THE AMERICAN COLLEGE, MADURAI
Department of Botany, Undergraduate
B.Sc. – Botany Programme (CBCS) 2020-2021 onwards

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	BOT1551	Ethnoecology	**5**	**5**	**75**
	IIIC	BOT1453	Learning Basic Skills In Biology(LBSB)	**4**	**4**	**60**
	IIIC	BOT1455	LAB I (Ethnoecology 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	BOT1552	Genetics and Plant Breeding	**5**	**5**	**75**
	IIIC	BOT1454	Evolution & Phycology	**4**	**4**	**60**
	IIIC	BOT1456	LAB II (Phycology &Genetics)	**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	BOT2551	Microbiology	5	5	75
	IIIC	BOT2553	Archegoniatae	4	5	75
	IIIC	BOT2355	Horticulture	4	3	45
	IIIC	**BOT2657**	**LAB III (Micro+Arche +Horticulture)**	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	BOT2454	Cell Biology	4	4	60
	IIIC	BOT2456	Anatomy and Reproductive Biology	4	4	60

			of Angiosperms (ARBA)			
	IIIC	BOT2658	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 3651	Plant Systematics	6	6	90
	IIIC	BOT3653	Biochemistry	6	6	90
	IIIC	BOT3555	Analytical Techniques and Research Methodology	5	5	75
	IIIC	BOT3657	LAB – V (Pt Systematics + Biochem)	3+3	6	90
	IVEVS	BOT 3259	Environmental Studies	4	2	30
	IVLS	***32XX	Life Skill – 3	3	2	30
				30	27	
6	IIIC	BOT3852	Plant Biotechnology (Lab cum Theory)	4+3L	8	75+45
	IIIC	BOT3454	Entrepreneurial Botany	4	4	60
	IIIC	BOT3656	Plant Physiology (Lab cum Theory)	5+2L	6	60+30
	IIIC	BOT 3558 BOT 3556	Botany Project / Bioresource management	5	5	75
	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	BOT1357	Plant Biology I (theory)	**3**	**3**	**45**
1	IIIS	BOT1159	Plant Biology I (lab)	**2**	**1**	**15**
2	IIIS	BOT1358	Plant Biology II (theory)	**3**	**3**	**45**
2	IIIS	BOT1160	Plant Biology II (lab)	**2**	**1**	**15**
3	IIIS	BOT2359	Botany for Chemists- I (theory)	3	3	45
3	IIIS	BOT2161	Botany for Chemists – I (lab)	2	1	15
4	IIIS	BOT2360	Botany for Chemists- II(theory)	3	3	45
4	IIIS	BOT2162	Botany for Chemists – II (lab)	2	1	15

***Life Skill Courses**

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	IVLS	BOT1251	Mushroom Culture Technology	**3**	**2**	**30**
2	IVLS	BOT1252	Nursery and Gardening	**3**	**2**	**30**
5	IVLS	BOT3251	Medicinal Botany	3	2	30
6	IVLS	BOT3252	Biofertilizers and Biopesticides	3	2	30

***Non Major Courses**

Semester	Part	Course No.	Course Title	Hr.	Cr.	Marks
1	IVE	BOT1253	Food and Nutrition	**3**	**2**	**30**
2	IVE	BOT1254	Plant Wonders	**3**	**2**	**30**

BOT1551 ETHNOECOLOGY 5 Hr./5 Cr.

Preamble: This course is designed for the fresher as an introduction to the ecology of their own community and landscape. The study material is prepared to introduce the basics of ethnoecology and its components with reference to Madurai. The course is aimed at giving proper explanation for the better understanding of their sorroundings. Furthur to understand the local knowledge on agriculture, natural resources management and traditional practices of the local community in their day to day life. After the completion of this course the student will be able to understand and appreciate the evolution of mankind and their tradition.

COURSE OUTCOME

At the end of the course, students will be able to

i. understand the climatological changes and apply his knowledge in taking suitable initiatives to protect and conserve life support systems
ii. analyse the origin of human race and learn their habitat, cultural practices and occupation and identify the invasive and native plant species.
iii. relate sangam literature and landscapes and learn about the importance of sacred groves.
iv. 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.
v. quantify the natural wealth and resources by using appropriate field methods to maintain the environmental serenity and take efforts to enhance the ecological elegance.

Unit I: Climate and Geography (15 hr)

Global, regional and local climatic conditions (overview) -Altitudinal Zonation and forest types of Tamilnadu- Significance of Forests and Grasslands- Climate Change.

Unit II: Human Ecology (15 hr)

Origin of human race ethnic communities of the world – Migration of human population – Occupation and culture - Local ethnic communities - Population explosion - Impact on Animal and Plant population; Native, exotic, and invasive species of plants - Vavilovian centres of Origin.

Unit III: Ecological History (15 hr)

Sangam Literature and landscapes - Sacred Groves, Nandavanam - Plants and Animals of socio-religious importance –Geography of Western Ghats & Eastern Ghats - Cultural ecology of Madurai .

Unit IV: Urban Madurai (15 hr)

Urbanization and Tourism- Sources of water – Vaigai - Irrigation practices- Land use- ecological conflicts- Agrobiodiversity - Monoculture - Waste management - Smart city.

Unit V: Vegetation and Floristic Elements (15 hr)

Analysis of local species diversity - Field ecology: Quadrat (frequency, density and abundance) Transect (belt and line)- Study of air microflora.

TEXT BOOKS

1. Pushpendra K. Karhana 2004. Agriculture Science " A complete study package" Arihant Publishers (ISBN- 13 ; 978-8183482875)

2. Krishnamurthy, K.V. 2003. A text Book on Biodiversity (principles and Practice), Science Publishers, USA. (ISBN 1578083257, 9781578083251)

REFERENCES

1. Anonymous, 2011. Handbook of Agriculture, Indian council of Agricultural Research Krishi Anusandhan Bhavan -I Pusa, New Delhi- 110012 (ISBN NO: 81-7164-050-8)

2. Prathipal Singh, 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 1453 LEARNING BASIC SKILLS IN BIOLOGY 4 Hr. /4Cr.

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

i. see the growth of botanical studies from an 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

ii. 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

iii. 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.

iv.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.

v.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

Unit I. History of Natural Sciences (10 hr)

Insights on botanical edifice - Contributions of Indian Botanists- S.R. Kashyap (Bryology) – Birbal Sahni (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) Watson and Crick (Cell Biology).

Unit II. Communication in Biology (20 hr)

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

Reading and Comprehension skills: Academic reading tips, making notes while reading.

Writing Skills : Purpose of writing (Class room, Examination, Scientific Publication)- logical sequence- botanical terms, interpretation of results and inferences- experimental records - Mnemonics.

Unit III: Quantitative Biology (10 hr)

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- Constants and standards- Principles of Calibration and Minimizing error – Collection, Processing and preservation of data.

Unit IV : Soft Skills (10 hr)

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 V: Computer in Biology(10hr)

Basic Computing and Arithmetic logic skill – Computer - Software & Hardware - Exploring MS office - Basics of networking and Internet applications - Smartphone and its application in biology.

TEXT BOOKS

1. Sanjay Kumar, Pushp Lata (2015) Communication skills 2nd edition. Oxford University Press. India. ISBN: 978-0199457069

2. Dinesh Maidasani(2008) Learning computer fundamentals, MS office and Internet and Web technology. Laxmi Publication. India. ISBN: 8131804062

REFERENCES

1. Adir J, (1997) Effective communication, Pan Book. U.K. ISBN 0330347861
2. Ghosh (2012) Managing soft skills for personality development, Mc Graw Hills India ISBN 978-0-07-107813-9
3. Jones A., Reed R & Weyers (2012), J. Practical skills in Biology, Pearsons review. ISBN 978- 1408245477.

Course outcome	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 1455 **4Hr./4Cr.**

ETHNOECOLOGY AND LEARNING BASIC SKILLS IN BIOLOGY- LAB 1

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 be able to
i. learnt to appreciate the college campus diversity.
ii. observe various ecological spots.
iii. experiment the use of measuring instruments and landscaping.
iv. acquire hands on training with the use of computer softwares.
v. visit agricultural fields to appreciate ecology of irrigation field.

Learning Basic skills in Biology

Visual documentaries:

1. National scientists.
2. International scientists.

Skill Assessment:

3. Observational and Interpretation Skills
4. Oral Presentation skills (Group wise presentation)
5. Report writing
6. Personality development
7. Time Management – 80:20 Rule

Fundamental Measurement:

8. Physical measurements
9. Volumetric apparatus & Gravimetric apparatus

Exploring with computers:

10. MS Word & Excel, Power Point Presentation
11. Data mining – Scientific web sites
12. Use of Smart phones in Biology.

Ethnoecology

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. Raunkier's biological and leaf spectrum.
4. Floristic studies in temples and parks.

5. Vegetation mapping in a nearby forest area (quadrat study 1x1, 10x10m)
6. Botanical elements of heritage (historical) sites.
7. Sacred groves in Madurai (any one site)
8. Importance of irrigation and traditional water management in Madurai;
9. Survey of traditional crops in Madurai.
10. Archeological sites and remains excavated (Keezhadi)
11. Madurai smart city- conservation strategies and waste management
12. Basic Landscape Mapping (application of GPS and GIS)

REFERENCES

1. Bendre, 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. of Practical skills in biology, Pearsons Review. ISBN 978-1408254477.
3.Sundararajan, S. (2000) Practical manual of Angiosperm Taxonomy. Anmol publication. New Delhi. (ISBN 81-261-0687-5)

Course outcome	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

SEMESTER -II

BOT 1552 GENETICS AND PLANT BREEDING 5Hr./5Cr.

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 course, the students will be able to

i. Conceptualize the laws governing our inheritance, compare and contrast the allelic and genic and polygenic interaction.
ii. Acquire knowledge about chromosome organization and recognize sex and sex linked inheritance.
iii. Formulate hardy Weinberg law, assess the effect of mutagens and appreciate the traits in humans.
iv. distinguish between qualitative and quantitative traits, expertise in various methods of breeding.
v. 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.

Unit I: Fundamentals of genetics (15 hr)

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

Unit II: Chromosomal structure and inheritance(15 hr)

Chromosome organization – types of chromosomes, sex chromosome- Sex determination in human, animals and plants (*Melandrium*)- sex linked inheritance- chromosomal aberration-, linkage and mechanism of crossing over.

Unit III: Population genetics (15 hr)

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 (15 hr)

Objectives – Qualitative and quantitative characters- Conventional methods of selection -Self pollinated crops - Cross pollinated crops - Hybridization types - Procedure of hybridization - hybrid vigour.

Unit V: Crop improvement (15 hr)

Crop improvement for resistant, tolerant and high yielding varieties.Traditional breeding programmes in Rice- Plant genetic resources of India- Germplasm centres. Sugarcane breeding institute (Coimbatore) - Tamil Nadu Rice Research Institute (Aduthurai) - Coconut Research Station (TNAU, Aliyarnagar) - Institute of Forest Genetics and Tree Breeding (Coimbatore) - National Research Centre for Banana (Tiruchirappalli).

TEXT BOOKS

1. Ahluwalia,K.B. (2009). Genetics, 2edn.New Age International Publishers. ISBN 978-81- 224-2390-7
2. Chahal, G.C and Gosal,S.S (2002) Principles and Procedures of Plant Breeding. Narosa Publishing House. ISBN 81-7319-374-6

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. Hayward,M.D, Bosemark,N.O, Romagosa,T(eds) Plant Breeding Principles and prospects Springer publication. ISBN 9780412433900
5. George Acquaah,(2012) Principles of plant genetics and breeding.2 nd edition.Wiley Blackwell Publishers. ISBN 9781118313695

	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 1454 EVOLUTION AND PHYCOLOGY 4Hrs./4Cr.

PREAMBLE:

The course provides an overview of formation and conditions of early earth, emergence of life forms and evolution process. Students will be inducted into the plant kingdom starting from algae as the simplest autotrophs and evolutionary trends. They will be able to comprehend the characteristics features of the major groups of algae, and their economic importance will be assessed.

COURSE OUTCOME:

At the end of the course, the students will be able to
i. understand formation of earth and explain the earliest environment conditions..
ii.analyze emergence of life and general theories on evolution.
iii.illustrate the evolutionary links from algae to vascular plants.
iv.formulate the characteristic features, life cycle patterns of major classes of algae.
v.assess the applications and economic potential of algae

Unit I : Genesis of life(12 hr)
Earth formation – Geological time scale – emergence of life - Miller and Urey experiment – basic theories on evolution – Origin of Species – contributions of Darwin and Lamarck – tree of life – evolution of human.

Unit II : Origin of plants: (12 hr)
Life forms – Five kingdom classification – evolutionary history of plants – fossils – Stromatolites – oxygenic photosynthesis - prokaryotic algae – endosymbiosis – chloroplast and membranes – vascularization – evolutionary trends from algae to land plants.

Unit III: Overview of algae:(12 hr)
Characterization and classification of Algae: pigments, storage reserves, cell wall, flagella, eyespot and pyrenoids - thallus construction – reproduction – Outline of classification (Smith, 1955) – Salient features of Cyanophyceae, Chlorophyceae, Phaeophyceae and Rhodophyceae – Contributions of Indian algologists.

Unit IV: Type study of algae:(12 hr)
Cyanophyceae (*Anabaena*) – Chlorophyceae(*Chara*, *Oedogonium*) – Phaeophyceae (*Sargassum*) – Rhodophyceae (*Gracilaria*).

Unit V: Applied Phycology:(12 hr)
Mass cultivation: SCP (*Spirulina*) –marine algae Mariculture (*Kapphaphycus*) - diatomaceous earth – algae as food, Agar agar (*Gracilliaria, Gelidiella*), Carrageenans, Alginates - biofertilizers, biofuel – Docosahexaenoic acid (DHA), Seaweed Liquid Fertilizer – algal blooms – symbiotic association (Azolla, Lichens).

TEXT BOOKS

1. Kumar, H.D.(1988). Introductory Phycology.East West Press.India. ISBN: 81-859-3896-2
2. Sharma,O.P. (2007). Textbook of algae. Tata McGraw Hill, India. ISBN 0-07-451928.

REFERENCE BOOKS

1. Bold, H.C and Wyne. M.J. (1978). Introduction to the algae: Structure and reproduction. Prentice-Hall.ISBN 0134777867
2. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge.4th edition. ISBN: 9780521141444
3. Morris, I. (1971). An Introduction to Algae.Hutchinson University Library. ISBN: 0-090-80713-8
4. Raven, P.H., Evert, R.F and Eichhorn, S.E. (2013). Biology of plants. 8th Ed. W.H. Freeman Publishers, ISBN: 1464113513.
5. Smith, G.M. (1971). Cryptogamic Botany Vol.1.Algae and Fungi. Tata McGraw – Hill book company. 2nd Edn.ISBN :0070995761.
6. Stewart, W.N and Rothwell G.W. (2010). Paleobotany and the Evolution of Plants.Cambridge University Press.2nd Edn. ISBN 10:0521126088
7. Willis,K.J and McElwain.J.C (2002). The Evolution of Plants. Oxford University Press.ISBN: 0198500653

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	5	5	4	1	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
Total							121
121/31=4.0							

BOT1456 GENETICS AND PLANT BREEDING AND EVOLUTION AND PHYCOLOGY (Lab-II) 2Hr/2 Cr.

The students will be able to

i.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.
ii.test viability of seed, experiment with emasculation techniques and familiarize with different hybridization techniques by visiting plant breeding stations.
iii. interpret the formation of earth, emergence of life and theories on evolution process.
iv. investigate the habitat and diversity of cyanobacteria and higher algal forms during the field study and draw a comparative analysis of thallus structure and life cycle patterns of important forms.
v. identify the different types of lichens and preserve algal specimens

Genetics and Plant Breeding

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
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

Evolution and Phycology

1. Formation of earth - documentary & discussion
2. Darwinism: Galapagos Island – documentary & discussion
3. Fossils – Stromatolites and Diatoms

Morphology and reproductive structures of

4. *Cyanophyceae – Nostoc, Anabaena* and *Oscillatoria* movement
5. *Chlorophyceae – Chlamydomonas, Volvox*
6. *Chlorophyceae - Oedogonium, Caulerpa, Chara*
7. *Phaeophyceae – Sargassum, Dictyota*
8. *Rhodophyceae – Batrachospermum, Gracilaria*
9. Algal cultivation Race way (*Spirulina)* – Demo
10. Marine algal cultivation (Mariculture) – Demo
11. Lichens – types and uses
12. Collection and preservation of algae

Reference books

1. Bendre, A. M., A. Kumar, 2006. A text book of practical botany.Vol I. Rastogi Publication New Delhi. (ISBN 81-7133-809-7)
2. Pandey, B. P. 2005. *College Botany*, Vol I. (5th ed.) S. Chand & Company New Delhi. ISBN 81-219-0593-1

SUPPORTIVE COURSES

BOT 1357 PLANT BIOLOGY I 3Hr./3Cr.

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 course, the students will be able to

i. 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
ii. describe the general characters of bryophytes, classify liverworts, hornworts and mosses as the structure and reproduction of *Riccia* and
iii. the alternation of generation in mosses are scrutinized in the process of highlighting the ecological and economic importance of the group
iv. present pteridophytes as first land plants and explain their general character and life cycle with morphology and reproduction of *Pteris* asa case study to illustrate the nifty-gritty and diversity of ferns and explore their ecology and evolutionary significance
v. 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
vi. 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.

UNIT I: Introduction: (9 hr)

Geological timescale -Five kingdom classification – evolution of plants -co-evolution-biological diversity.

UNIT II: Non – vascular plants: (9 hr)
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: (6 hr)
Non-flowering plants – General characters of Pteridophytes – morphology of ferns (*Pteridium aquilinum*)- economic importance of ferns

UNIT IV: Primitive seed plants: (6 hr).
General characters of Gymnosperms–morphology and reproductive structures of *Pinus* – economic importance of gymnosperms

UNIT V: Flowering plants: (15 hr)
Bentham and Hookers classification (up to series level) -Diagnostic characters of Malvaceae (Polypetalae)-Solanaceae (Gamopetalae)- Euphorbiaceae (Monochalamydeae) - Poaceae (Monocotyledons) with a species from each family as an example.

TEXT BOOKS

1. Pandey, B. P. 2005. *College Botany*, Vol I. (5th ed.) S. Chand & Company New Delhi. ISBN 81-219-0593-1
2. Pandey, B. P. 2009. *College Botany*, Vol II. (7^{th}ed.) S. Chand & Company New Delhi.ISBN 81-219-0601-6

REFERENCES

1. Vashishta, P. C. 2001. *Pteridophyta* (Vascular Cryptogams). S. Chand & Company, New Delhi. ISBN 81-219-0828-0
2. Vashishta,P. C. 2009. *Gymnosperms*. S. Chand & Company, New Delhi. ISBN 81-219-2618-1
3.Vashishta, B.R., A. K. Sinha & A. Kumar 2005. *Bryophyta*. S. Chand & Company, New Delhi.ISBN 81-219-0463-3
4. 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 1159 PLANT BIOLOGY- I (LAB) 2Hr./1Cr.

At the end of the lab course, the students will be able to

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.
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.
iii. categorize the tissue organization in thallophytes, pteridophytes and gymnosperms.
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.
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 or Sirumalai

REFERENCES

1. Sundararajan, S. 2003. Practical manual of plant morphology. Anmol publication New Delhi. (ISBN 81-261-1403-7)
2. Bendre, A. M., A. Kumar, 2006. A text book of practical botany. Vol I. Rastogi Publication New Delhi. (ISBN 81-7133-809-7)
3. 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)
4. Sundararajan, S. 2000. Practical manual of Angiosperm Taxonomy. Anmol publication New Delhi. (ISBN 81-261-0687-5)

BOT 1358 PLANT BIOLOGY II 3Hr./3Cr.

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 course, the students will be able to

i. 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

ii. 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

iii. 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.

iv. 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.

v. 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.

UNIT I Water relations: (9 hr)

Pipeline systems in plants- Water potential- Guttation- Imbibition- Osmosis-, Active transport- Passive transport - Carrier mediated transport- Tissue organization of xylem and phloem – role in conduction.

UNIT II Ventilating systems: **(9 hr)**
Stomata- hydathodes- transpiration- evaporation- convection- photorespiration.

UNIT III Photobiology: **(9 hr)**
Photosynthetic pigments- Photosynthetic electron transport- exploring the path of carbon in photosynthesis –photoperiodism – phytochrome- cryptochromes – photomorphogenesis.

UNIT IV Nitrogen metabolism: **(9 hr)**
Nitrogen sources – symbiotic and asymbiotic nitrogen fixation- Nitrogen fixing Organisms – Use of biofertilizers.

UNIT V Growth and development (9 hr)
Plant hormones, growth promoters-auxin, gibberelin, cytokinins – growth inhibitors- ethylene, ABA- Plant Movements - nastic and tactic movements.

TEXT BOOKS

1. Srivastava. H. S. 2005. *Plant physiology*. Rastogi Publications, Meerut. ISBN 81-7133-785-6
2. Ghosh. M. S. 1996. *Plant physiology*. (Ist Central Edition) New Central Book Agency (P) Ltd. ISBN 81-7381-478-3.

REFERENCES

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

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

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

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

	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 1160 PLANT BIOLOGY II (LAB) 2Hr./1Cr.

At the end of the course, the students will be able to

i. investigate the movement of food and water through the specialized tissues ,intercellular translocation in plants with the influence of environmental factors.
ii. analyse the external factors which brings changes in the physiology of plants through live experiments**.**
iii. **e**quip himself to calculate the duration, rate of reaction and measurements of various physiological reactions.
iv. 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.
v. 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 osmoscope
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. Evolution of O_2 during photosynthesis using Wilmott bubbler counter.
7. Effect of different wavelength of light during photosynthesis
8. Measurement of growth using auxanometer
9. Phototropism& Gravitropism using potted plants
10. Use of biofertilizer to promote root nodule
11. Methods of studying plants nutrition – Hydroponics
12. Symbiotic nitrogen fixation – sectioning of legume root nodule

REFERENCES

1. 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.

LIFE SKILL COURSES

BOT 1251 MUSHROOM CULTURE TECHNOLOGY (LIFE SKILL) 3Hr. /2Cr.

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 course, the students will be able to

i. List different varieties of mushroom, distinguish between edible and non edible, and classify them.
ii. characterize, compare the cultivating mushroom and trace the lifecycle.
iii. experiment the cultivation procedure, design new culture technique, analyze the pest and factors affecting growth of mushroom.
iv. develop technologies for harvesting, packaging and acquire knowledge to avail loan from banks
v. Summarize uses of mushroom and create new recipes for marketing.

Unit I. Introduction (9 hr)

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 Tamil nadu.

Unit II. Morphology and Taxonomy of Mushroom: (9 hr)

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

Unit III. Cultivation of Mushroom: (9 hr)

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 IV. Harvesting and Packaging : (9 hr)

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

Unit V. Uses of Mushroom: (9 hr)

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

TEXT BOOKS:

1. Tripathy D.P 2005. Mushroom cultivation. Oxford and IBH publishing co. pvt.Ltd.New Delhi. ISBN 8120416449

2. Nita Bahl. 2000. Handbook on mushrooms, Oxford &IBH publishing pvt. Ltd. India. ISBN 9788120413993

REFERENCES:

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

2. Stamets P and Chilton J. S 1985. The mushroom cultivator, Richmond publishing company. U.K. ISBN 096-1079-80-0.

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
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 1252 NURSERY AND GARDENING 3 Hr./2Cr.

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 garde .

COURSE OUTCOME

At the end of the course, the students will be able to

i. Identify the varieties of plants maintained in a nursery, forecast the risk of climatic factors affecting nursery plants, create facilities of his own.
ii. Develop seed storage strategies, track the pest and evolve the right method to control them.
iii. Specialize himself in cultivation technique and manage the nursery.
iv. Categorize the plants, select right choice of the plant for different gardens and develop himself as a entrepreneur
v. Recognize the various types of parks and gardens in his locality, appreciate the role of parks in society thereby conserving it.

UNIT 1: Nursery development (9 hr)

Definition –Objectives and Scope for nursery –role of nursery curator– Facilities needed(land – soil - water- climate-special growing structure-manure/fertilizer – pesticide – pots – polybags - labour- transport)-steps in raising nursery - factors affecting nursery plants- varieties of plants sold in nursery and trade.

UNIT II:Propagation by seeds: (9 hr)

Seed storage - seed viability – seed treatment methods -seed sowing – germination and seedling stage- soil mixture –transplanting – watering – control of pest in nursery.

UNIT III:Vegetative propagation and maintenance: (9 hr)

Cutting- layering –budding –grafting –collecting season – planting methods – treatments for propagating materials – propagules – growing in special structures – hardening – pruning – cleaning – fertilizing.

UNIT IV:Nursery plants: (9 hr)

Ornamental plants (flowering) Crotons (non flowering) - medicinal plants – arboreal varieties – climbers – fencing plants – Ornamental palms – Orchids – Gymnosperms – ferns – Cacti – Bonsai.

UNIT V:Gardens and Parks: (9 hr)

Definition - Objectives and scope – Types of garden – landscape gardening –- water garden- ornamental gardening in homes – Kitchen garden - Components of garden/ parks – choice of the plants for garden components – Rockery – Role of gardener - Benefits of garden – Popular parks and gardens –Role of parks in well being of human and environment.

TEXT BOOKS

1. Kumar, N., 2017, Introduction to Horticulture, Med tech publishers, India. ISBN 9386479834
2. Sadhu, M.K., 1989, Plant propagation, New Age International publishers. India. ISBN 8122400655

REFERENCES:

1. Agarwal, P.K.1993, Hand Book of Seed Technology, Dept. Of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi. ISBN 8120409949
2. Bose T.K. Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi. ISBN 9788120402294
3. Edmond Musser, Andrews. 1997. Fundamentals of Horticulture, McGrawHill Book Co., New Delhi.ISBN 9780070189782
4. JanickJules. 1979. Horticultural Science. (3rd Ed), W.H.Freeman and Co., San Francisco, USA.ISBN 0716717425

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	3	3	4	4	4	4	22
CO2	3	3	3	4	4	34	21
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	117
117/30=3.9							

NON MAJOR ELECTIVES (NME)

BOT 1253 FOOD AND NUTRITION 3Hr./ 2Cr.

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 course, the students will be able to

i. 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

ii. identify the carbohydrate, protein, fat, mineral and vitamin source of food.

iii. gain a knowledge on the types of food preservative -significance of sweeteners, emulsifiers and probiotics -methods of coloring it with suitable colorants, adding flavor

iv. 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

v. 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.

UNIT I: Food facts: **(9 hr)**

Concept of food- Brief history of food and agriculture- Cuisines and culture- Classification of foods-(Western foods, Indian food, continental foods, Ethnic foods, Junk foods, Fast foods)- F-Famous food recipes of Madurai

UNIT II.Nutrition of food: (9 hr)

Carbohydrates -Protein – Fats - Vitamins – Minerals - Fibres – water – Deficiency disease.

UNIT III: Food preservatives and additives (9 hr)
Food preservatives- types- expiry date- Artificial sweeteners- Emulsifiers –Probiotics -Enzymes- Microbes in food industry. Food colorants- Types- Food flavors- Types- advantages and limitations of food additives and preservatives

UNIT IV: Food Adulteration(9 hr)
Adulterants- types of adulteration- simple tests in identifying adulteration in food stuffs- Impact on health- case study.Food policies and laws.

UNIT V: Know your food(9 hr)
Balance diet and choice of food – BMI calculation – Nutritional requirements based on age, body mass and gender- role of dieticians- Master Health Checkup Programs - Comparative analysis of Cooked food Vs Raw food - vegetarian food Vs non vegetarian food- prevention of loss of nutrients.

TEXT BOOKS

1. Srilakshmi, B. 2006. Nutrition science.2nd edition New age international publishers, ISBN 81-224-1633-0
2. Sumathi R.M 2007. Fundamentals of food, Nutrition and Diet therapy, New age International Publication ISBN 81-22419828

REFERENCES

1. Anita Tull 1996. Food and Nutrition Oxford University press, U.K. ISBN: 01-98327668
2. Annie Fredrick 2006. Text book of Food and Nutrition, Lotus Press ISBN: 8193820735
3. Sanjeev 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 1254 PLANT WONDERS (NME) 3 Hr./2Cr.

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 course, the students will be able to

i. relate plants and civilization, identify plants as source of food, fuel, energy.
ii. acquire knowledge about various life forms of plant, able to benefit from the uses of plants
iii. describe the amazing plants, utilize plants as fertilizer
iv. rank the plants according to their magnitude, identify the indicators of pollution and minerals
v. discover plants in various extreme environment, discuss the plant's adaptation.

UNIT I Plant as resource: (9 hr)

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: (9 hr)

Unique characters and Importance of - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

UNIT III Plants of curiosity(9 hr)

Sensitive plants (*Mimosa pudica*)- Aromatic plants(*Tagetus*)- fertilizing plants(*Tephrosia purpurea*) –camaouflage plants (*Corydalis hemidicentra*) – stinky plants(*Titan arum*) Biolumenscing plants – model plants- dancing plants- seed dispersing plants

UNIT IV Amazing plants(9 hr)

Tallest, largest, oldest and smallest plant -magnitudes in size, flowers, leaves and fruits – Epiphytes(*Vanda*) – Parasites(*Cuscuta*) – Orchids(*Bulbophyllum*) – Insectivores*(Nepenthes*) pollution indicators - mineral indicators

UNIT V Extreme plants and their adaptation: (9 hr)

Plants thriving inspace (*chlorella*) – volcanoes (hawaiian *argyroxiphium*)- ocean(-sea weed) – swamps(mangroves -*Avicennia*) –desert (*Saguaro cactusti*) – alpine (Junipers) – tundra (arctic lichen) .

REFERENCES

1. Pandey B.P. 2005 Collage Botany : Vol I, 5th edn. S.Chand &Company LTD. New Delhi. ISBN -81-219-0593-1
2. Raven PH Evert RF and Eichhorn SE 2013. Biology of plants. VIIIth Ed. W.H. Freeman Publishers, 1464113513.
3. 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
4. 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 2551 MICROBIOLOGY 5Hr./5Cr.

PREAMBLE: This course provides an overview of microbial diversity and their life forms to the students. Students will be apprised about the basic microbial techniques and handling of microscopes.Students will be facilitated to explore the diversity of microbes and their role in the variety of habitats. Viruses will be dealt separately with emphasize on the diseases caused by them to plants and animals. Commercial aspects of microbes will also be dealt in this course.

COURSE OUTCOME

At the end of the Semester Students will be able to

i. employ microscopes with confidence and observe the microorganisms
ii. perform basic experiments and explore the diversity of microbes in different habitats
iii. comprehend the classification, life process and reproduction in microbes
iv. infer the invisible but substantial role of microbes in agriculture
v. screen and evaluate the potentially important microbes for commercial use

Unit I: Fundamentals of microbiology (15 hr)

History, development and scope of microbiology–contributions of A.V. Leeuwenhoek, L.Pasteur and Robert Koch– principles of microscopy – types of microscopes - microbial diversity based on habitat. Viruses: Discovery, DNA virus (T-phage) – RNA virus (HIV, Covid19) –comparison of plant and animal viruses– mycoplasma.

Unit II: Methods in microbiology (15 hr)

Sterilization techniques (chemical and physical) – microbial culture media – isolation of microorganism–microbial growth measurements – pure culture –preservation and stability – preservation techniques – culture collection centers - staining techniques.

Unit III: Bacteria (15 hr)

Prokaryotic organization:ultrastructure of bacteria – cell wall – genetic material - nutritional types. Bacterial classification: morphotypes, outline of Bergey's system of classification.Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction)– actinomycetes.

Unit IV: Agricultural microbiology (15 hr)

Plant-microbe interaction – biogeochemical cycles (nitrogen) – biological nitrogen fixation – biofertilizers – phosphate and silicatesolubilizers – legume – *Rhizobium* interaction – root nodule –nitrogenase –biopesticides – bacterial (*Pseudomonas fluorescens, Bacillus thuringiensis*) – fungal (*Trichoderma, Metarhizium*) –viral (Nucleopolyhedrovirus, Granulosis virus)–plant growth promoting bacteria (PGPB).

Unit V: Applied microbiology (15 hr)

Harmful and beneficial microbes – clinical microbiology –food microbiology: microbes in milk, meat– microbial contamination – food poisoning –food borne diseases –microbialproducts: dairy products –cheese – microbial enzymes – vitamins – water & air microbiology: water and air borne contamination and treatment.

TEXT BOOKS

1. Dubey, R. C and Maheswari,D.K.(2013). A Textbook of Microbiology, S.Chand& Comp. ISBN 8121926203.
2. Purohit, S.S. (2004). A Textbook of Microbiology, Student Edition. ISBN 8188826170.
3. Rangaswami, G and Bagyaraj, D. J. (1993). Agricultural Microbiology, 2nd Ed. Prentice Hall of India Pvt. Ltd. New Delhi. ISBN 0876926685.
4. Sullia, S. B and Shantharam, S. (2008). General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi. ISBN 8120412117.
5. GeetaSumbali and Mehrotra R.S. (2009). Principles of Microbiology. First edition, Tata McGraw Hill P. Ltd., New Delhi.

REFERENCES

1. Atlas, M.R. (1997). Principles of Microbiology. W.C. Brown Publishers. ISBN 0815108893
2. Frazier, W. C. and Westhodd. D. C. (2000). Food Microbiology - 10th Ed. Tata McGraw Hill.
3. Pelczar,H. J. E. C.S. Chan and Kreig.N.R. (1993). Microbiology concepts and applications. Tata McGraw Hill Inc. ISBN 0070492344.
4. Prescott, L.M., Harley J.P., Klein D. A. (2008). Microbiology.6th Edition, McGraw Hill,India.ISBN 0071267271.
5. Stanier,R.Y. (1987). General Microbiology. 5th Edition.McMillan Education Ltd. ISBN 033341768.

Mapping of course outcomes with Bloom's Taxonomy

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	4	5	4	4	3	2	22
CO2	5	5	5	3	3	3	24
CO3	4	4	4	5	5	3	25
CO4	4	4	4	4	5	3	24
CO5	3	4	5	5	5	3	25
	20	22	22	21	21	14	120
							120/30 = 4.0

BOT 2553 ARCHEGONIATAE 4Hr./5Cr.

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 an account 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

i. comprehend the evolution of plants and their changing nature of life cycle pattern and reproductive structures
ii. understand the salient features of bryophytes with their adaptive features and its ecological significance
iii. evaluate the need for colonization of land by vascular plants withheterospory and the seed habit
iv. correlate and analyze the relationship between the ferns and the true land plants "the gymnosperms"
v. justify the rise of flowering plants from their single cell ancestors by studying the historical evidence of fossils through ages.

Unit I: Morphological adaptations on land (15 hrs)

Terrestrial habitats (morphological and anatomical characters for heterotrichous habit) - evolution of sex organs (antheridium, oogonium, archegonium, ovule).

Unit II: Bryophytes (15hrs)

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

Unit III: Pteridophytes (15hrs)

Classification and Salient features; Introduction to Psilotopsida,Lycopsida, Sphenopsida and Filicopsida, Heterospory and seed habit. Morphology, anatomy and reproduction of *Lycopodium,Selaginella,*Stelar evolution,Aquatic & Terrestial Ferns (*Marsilea, Azolla, Adiantum, Nephrolepis)*

Unit IV: Gymnosperms (15hrs)

Classification and Salient features; Introduction to Cycadopsida, Coniferopsida, Gnetopsida, Morphology, anatomy and reproduction of*Cycas, Gnetum.* Economic importance -Origin of angiosperm

Unit V: Evolution of land plants:**(15hrs)**

Paleoclimatic changes across the Geological time zones. Fossilization and fossil types (Impression, Compression, Petrifaction, Cast, Coal ball) - mega extinction - Reconstruction*(Lepidodendron*)

TEXT BOOKS

1. Pandey, B. P. (2005). College Botany, Vol I. 5th Edn., S. Chand & Company New Delhi. ISBN 81-219-0593-1
2. Pandey, B. P. (2009). College Botany, Vol II. 7th Edn., S. Chand & Company New Delhi. ISBN 81-219-0601-6
3. Rashid,A.(1982). An Introduction to Pteridophyta, Vikas Publishers Co. New Delhi. ISBN: 81-259-0709-2
4. P. R. Vasista (2017) Botany for Degree student, Bryophyta, S. Chand Publication, New Delhi.
5. Singh, Pandey and Jain (2017). Archegoniate, Rastogi Publication, Meerut.

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: 81-25,9-0569-3
3.Vasishta, P.C. (2006). Gymnosperms. S. Chand & Company New Delhi. ISBN 81-219-2618-1
4. Willis,K.J and McElwain.J.C (2002). The Evolution of Plants.Oxford University Press. ISBN 0-19-850065-3
5. Stewart,W.N and Rothwell G.W. 2010 Paleobotany and the evolution of Plants Cambridge University Press 2nd edition ISBN 10:0521126088

Mapping of Course Outcomes with Bloom's Taxonomy

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	4	4	2	1	21
CO2	5	5	5	3	3	1	22
CO3	5	5	4	4	4	2	24
CO4	5	5	4	4	3	1	22
CO5	5	5	4	4	3	3	24
	25	25	21	19	15	8	113
							113/30 = 3.7

BOT 2355 HORTICULTURE 4Hrs /3 Cr.

PREAMBLE: A skill-based course, exclusively designed for 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 into plants. The students will also explore the reproductive biology of the plants and understand the role of seeds in propagation.This course will give them a confidence to nurture plants with care and add on fine skills in propagation. At the end of the course, students will gain a professional skill.

COURSE OUTCOME

At the end of the course, the students will be able to

i. examine soil characteristics, understand suitability of crops for seasons, identify various fertilizers and manures for improving soil and to assess the soil.

ii. acquire professional competency in choosing the propagation methods for horticultural crops, experiment the techniques.

iii. develop physical protections and growing structures in their own terrace and garden.

iv. cultivate certain vegetable crops, flowering plants and fruit trees by understanding the method of cultivation and maintenance.

v. apply the knowledge acquired in marketing the crop produces and to gain entrepreneurial skill.

Unit I: Soil science (12 hrs)

Soil components- types - characteristics (colour, pH, porosity, organic matter, inorganic matter, organisms - water) – soil map of Madurai- suitable crops for seasons (kharif, rabi, Zaid) - fertilizer types – manure types and manuring – soil less culture (hydroponics and aeroponics) – Potting media - role of soil testing centre.

Unit II: Propagation and Maintenance (14 hrs)

Vegetative propagation: Stem, Leaf, Root - Propagules: Rhizome – Bulb – tuber – sucker – corm - offsets; Horticultural techniques: Cutting - Layering – Budding – Grafting; maintenance:

Irrigation – fertilizing- pruning- Sexual propagation: Seed dormancy - treatment – testing – Pest & Disease management.

Unit III: Special Infrastructure / facilities (12 hrs)

Plant growing structures: hot bed – cold frame – net house- polytunnel – green house - front yard flower garden – backyard vegetable garden - terrace garden. Facilities and tools needed for growing horticultural crops.

Unit IV: Cultivation and Harvesting practices (14 hrs)

Vegetable crops: Brinjal, Potato, Bitter gourd - Flowering crops: Rose, *Tagetus,* Jasmine - Fruit Trees: Mango, Guava, Banana - Maturity indices (Visual, Physical appearance) – Harvesting methods (Manual & Mechanical) – Harvesting tool– processing - storage (Cold, dry) – value addition – marketing.

Unit V: Applied horticulture (8 hrs)

Landscaping – Lawn maintenance - Ikabana – Bonsai –vegetable carving – Indoor plants - Ornamental succulents - Terrarium- Bouquet making- flower export (cut and dried flowers) – career opportunities and entrepreneurial skills.

TEXT BOOKS

1. Agarwal. P.K. (1993) Hand book of Seed technology, Dept of Agriculture and cooperation, National Seed corporation Ltd., New Delhi
2. Kumar, N. (2017),Introduction to Horticulture, I.K. International Publishing houses ltd. 8th edition.H.D.Kumar, (2009), Handbook of horticulture, McMillan India Ltd. Pub. New Delhi
3. Edmond Musser & Andrews, (2008). Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi
4. Manibhushan Rao K (2005) Text book of Horticulture, McMillan India Ltd. Pub. New Delhi. ISBN 1403-9281.

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

Jules, (1979).Horticultural Science.(3rd Edn.)W.H.Freeman and Co., San Francisco, USA.

Mapping of course outcome with Bloom's Taxonomy

	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	
CO1	5	5	5	5	4	3	27
CO2	5	5	5	3	1	4	23
CO3	5	5	5	3	3	5	26
CO4	5	5	5	5	4	4	28
CO5	5	5	5	3	4	4	26
							4.3

BOT2657 LAB III (MICRO + ARCHE + HORTI) 2+2+2=6hrs.

COURSE OUTCOME

The students will be able to

i. carry out basic microbiological techniques to explore the microbial world by conducting appropriate experiments.
ii. investigate different microbial habitat during the field study and daily walk of life.
iii. understand evolutionary relationship among different group of plant forms and analyze the morphological and physiological adaptations to varying habitats.
iv. 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
v. build different protection facility, construct plant growing structures, practicepropagating techniques for multiplication of plants.

MICROBIOLOGY

1. Good laboratory practices and observation of ubiquitous presence of microbes
2. Microscopic techniques – specimen preparation for compound and dissection microscopes
3. Simple staining and Gram staining
4. Media preparation and sterilization techniques
5. Microbial isolation from natural habitat– Serial Dilution
6. Pure culture techniques (Smear, spread and pour plate and streaking)
7. Morphological studies – colony characterization
8. Growth measurements: (Direct method, haemocytometer, turbidity method)
9. Assessment of microbial load in water sample
10. Microbial analysis of legume root nodules
11. Antimicrobial assay: sensitivity test with antibiotics.
12. Microbial assay for food and milk

Field and Industry visit (Any two):

1. Aavin dairy farm, Madurai
2. Sewage treatment plant, Vellaikkal
3. Potable water treatment plant, Anaipatty
4. Pasteur's Institute, Coonoor

REFERENCES

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

ARCHEGONIATAE

1. Panoramic view of archegoniates : whole mount and charts
2. Liverworts (leafy / Non leafy): vegetative and reproductive features of *Riccia*&*Anthoceros*
3. A study on mosses based on *Sphagnum* / *Funaria*
4. *Lycopodium*-sectional view of stem & strobilus.
5. Ecological adaptations of *Equisetum*: Study of shoot and strobilus.
6. Aquatic ferns – *Azolla, Marsilea*
7. Morphology, rachis, pinna and sori of a fern.
8. Vegetative and reproductive structures of *Cycas*
9. Morphology and Anatomy of *Pinus*
10. Plant evolution I –activity based learning with Geological time scale
11 Plant evolution II – study of fossils
12. Field visits:

    Hill flora - Ooty / Kodaikanal
    Fossils - Ariyalur / Thiruvakkarai
    Local flora - Azhagar Hills, Madurai

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

Horticulture

1. Soil sampling technique and analysis
2. Preparation of Land – Cleaning, Ploughing, Plotting, Potting mixture
3. Sowing &Planting methods
4. Irrigation types
5. Crop nutrition: Manure (Compost, Panjakavya), fertilizers,
6. Crop protection – inorganic, organic & Biopesticide
7. Propagation techniques – Cutting, Layering, Grafting & Budding
8. Farm management practice – Pruning & Weeding
9. Plant growing structures
10. Kitchen Garden, Terrace garden
11. Components of garden – Landscape gardening
12. Horticulture tools and equipments

Field Visits:

Horticultural station - Periyakulam
Organic farm (Israel Technology) – Dindigul

REFERENCES

1. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

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

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

i. understand the features of fungi and relate this knowledge to the daily walks of life.
ii. gain an overview of classification based on structure, reproduction and life cycle patterns to distinguish the major groups of fungi.
iii. recall the concepts in pathology to understand the mechanism of pathogenesis in delineating host pathogen interactions.
iv. interpret the symptomatology to diagnose fungal, bacterial and viral disease to recommend suitable control measures.
v. understand epidemiology and forecast disease and employ suitable disease management strategies.

Unit I: Basics of mycology (15 hr)

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 (15 hr)

Alexopoulos and Mims (1979) classification –salient features of Gymnomycota (cellular and slime moulds), Mastigomycota (Oomycetes), and Amastigomycota (Ascomycetes, Basidiomycetes and Deuteromycetes) – fungal associations (lichens, mycorrhiza and endophytes).

Unit III: Genesis of pathology (15 hr)

Concept of plant disease – Koch's postulates – Disease tetrahedron – Pathogenesis (enzymes and toxins) –Structural and functional defense mechanisms in plants.Plant diseases and human civilization.

Unit IV: Plant diseases **(15 hr)**

Classification, symptoms and diagnosis – traditional and molecular methods. Case studies: Bacterial disease (Bacterial blight, Citrus canker), Fungal disease (Red rot of sugarcane, Rice blast), Viral disease (Bunchy Top of Banana, TMV).

Unit V: Disease management **(15 hr)**

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 viride*) – Integrated disease management.

TEXT BOOKS

1. Mehrotra, R. S. and Agarwal, A. (2003). Plant Pathology. 2nd Edn. Tata McGraw Hills Publi. Co. New Delhi ISBN 0-07-047399-4.
2. Mishra, B.K. (2017), Mycology and Phytopathology, Kalynai Publishers, New Delhi.
3. Sumbali, G. (2005). The Fungi. Narosa Publishing House. New Delhi. ISBN 81 -7319-512-9.
4. Sharma, P. D. (2017). Mycology and Phytopathology Rastogi Publication, Meerut.
5. Webster, J. and Weber R. (2007). Introduction to Fungi. 3rd Edition, Cambridge University Press. ISBN 05 2101 4832.

REFERENCES

1. Alexopoulos, C. G. and Blackwell, M. (1996). Introduction to modern mycology, John Wiley. New York. ISBN 9814-12-612-8.
2. Agrios, G. N. (2006) Plant pathology. 5th Edn. Elseviers Publication, Academic press. New Delhi. ISBN 13: 978-81-312-0639-3.
3. Chaube, H. S. and Pundir, V.S. (2005). Crop disease and their management.Prentice Hall of India Pvt. Ltd. New Delhi. ISBN 81-203-2674-1.
4. Hull, R. (2002). Plant Virology.Elsevier Publication.Academic Press. New Delhi. ISBN 0-12- 361160-1.
5. Singh, R.S. (2005). Plant disease.Oxford and IBH publishing. Co. Pvt. Ltd. New Delhi. ISBN 81-204-1658-9.

Mapping of course outcome with Bloom's Taxonomy

	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

BOT2454 CELL BIOLOGY 4Hr/4Cr.

PREAMBLE: This course is designed as preparatory 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 are 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 course, the student will able to

i. write a brief resume of cell science
ii. demarcate the importance of cell surface and matrix
iii. identify the significance of the endomembranes and the vitality of GERL complex
iv. learn the role of nucleus as organelle for genetic material and the cell cycle events
v. acquaint knowledge on analytical procedures

Unit I:Historical perspectives (15 hr)

History –Cell theory – Organization of a prokaryotic and eukaryotic cell, endosymbiotic theory and evolution of plant cell –Exclusive features of plant cell (Cell wall, Vacuoles, cytoskeleton).Visualizing cells –Light Microscopy (cytochemistry,fluorescence, confocal scanning and phase contrast) – Electron Microscopy (TEM, SEM and Freeze Fracture) – Radioisotopes, Autoradiography and antibodies – Fluorescence-activated cell sorter.

Unit II: Cell Surface and Matrix (10 hr)

Cell wall organization – cytocavitory network - plasma membrane structure (unit membrane, fluid-mosaic model) and functions – cell adhesion, cell movement and extracellular matrix – properties of cytoplasm.

Unit III: Sub cellular components (10 hr)

Ultrastructure and functions of chloroplast and mitochondria–GERL complex - endoplasmic

reticulum – golgi apparatus – lysosomes and peroxisomes – ribosomes and protein synthesis – micro bodies and ergastic substances (crystals and raphides).

Unit IV: Nucleus and cell duplication (10 hr)

Nuclear envelope and nuclear matrix – organization of chromatin and chromosomes – DNA as a central dogma - mechanism of cell communication – cell division (amitosis, mitosis, meiosis) - cell cycle –abnormal cell cycle (apoptosis, tumour and cancer cells).

Unit V: Analytical procedures (15 hr)

Microsomal fraction - sample preparation and isolation of organelles (homogenization,differentialand density gradientcentrifugation) – silicone layer filtering centrifugation – patch- clamp technique –haemocytometry– tissue culture and cinemicrography.

TEXTBOOKS

1. De Robertis, E.D.P. and Robertis, E.M.F. (1991). Cell and molecular biology. Lea and Febiger
2. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
3. Kimball T.W. (1984). "Cell Biology", Wesley Publishers. ISBN:978-0201117325
4. Power, C.B.(2017). Cell Biology, Himalaya Publishing House, New Delhi
5. Sahu, A.C. (2017). Essentials of Molecular Biology, Kalynai Publishers, New Delhi.

REFERENCES

1. Gerald Karp. (2003). Cell Biology. 7thEdn. (International student version)JohnWilley. ISBN:9781118318744
2. Geoffrey M. Cooper (2015). 7thEdn. The Cell- A Molecular Approach, ASM publications Washington.
3. Albertis B.,JohnsonA.,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). 10thEdn. Cell biology.Rastogi publications.Meerut.ISBN-978-81-7133- 969-3.
5. Lodish, H., Berk, A., Kaiser C. A., Krieger M., Scott M. P., Bretscher, A. and Matsudaira, P. (2008). *Molecular cell biology*. Macmillan.

Mapping of course outcome with Bloom's Taxonomy

	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	
CO 1	5	5	5	5	5	5	30
CO 2	4	5	5	5	5	5	28
CO 3	4	5	5	5	5	4	28
CO 4	4	5	5	5	5	4	28
CO 5	5	5	5	5	5	5	30
							144/30
							4.8

BOT 2456 ANATOMY & REPRODUCTIVE BIOLOGY OF ANGIOSPERMS 4 Hr / 4 Cr

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

i. recognize different types of cells and tissues in plant anatomy with the theories related to meristem.

ii. conceptualize the primary and secondary structures of plant parts and understand the process of anomalous growth in plants.

iii. understand and describe the structure of stamen and pistil and the development of pollen and embryo sac.

iv. identify the agents of pollination and examine the embryo and endosperm in a seed.

v. gain confidence in sectioning and effectively using stains for staining and utilize technology to develop parthenocarpy.

Unit I: Cells and Tissues (12 hr)

Basic frame work of plants: cell types, structure and functions – localization of cell – Meristems-types-theories.

Unit II: Vegetative organization (12 hr)

Primary and secondary structure of root and stem (Dicot and Monocot)- Leaf anatomy (Dicot and Monocot) – nodal anatomy-abscission. Wood: stretched and compressed- heart wood-sapwood. Anomalous secondary growth of stem

Unit III: Reproductive structures **(12 hr)**

Essential and auxillary units of flower – male gametophyte (Androecium – Stamen – Anther- Pollen grain) and female gametophyte (Gynoecium – Pistil – Ovary – Ovule - embryosac) - pollen grain - structure –types- germination- ovule and its types.

Unit IV:Pollination and fertilization **(12 hr)**

Types and agents of pollination–pollen-pistil interaction, double fertilization and triple fusion- endosperm formation – types - embryo development - types – seed structure (dicot and monocot) – Fruit types.

Unit V:HistologicalTechniques and Applied Embryology **(12 hr)**

Microtomy - micro technique: sectioning- staining - permanent slide preparation - Annual rings - Maceration technique- Apomixis - polyembryony - parthenocarpy.

TEXT BOOKS

1. Pandey, S.N. and Misra S.P. (2008). Taxonomy of Angiosperms. Ane Books Pvt Ltd. ISBN-978-8180521768

2.Pandey B.P. (2012). Plant Anatomy. S.Chand & Company Ltd. ISBN-9788121901451

3. Bhojwani, S.S and S.P. Bhatnagar, S.P. (2009). The Embryology of Angiosperms. 5th edition, Vikas Publishing. ISBN- 8125923462.

REFERENCES

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

Mapping of course outcome with Bloom's Taxonomy

	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							

BOT 2658 LAB IV (Myco+CellBio+ARBA) (2+2+2 Hrs)

COURSE OUTCOME

At the end of the course, students will be able to

i. locate and understand the characteristic features and habitats of micro and macro fungi,
ii. analyze the epidemiology and management of major plant diseases and apply the recent diagnostic methods in and around Madurai region,
iii. visualize the ultrastructure of a cell and subcellular components as a integrated entity,
iv. distinguish the organization of different cells and tissues in different organs of the plant through various sectioning and staining techniques,
v. identify inherent growth and developmental changes related to the reproductive processes of plants.

I - MYCOLOGY & PATHOLOGY (Lab) (2hr)

1. Observations of *Mucor* and *Rhizopus*
2. Mycelial studies and fruiting bodies of *Pilobolus*
3. Study 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. Antagonisticstudy –dual culture assay
11. Mass production and formulation of biocontrol strains (*Trichoderma*, VAM)
12. In- vitro screening of fungicides against pathogens
13. Disease forecasting – web-based model

Field Visit:
Plant Pathology division, TNAU, Madurai.
Meteorological station, Kannivadi, Dindigul.

REFERENCES

1. Aneja, K. R. (2009). Experiments in Microbiology, Plant Pathology, and Biotechnology. New Age International Publishers, New Delhi. ISBN 978-81-224-1494-3.

2. Alexopoulos, C. G. and Blackwell, M. (1996). Introduction to modern mycology, John Wiley. New York. ISBN 9814-12-612-8.

CELL BIOLOGY

1. Light and Phase contrast microscope - working principles through models
2. Cytological investigations: animal (mouth swab) and plant cell (Onionpeel, *Tradescantia*).
3. Cytoplasmic streaming (Chara and Hydrilla)
4. Cell inclusions: Starch grains, raphides, Cystolith
5. Histochemical test for lipids, terpenes and secondary metabolites.
6. Chromosome staining
7. Isolation and observation of Chloroplast
8. Cell isolationtechnique
9. Mitosis: squash technique withonion root tip.
10. Meiosis: Rheo / Tradescantia antherSquash.
11. Chromosomal structure: Satellite and Giant Chromosome.
12. Electron microscope and cell imaging techniques

REFERENCES

1. Santra S.C Chatterjee T.P. Das A.P (1989) College Botany Practical – Volume 1, New central book agency, Kolkatta.
2. Shanmugam G 1988 Cell biology A laboratory Manual, Macmillan India Limited ISBN 033392 087 2
3. Sheeler P and Bianchi ED 1987.Cell and Molecular Biology.3rd ed. John willey and Son (Asian) Ltd. Singapore. ISBN: 9814-12-648-9.

PLANT ANATOMY AND REPRODUCTIVE BIOLOGY LAB

1. Examination of plant tissues (sectioning and staining).
2. Primary structures (C.S. of Dicot & monocot stem and root)
3. Anatomy of meristems – shoot tip and root tip
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 (RLS & TLS)
7. Maceration and micrometry
8. Study of flower and inflorescence.
9. Stamen (Anther, Pollen types and pollen germination).
10. Pistil (Ovary, style, stigma, placentation and ovule structure).
11. Isolation of embryo (*Tridax, Cleome)*
12. Polyembryony in citrus and endosperm types, aril and haustoria

Submission:

1. Record and photomicrograph
2. 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

BOT2359 BOTANY FOR CHEMISTS-I 3H/3CR

PREAMBLE: This course is designed for the chemistry students as a major supportive course with a basic understanding of plant forms and functions. Awareness is created on plants as a repository of biopolymer and biomolecules. Skills in recognizing and utilizing of biological resources are added.

COURSE OUTCOME

At the end of the course, the students will be able to

i. 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
ii. 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
iii. 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.
iv. develop a 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.
v. 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

Unit I: An overview of plant groups (9 hr)

Basics of evolution- Five kingdom classification-Salient features of Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Unit II: Cell as the basic entity (9 hr)

Prokaryotic and eukaryotic cells, endosymbiosis, chemistry of cell wall and plasma membrane, Structure and function of chloroplast and mitochondria.

Unit III: Nucleus and heredity (9 hr)

Organization of nucleic acids and chromosome – functions of nucleus- DNA as a genetic material and central dogma of life.

Unit IV: Plant – water relations and carbon assimilations (9 hr)

Biological significance of water molecule (Osmotic relations, uptake an conduction). Photosynthesis (light dependent and light independent reaction).Respiration and energy harnessing (Glycolysis, TCA cycle and ETS).

Unit V: Plant growth and nutrient management (9 hr)

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

TEXTBOOKS

1. Pandey, B. P. (2005). College Botany, Vol I. 5th Edn., S. Chand & Company New Delhi. ISBN 81- 219-0593-1
2. Pandey, B. P. (2009). College Botany, Vol II. 7th Edn., S. Chand & Company New Delhi. ISBN 81- 219-0601-6
3. Sinha, R.K. (2004). Modern plant physiology. Narosa Publishing House New Delhi. ISBN 81-7319- 333-9
4. Sheeler P and Bianchi ED (1987).Cell and Molecular Biology.3rd ed. John willey and Son (Asian) Ltd. Singapore. ISBN: 9814-12-648-9.
5. Shanmugam G.(1988). Cell biology A laboratory Manual, Macmillan India Limited ISBN 033392 087 2

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, NewDelhi.
4. Sinha, R.K. (2004). Modern plant physiology. Narosa Publishing House New Delhi. ISBN 81-7319- 333-9

Mapping of course outcome with bloom's taxonomy

	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							

BOT2161 BOTANY FOR CHEMISTS-I (LAB) 2H/1Cr

COURSE OUTCOME

At the end of the end of the lab course, students will be able to

i. understand the diversity of plant kingdom
ii. survey trees of the campus
iii. learn the use instruments to study the basic biochemical parameters of soil
iv. experience the physiology of plant system
v. identify symptoms in plant system

1. Morphology of *Sargassum, Riccia, Fern* and identification of cryptogams infield
2. Morphology of*Cycas*
3. Angiosperms – morphology of monocot and dicotplant
4. Survey of campustrees.
5. A study on plant cell - Onion peel/ *Tradescantia ,Hydrilla&Vernonia* (c.s. ofstem)
6. Soil test – pH, temperature, EC, alkalinity, acidity.
7. Plant growth measurement and movement – auxanometer, phototropism.
8. Plant water relations: Potatoosmoscope
9. Photosynthesis – DCPIP experiment, starch test
10. Transpiration – Cobalt Chloride paper test, stomatalindex
11. Respiration –Kuhn's tube, Ganong'srespiroscope
12. Collection and submission of plants specimens with mineral deficiencysymptoms

REFERENCES

1. Bendre, A. M., and Kumar, A. (2006). A text book of practical botany. (Vol I). Rastogi Publication New Delhi. ISBN81-7133-809-7
2. Bendre, A. M. and Kumar,A. (2006). A text book of practical botany. (Vol II) Rastogi Publication New Delhi. ISBN81-7133-852-6

BOT2360 BOTANY FOR CHEMISTS-II 3H/3CR

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 course, the students will be able to

i. 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
ii. 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
iii. 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
iv. 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
v. reflect on the caution, risks ad dangers in trading of bioresources and make an assessment of supply and demand in standalone businesses and trading networks that a fair price is ensured at all times.

Unit I: Assessment of bioresources (9 hr)

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

Unit II: Chemistry of plant medicine (9 hr)

Brief study of Phytochemicals (secondary metabolites): source, useful part, active principles and used as essential oil: menthol, citronella; Alkaloids: curcumin; Glycosides – digitalin; Steroids – dioscorin; Flavanoids – pelargonium;

Unit III: Plant produce as industrial inputs (9 hr)

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 (9 hr)

Jeevani**,** Artemisin, Noni, Brahmi, Indian Ginseng. Traditional knowledge as marker for bioprospecting: access and benefit sharing.

Unit V: **Trade and conservation of resources** **(9 hr)**

Supply and demand assessment –threats – loss of resources –ex–situ and in–situ preservation methods - sustainable management- Cannabis and Opium - Drug abuse and addiction.

TEXTBOOKS

1. Trease G.E. and Evans. W.C. (2002). Pharmacognosy ELBS 15th Edition
2. Verma, V. (2009).*Text book of economic botany* Ane Books Pvt Ltd. New Delhi (ISBN - 978-81-8052-167-6)
3. Wallis,T.E. (2003).Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition)
4. Kochhar, S.L. (2011). *Economic Botany in the Tropics*, MacMillan Publishers India Ltd., New Delhi. 4thedition. (ISBN (13) 978-0230- 63893-8)
5. Suresh kumar, P., Varalakshmi, D. and Pullaih, T. (2016). Textbook of Pharmacognosy, Publisher: CBS Publishers & Distributors.

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1. Anonymous. The AyurvedicPharmacopia of India Volume-I and IV, Govt. of India, Ministry of Health and Family Welfare, Department of Ayush.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Kokate C.K. (2014). Practical Pharmacognosy, Vallabhprakashan, New Delhi, 5th edition.
4. 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.
5. Hill, a. F. (1937). *Economic botany: a textbook of useful plants and plant products*, Mcgraw-hill book company, Inc. New York and London.

Mapping of course outcome with bloom's taxonomy

	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							

BOT2162 BOTANY FOR CHEMISTS-II (LAB) 2H/1Cr

At the end of the course, the students will be able to

i. identify the basic importance of plants
ii. locate plant diversity in the college campus
iii. extract common ingredients of plant like oil
iv. familiarize with fermentation technique
v. undrestand the importance of alternate fuels like biogas

COURSE OUTCOME

1. Identification of plant resources mentioned insyllabus
2. Locating potential plant resources on and offcampus
3. Survey of plant based medicines in localmarket
4. Histo-chemical staining and identification of importantphytochemicals
5. Solvent extraction of selected plantingredients
6. Distillation of essentialoil
7. Extraction of bio-fuel from *Madhuca* /*Pongamia*
8. Tea adulteration andtesting
9. Homemade chocolatepreparation
10. Fermentation - Winepreparation
11. Biogas unit – design anddemo
12. Natural dyes – extraction and dyeing offibres

REFERENCES

1. Hill, a. F. 1937. *Economic botany: a textbook of useful plants and plant products,* mcgraw-hill book company, inc. New york and london1937
2. Trease G.E. and Evans. W.C. (2002) Pharmacognosy ELBS 15thEdition.

BOT 3651 PLANT SYSTEMATICS 6 Hr/ 6 Cr.

Preamble

This course is designed to give an overview on the identification, nomenclature and classification of plants to the young minds. The morphology and the history of classification will make them understand and appreciate the subject. The hands-on experience with locally available flora can give ample opportunity to the students to touch and feel the plants around them which will lead them towards the conservation of plants. The student will be able to understand and explain the principles of plant systematics, distinctive features and the economic value of the plants in the cited familiesafter the successful completion of the course.

Course Outcome

At the end of the Semester, the Students will be able to

i. appreciate the contributions of various people through ages, and admire the morphological variations in plants that may pave way to conservation.
ii. engross the importance of rules in the naming of plants and its importance in the field of taxonomical research and enlighten about other fields of high reputation related to plant systematics.
iii. understand the basic concepts of Angiosperm Phylogeny Group, principles and basics of recent advancements in plant systematics such as chemo and numerical taxonomy.
iv. contemplating upon the floral characters of selected families of *Polypetalae* and *Gamopetalae*with their phylogenetic relationship and economic importance.
v. investigate the vegetative, floral characters and phylogenetic affinities of selected families of *Monochlamydeae*&*Monocotyledonae*will make them understand the importance and its conservation and ensures sustainability.

Unit I: History of Classification and PlantMorphology(20 hrs)

Contributions of Theophrastus, Linnaeus (1753), Bentham & Hooker (1862-1883), and Engler&Prantle (1886); Morphology of root, stem, leaf, inflorescence, flower and fruit.

Unit II: Principles of Plant Taxonomy (20 hrs)

Chronology of code of nomenclature -ICBN to ICN - principles of code (Shenzhen code 2018)-articles and recommendations-active principles (priority of publication, typification and effective publication) - author citation - naming of plants - herbarium taxonomy -taxonomic databases-IPNI (International Plant Names Index).

Unit III: Contemporary Systematics(16 hrs)

APG system of classification -basic principles, methods and concepts of cladistics - numerical taxonomy - chemotaxonomy-genome analysis-bar coding.

Unit IV*: Dicotyledonae (18 hrs)

Polypetalae:Annonaceae, Rutaceae, Leguminosae and Cucurbitaceae.***Gamopetalae:*** Asteraceae, Sapotaceae, and Solanaceae.

Unit V*:*Monochlamydae* (16 hrs)
Nyctaginaceaeand Euphorbiaceae; **Monocotyledonae -** Orchidaceae, Arecaceae and Poaceae.

***Systematic study of plant groups (features, economic importance and phylogeny) up to family level.**

TEXTBOOK

1. Lawrence, G.H.M. (1965). Taxonomy of vascular plants. The MacMillan co, New York. ISBN: 978-0023681905.
2. Pandey, B. P. (2013). Taxonomy of angiosperms, S. Chand Pub. New Delhi. ISBN: 978-8121909327.
3. Pandey, S. N. and Misra, S. P. (2008). Taxonomy of angiosperms. Ane books India, New Delhi. ISBN: 978-8180521768.
4. Sambamurty, A. V. S. S. (2005). Taxonomy of angiosperms. I. K. International private limited, New Delhi. ISBN: 978-8188237166.
5. Singh, G. (2012). Plant Systematics, Third edition. Oxibh publishers, New Delhi. ISBN: 978-8120417632.
6. Verma, B.K. (2011). Introduction to taxonomy of angiosperms, PHI learning private limited, New Delhi. ISBN: 978-8120341142.

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. 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. Kochar, S. L. (2016), Economic botany, Cambridge university press, UK. ISBN 978-1-316-63822-4.
5. Matthew, K.M. (1995). An excursion flora of Central Tamilnadu, India. Oxford IBH publication, New Delhi. ISBN 978-9054102861

Mapping of course outcomes with Bloom's Taxonomy

Course outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
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
Total	25	25	24	24	16	15	129
							129/30 = 4.3

BOT3653 BIOCHEMISTRY 6Hr./6Cr.

Preamble

A cognitive and pedagogical exposure of biochemistry is useful for a concrete understanding of biology. The course work provides students a broadbased training to look at life as an outcome of interlocked events of simple biochemical reactions, biosynthetic pathways and metabolism. Emphasis will be placed on the applications and forefront areas of experimental biochemistry. A multidisciplinary approachwill 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

i. picturize the array of molecules in a living cell and understand how differentchemicals interact among themselves in establishing the cellular basis of life.
ii. explore the various sources of carbohydrates, structural and functional properties andevaluate its significance.
iii. understand lipids as an important source of reserve food and emphasize ontheir vitality in cell membranes.
iv. comprehend proteins and nucleic acids as important heteropolymers offering toheterogeneity as well as specificity to cell functions.
v. categorize different enzymes, vitamins and recognize its role in driving biochemical reactions.

Unit I: Overview(10hrs)

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.

Unit II:Carbohydrates and Glycobiology(20hrs)

Sources– classification – physiochemical and optical properties of monosaccharides: Aldoses and Ketoses; Disaccharides: Sucrose, Maltose; Polysaccharides: Starch, Cellulose.Glycoconjugates: Proteoglycans, Glycoproteins and Glycolipids.

Unit III:Lipids (20hrs)

Classification—types—storage lipids: Triglycerides —membrane lipids–outline of lipidmetabolism—β-oxidation and lipid peroxidation —dietary value of lipids.Lipids as signals, Cofactors and Pigments.

Unit IV:Nucleic acids, Amino acids and Proteins(20hr)

Types of nucleic acids – components – synthesis of purines and pyrimidines—properties, classification and precursors for amino acid biosynthesis – structure and conformation of proteins — significance of Ramachandran plot— acid-base solubility — properties of proteins.

Unit V:Vitamins and Enzymes(20hr)

Vitamins as Coenzymes — Enzymes as quaternary proteins — properties—classification and nomenclature—specificity of enzyme action— determination of the catalytic activity—

Activation energy.Enzyme Kinetics —Michaelis and Menton concept—Lineweaver-Burk plot—Enzyme inhibition-Reversible and Irreversible inhibition —Isozymes.Integration of metabolism.

TEXTBOOK

1. Bowsher, C., Steer, M.& Tobin, A. (2008). Plant biochemistry. Garland Science.
2. Campbell, M.K. & Farrell, S.O. (2011). Biochemistry, 7th Reprint, Cengage Learning Publishers.
3. Dey, P. M.&Harborne, J. B. (Eds.). (1997). Plant biochemistry. Elsevier.
4. Heldt, H. W.&Piechulla, B. (2021). Plant biochemistry. Academic Press.
5. Conn,E. K. Stumpf, G. Bruening and H. Doi (2004) Outlines of Biochemistry. Replika Press Pvt. Ltd.

REFERENCES

1. Berg, J.M. Tymoczko, J.L. and Stryer, L., (2002). Biochemistry, Fourth edition. W. H Freeman and company, New York. ISBN: 07 16749548.
2. Bonner, J. & Varner, J. E. (Eds.). (2012). Plant biochemistry. Elsevier.
3. Buchanan, B. B., Gruissem, W.& Jones, R. L. (Eds.). (2015). Biochemistry and molecular biology of plants. John wiley& sons.
4. Gasser, R.P.H. and Richards, W.G., (1986). Entrophy and energy levels. Oxford university publication, London. ISBN: 10-0194424111.
5. 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.
6. 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.
7. Voet, D. and Voet, J.G., (2004). Biochemistry, Third edition. John wiley and sons, New Jersey, United States. ISBN: 10:047119350X.
8. Zubay, G.L., (1998). Biochemistry, Fourth edition. Brown publishers, Chicago. ISBN:0-697-21900-3.

Mapping of course outcomes with Bloom's Taxonomy

Course outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	5	3	3	26
CO2	5	5	5	5	4	3	27
CO3	4	5	5	5	4	3	26
CO4	5	5	5	4	5	4	28
CO5	3	4	5	5	5	4	26
Total	22	24	25	24	21	17	133
							133/30=4.4

BOT 3657 LAB V (Plant Systematics and Biochemistry) 6 Hr / 6 Cr.

Course Outcome

At the end of this lab course the students will be able to

i) appreciate the plant kingdom
ii) differentiate the diverse forms of plant fraternity
iii) understand the economic importance of green plants
iv) perform basic biochemical experiments using various instruments
v)extract secondary metabolites from plants

Plant Systematics 3h/wk

1. Understanding the various parts of a plant
2. Plant Morphology-I: vegetative parts
3. Plant Morphology-II: reproductive parts
4. Phytography (understanding the use of technical terms and pattern)
5. Dichotomous Key construction (Indented and bracketed key)
6. Identification of plant families using local floras
7. **Dicotyledonae**: ***Polypetalae*** I: Annonaceae, Rutaceae
8. ***Polypetalae*** II: Leguminosae (Fabaceae, Caesalpiniaceae, Mimosaceae) and Cucurbitaceae
9. ***Gamopetalae*** I: Asteraceae
10. ***Gamopetalae*** II: Sapotaceae and Solanaceae
11. ***Monochlamydeae***: Nyctaginaceae and Euphorbiaceae
12. **Monocotyledonae**: Orchidaceae, Arecaceae and Poaceae
13. Economic importance of plant families studied
14. Understanding taxonomic problems

Further students are encouraged to participate in field trips to nearby botanically rich areas to study plants in their natural habitat. (Suggested places: Alagar Hills, Karungalakudi, Sathuragiri, Kodaikanal, Sirumalai and Udhagmandalam).

REFERENCES

1. Gamble, J.S. and Fischer, C.E.C. (2011). Flora of the presidency of Madras, vols.I – III, Bishen Singh Mahendrapal Singh, Jodhpur.ISBN : 978-8121106290.
2. Lawrence, G.H.M. (1965). Taxonomy of vascular plants. The Mac Milan 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 Lab **3h/wk**

Lab Experiments:

1. pH metry
2. Colorimetry - Verification of Beer – Lambert'slaw
3. Spectrophotometer- Determination ofλ-max.
4. Qualitative test forcarbohydrates
5. Quantitative estimation of carbohydrates by Anthrone'smethod
6. Qualitative test for proteins and aminoacids
7. Quantitative estimation of protein by Lowry'smethod
8. Qualitative test for lipids and estimation of oil inseeds
9. Separation of amino acids using paperchromatography.
10. Separation of pigments using thin layerchromatography.
11. Enzyme activity (Catalase /Peroxidase)
12. Isolation of chloroplast for electron transportstudies.
13. Estimation of PS II activity (DCPIP reductionmethod)

REFERENCES

1. Cooper, T.G. (1991). The tools of biochemistry. John Wiley and sons, New York. ISBN: 0-47117116-6.
2. Jeyaraman, J.(1998). Laboratory manual in biochemistry. New ageinternational 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 3555 ANALYTICAL TECHNIQUES AND RESEARCH METHODOLOGY

5hr./5cr.

Preamble

This course imparts knowledge on principles of various instruments and gadgets employed in scientific enquiry. Students will learn various qualitative and quantitative techniques and will gain knowledge in designing scientific experiments, leading to data collection, analysis and scientific paper writing.

Course Outcome

At the end of the Semester, the Students will be able to

i. follow the standard and good laboratory practices and observe safety norms at every stage of work and be confident in handling basic science experiments
ii. confidently and independently use spectrophotometer and its variants and effectively perform analytical work and do quantitative measurements with accuracy
iii. understand how the principle of centrifugation, chromatography, electrophoresis and blotting techniques can be utilized to resolve queries in plant biochemistry
iv. design and carry out scientific enquiries by sampling, surveys, and statistical analysis employing data collection and analysis using suitable statistical tools
v. summarize their scientific observations, interpret and write thesis and make scientific presentations

Unit I: Basic Principles (10 hrs)

Units of measurement, expression of solution concentration (molarity, molality, normality, percentage, parts per thousand, and ppm) – electromagnetic spectrum – gravitational force – Good Laboratory Practices (GLP).

Unit II: Analytical Procedures (20 hrs)

Instrumentation for field and ecological studies (sonometer, clinometer, altimeter, barometer, hygrometer, anemometer, lux meter, thermometer, rain gauge and smart phone Apps.). Working principle, components and applications: pH metry, colorimetry, Spectroscopy (UV-Visible spectrophotometer), Flame Photometer.

Unit III: Separation Techniques (15 hrs)

Centrifugation (types and applications) – Chromatography (paper and thin layer) – working principle and applications: HPLC, GC–MS, electrophoresis (Agarose and Poly Acrylamide), Southern, Northern and Western blotting – Isoelectric focusing.

Unit IV: Scientific Experimentation (15 hrs)

Scientific observations – critical thinking – development of scientific thought - research aptitude – defining a research problem, hypothesis testing and experimental design – review of literature (journal references, online resources.) – population and sampling methods (random and non–random sampling) –field note – Microphotography and photo documentation – Geotagging.

Unit V: Data Collection and Analysis (15 hrs)

Collection of primary and secondary data - questionnaire – survey – Biostatistics (mean, mode, frequency distribution, standard deviation, standard error) — Data processing softwares (SPSS) – Thesis writing: format, abstract, data presentation (tabulations, graphic representation) – interpretation of data – MS-Office (word, excel and power point) – oral presentation – plagiarism – research ethics.

TEXTBOOK

1. Gurumani,N. (2020). Research Methodology for Biological Sciences.MJB Publishers.Chennai.ISBN8180940160
2. Jeyaraman, J. (2011). Laboratory Manual in Biochemistry, Second edition. New age international private limited, New Delhi. ISBN: 9788122430493.
3. Kothari, C.R. and Garg, G. (2019). Research Methodology: Methods and Techniques. New Age International Publishers, New Delhi, India.ISBN 9386649225.
4. Palanivelu, P. (2009). Analytical Biochemistry and Separation Techniques – A Laboratory Manual, Fourth edition.21stCentury Publications. India. ISBN:9788190848909.
5. Rastogi, V.B. (2009). Fundamentals of Biostatistics. Ane books Pvt. limited, New Delhi. ISBN: 9788180522550.

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1. Plummer, D.T. (1987). An Introduction to Practical Biochemistry, Tata McGraw Hill publishing company limited. New Delhi. ISBN: 9780070994874.
2. Rana, S,V.S. (2005). Biotechniques: Theory and Practice. Rastogi Publications. India. ISBN 8171337201.
3. Stephenson, F.H. (2003). Calculations for Molecular Biology and Biotechnology. Elsevier, Academic Press, USA. ISBN 0126657513.
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5. Wilson, K. and Walker, J. (2010). Principlesand Techniques of Biochemistry and Molecular biology, Seventh Edition. Cambridge University Press, New York. ISBN: 9780521178747.

Mapping of course outcomes with Bloom's Taxonomy

Course outcome	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
Total	14	18	21	21	16	18	108
108 / 30 = 3.6							

BOT 3259 ENVIRONMENTAL STUDIES 4Hr./2Cr.

Preamble

The course presents an overview on the components, its interactionsand importance in 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 the local and global environmental issues and strategies to manage them.

Course Outcome

At the end of the semester, the students will be able to

i. understand, analyze and enjoy the environment with its various elements and also know the importance of it in a larger perspective
ii. get adequate information on ecosystem and phytogeography and their importance in the distribution of various flora and fauna in an ecosystem.
iii. comprehend the relationship between the ecosystem and the community better and also have a better insight on the population
iv. recognize the everchanging climates and its effect on the elements of an ecosystem and also the effective handling of the disasters.
v. formulate proper environmental policies on the conservation of nature and cope up with all kinds of pollution and the treatment of pollutants for clean environment.

Unit I: Life Support and Energy Resources (8hrs)

Origin of life and speciation –Ecological factors (biotic, abiotic and climatic) – man & environment-seasons – biosphere-utilization and generation of renewable and non-renewable energy resources (solar – wind – hydro – tidal - thermal – nuclear – hydrogen fuel)- Environmental education in India

Unit II: Ecosystem and Phytogeography (12hrs)

Components and its functions - Types - forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands; energy flow: food chain and web; Ecological Pyramids: number, biomass, and energy - Biogeochemical cycles - Ecological Succession - Species diversity-concept; ecotone, ecotype, edge effects and niche - **Phytogeography:** Principles-distribution (wides, endemic, discontinuous)-barriers – endemism-types and causes-age and area hypothesis-Phytogeographic regions of India and World.

Unit III: Climate Change (10hrs)

Causes and concerns of Greenhouse effect, Ozone depletion- acid rain - Natural disasters (land slide - earthquake – volcanic eruption – floods – cyclones – tsunami); Man-made disasters (forest fire, Rampant Urbanization, Deforestation)–reasons and needs for mitigation –measurement – monitoring –management strategy–participatory management.

Unit IV: Conservation of Natural Resources (18 hrs)

Water conservation-development of watersheds, Rain Water Harvestingand Ground water recharge- eutrophication and restoration of lakes; Soil erosion, reclamation of degraded land,

desertification and its control; social and agroforestry – Monoculture – Green Audit –carbon sequestration - waste management (solid and water).

Unit V: Environmental Issues(12 hrs)

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

TEXTBOOK

1. Ambasht, R.S. &Ambasht, N.K. (2008). A Text Book of Plant Ecology. CBS Publishers Ltd,New Delhi.
2. Chapman, J.L. & Reiss, M.J. (2003). Ecology: Principles and Applications. Cambridge University Press, London.
3. Kapur, P &Govil, S.R. (2004). Experimental Plant Ecology.CBS Publishers Pvt. Ltd.,New Delhi
4. Odum, E. P.& Gary W. Barrett, G. W. (2005). Fundamentals of ecology, Thompson Brooks / Cole. ISBN: 9780534420666, 0534420664
5. Sharma, P.D. (2017). Ecology and Environment. Rastogi Publications, Meerut
6. Siddhartha, K. (2013). Ecology and Environment. Kisalaya Publications, New Delhi
7. Verma, V. (2011). Plant Ecology. Ane Books Pvt.Ltd., New Delhi.

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1. Odum, E. P. & Gary W. Barrett, G. W. (2005). Fundamentals of Ecology, Thompson Brooks / Cole. ISBN:9780534420666, 0534420664
2. Philander, S.G. (2012). Encyclopaedia of Global Warming and Climate Change (2nd edition). Sage Publications.
3. Pimentel, D. (Ed.). (2011). Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species. CRC Press.
4. Singh, J.S., Singh, S.P. & Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications
5. Whyte, I. (2013). A Dictionary of Environmental History, Bloomsbury Academic ISBN 9781845114626 & 1845114620
6. Williams, D. M., Ebach, M.C. (2008). Foundations of Systematics and Biogeography. Springer Pub.

Mapping of course outcomes with Bloom's Taxonomy

Course outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	3	3	4	2	22
CO2	5	5	5	4	3	3	25
CO3	5	5	4	3	4	4	25
CO4	5	5	3	5	3	4	25
CO5	5	4	5	5	5	5	29
Total	25	24	20	20	19	18	126
							126/30 = 4.2

BOT3852 PLANT BIOTECHNOLOGY 4Hr/ 8Cr+3L

(Lab cum Theory)

Preamble

This course opens up the vistas of molecular biology, bioprocess technology and its applications.Besides an exposure to genetic engineering, Students will learn the art of tissue culture for propagation and genetic transformation of plants. In addition, they will explore the opportunities in fermentation industries and know about the nitty-gritty of making marketable microbial and plant based products.

Course Outcome

At the end of the semester, students will be able to

i. take up jobs and employment in plant tissue culture industries or starting own entrepreneurial ventures.
ii. understand the molecular basis of life and interpret contemporary approaches in modern biology.
iii. apply their understanding on rDNA techniques and take up gainful employment in plant genetic engineering laboratories.
iv. used 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 centres.
v. pursuedesigning culture equipments and fermenters for production of value added products.

Unit I:Tissue culture as a Tool(12hrs)

Objectives and goals – historical perspective –laboratory lay out and equipments – Culture media – aseptic techniques –organogenesis–somatic embryogenesis – micropropagation–hardening - Applications of artificial seeds, protoplast techniques and haploid plants.

Unit II: Basics of Molecular Biology (12hrs)

Structure and types of DNA – Central Dogma – Initiation, elongation and termination of replication, transcription, translation –enzymology – Post transcriptional and translational modifications – Ribozymes.

Unit III: Recombinant DNA Technology(12hrs)

Principles of gene cloning –Restriction endonucleases- Vectors(Plasmids and bacteriophages)– PCR (principle, types and application) – RT-PCR – Restriction mapping–*Agrobacterium* mediated gene transfer- Biolistics- Selectable markers. Transgenic plants – Golden Rice, *FlavrSavr*.

Unit IV:Bioinformatics(12hrs)

*In silico*assistance in sequencing biomolecules –DNA sequencing methods (Sanger's and Next generation sequencing)nucleotide and protein databases (EBI and NCBI) and tools (Primer design, BLAST, FASTA, ClustalW and PHYLIP) -Phylogenetic tree – cladistics. Human Genome Project (HGP).

Unit V:Bioprocess Technology(12hrs)

Bioreactors and its operation – microbial culture and characterization – strain development – microbial growth and culture system – media formulation – growth kinetics – downstream processing. Fermentation products – Organic acid (Lactic acid) Amino acid (Glutamic acid); Vitamin (Riboflavin); Antibiotics (Tetracycline); Fermented Food (Cheese); Alcoholic beverages (Beer); Enzyme (Protease)- Single Cell Protein (SCP), Enzyme immobilization.

TEXTBOOK

1. Chawla, H. (2011). Introduction to plant biotechnology (3/e). CRC Press.
2. Dubey, R.C.(2014). Advanced Biotechnology. S. Chand and company, New Delhi. ISBN: 81-219- 4290-X.
3. El-Mansi, E. M. T., Nielsen, J., Mousdale, D.& Carlson, R. P. (Eds.). (2018). Fermentation microbiology and biotechnology. CRC press.
4. Glick, B. R., & Patten, C. L. (2017). Molecular biotechnology: principles and applications of recombinant DNA (Vol. 34). John Wiley & Sons.
5. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A.&Matsudaira, P. (2006). Molecular cell biology.
6. Razdan, M. K. (2003). Introduction to plant tissue culture. Science Publishers.
7. Roberts, K., Alberts, B., Johnson, A., Walter, P., & Hunt, T. (2002). Molecular biology of the cell. *New York: Garland Science*.
8. Xiong, J. (2006). Essential bioinformatics. Cambridge University Press.

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1. Bergeron, B. P. (2003). Bioinformatics computing. Prentice Hall Professional.
2. Brown, T.A.(2010). Gene cloning and DNA analysis: an introduction, Sixth edition. Wiley blackwell, United States. ISBN:9781405181730.
3. Demain, A.L. and Davis, J.E.(2004). Industrial microbiology and biotechnology, American society for microbiology press. ISBN:9781555811280.
4. Joshi, V.K.(2009). Biotechnology: Food fermentation-Volume I. Educational publishers and distributors, Kerala. ISBN: 978-8187198048.
5. Peterson, C.S. (1971). Microbiology of food fermentations, Second revised edition. AVI publishing company, Connecticut. ISBN:978-0870552779.
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. (2009). Principles of fermentation technology, Second edition, Butterworth- heinemann publisher- Elsevier, United Kingdom.ISBN:9780080999531.
8. Stansbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of fermentation technology, Butterworth-Heinemann publisher-Elsevier, United Kingdom. ISBN:978-0750645010.

Mapping of course outcomes with Bloom's Taxonomy

Course Outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	5	3	3	26
CO2	5	5	5	5	4	3	27
CO3	4	5	5	5	4	3	26
CO4	5	5	5	4	5	4	28
CO5	4	4	5	5	5	5	28
Total	23	24	25	24	21	18	135
							135/30 = 4.5

BOT3852 PLANT BIOTECHNOLOGY LAB 3Hr

Lab Experiments:

1. Sterilization and Mediapreparation
2. Organculture
3. DNA Extraction and agarosegelelectrophoresis
4. DNAQuantification
5. Restriction Digestion of DNA
6. Introduction todatabases
7. Usage of tools-BLAST, ClustalWanalysis
8. Production of primary and secondary metabolites (catalase,amylase)
9. Wine/Beerproduction
10. Production of acetic acid and lacticacid
11. Bioethanolproduction
12. Construction and design of Fermentor

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1. Agostino, M. (2012). Practical bioinformatics. Garland Science.
2. Bhojwani, S. S., &Razdan, M. K. (1986). Plant tissue culture: theory and practice. Elsevier.
3. Bujnicki, J. M., Droogmans, L., Grosjean, H., Purushothaman, S. K., &Lapeyre, B. (2008). Practical Bioinformatics. Springer.
4. McNeil, B.& Harvey, L. (Eds.). (2008). Practical fermentation technology. John Wiley & Sons.
5. Punia, M. S. (2018). Plant biotechnology and molecular biology: A laboratory manual. Scientific Publishers.
6. Sambrook, J., Fritsch, E. F. &Maniatis, T. (1989). Molecular cloning: a laboratory manual (No. Ed. 2). Cold spring harbor laboratory press.

BOT 3454 ENTREPRENEURIAL BOTANY 4Hr/4Cr

Preamble

This course is a blend of theory and practice of using the knowledge experience gained in the three years of his study for application in real time situation. On completion of this course, the learners will be able to develop ideas to enable them to initiate business ventures with professional competency and market vibrancy.

Course Outcome

At the end of the semester, students will be able to

i. exercisethe knowledge and skills gained in this course to start their own business ventures.

ii. comprehendthe relationship between business, market, and society in the context of effective utilization of valueadded products.

iii. apply the knowledge gained in creating and maintaining business in the suggested avenues.

iv. approach the governmental, non-governmental and other funding agencies to develop a business preposition.

v. handle entrepreneurial projects with effective trading and business skills.

Unit I: Entrepreneurial Start-up (15hrs)

Entrepreneurial traits – definition and concept – types and characterization, values – motivation, barriers and innovations – basics of organizational behaviour - risk assessment and solutions - various form of business organization (sole proprietorship, partnership, corporations, Limited Liability Company), mission, vision and strategy formulation. Communication - power of talk, personal selling, risk taking, resilience and negotiation. Case study and biographical analysis of successful entrepreneurs.

Unit II: Value Added Products (10hrs)

Cataloguing of potential sources - Canning of fruits – process and equipment – fruit and vegetablebased products (squash) – ready to serve (RTS) (syrup, pulp, paste, ketchup, soup, vegetable sauces, jam and jellies) – Bamboo and cane based products – virgin coconut oil, jasmine oil – nutraceuticals – standards and quality management.

Unit III: Bioventure (10hrs)

Industrial utility of *Spirulina*, *Pleurotussajor-caju*, *Lentinusedodes*, drumstick and coconut – Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO) - methods and marketing of fresh and dry flowers – Aromatic plants – essential oils; Medicinal plants -cultivation and extraction, seaweed liquid fertilizers, organic farming and their products - Bonsai, Ikebana.

Unit IV: Organizational Assistance (10hrs)

Mobilizing resources for start-up – financial assistance by different agencies.SIDCO – Micro Small and Medium Enterprises – support structure for promoting entrepreneurship – various governmental (Mudra Yojana, PradhanMantriRozgarYojana, Udyogini Scheme) and non-

governmental schemes (MAHIA, Shakti Scheme, Women Entrepreneurs India Scheme) – Women supportive project SHG - TIIC, DIC, NABARD, MICROSTAT and DBT.

Unit V: Business Aptitude and Arithmetic (15hrs)

Marketing – Packaging – Advertisements – Supply chain assessments - Unit of Sale, unit price and unit Cost - for single product or service, Types of Costs - Start up, Variable and Fixed, Income Statement, Fund flow and Cash flow Projections - 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 – Industrial visit.

TEXTBOOK

1. Gorden, E. and Natarajan, K. (2018). Entrepreneurship Development, Himalaya Publishing House, Mumbai. ISBN: 978-5202-540-4.

2. Nanasaheb, R.B., Mahadeo, M. K. and Suresh, D.G. (2018). Entrepreneurship Development and communication skills in Agriculture Extension Education, CBS Publishers & Distributors Pvt. Ltd., New Delhi. ISBN: 978 -93-87742-90-1.

3. Taneja, S. and Gupta, S.L. (2015). Entrepreneurship development, New venture creation, Galgeha publication company, New Delhi. ISSN: 2321-8916.

REFERENCES

1. Desai, V. (2015). Entrepreneurship Development, First Edition. Himalaya Publication House, Mumbai. ISBN: 9789350973837.
2. Khanna, S.S. (2016). Entrepreneurial Development. S. Chand Company Limited, New Delhi. ISBN: 9788121918015.
3. Manohar, D. (1989). Entrepreneurship of Small Scale Industries, vol.III. Deep and deep Publication, New Delhi. ISSN: 09735925.
4. Lal, G., Siddhapa, G.S. and Tandon, G.L. (1988). Preservation of fruits and vegetables.Indian Council of Agricultural Research (ICAR). ISSN: 0101-2061.
5. Ranganna, S. (2001). Hand book of analysis and quality control of fruits and vegetable products, Second Edition, Tata Mcgraw hill, New Delhi. ISBN: 9780074518519.
6. Cruses, W.V. and Fellows, P.J. (2000). Commercial fruits and vegetable processing.CRC press, United States. ISBN: 9780849308871.

Mapping of course outcomes with Bloom's Taxonomy

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

BOT 3656 PLANT PHYSIOLOGY (Theory Cum Lab) 5+2L Hr./6Cr.

Preamble

This course is for the students to learn the intricate details on the functional aspects of plants with reference to physiological pathways, water transport, transpiration and the uptake of nutrients. It also facilitates them to have a deeper insight on energy generation and utilizationmechanisms. Eventually learners will understand the plant growth from the notations of chemical regulation and metabolism.

Course Outcome

At the end of the semester, students will be able to

i. competein dealing and solving the issues of growing plants and crops.
ii. discern and make recommendations on the role of micronutrients on plant growth and development.
iii. decipher the knowledge about path of energy harnessing and release in photosynthesis and respiration.
iv. acquire and apply knowledge on the role of nitrogen in plant growth and development.
v. comprehend the role of PGRs and assess the effects of various stresses on plants.

Unit I: Plant-Water Relations (10hrs)

Unique characteristics and importance of water molecule – Diffusion, Osmosis, Imbibition, Plasmolysis– diffusion pressure deficit–guttation— transpiration–stomatal movement - factors affecting transpiration – transport of water -translocation - Ascent and descent of sap.

Unit II: Mineral Nutrition and Transport Processes (10hrs)

Essential elements – macro and micronutrients – transport of ions across membrane – active and passive transport – deficiency symptoms and toxicity– phosphate solubilization and phosphorylation - Phloem transport – Source & Sink relation, Phloem loading and unloading.

Unit III: Carbon Metabolism (20hrs)

Pre requisites of Photosynthesis (Pigments-LHCP 1 and LHCP II) – Emerson enhancement and Red drop– reaction centres – light dependent and independent reactions (C3, C4 and CAM) – C2 cycle – factors affecting photosynthesis – gross net productivity.Respiratory pathways in outline (Glycolysis and TCA) and electron transport – pentose phosphate pathway–respiratory quotient.

Unit IV: Nitrogen Metabolism (20hrs)

Nitrogen availability – uptake and utilization – Nitrateassimilation –Assimilation of amino acids and protein- physiological implications of transcription and translation- integration of metabolic pathways - Chemical regulation and synthesis of enzymes -nitrogen fixation, (*Rhizobium*-legume symbiosis)- Reductive amination and Transamination in the metabolic milieu.

Unit V: Growth and Development (15hrs)

Phases of plant growth – Seed and Bud Dormancy-Germination – Physiological role of auxins, gibberellins, cytokinin, abscissic acid, ethylene and new age PGRs – Photoperiodism -

Photomorphogenesis –Cryptochrome -Phytochromes – LDP, SDP and DNP –Vernalization-Biorhythms and Plant Movements –Senescence – Plant's response to abiotic stresses (water, radiation, oxidative stress).

TEXTBOOK

1. Datta, S.C. (2010). Plant Physiology. New Age International Publishers, New Delhi.
2. Dhaka, T.S., Singh, L. & Kumar, A. (2015). Plant Physiology. PragatiPrakashan, Meerut.
3. Jain, V.K. (2016).Fundamentals of Plant Physiology. S.Chand& Co. Pvt. Ltd, New Delhi.
4. Sinha, R.K. (2015). Modern Plant Physiology. Narosa Publishing House, New Delhi. ISBN 81-7319-333-9
5. Srivastava, H. S. (2005). Plant Physiology. Rastogi publications, Meerut. ISBN: 81-7133-785-6.
6. Stiles,W. (2016). Principles of Plant Physiology. Discovery Publishing House, New Delhi.
7. Verma,V. (2008).Text book of Plant Physiology, Ane's student edition, New Delhi.

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1. Ghosh, M. S. (1996). Plant Physiology, First central edition. New central book agency private limited, New Delhi. ISBN: 81-7381-478-3
2. Hopkins, W.G. Huner, N.P. (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Oxlade, E. (2010). Plant Physiology. The Structure of Plants Explained. Viva Books, New Delhi.
4. Salisbury, F. B. and Ross, C.W. (1992). Plant Physiology, Fourth edition. Eastern press, Bangalore. ISBN: 981-243-853.
5. Taiz, L. &Zeiger, E. (2010). Plant Physiology.Sinauer Associates Inc., U.S.A. 5th Edition.
6. Williams, M. B. (1984). Advanced plant physiology. Pitman publishing, New Zealand. ISBN: 0-273-02306-3.

Mapping of course outcomes with Bloom's Taxonomy

Course Outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	4	4	2	25
CO2	5	5	4	4	4	4	26
CO3	5	5	2	4	4	4	24
CO4	5	5	3	4	4	4	25
CO5	5	5	5	4	4	5	28
Total	25	25	19	20	20	19	128
							128/30 = 4.3

BOT 3656 PLANT PHYSIOLOGY (LAB) 2Hr./2Cr.

Lab Experiments:

1. Experiments on imbibition, diffusion and plasmolysis
2. Demonstration of osmosis using potato osmoscope.
3. Determination of water potential (DPD, Chardakov).
4. Influence of temperature over permeability of membrane.
5. Transpiration measurement by Ganong'spotometer.
6. Oxygen evolution in photosynthesis (Thistle funnel experiment/ Wilmott'sbubbler).
7. Calculation of stomatal index and frequency.
8. Characterization of C3 and C4 plants.
9. Demonstration of respiration using Ganong'srespiroscope and respirometer.
10. Measurement of growth and biomass – auxanometer, scale, weighing balance
11. Hydroponics and nutrient utilization
12. Phototropic and geotropic movements in plants.

REFERENCES

1. Bajracharya, D. (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi. ISBN-13: 978-8173193101
2. Inam, A. (2012). A Laboratory Manual of Plant Physiology, Biochemistry and Ecology. Agrobios (India), Jodhpur.
3. Kochhar, S.L. &Gujral, S.K. (2012). Comprehensive Practical Plant Physiology. MACMILLAN Publisher India Ltd, Delhi.
4. Nobel, P.S. (1990). Physiochemical environmental plant physiology. Academic press, United States. ASIN: B0043KK4KY.
5. Taiz, L. (2015). Plant physiology, Sixth edition. Sinauer associates, United States. ISBN: 978- 1-60535-255-8.
6. William, G H. (2009). Introduction to plant physiology. John wiley, New Jersey, United States. ISBN: 9780123741431.

BOT 3558 BOTANY PROJECT 5hr./5Cr.

PREAMBLE: Botany Project work is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation or problems. A project work will be given to the students to provide an opportunity to carryout research project at the department laboratories.

COURSE OUTCOME

At the end of the semester, students will be able to

i. gain hands-on experience in designing and executing a research enquiry based on accepted scientific norms individually.

ii.inspect basic information, details and preliminary data based on which his research will be positioned

iii.perform scientific observations, collect and collate meaningful information.

iv.build arguments based on the strength drawn from the statistical tools and tests used for analyzing the data

v. translate his findings in the approved format with originality and to add the knowledge to the scientific community

Allocation

- Students will be allotted based on their academic performance
- Each research supervisor may be allotted a group not exceeding 8 students.

Evaluation

Interim assessment:

- Students need to make an interim presentation during the mid of sixth semester (after 45 working days). This interim report should form the basis for the final project report.

Final assessment:

- Final evaluation will be based on interim assessment, evaluation by the supervisor, dissertation and presentation at the end of the semester.

Mark distribution:

S.no	Details	Marks	(%)
1.	Interim assessment	20	CA (75%)
2.	Evaluation by supervisor*	30	
3.	Dissertation,	25	
4.	Final presentation	25	Final (25%)
	Total	100	

*(50% attendance mandatory, regularity, maintenance of data)

Dissertation format:

- Introduction
- Review of literature
- Materials and methods
- Result
- Discussion
- Summary
- Bibliography

Mapping of course outcome with Bloom's Taxonomy

	K1 (Recall)	K2 (Understanding)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
CO1	5	5	5	4	3	3	25
CO2	5	5	5	3	3	3	24
CO3	5	5	5	5	4	4	28
CO4	5	5	5	5	3	4	27
CO5	5	5	5	5	5	4	29
Total	25	25	25	22	18	18	133
133/30= 4.4							

BOT3556 BIORESOURCE MANAGEMENT 5Hr./5Cr.

Preamble

This course is to create an awareness and understanding on the major and minor bioresources for its utilization and conservation in India. *In situ* and *ex situ* methods of conservation are being taught to create a holistic approach in preserving the natural resources. Exposure gained from this course shall nurture 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

i. classify landscapes and waterscapes using geological and geographic inputs and analyze the current status of mineral resources of our country
ii. identify fresh water, marine aquatic resources and wet land ecosystem and develop appropriate techniques for water shed management and water resource management
iii. analyze the biological wealth of our country as a potential resource and integrate its use with the need for conservation
iv. understand agriculture as a main resource of food production and assess the Indian and international strategies for food management
v. develop strategy for conservation, policies specific to Indian scenario and effectively manage the resources.

Unit I:**Geology of India (15 hrs)**

Geological principles – types of rocks – geographical position and boundaries – soil types – pedology – soil as natural capital – soil and ecosystem – mineral sources – mining and its impact – depletion of minerals – conservation strategies.

Unit II:**Water, Wetlands and Marine Resources (20hrs)**

Watershed management – rainfall pattern – harvesting and storage – indigenous techniques - fresh water and wetland resources in India – numerical data – importance of wetlands–marine ecosystems(status, dependence, issues and challenges for resource supply, threats and prospects).

Unit III:**Phytogeography (10hrs)**

Mega diversity centres – endemism and biodiversity hotspots- biogeographical realms – flora and fauna – forest types (Champion and Seth 1968) Phytogeographic regions of India – physiography, climatology, diversity of plants and animals, distribution of maps.

Unit IV:**Food, Agriculture and Forestry (15hrs)**

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) – Minor forest produce (MFP)

Unit V: **Conservation and Management (15hrs)**

Values and loss of biodiversity - IUCN categories - Heritage sites of UNESCO – Man and Biosphere Reserve (MAB) program – *ex-situ* and *in situ* conservation, national parks – wildlife

sanctuaries – botanical gardens – seed bank - field gene bank – cryopreservation – Miyavaki forest – Silvicultural practices – Sacred Grove.

TEXTBOOK

1. Krishnamurthy, K.V. (2003). A text Book on Biodiversity (Principles and Practice), Science Publishers, USA. (ISBN 1578083257, 9781578083251
2. Sharma, P. D.(2017). Ecology and environment. Rastogi publications, New Delhi. ISBN: 9789350781227.
3. Subramanyam, N.S. and Sambamurty,A.V.S.S. (2017). Ecology, NarosaPub.ISBN: 978-81-7319-740-6

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1. Anonymous, (2011). Handbook of Agriculture, Indian council of Agricultural Research KrishiAnusandhanBhavan -I Pusa, New Delhi- 110012 (ISBN NO: 81-7164-050-8)
2. Bawa, K.S., Primack, R.B. and Oommen, M.A. (2012). Conservation biology. Universities press, New Delhi. ISBN: 9788173717246
3. Negi,S. S. (2008).*India's Forests, Forestry & Wildlife,* Indus Publishing Company ISBN: 9788173871917, 9788173871917
4. Prathipal Singh, (2010). Introduction to biodiversity. Ane books Pvt. Ltd. New Delhi. (ISBN 978-1-8052-185-0)
5. Rana, S.V.S. (2012).Environmental studies. Rastogi publications, New Delhi. ISBN: 81-7133-728-7.
6. Sharma, P. D. (2013). Environmental biology and toxicology. Rastogi publications, New Delhi. ISBN: 978-81-7133-964-8.
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Mapping of course outcomes with Bloom's Taxonomy

Course Outcome	K1 (Recall)	K2 (Understand)	K3 (Apply)	K4 (Analyze)	K5 (Evaluate)	K6 (Create)	Total
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	4	25
CO 4	5	5	5	5	5	4	29
CO 5	5	5	5	5	5	5	30
Total	25	25	22	24	21	21	138
							138/30 = 4.6

LIFE SKILL COURSE

BOT 3251 MEDICINAL BOTANY 3Hr./2Cr.

Preamble

This course is designed to impart knowledge on botanical and therapeutic value of selected locally available and easily cultivable herbs. Varioussystem of medicines such as Siddha, Ayurveda, Unani, Homeopathy and Allopathy are introduced to the learners. Students will be exposed to the domestic usage of medicinal plants and be appraised about the scope for documentation of folk medicinal knowledge, collection, processing, marketing and sustainable utilization of medicinal plants.

Course Outcome

At the end of the course, the students will be able to

i. quote the names of different Indian medical practices, related to various indigenous treatments.
ii. comprehend the knowledge of tribal communities, documenting medicinal sources and monitoring through research projects.
iii. identify medicinal plants and add medicinal knowledge about locally available plants.
iv. practice analytical pharmacognosy and find out drug adulteration.
v. prepare siddha medicines and to commercialize the products.

Unit I: Medical Practices in India (9hrs)

History, Scope and Importance of medicinal plants – medical systems in India: Ayurvedha, Siddha, Unani,Homeopathy and Allopathy (origin, concept and application) - standardization of drugs.

Unit II: Folk Medicine (9hrs)

Principles, importance, merits and demerits. Complimentary Medicines: Medicinal sources - Herbal sources, Mineral sources, Animal sources -collection, purification and processing - rules and regulations- grandma therapy - AICRPE.

Unit III: An Overview of Selected Medicinal Plants (9hrs)

Morphology, family, vernacular and botanical name, useful part and active principles of phytotherapeutics.

I.Root : Sarpagandha(*Rauwolfia serpentina), Shatavari(Asparagus racemosus)*

II.Leaf : Nilavembu (*Andrographis paniculata*), *Shirukurinjan(Gymnema sylvestre)*

III. Bulb: Onion(*Allium cepa*),Garlic(*Allium sativum*)

IV. Rhizome: Vashambu (*Acorus calamus*), *Senk*andhal*(Gloriosa superba)*

V.Fruit:*Vilvam*(*Aegle marmelos),Thippili*(*Piper longum)*

VI. Seed: *Kadukkai*(*Terminalia chebula), Jathikai*(*Myristica fragrans)*

VII. Oil seed: *Ellu*(*Sesamum indicum*)*,Aali (Linum usitatissimum)*

Unit IV: Analytical Pharmacognosy(9hrs)

Principles - Phytochemical screening and Pharmaceutical applications of secondary metabolites - alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds, glycosides, volatile oils, tannins and resins - Drug adulteration- types, methods of drug evaluation and biological testing- Food & Drug Administration (FDA , India)

Unit V: Plant Based Drugs (9hrs)

Formulation– choornam, legiyam, thailam, parpum, kasayam and herbal concoction- commercial products – medicinal plants outlets – preclinical trials - packing & storage- certification - marketing –GMP - role of NMPB, AYUSH and CDRI –Nilavembu and Kabasurakudineer.

TEXTBOOK

1. Amit Krishna, De. (2000). Recent trends in Spices and Medicinal Plants, Research. Associated Publishing Company. New Delhi. ISBN: 81-85211-42-7.
2. Chopra, R.N, Nayer, S.L. and Chopra, I.C. (1986). Glossary on Indian Medicinal Plants.Publication and Information Directorate, CSIR, New Delhi.
3. Panda, H. (2012). Hand book on Ayurvedic Medicines with formulae, processes and their uses. National Institute of Industrial Research, New Delhi.ISBN: 81-86623-63-9.
4. Shahid Akbar. (2020). Handbook of 200 Medicinal Plants, Springer International Publishing, Switzerland.ISBN:978-3-030-16807-0.

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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 encyclopaedia 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. Mathur, N. (2010). Medicinal plants of India. RBSA publishers, New Delhi. ISBN: 8-176114995.
5. Singh, M. (2009). Medicinal plants of India. New central book agency, New Delhi. ISBN: 8173815933.
6. Wallis, T.E. (1997). Textbook of Pharmacognosy, Fifth Edition.CBS Publishers, New Delhi. ISBN: 0700012915.

Mapping of course outcomes with Bloom's Taxonomy

Course Outcome	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
Total	25	25	25	21	13	21	130
							130/30=4.3

LIFE SKILL COURSE

BOT 3252 BIOFERTILIZERS AND BIOPESTICIDES 3Hr./2Cr.

Preamble

This course will help the students to acquire knowledge on biofertilizers and its role in the environment and develop skill regarding mass production. The learner will get adequate information on theimportance of eco-friendly approaches in agriculture and to get awareness to mitigate the usage of synthetic fertilizers.Students will learn the benefits of organic farming and its relation to waste management.On completion, the students will be well versed with the latest regulations adopted in organic farming practices.

Course Outcome

At the end of the semester, students will be able to

i. understand the traditional agricultural practices and also the recent anthropogenic onslaughts.
ii. assess the advantages of organic farming as an alternate to synthetic inputs and enhance natural means of crop production and protection.
iii. augment various microbial forms as biofertilizers to enrich soil.
iv. apply the knowledge on biopesticides as a part of IPM to avert crop loss.
v. prepare ecofriendly commercial formulations and float newer entrepreneurial ventures.

Unit I: Domestication of Plants (10hrs)

Traditional agricultural practices- mechanization and green revolution – major cultivated crops in India (rice, wheat, soya, maize and brinjal) — indiscriminate use of agrochemicals – negative fallout - soil health and management- water conservation –permaculture - organic sources of nutrients.

Unit II: Organic Farming (12 hrs)

Principles and practices of organic farming – organic matter management inagricultural 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 III: Biofertilizers (8 hrs)

Scope, application, types – mass cultivation of biological nitrogen fixers – Blue greenalgae – *Rhizobium, Azolla*– Phosphate solubilizing bacteria (*Pseudomonas fluorescens)* – Mycorrhiza – Sea weed extract formulations (gel, powder, granules) –INM - cost-benefit analysis.

Unit IV: Biopesticides (8hrs)

Historical insights– comparative study of bio and synthetic pesticides – IPDM - mass production andeconomic aspects of microbial biopesticides (case study on *Trichodermaviride*, *Pseudomonasfluorescens*, *Bacillus thuringiensis (Bt) Verticilliumlecanii* – plant pesticides (a case study on Neem / Pungam).

Unit V: Marketing and Certification (7hrs)

Bioformulation – types – dry - liquid conventional and Nano-formulations products– shelf-life, Stabilization, Methods of field application– CIB RC regulations on pesticides (India registration and licence) - product certification - MRL limitations (EU, USDA) - Bureau of Indian Standards (BIS) - economic viability of a farm - Benefit/ cost ratio, marketing, imports and exports - Farm inspection and certification.

TEXTBOOK

1. Adams, C.R. and M. P. Early. (2004). Principles of horticulture. Butterworth – Heinemam, Oxford University Press.
2. Joshi, M. (2014). New Vistas of Organic Farming 2nd Ed. Scientific Publishers, Jodhpur.
3. Kumar, N.(1997). Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.
4. Pushpendra K. Karhana. (2004). Agriculture Science "A complete study package" Arihant Publishers (ISBN- 13; 978-8183482875).
5. Subbarao, N.S. (2020). Biofertilizer in agriculture and forestry. CBS Publications. III edition. ISBN: 9788120407916

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

Mapping of course outcomes with Bloom's Taxonomy

Course outcome	K1 Recall	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create	Total
CO1	5	5	4	2	4	3	23
CO2	5	5	5	3	4	4	26
CO3	5	5	5	3	4	4	26
CO4	5	5	5	3	4	4	26
CO5	5	5	4	4	3	3	24
Total	25	25	23	15	19	18	125
							125/30 = 4.2