unit I: Cells and Tissues: Tissues as architectural skeleton of plants - Tissue types – structure and

functions – localization of cell – Meristems– theories.

Unit II: Anatomy of vegetative structures: Primary structure of root and stem (Dicot and Monocot) – secondary structure – Anomalous secondary growth — Leaf anatomy – nodal anatomy.

Unit III: Reproductive structures: Stamen and pistil structure – pollen structure-male gametophyte - pollen germination- ovule structure and types – female gametophyte and embryo sac.

Unit IV: **Pollination and fertilization**: Types of pollination- agents of pollination–pollen - pistil interaction, double fertilization – triple fusion- embryo formation -embryo types -endosperm formation and types- seed.

Unit V: **Techniques in anatomy and applied embryology** : Stains used in anatomy- Maceration techniques – procedure for sectioning- permanent slide preparation. Wood anatomy and pharmacognosy -Applied embryology: polyembryony - parthenocarpy.

References:

1. Maheshwari.P (1985) An introduction to the embryology of angiosperm. Tata McGraw Hill. ISBN 0 0709 9434 X
2. Fahn,A (1989) Plant Anatomy. Mac Millan pub. New York. ISBN 008 028030 7.
3. Raghavan V. 1986. Embryogenesis in angiosperms. Cambridge University Press. ISBN 0 5212 6771
4.Esau,K . 2002. Plant Anatomy. John Wiley and sons. ISBN 9 8141 2649 7.
5. Burgess,J. 1985. An introduction to plant cell development. Cambridge University press. ISBN 05213 0273 0.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	4	3	2	24
CO2	5	5	5	5	3	1	24
CO3	5	5	5	4	2	2	23
CO4	5	5	5	5	5	4	29
CO5	5	5	5	5	4	2	26
	25	25	25	23	17	11	126
							126/30=4.2

BOT2638 LAB IV (Myco+CellBio+ARBA) (2+2+2 Hrs)

The students will be able to

CO1: At the end of the semester students will be able to understand characteristic features and habitats of microfungi. Field studies to analyze macrofungal diversity in the locality and their role in environment.
CO2: Analyze the epidemiology and management of major plant diseases in and around Madurai region. Apply the recent diagnosis methods and practices for effective management of plant diseases.
CO 3: obtain the larger picture of a cell
CO 4: distinguish between different types of cells and tissues, view the difference between shoot and root region through anatomical section, equip in maceration techniques, evaluate the quality of wood.
CO5: identify the different parts of reproductive structure, dissect an embryo from the seed, develop polyembryo seeds, utilize the pattern of placentation design in screen printing.

I - MYCOLOGY & PATHOLOGY (Lab) 2H
1. Observations of *Mucor* and *Rhizopus*
2. Observations of *Pilobolus*
3. Documentation of macro fungi from college campus
4. Documentation of plant diseases – rust, wilt, blast, rot, canker
5. Isolation of fungal plant pathogens
6. Isolation of plant pathogenic bacteria
7. Testing Koch's postulates – (*Rhizoctonia solani*) potted plants
8. Study of endophytes in plants
9. Disease assessment methods – different assessment scales (paddy)
10. Testing antagonistic property – biocontrol agent against pathogens – dual culture assay
11. Mass production and formulation of biocontrol strains
12. In- vitro screening of fungicides against pathogens
13. Disease forecasting – web based model

Visit to TNAU
Submission of summative Report on disease incidence in the state

REFERENCES
Aneja KR. 2009. Experiments in Microbiology, Plant Pathology, and Biotechnology. New Age International Publishers, New Delhi. ISBN 978-81-224-1494-3
Alexopoulos CG and Blackwell M. 1996: Introduction to modern mycology, John Wiley. New York. ISBN 9814-12-612-8

II- Cell Biology (2hrs/week)
1. Light and electron microscope - working principles through models
2. Cytological investigations: animal (mouth swab) and plant cell (Onion peel).
3. Cell inclusions: Starch grains, raphides, Cystolith Cytoplasmic streaming (Hydrilla and Tradescantia)
4. Cytochemistry I: Staining for starch ,reducing sugar, proteins.

5. Cytochemistry II: Staining for lipids, terpenes and secondary metabolites.
6. Cytochemistry III: Chromosome staining
7. Microscopic observation of Chloroplast
8. Cell isolation technique
9. Mitosis: smear technique with onion.
10. Meiosis: Rheo / Tradescantia anther Squash.
11. Chromosomal structure: Satellite and Giant Chromosome.

REFERENCES

Sheeler P and Bianchi ED 1987.Cell and Molecular Biology.3rd ed. John willey and Son (Asian) Ltd. Singapore. ISBN: 9814-12-648-9.

Shanmugam G 1988 Cell biology A laboratory Manual, Macmillan India Limited ISBN 033392 087 2

Santra S.C Chatterjee T.P. Das A.P (1989) College Botany Practical – Volume 1, New central book agency, Kolkatta.

III. PLANT ANATOMY AND REPRODUCTIVE BIOLOGY LAB

1. Examination of plant tissues –types.
2. Anatomy of meristems – shoot tip and root tip
3. C.S. of primary structures (Dicot & monocot stem and root)
4. T.S. of secondary structure of stem and Anamolous secondary growth.
5. Anatomy of leaf (Dicot & monocot) & node.
6. Wood anatomy - any three timber
7. Maceration and micrometry
8. Study of reproductive structure (Stamen and pistil).
9. Pollen types and pollen germination.
10. Ovule structure and placentation.
11. Excision of embryo (*Tridax*) and polyembryony in citrus
12. Endosperm types, aril and haustoria

Submission – Report of group activity

REFERENCES:

1. Johri.B.M 1982. Experimental Embryology of Vascular plants –springer-verlag. Nerlin. ISBN 3 5401 0334 1.

2. Esau,K. 1977. Anatomy of seed plants.Wiley Eastern.Publ. ISBN 04712 4520 8.

3. Raghavan V. 1986. Embryogenesis in angiosperms, Cambridge University press . ISBN 05212 6771

BOT 2346 **Botany for Chemists II (Theory)** **3Hr./3Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	35	5	3	2

PREAMBLE: Plant life is essential for the survival of all animals and human being on earth. This course is aimed to inculcate the chemistry of economically important plants which are intertwining in our day today life and also the course is designed to cater the need of young mind of students who take chemistry as major. This course will kindle the inquisitiveness of the students. After completing this course the students will be able to appreciate the plants in terms of its chemical makeup.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: locate bioresources that are of potential utility in human welfare as plants yielding food, flavor, beverage, fiber, fuel and medicine besides that which are of socio-cultural significance, and evaluate them for phytochemical value	1	9
CO2: catalogue of secondary metabolites in plants, especially in the context of housing oils, alkaloids, glycosides, terpenoids, steroids and such other constituents that have potential applications in drug discovery	2	9
CO3: cull out plant recourses in the form of useful biopolymers, rubber, Non-alcoholic beverages and alcoholic beverages, wood, wood pulp and fruit pulp that serve as raw material for bio-based industries	3	9
CO4: experiment the idea of *Biotransformation* and *Bioprospecting* in the like of the production health tonic *Jeevani* which is shown as model for benefit sharing agreements and the protection for guarding indigenous & traditional knowledge	4	9
CO5:reflect on the caution, risks ad dangers in trading of bioresources and make an assessment of supply and demand in standalone businesses and trading net works that a fair price is ensured at all times	5	9

SYLLABUS

Unit I. Introduction: Bioresources and human welfare – types of bioresources (food, beverages, fiber, medicine, industrial resources, fuel), food and culture.

Unit II: Chemistry of plant medicine: Brief study of Phytochemicals (secondary metabolites): source, useful part, active principles and uses of the following: Essential oil: menthol, citronella; Alkaloids: curcumin, Morphine and Vincristine; Glycosides – digitalin, steviosides; Steroids – *Dioscorea*; Flavanoids – *Pelargonium; T*erpenoids– cannabinoids (Cannabis) curcuminoids (mustard seed) an outline of drug discovery and design.

Unit III: Plant produce as industrial inputs: Botany and chemistry of Rubber. Pulp woods – grapes - papaya – potato – tapioca. Beverages: Non- alcoholic beverages -– history, botany, chemistry of tea, coffee and cocoa.

Unit IV: Bioprospecting and drug development: Jeevani**,** Artemisin, Noni, Brahmi, Indian Ginseng. Traditional knowledge as marker for bioprospecting: access and benefit sharing. Drug abuse and addiction.

Unit V: **Trade and conservation of resources**: Supply and demand assessment –threats – loss of resources - sustainable management.

References:

1. Anonymous . The Ayurvedic Pharmacopia of India Volume-I and IV, Govt. of India, Ministry of Health and Family Welfare, Department of Ayush Page 41.
2. Buchanan, B., Gruissem, W. and Jones, R. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Kochhar, S.L. 2011. *Economic Botany in the Tropics*, MacMillan Publishers India Ltd., New Delhi. 4th edition. (ISBN (13) 978-0230- 63893-8)
4. Kokate C.K. 2014. Practical Pharmacognosy, Vallabhprakashan, New Delhi, 5 th edition
5. Trease G.E. and Evans. W.C. (2002) Pharmacognosy ELBS 15th Edition
6. Verma, V. 2009. *Text book of economic botany* Ane Books Pvt Ltd. New Delhi (ISBN (13) 978-81-8052-167-6)
7. Wallis,T.E. (2003)Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition)
8. Simpson, B B. . and Ogorzaly, M.C. (2000)Economic Botany: Plants in our World 3rd Edition, McGraw Hill Book Company, New Delhi, ISBN-13: 978-0072909388.
9. Hill, a. F. 1937. *Economic botany: a textbook of useful plants and plant products*, mcgraw-hill book company, inc. New york and london 1937.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	5	5	3	28
CO2	5	5	5	4	3	2	24
CO3	5	5	5	5	5	3	28
CO4	5	5	5	5	5	5	30
CO5	5	5	5	5	5	3	28
Total	25	25	25	24	23	16	138
							138/30=4.6

BOT 2148 **Botany for Chemists II – Lab** **2Hr./1Cr.**

The student will be able to

CO 1: identify the basic importance of plants
CO 2: locate plant diversity in the college campus
CO 3: extract common ingredients of plant like oil
CO 4: familiarize with fermentation technique
CO 5: undrestand the importance of alternate fuels like biogas

1. Identification of plant resources mentioned in syllabus
2. Locating potential plant resources on and off campus
3. Survey of plant based medicines in local market
4. Histo-chemical staining and identification of important phytochemicals
5. Solvent extraction of selected plant ingredients
6. Distillation of essential oil
7. Extraction of bio-fuel from *Madhuca* / *Pongamia*
8. Tea adulteration and testing
9. Homemade chocolate preparation
10. Fermentation - Wine preparation
11. Biogas unit – design and demo
12. Natural dyes – extraction and dyeing of fibres

References:

1. Hill, a. F. 1937. *Economic botany: a textbook of useful plants and plant products,* mcgraw-hill book company, inc. New york and london 1937
2. Trease G.E. and Evans. W.C. (2002) Pharmacognosy ELBS 15th Edition

BOT 3631 **PLANT SYSTEMATICS** **6 Hr./6Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	90	-	70	10	10

PREAMBLE: This course is designed to give an introduction on plant systematics to the young minds who study the subject for the first time. The morphology and the history of classification will be an eye opener to the students. Further the on hand study of locally available flora can give them the basic knowledge of plants. This study will further helping the young students to appreciate and enjoy the nature and also lead them towards conservation of plants. After the successful completion of the course, the student will be able to understand and explain the principles of systematics, distinctive features of selected families, recall the economic value of the plants in the cited families

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO 1: experience and admire the morphological variations in plants and the contributions of various people in terms classification of plants may pave way to conservation.	1	20
CO 2: engross the importance of rules in the naming of plants and it's importance in the field of taxonomical research and enlightened about other fields of high reputation related to plant systematics.	2	20
CO 3: keep himself amused to know the floral characters and economic importance of select families in the group Polypetalae and their phylogenetic relationship with other plant groups	3	15
CO 4: contemplating upon the floral characters and economic importance of select families of Gamopetalae and their phylogenetic relationship will enlighten further to appreciate and save the nature given chow.	4	15
CO 5: take pleasure in investigating the floral characters and economic importance of select families of Monochlamydeae & Moclootyledonae and their phylogenetic characters which will make them enjoy and formulate the ways to sustain.	5	20

SYLLABUS

UNIT 1. Morphology of plants & History of classification:
Morphology of root, stem, leaf, inflorescence, flower and fruit – History of classification (Theophrastus, Linnaeus, Bentham and Hooker, and Engler and Prantle.)

UNIT 2. Principles of plant taxonomy: Principles of Taxonomy – Minor and Major categories, rules and recommendations – ICBN and ICN – principles of ICN – active principles (priority of publication, typification and effective publication) author citation – naming of plants – rejection of names – dichotomous key – phytography – herbarium techniques – numerical taxonomy – Chemotaxonomy.

UNIT 3. Study of the locally available *Polypetalae* flora: Annonaceae, Leguminosae (Fabaceae, Caesalpiniaceae, Mimosaceae), Rosaceae and Cucurbitaceae with their economic importance and phylogeny.

UNIT 4. Study of the locally available *Gamopetalae* flora: Asteraceae, Sapotaceae, Apocynaceae, Rubiaceae and Lamiaceae with their economic importance and phylogeny.

UNIT 5. Study of the locally available *Monochlamydae* and Monocot flora:
Amaranthaceae, Euphorbiaceae, Orchidaceae , Arecaceae and Poaceae with their economic importance and phylogeny.

TEXT BOOKS

1. Singh, G., 2012. Plant systematics, Third edition. Oxibh publishers, New Delhi. ISBN: 978-8120417632.
2. Pandey, S. N. and Misra, S. P., 2008. Taxonomy of angiosperms. Ane books India, New Delhi. ISBN: 978-8180521768.
3. Verma, B.K., 2011. Introduction to taxonomy of angiosperms, PHI learning private limited, New Delhi. ISBN: 978-8120341142.
4. Lawrence, G.H.M., 1965. Taxonomy of vascular plants. The Macmilan co, New York. ISBN: 978-0023681905.
5. Pandey, B. P., 2001. Taxonomy of angiosperms, S. Chand and co limited. New Delhi. ISBN: 978-8121909327.

REFERENCE BOOKS

1. Gamble, J.S and Fischer, C.E.C., 1957. Flora of the presidency of madras, I –
III, W. C. Adlard and son limited, London. ISBN: 978-1152544420.
2. Jeffrey, C., 1982. An introduction to plant taxonomy. Allied publishers private limited, New Delhi. ISBN: 978-0521287753.
3. Jones Jr, S. B. and Luchsinger, A. E., 1987. Plant systematics. Mcgraw hill book company, New Delhi. ISBN: 978-0070327962.
4. Sambamurty, A. V. S. S., 2005. Taxonomy of angiosperms. I. K. International private limited, New Delhi. ISBN: 978-8188237166.
5. Singh, H.B. and Subramanian, B., 2008. National institute of science communication and information resources, New Delhi. ISBN: 978-8172363307.

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	5	5	3	3	26
CO 2	5	5	5	5	4	3	27
CO 3	5	5	4	4	3	3	24
CO 4	5	5	5	5	3	3	26
CO 5	5	5	5	5	3	3	26
							129/30
							4.3

BOT 3633 BIOCHEMISTRY 6Hr./6Cr.

PEDAGOGY	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	6	4	0	1	1

PREAMBLE: A cognitive and pedagogical exposure of biochemistry is useful for a concrete understanding of biology. The course work envisaged endeavors to provide students a broad based training to look at life as an outcome of interlocked events of simple biochemical reactions, biosynthetic pathways and metabolism which eventually gets expressed as physical and physiological changes. In addition to the theoretical knowledge imparted on the basic rules, emphasis will be placed on the applications and forefront areas of experimental biochemistry. A multidisciplinary approach will provide the learner a good leverage for better comprehension of integrated metabolism.

COURSE OUTCOME At the end of the semester, students will be able to	Hrs P/S
CO1: Picturize the array of molecules in a living cell and understand how different chemicals interact among themselves in establishing the cellular basis of life.	15
CO2: explore the various sources of carbohydrates, structural and functional properties and evaluate its significance	15
CO3: understand lipids as an important source of reserve food and emphasize on their vitality in cell membranes, besides referring to the dietary significance of vitamins	15
CO4: Comprehend proteins and nucleic acids as important heteropolymers offering to heterogeneity as well as specificity to cell functions.	28
CO5: Categorize different enzymes and recognize its role in driving biochemical reactions	17

with specificity and use this knowledge eventually for commercial ventures	

SYLLABUS

Unit 1. Introduction: An overview of the cell structure and brief survey of major bioconstituents (Atoms – molecules – bonds and bonding – functional groups) – basic principles of thermodynamics – Gibbs free energy – entropy and enthalpy – redox reaction – electron transfer and its significance.

Unit 2. Carbohydrates: Sources of various carbohydrates – classification – physio-chemical and optical properties of monosaccharides – structural and functional significance of sucrose, starch and cellulose.

Unit 3. Lipids: Triglycerides – saturated and unsaturated fatty acids – brief outline on lipid metabolism – β-oxidation and lipid peroxidation – dietary value of lipids and vitamins

Unit 4. Nucleic acids, Amino acids and Proteins: Types of nucleic acids – components – synthesis of purines and pyrimidines in outline – properties, classification and precursors for amino acid biosynthesis – structure and conformation of proteins – significance of Ramachandran plot – acid-base solubility – properties of proteins.

Unit 5. Enzymes: Enzymes as quaternary proteins – properties –classification and nomenclature – mechanism of action – significance of Km – Michaelis and Menton concept– Enzyme catalysis – coenzymes and cofactors – competitive and non competitive inhibition – allosteric regulation – isoenzymes.

REFERENCE BOOKS

1. Berg, J.M. Tymoczko, J.L. and Stryer, L., 2002. Biochemistry, Fourth edition. W. H Freeman and company, New York. ISBN: 07 1674 9548.

2. Gasser, R.P.H. and Richards, W.G., 1986. Entrophy and energy levels. Oxford university publication, London. ISBN: 10- 0194424111.

3. Lehninger, A.L., Nelson, D.L. and Cox, M.M., 2000. Principles of biochemistry, Fifth edition. CBS publishers and distributors, New Delhi. ISBN: 10: 0716743396.

4. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Weil, P.A., 2009. Harper's illustrated biochemistry, Twenty-eighth edition. Mcgraw hill education, New York. ISBN: 978-0-07-162591-3.

5. Voet, D. and Voet, J.G., 2004. Biochemistry, Third edition. John wiley and sons, New Jersey, United States. ISBN: 10: 047119350X.

6. Zubay, G.L., 1998. Biochemistry, Fourth edition. Brown publishers, Chicago. ISBN: 0-697-21900-3.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	3	2	25
CO2	5	5	5	5	5	2	27
CO3	5	5	5	5	5	2	27
CO4	5	5	5	4	3	1	23
CO5	5	5	5	4	3	3	25
	25	25	25	23	19	10	127
							127/30=4.2

BOT3535 ANALYTICAL TECHNIQUES AND RESEARCH METHODOLOGY 5Hr./5Cr.

Pedagogy	Hours	Lecture	Dept. resources	Field/Indust./Lab	Subject experts	ICT Virtual learning	Peer teaching	Super special models
	75	60	-	-	-	13	2	-

PREAMBLE:
This course imparts knowledge on principles of various instruments and gadgets employed in scientific enquiry. Students will learn various qualitative and quantitative techniques. Further students will gain skills to design scientific experiments, data mining, analysis and scientific paper writing.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: follow the standard and good laboratory practices and observe safety norms at every stage of work and be confident in handling basic science experiments	1	12
CO2: confidently and independently use spectrophotometer and its variants and effectively perform analytical work and do quantitative measurements with accuracy	2	10
CO3: understand how the principle of centrifugation, chromatography, electrophoresis and blotting techniques can be utilized to resolve queries inplant biochemistry	3	20
CO4: design and carry out scientific enquiries doing sampling , surveys, and statistical analysis employing data collection and analysis using suitable statistical tools	4	15
CO5:design and execute science projects recalling the training they had undergone in making scientific observations showcasing skills	5	18

developed in thesis writing report writing and in making scientific presentations		

SYLLABUS

UNIT I. Basic principles:

Units of measurement, expression of solutions concentration (molarity, molality, normality, percentage, parts per thousand, and ppm) – pH metry (working principle, components and buffers) – electromagnetic spectrum – gravitational force – Good Laboratory Practices (GLP).

UNIT II. Analytical Procedures:

Instrumentation for environmental analysis (sonometer, clinometer, altimeter, barometer, hygrometer, anemometer, lux meter, thermometer, rain gauge and smart phone Apps.) colorimetry and spectrophotometry (working principle, components and applications) – Spectroscopy, UV visible and Mass spectrometry (working principle, components and applications.).

UNIT III. Separation Techniques:

Centrifugation (principle, types of centrifuge and applications) – Chromatography (principle of paper and thin layer) – applications of HPLC, GC–MS, FTIR, NMR – electrophoresis – (principle, agarose and Poly Acrylamide Gel Electrophoresis) – applications of Southern and Northern blotting.

UNIT IV. Scientific experimentation:

Scientific observations – critical thinking – development of scientific thought - research aptitude – defining a research problem, hypothesis testing and experimental design – review of literature (journal references, on line resources.) Collection of primary and secondary data – population and sample – sampling methods (random and non–random sampling) – questionnaire – survey – field note – photo documentation. Model biological organisms (*Escherichia coli* and *Arabidopsis thaliana*).

UNIT V. Data collection and analysis:

Biostatistics (mean, mode, frequency distribution, standard deviations, standard error) – data processing softwares – thesis writing – format of report, abstract, data presentation (tabulations, graphic representation) – interpretation of results – acknowledgements – MS-word, excel and power point – oral presentation – plagiarism.

REFERENCE

1. Jeyaraman, J., 2011. Laboratory manual in biochemistry, Second edition. New age international private limited, New Delhi. ISBN: 9788122430493.

2. Kothari, C.K., 1985. Research methodology – methods and techniques. Wishwa prakashan publications, New Delhi. ISBN: 81 224 0002 7.

3. Palanivelu, P., 2009. Analytical biochemistry and separation techniques – A laboratory manual, Fourth edition. Twenty first century publications. India. ISBN: 978–8190848909.

4. Plummer, D.T., 1975. An introduction to practical biochemistry, Tata mcgraw hill publishing company limited. New Delhi. ISBN: 9780070994874.

5. Rastogi, V.B., 2011. Fundamentals of biostatistics. Ane books private limited, New Delhi. ISBN: 978 81 8052 2550.

6. Wallwork, A., 2011. English for writing research papers. Springer science publications, New York. ISBN: 9781441979216.

7. Wilson, K. and Walker, J., 2006. Principles and techniques of biochemistry and molecular biology, Sixth edition. Cambridge university press, New York. ISBN: 10 0521 69180.

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	4	4	5	4	2	2	21
CO2	3	4	5	4	3	3	22
CO3	3	4	4	5	3	3	22
CO4	2	3	3	4	4	5	21
CO5	2	3	4	4	4	5	22
	14	18	21	21	16	18	108
108 /30 = 3.6							

BOT 3637 LAB V (PLANT SYSTEMATICS AND BIOCHEMISTRY) 6Hr./6Cr.

Students will be able to

CO1: appreciate the plant kingdom
CO2: differentiate the various forms of plant diversity
CO3: learn the economic importance of plants
CO4: have hands on experience with biochemical instruments
CO5: extract secondary metabolites from plants

Plant Systematics 3h/wk

The lab course is aimed at giving on hand experience to the students. The students will be encouraged to observe and understand the various vegetative and reproductive structures of the plant.

1. Introduction: Various plant parts
2. Morphology of vegetative parts
3. Morphology of flowers and fruits
4. Phytography (description of plants)
5. Key construction (Indented and bracketed key)
6. Identification of plants up to family level using dichotomous keys used in the floras
7. Polypetalae I Annonaceae, Leguminosae (Fabaceae, Caesalpiniaceae, Mimosaceae),
8. Polypetalae II Rosaceae & Cucurbitaceae
9. Gamopetalae I Asteraceae, Asclepiadaceae,
10. Gamopetalae II (Convolvulaceae, Acanthaceae & Lamiaceae)
11. Monochlamydeae (Amaranthaceae, Euphorbiaceae.)
12. Monocots : Orchidaceae, Arecaceae, & Poaceae
13. Economic botany
14. Taxonomic problems

Further students are encouraged to participate in Field trips arranged by the Course Teacher to nearby botanically rich areas to study plants in their natural habitat.

Suggested places for field study:
Alagar Hills, Karungalakudi, Sathuragiri, Kodaikanal, Kuttupatti, Sirumalai .

REFERENCES

1. Gamble, J.S. and Fischer, C.E.C., 1957. Flora of the presidency of madras, I – III, W. C. Adlard and son limited, London. ISBN : 978-1152544420.
2. Lawrence, G.H.M., 1965. Taxonomy of vascular plants. The macmilan co, New York. ISBN: 978-0023681905.
3. Matthew, K. M., 1995. An excursion flora of central tamilnadu, Oxford press, New Delhi. ISBN: 978-905410286.

Biochemistry **3h/wk**

This laboratory session is to train the student to quantitatively and qualitatively analyse biomolecules and metabolites besides providing knowledge about the principles and knowhow of using various instruments**.**

1. pH metry
2. Colorimetry - Verification of Beer – Lambert's law
3. Spectrophotometer- Determination of λ-max.
4. Qualitative test for carbohydrates
5. Quantitative estimation of carbohydrates by Anthrone's method
6. Qualitative test for proteins and amino acids
7. Quantitative estimation of protein by Lowry's method
8. Qualitative test for lipids and estimation of oil in seeds
9. Separation of amino acids using paper chromatography.
10. Separation of pigments using thin layer chromatography.
11. Enzyme activity (Catalase / Peroxidase)
12. Isolation of chloroplast for electron transport studies.
13. Estimation of PS II activity (DCPIP reduction method)

REFERENCE BOOKS

1. Cooper, T.G., 1991. The tools of biochemistry. John wiley and sons, New York. ISBN: 0-471 17116-6.
2. Jeyaraman, J., 1998. Laboratory manual in biochemistry. New age international publishers limited, New Delhi. ISBN: 0852264283.
3. Plummer, D.T., 2003. An introduction to practical biochemistry, Third edition. Tata Mcgraw hill publishing company limited, New Delhi. ISBN: 0-07-0994870

BOT 3239 **MEDICINAL BOTANY** **3Hr./2Cr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	Field work
	45	30	2	7	3	3

PREAMBLE:

This course will provide knowledge on botanical and therapeutic value of selected locally available and easily cultivable herbs. The students will be introduced to a few systems of medicines such as Siddha, Ayurveda, Unani and Homeopathy. Students will learn domestic usage of medicinal plants and be apprised about scope for documentation of folk medicinal knowledge, collection, marketing and sustainable utilization of medicinal plants.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: Quote the names of physicians and literature related to Indian medical practices. Distinguish various medical practices.	1	7
CO3: identify medicinal plants, describe its morphology, add medicinal knowledge about locally available plant.	3	15
CO4 do cultivation practices of certain medicinal herbs, learn processing, storing and packing of medicinal produce.	4	7
CO5: practice preparation techniques of siddha medicines, commercialize the products.	5	9

SYLLABUS

UNIT 1. Introduction to medical practices in India: History – Literatures and physicians of ancient period. – Ayurvedha – Siddha – Unani-Homeopathy – Allopathy.

UNIT 2. Ethnobotany and Folk lore medical practices: Ethnic communities in Tamil Nadu and their medicinal plant usage – patented products (Kani Tribe) – popular folklore medicines – methods of documenting the ethnobotanical knowledge – AICRPE.

UNIT 3. An overview of selected medicinal plants: Morphology, family, vernacular and botanical name, useful part and active principles phytotherapeutics.

I. Root (*Asparagus racemosus & Gloriosa superba)*
II. Leaf (*Aloe vera, Azadirachta indica)*
III. Bulb(*Allium cepa, Allim sativum)*
IV. Rhizome(*Zingiber officianale, Curcuma longa)*
V.Fruit (*Solanum nigrum, Solanum xanthocarpum)*
VI. Seed(*Trigonella foenum graceum.Cuminum cyminum)*
VII. Oil seed (*Cocus nucifera, Ricinus communis)*

UNIT 4. Cultivation and processing of medicinal plants: Propagules (Seed, leaf, stem, root, rhizome and bulbs) – cultivation methods – harvesting – processing – packaging – storage.

UNIT 5. Good Manufacturing Practices: Choornam – legiyam – thailam – parpum– kasayam– herbal concoction – Processing of medicinal plants – medicinal plants in commercial products – list of commercial outlets.

REFERENCES

1. Akerele, O., Heywood, V. and Synge, H., 1991. The conservation of medicinal plants. Cambridge university press. Cambridge. ISBN: 0521112028.
2. Chevallier, A., 1996. The encyclopedia of medicinal plants. D.K publishing, Michigan. ISBN: 0-789-41067-2.

3. Cunningham, A.B., 2001. Applied ethnobotany- people, wild plant use and conservation. Earth scan publications limited, London. ISBN: 1853836974.
4. Singh, M., 2009. Medicinal plants of india. New central book agency, New Delhi. ISBN: 8173815933.
5. Mathur, N., 2010. Medicinal plants of india. RBSA publishers, New Delhi. ISBN: 8- 176114995.
6. Wallis, T.E., 1997. Textbook of pharmacognosy, Fifth edition. CBS publishers, New Delhi. ISBN: 0700012915.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	1	1	1	18
CO2	5	5	5	5	3	5	28
CO3	5	5	5	5	4	5	29
CO4	5	5	5	5	2	5	27
CO5	5	5	5	5	3	5	28
							129/30=4.3

BOT 3200 ENVIRONMENTAL STUDIES 4Hr./2Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	60	45	-	10	5

PREAMBLE: The course presents an overview on the components of environment. Students will learn about the fragility and delicate balance between the interactive variables of habitat. Various causes of pollution with special reference to anthropogenic influences will be investigated. Learners will have an opportunity to get sensitized about local and global environmental issues and strategies to manage them.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: look at the nature differently so that one can appreciate and take efforts to conserve it in order to use the resources wisely and sustainably	1	15
CO2: comprehend the relationship between the Ecosystem and the Community better and also have a better insight on the population	2	10
CO3: cope up with all kinds of pollution and the treatment of pollutants through the study of several worst case scenarios of different degrees.	3	15
CO4: understand better the ever changing climates and its effect on the elements of an ecosystem so that effective combating measures could be taken in a swift manner	4	10

CO5: formulate proper environmental policies on conservation of nature and energy through phytoremediation in order to create a green and clean environment	5	10

SYLLABUS

UNIT 1. Living Earth: Elements of Nature – Biotic, abiotic and climatic factors – lithosphere – atmosphere –hydrosphere – biosphere – renewable and nonrenewable energy resources (types – utilization – generation – solar – wind – hydro – wave – nuclear – biomass –fossil fuel.)

UNIT 2. Ecosystem, Community and Population ecology: Structure – **t**ypes – pyramids–food web – food chain – succession (hydrosere) – Clement's classification of community – attributes of population.

UNIT 3. Pollution: Pollution and its types – sources – effect – control (air –noise – space – water – land – thermal – biomedical and e-waste) – treatment of pollutants (reduce/ reuse/ recycle techniques) – episodes of concern (Ennore oil slick, Bhopal gas tragedy, Pacific gyre,
Fukushima nuclear plant disaster)

UNIT 4. Climate change and natural disasters: Factors affecting global climate (green house effect, ozone depletion, acid rain) – disasters (occurrence – reasons – types – measurement – monitoring – management strategy) – participatory management – earthquake – volcanic eruption – floods – cyclones – tsunami – forest fire.

UNIT 5. Environmental policies: Future energy – environmental movements – national environmental issues – Indian environment policies – environment education – phytoremediation – aforestation and reforestation – social and agroforestry.

REFERENCES

1. Chauhan, B.S., 2015. Environmental studies, Second edition. Laxmi publications, New Delhi. ISBN: 8-131-80328-7.
2. Cunningham, W. P., Cunningham, M.A. and Saigo, B. W., 2006. Environmental sciences, Nineth edition. Mcgraw-hill higher education, United States. ISBN: 978-0073218816.
3. Odum, E.P., 1971. Fundamentals of ecology, Third edition. W.B. Saunders company, Philadelphia. ISBN: 0-7216-6941-7.
4. Rai, G.D., 2011. Non conventional energy resources. Khanna publishers, New Delhi. ISBN: 1- 364-63010-1.
5. Rao, C.S., 2006. Environment pollution control engineering, Second edition. New age international publishers, New Delhi. ISBN: 812241835X.
6. Sharma, P.D., 1999. Ecology and environment. Rastogi publications. Meerut. ISBN: 81- 713381-43.
7. Subramanyam, N.S. and Sambamurthy, A.V., 2000. Ecology. Narosa publishing house, New Delhi. ISBN: 81-7319-289-8.

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	5	5	4	4	28
CO 2	5	5	4	5	3	3	25
CO 3	5	5	4	4	4	4	25
CO 4	5	5	5	5	5	4	29
CO 5	5	5	5	5	5	5	30
							137.30
							4.5

BOT3832 PLANT BIOTECHNOLOGY 5T+3L/8Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	75	60	5	5	5

PREAMBLE:

This course opens up the vistas of molecular biology and its application in genetic engineering. Students will learn the purpose and the art of tissue culture for propagation and genetic transformation of plants. Students will analyze the wet lab data at dry lab. They will explore the practical issues involving fermentation industries and nitty-gritty of making marketable plant based products. On completion of the course students will appreciate the art of fermenting foods and beverages.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: realize the potential of the *in vitro* technique and capitalize on the knowledge to take up jobs and employment in plant tissue culture industries or starting their own plant production and plant propagation units to propagate and market elite planting stocks	1	15
CO2: apply their understanding on DNA techniques , plasmids, vectors, Ti plasmids to vocationally use them in r DNA processes that they take up gainful employment in plant genetic engineering laboratories within and outside the country.	2	15
CO3: hire the experience gained in handling biological data bases to access genomic and proteomic data vested with NCBI, EMBL, DDBJ and other leading molecular biology research centers and lab that show themselves ready for job ready for contemporary innovations and breakthroughs.	3	15
CO4: benefit from identification and characterization of potential microbes to pursue strain development, designing culture equipments and fermentors suitable enough to produce a host of fermented products for SSI and MSI commercial entrepreneurial ventures	4	15
CO5: try their luck in making useful secondary metabolites from plants,	5	15

biotransformation and cell immobilization, SCP, plant vaccines and marketable enzymes, biofuels and gm crops with due consideration of issues of bioethics and biosafety that shall launch many agrobiotechnological initiatives using the skilling		

SYLLABUS

Unit 1. Tissue culture as a tool for plant biotechnology: Objectives and goals – historical perspective – laboratory design and equipments– MS Media composition and supplementation – explants selection, sterilization, inoculation –induction of callus – organogenesis – somatic embryogenesis and hardening – micro propagation – artificial seeds – protoplast isolation, culture and fusion – haploid plants.

UNIT 2. Basics of rDNA technology : Central Dogma – DNA structure, variations and organization – replication – transcription, translation and protein synthesis – mutations – principles of recombinant DNA technology – pGEMT vector – restriction mediated and PCR based cloning – *Agrobacterium* mediated gene transfer.

Unit 3. Elements of bioinformatics: *In silico* assistance in sequencing biomolecules – online nucleotide and protein databases (EBI and NCBI) and tools (BLAST,FASTA ,ClustalW and PHYLIP)

Unit 4 : Fundamentals of Fermentation Technology: Potential microorganisms – culture and characterization – strain development – batch and continuous culture – media formulation – growth kinetics – fermented products – food (curd, yoghurt, dhokla, miso, sauerkrauts , sausages , vinegar and cheese) – beverages (wine, beer) – types of fermenters – design – control and scale-up – upstream and downstream processing – introduction to bioreactors.

UNIT 5. Marketable products and bio-applications: Secondary metabolites production – immobilisation – Single Cell Protein(SCP) – enzymes – planticcines – biofuels – GM crops – terminator seed technology – bioremediation – bioethics and biosafety.

TEXT BOOKS

1. Demain, A.L. and Davis, J.E., 2004. Industrial microbiology and biotechnology, American society for microbiology press. ISBN: 9781555811280.

2. Brown, T.A., 2010. Gene cloning and DNA analysis: an introduction, Sixth edition. Wiley blackwell, United States. ISBN: 9781405181730.

3. Dubey, R.C., 2006. Textbook of biotechnology, Fourth revised edition. S.Chand and company, New Delhi. ISBN: 8-219-2608-4.

4. Dubey, R.C., 2014. Advanced Biotechnology. S. Chand and company, New Delhi. ISBN: 81-219-4290-X.

5. Stansbury, P.F., 2009. Principles of fermentation technology, Second edition, Butterworth-heinemann publisher- Elsevier, United Kingdom.ISBN: 9780080999531.

6. Razdan, M.K., 2003. Introduction to plant tissue culture. Oxford and IBH publishing, New Delhi. ISBN: 81-210-41571-X.

7. Stansbury, P.F., Whitaker, A. and Hall, S.J., 1997. Principles of fermentation technology, Butterworth-Heinemann publisher-Elsevier, United Kingdom. ISBN: 978-0750645010.

REFERENCE BOOKS:

1. Peterson, C.S., 1971. Microbiology of food fermentations, Second revised edition. AVI publishing company, Connecticut. ISBN: 978-0870552779.

2. Joshi, V.K., 2009. Biotechnology: Food fermentation-Volume I. Educational publishers and distributors, Kerala. ISBN: 978-8187198048

LAB IN PLANT BIOTECHNOLOGY **3L**

1. Sterilization
2. Media preparation
3. Callus culture
4. DNA Extraction and agarose gel electrophoresis
5. DNA Quantification
6. Restriction Digestion of DNA
7. Introduction to databases
8. Usage of tools-BLAST, ClustalW analysis
9. Growth curve of *Escherichia coli*
10. Production of primary metabolites-catalase, amylase
11. Wine/Beer production
12. Production of acetic acid and lactic acid
13. Biodiesel production-*Jatropha*

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	5	2	27
CO2	5	5	5	5	3	2	25
CO3	5	5	5	5	5	5	30
CO4	5	5	5	5	5	5	30
CO5	5	5	5	5	4	3	27
	25	25	25	25	22	17	139
							139/30=4.6

BOT 3434 ENTREPRENEURIAL BOTANY 4Hr/4Cr

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	60	50	3	2	5

PREAMBLE:

This course is designed to help students gain the know-how on contemporary opportunities in business situations and develop skills needed to successfully convert them into entrepreneurial ventures. The basics of entrepreneurship as a concept and the fundamentals training they may require to meet their livelihoods will be explored. On completion learners will be able to develop ideas that will lead them to start their own business and enable them to be professionally competent.

Objectives:

1. To provide an understanding the essentials of entrepreneurship.
2. To introduce organizations and agencies that can backup entrepreneurial initiatives.
3. To expose students to various business opportunities emerging around the study of plants.
4. To encourage students to built proposals and projects to become an entrepreneur.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: pragmatically asses the scope of using the knowledge gained in learning Botany for gainful applications by starting own business ventures.	1	12
CO2: evaluate the feasibility designing projects of their own in the model of the various case studies they have investigated in this course.	2	12
CO3: work out the breakeven of small scale business ventures and evaluate the feasibility of value additions in the project the break grounds for achieving cost effectiveness	3	12
CO4: tap agencies that can possibly provide full or partial support to kick start their projects that stabilize the same for making their livelihood	4	12
CO5: assess the market worth of their entrepreneurial exercise and clearly rate the viability considering the opportunities and risks matching it with that of their peers and competitors on real time basis.	5	12

SYLLABUS

Unit 1. Introduction: Need – definition and concept – Types and characterization – entrepreneurial values – motivation and barriers – entrepreneurship as innovation, risk assessment and solutions.

Unit 2. Bioventure: Industry – overview of *Spirulina*, *Pleurotus sajor-caju*, *Ganoderma*, *Lentinusedodes*, drumstick and coconut – Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO) - methods and marketing – fresh and dry flowers for aesthetics.

Unit 3. Value added products: Canning of fruits – process and equipment – fruit and vegetable based products (squash) – ready to serve (RTS) (syrup, pulp, paste, ketchup, soup, vegetable sauces, jam and jellies) –bio-fuel production – Bamboo and cane based products – virgin coconut oil, jasmine oil production – nutraceuticals – standards and quality management.

Unit 4. Organizations and agencies: TIIC, DIC, NABARD, MICROSTAT, DBT – case study – sarvodaya – SIDCO – Micro Small and Medium Enterprises – support structure for promoting entrepreneurship – various government schemes.

Unit 5. Entrepreneurial opportunities: Understanding a market and assessment – selection of an

enterprise – business planning –mobilization of resources – Break Even Analysis – project proposal (guidelines, collection of information and preparation of project report) – steps in filing patents – trademarks and copyright – Intellectual Property Rights – export and import license.

REFERENCE BOOKS

1. Taneja, S. and Gupta, S.L., 2015. Entrepreneurship development, New venture creation, Galgeha publication company, New Delhi. ISSN: 2321-8916.
2. Desai, V., 2015. Entrepreneurship development, First edition. Himalaya publication house, Mumbai. ISBN: 9789350973837.
3. Khanna, S.S., 2016. Entrepreneurial development. S.Chand company limited, New Delhi. ISBN: 9788121918015.
4. Manohar, D., 1989. Entrepreneurship of small scale industries, vol.III. Deep and deep publication, New Delhi. ISSN: 09735925.
5. Lal, G., Siddhapa, G.S. and Tandon, G.L., 1988. Preservation of fruits and vegetables. Indian Council of Agricultural Research (ICAR). ISSN: 0101-2061.
6. Ranganna, S., 2001. Hand book of analysis and quality control of fruits and vegetable products, Second edition, Tata mcgraw hill, New Delhi. ISBN: 9780074518519.
7. Cruses, W.V. and Fellows, P.J., 2000. Commercial fruits and vegetable processing. CRC press, United States. ISBN: 9780849308871.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	4	3	2	24
CO2	5	5	5	4	3	1	23
CO3	5	5	5	5	5	3	28
CO4	5	5	5	5	4	3	27
CO5	5	5	5	5	5	5	30
	25	25	25	23	20	14	132
							132/30=4.4

BOT3536 BIORESOURCE MANAGEMENT 5Hr./5Cr.

Pedagogy	A	B	C	D	E	F	G
	Course Teacher's Contribution	Department Resources	Field /Industry/ Lab	Subject Experts	ICT Virtual Learning	Peer Teaching	Super-Special method
	65	3	2	-	3	2	-

PREAMBLE:

This course is framed to cater the need of non major students about the Bioresources and its conservation of Indian subcontinent. Current status of our country's wealth is given a greater emphasis. *In situ* and *ex situ* methods of conservation are being taught to create a holistic approach in natural resources management. The course is designed to create leadership abilities among students and transform them as stewards of our natural resource.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: classify landscapes and waterscapes using geological and geographic inputs and analyze the current status of mineral resources of our country	1	15
CO2: identify fresh water and marine aquatic resources and wet land ecosystem and develop appropriate techniques for water shed management and water resource management	2	15
CO3: analyze the biological wealth of our country as a potential resource and integrate its use with the need for conservation	3	15
CO4: understand agriculture as a main resource of food production and assess the Indian and international strategies for food management	4	15
CO5: develop strategy for conservation, policies specific to Indian scenario and effectively manage the resources.		

SYLLABUS

UNIT 1. Geology of India: Introduction of Geology – types of rocks – geographical position and boundaries – soil types in India – pedology – soil as natural capital – ecosystem services of soil – mineral sources – mining and its impact – depletion of minerals – conservation strategies.

UNIT 2. **Water, Wetlands and Marine resources:**Watershed management – raining pattern – harvesting and storage – indigenous and remote sensing techniques – fresh water and wetland ecosystems located in India – global and national statistics of water resources – an overview of ecosystem services of wetlands – types of marine ecosystems – marine resources (production, status, dependence, issues and challenges for resource supply, threats and prospects.)

UNIT 3. Phytogeography: Mega diversity countries – biodiversity hotspots- endemism biogeographical realms – flora and fauna – forest types (Champion and Seth 1968) – Eastern and Western Ghats (physiography, distribution maps, diversity of plants and animals.) – desert ecosystem.

UNIT 4. Food, Agriculture and Forestry: Native seeds and agricultural implements – land use patterns – ancient and modern agriculture –Food (sources,sustainable usage, shortage and management,food storage methods merits and demerits.) Public distribution system (FAO, IBPGR, NBPGR.) – timber and Non timber forest produce (NTFP).

UNIT 5. Conservation and Management: Heritage sites of UNESCO – Man and Biosphere Reserve (MAB) program – national parks – wildlife sanctuaries – botanical gardens – field gene bank – cryopreservation – reintroduction – silviculture.

REFERENCES

1. Sharma, P. D., 2015. Ecology and environment. Rastogi publications, New Delhi. ISBN: 978-93-5078-068-8.
2. Rana, S.V.S., 2012. Environmental studies. Rastogi publications, New Delhi. ISBN: 81- 7133-728-7.
3. Sharma, P. D., 2013. Environmental biology and toxicology. Rastogi publications, New Delhi. ISBN: 978-81-7133-964-8.
4. Sharma, P. D., 2013. Ecology and utilization of plants. Rastogi publications, New Delhi. ISBN: 81-7133-861-5.
5. Bawa, K.S., Primack, R.B. and Oommen, M.A., 2012. Conservation biology. Universities press, New Delhi. ISBN: 9788173717246

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO 1	5	4	4	5	3	2	23
CO 2	4	4	4	5	4	4	25
CO 3	5	5	4	5	3	3	25
CO 4	4	4	5	4	3	2	22
CO 5	5	5	5	4	3	3	25
	23	22	22	23	16	14	120/30
							4

BOT 3538 **Botany Project** **5Cr./5hr.**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	75	-	-	-	-

PREAMBLE:

Botany Project work is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation or difficult problem. A project work may be given in lieu of an elective paper (Bio-resource Management). Interested students will get an opportunity to carryout research project at the department laboratories.

Every year, based on the faculty availability a few areas will be identified and informed well in advance. Eligible students will be asked to make a list of three areas according to his/ her ranked choice. According to his/ her ranked choice of the area, project will be allotted. In the case of competition for a specific project the cumulative credential of first four semesters would be considered for project allotment. At the end of the research work students will be encouraged to create fact sheets and posters to report their findings.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: gain an hands-on experience of personally designing and executing a research enquiry based on accepted scientific norms	1	-
CO2: gather basic information, details and preliminary data based on which his/ her research will be positioned	2	-
CO3: garner skill is making scientific observations that ability to collect and collate meaningful information will be fortified	3	-
CO4: galvanize arguments based on the strength of drawn from the statistical tools and tests used for analyzing the data	4	-
CO5:garnish his/her findings in the approved format that even the little original information honestly generated in the study will be added on the exciting body of knowledge known to the scientific community	5	-

	K1 (Recall)	K2 (Understanding)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	4	3	2	24
CO2	5	5	5	3	3	2	23
CO3	5	5	5	5	4	2	26
CO4	5	5	5	5	3	3	26
CO5	5	5	5	5	5	4	29
Total	25	25	25	22	18	13	128
							128/30= 4.2

BOT 3642 Plant Physiology (Theory Cum Lab) 4+2L Hr./6Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	60	40	5	10	5

Preamble: This course explores the knowledge on life processes exclusive to plants. Students learn intricate details on water transport, transpiration and the uptake of nutrients of plants. It also facilitates them to have a deeper insight on energy generation and utilization mechanisms. Eventually learners understand the music of 'plant growth' from the notations of 'chemical regulators'.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: characterize water physical and chemical nature. Experiment with plants to prove conduction of water and photosynthesis.	1	14
CO2: tabulate macro and micro nutrients needed by plants, observe nitrogen fixers and their role, enrich the soil using minerals	2	15
CO3: distinguish between photosynthetic and non photosynthetic pigments in plants, evaluate the efficiency of photosynthesis in plants	3	10
CO4 describe glycolytic pathway and subsequent pathway leading to the synthesis of ATP, assess the respiratory quotient of various substrates	4	8

CO5: experiment with hormones to evaluate the efficacy of hormones in improving the growth of plants, observe rhythmic movements and responses in plants	5	13

SYLLABUS

Unit 1. Plant-Water relations:

Characteristics of water molecule – Diffusion, osmosis, Imbibition– diffusion pressure deficit–guttation— transpiration–factors affecting transpiration – transport of water - translocation and descent of sap –components of xylem and phloem– girdle experiment

Unit 2. Mineral nutrition:

Essential elements – macro and micronutrients – transport of ions across membrane – active and passive transport – deficiency symptoms and toxicity– nitrogen metabolism and phosphate solubilization.

Unit 3. Photosynthesis:

Photosynthetic pigments –Non photosynthetic pigments - PS I and PS II– reaction centres –antenna pigments – light dependent and independent reactions (C3, C4 and CAM) – C2 cycle – factors affecting photosynthesis.

Unit 4. Respiration:

Glycolysis – Krebs cycle- electron transport system – oxidative phosphorylation– pentose phosphate pathway–respiratory quotient.

Unit 5. Growth Physiology:

Introduction to plant growth –seed germination – physiological role and assays of auxins, gibberellins, cytokinin, abscissic acid, ethylene – photoperiodism and vernalization – photo morphogenesis – phytochromes – LDP, SDP and day neutral plants – Biorhythms and plant movements –senescence –plant response to abiotic stresses.

TEXT BOOKS

1. Sinha, R. K., 2004. Modern plant physiology. Narosa publishing house, New Delhi. ISBN: 81-7319-333-9.

REFERENCES

1. Bidwell, R. G. S., 1975. Plant physiology. Macmillan publishing co. inc., New York. ISBN: 0-02-309430-3.
2. Salisbury, F. B. and Ross, C.W., 1992. Plant physiology, Fourth edition. Eastern press, Bangalore. ISBN: 981-243-853.
3. Srivastava, H. S., 2005. Plant physiology. Rastogi publications, Meerut. ISBN: 81-7133-785-6.
4. Williams, M. B., 1984. Advanced plant physiology. Pitman publishing, New Zealand. ISBN: 0-273-02306-3.
5. Ghosh, M. S., 1996. Plant physiology, First central edition. New central book agency private limited, New Delhi. ISBN: 81-7381-478-3

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	4	4	2	25
CO2	5	5	5	4	4	5	28
CO3	5	5	2	4	4	5	25
CO4	5	5	5	4	4	5	28
CO5	5	5	5	4	4	5	28
							134/30=4.4

PLANT PHYSIOLOGY (LAB)

CO1: experiment on diffusion and plasmolysis, observe influence of temperature on permeability of membrane
CO2: measure the photosynthetic and respiratory rate of plants.
CO3: differentiate between C3 and C4 plants, calculate the stomata in plant leaf
CO4: evaluate the effect of various hormones on growth of plants, measure the growth attributes.
CO5: observe various movements exhibited by plants in response to stimuli.

1. Experiment on imbibition, diffusion and plasmolysis
2. Demonstration of osmosis using potato osmoscope.
3. Determination of water potential.
4. Influence of temperature over permeability of membrane.
5. Transpiration measurement by photometer, Cobalt chloride
6. Oxygen evolution in photosynthesis (Thistle funnel experiment/ wilmott's bubler).
7. Calculation of stomatal index and stomatal frequency of mesophytes and xerophytes.
8. Characterization of C3 and C4 plants.
9. Demonstration of respiration using Ganong's respiroscope and repirometer.
10. Measurement of growth and biomass – auxanometer, scale, weighing balance
11. Auxin, giberellin and ethylene response on plants
12. mineral nutrient efficiency using hydroponics
13. Phototropic and geotropic movements in plants.

REFERENCES:

1. William, G H., 2009. Introduction to plant physiology. John wiley, New Jersey, United States. ISBN: 9780123741431.
2. Nobel, P.S., 1990. Physiochemical environmental plant physiology. Academic press, United States. ASIN: B0043KK4KY.
3. Taiz, L., 2015. Plant physiology, Sixth edition. Sinauer associates, United States. ISBN: 978- 1-60535-255-8.
4. Bajracharya, D., 1999. Experiments in plant physiology. Narosa publishing house, New Delhi. ISBN-13: 978-8173193101, ISBN-10: 817319310X

BOT3240 BIOFERTILIZERS AND BIOPESTICIDES 3Hr./2Cr.

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	45	40	3	-	2

PREAMBLE:

Through this course the non biology students will come to know the importance of eco-friendly approaches in agriculture. By enrolling in this course students will primarily know about the common agriculture practices and will able to appreciate the use of natural methods of providing nutrition and controlling pests and herbs. They will further learn about the regulations governing the organic farming.

COURSE OUTCOME At the end of the semester, students will be able to	Unit	Hrs P/S
CO1: understand the ancient agricultural practices and protect the environment from the recent indiscriminate, avaricious anthropogenic onslaughts that the extent of damage done is at least be mitigated.	1	9
CO2: assess the advantages of organic farming with as an alternative to use of anthropogenic chemicals that biofertilizers and natural means of crop protection including the advocacy of IPM can ensure profitable farming.	2	8
CO3: analyse the various forms of microbes as suppliers of organic nutrients, including nitrates, phosphates enriching the soil that would eventually have a bearing on the methods of cultivation with enhanced nitrogen supply.	3	10
CO4: apply the knowledge of using biopesticides without harming the co-living microbiota and life forms in the ecosystem that the use crop protection chemicals can be avoided to safe guard environment.	4	9
CO5:use the acquired knowledge needed to prepare eco friendly commercial formulations meeting national and international standards and regulations and float newer entrepreneurial ventures	5	9

SYLLABUS

Unit 1. Introduction to Agriculture: Domestication of plants – early agricultural practices – shifting cultivation – settled cultivation– major cultivated crops in India (rice, wheat, soya, maize and brinjal) – industrialization and consequences– green revolution – indiscriminate use of agrochemicals.

Unit 2. Organic farming: Principles and practices of organic farming – organic matter management in agricultural fields – crop rotation – plant health – sustainable agriculture– supplementation of NPK as bioresource – vermicomposting – green manure – terrace and kitchen garden– value addition in organic products – government policies.

Unit 3. Biofertilizers: Scope, application, types – mass cultivation of Biological nitrogen fixers – Blue green algae – *Rhizobium, Azolla* – Phosphate solubilizing bacteria (*Pseudomonas fluorescens)* – Mycorrhiza – cost-benefit analysis.

Unit 4. Biopesticides: History – comparative study of bio and synthetic pesticides – mass production and economics of microbial biopesticides (case study on *Trichoderma, Pseudomonas fluorescens, Bacillus thuringiensis (Bt)* – plant pesticides (a case study on Neem.)

Unit 5. Commercial formulation: Types of formulation – dry and liquid product – shelf-life,

Stabilization, Methods of field application, certification – Bureau of Indian Standards (BIS) – biopesticide regulations (national and international with special emphasis on European Union.)

REFERENCE BOOKS

1. Dubey, R.C., 2014. A textbook of biotechnology. S. Chand and co private limited, New Delhi. ISBN: 81–219–2608–4.
2. Lakshmana, H.C. and Channabasava, A., 2014. Biofertilizers and biopesticides. Pointer publishers, Jaipur. ISBN: 8171327753.
3. Himadri, P. and Dharamvir, H., 2007. Biofertilizers and organic farming. Gene–tech books, New Delhi. ISBN: 978–8189729202.
4. Hegazi, N. I., Fayez, M. and Hamza, M., 2013. Biofertilizers for organic farming. Academic publishing, Egypt. ISBN: 978–3659336157.
5. Dilip, N., 2016. Organic farming for sustainable agriculture. Springer publishing, New Delhi. ISBN: 978–3319268019.

	K1 (Recall)	K2 (Understanding)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	2	4	4	5	1	1	17
CO2	2	4	5	3	2	4	20
CO3	2	4	5	3	2	4	20
CO4	2	4	4	5	3	4	22
CO5	3	4	5	3	3	1	19
Total	11	20	23	19	11	14	98
							98/30= 3.2