ST. XAVIER'S COLLEGE (AUTONOMOUS)

Palayamkottai - 627 002

(Recognized as "College with Potential for Excellence" by UGC)

(Re-accredited with "A^{++}" Grade with a CGPA of 3.66)

SYLLABUS

B.Sc. BOTANY
(w.e.f 2023 - 24)

Programme: B.Sc. Botany

Programme Code: UBO

TheB.Sc. Botany program is designed to achieve the following objectives (Programme Outcomes PO)

1. Apply the knowledge of science and technology fundamentals for findings solution for complex problems.
2. To provide up to date theoretical knowledge on various forms of plants, their interactions with biotic and abiotic entities in the ecosystem and relevant practical skills.
3. To comprehend and interpret various facets of Botany including the importance and judicious utilization of plant sources.
4. Exploration of diverse plant life-forms and to nature the conservation of biodiversity.
5. To understand the principles and applications of various traditional and modern techniquesused in Botany.
6. TodisseminateknowledgeonthedesignandexecutionofexperimentsinBotanywithemphasis on the operation of relevant ophisticated instruments.
7. To impart knowledge on the economic importance of plant/micro bialresources and the irproducts and to promote entrepreneurship skill.
8. To promote proficiency in designing the research problems, review of literature, laboratory experiments, data analyses and preparation of reports with professional ethics.
9. To motivate the students to takeup innovative and cutting-edge research infront ierareas of Botany and related biology subjects
10. To enable the students to take up various qualifying examinations concerning Botany and to face the challenges in career opportunities

Program Specific Outcomes (PSO)

On successful completion of the B.Sc. Botany program, the students are expected to

1. Implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology and Plant Biotechnology.
2. Ensure the use of contemporary tools and techniques in understanding the scope and

significance of Botany

3. Develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data
4. Design scientific experiments independently and to generate useful information to address various issues in Botany.
5. Enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings
6. Design and standardize protocols for public health and safety, and cultural, societal, and environmental considerations
7. Apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.
8. Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.
9. Follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom.
10. Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively.

Upon graduation, Botany majors should have mastered a set of fundamental skills which would be useful to function effectively as professionals and to their continued development and learning within the field of Plant Biology. These skills include the following:

1. *Field and Laboratory Research Skills:* Botany majors should be competent observers and experimentalists, whether such research takes place in the field or in the laboratory.

2. *Critical Thinking Skills:* Botany majors should be able to engage in the following aspects of critical thinking: (i) differentiate between fact and opinion, (ii) develop inferential skills, (iii) recognize logical fallacies and faulty reasoning, and (iv) make decisions and judgments by drawing logical conclusions using sound quantitative or statistically-based reasoning. Critical thinking does not exclude imaginative and speculative thinking as it applies to science in general and botany specifically. To the extent that critical thinking skills are discipline- specific, students should understand that science and its methodology is a way of knowing.

3. *Problem-Solving Skills:* Botany majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information.

4. *Communications Skills:* Botany graduates will be required to demonstrate competence in communication, both written and oral.

5. Computer *Skills:* Botany graduates should be competent users of computer software including,

but not limited to, word processing, spreadsheet, graphing, and web-search programs. Such skills are also imperative for organizing their required portfolios.
6. *Information-Seeking Skills*: For success in college and for lifelong learning, graduates must be able to: recognize when information is needed; to identify appropriate types of information; and to locate, evaluate, and use information effectively, ethically, and legally.
7. *Cooperation/Social Responsibility Skills:* Graduates ought to understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills.
8. *Self-Assessment Skills:* Graduates should be able to demonstrate progress in the development of their ability to make a realistic appraisal of growth in all three domains of learning (cognitive, conative, and affective). They should be able to identify, evaluate and explain major, if not pivotal, influences in their development as a botanist.

Upon graduation, Botany majors should demonstrate significant value-added progress in developing the following values:
1. *Appreciation* of the *diversity* of cultures and intellectual points of view.
2. *Understanding* of *ethical issues* and responsibilities such as the environmental costs of excessive consumerism, impacts of technology upon society, etc.
3. *Commitment* to the development of cultural perspectives that do not disparage others solely on the basis of an individual's or group's ethnicity, caste, gender, religion, sexual orientation, marital status, age or disability.
4. *Appreciation* that Botany follows the *Liberal Arts* tradition which is based upon the notion that, in a world of ideas, a person is not free or liberated from the bonds of ignorance if s/he makes decisions based upon closed-minded habits, prejudices, or unconscious emotions that preclude critical thinking. Additionally, graduates will need to demonstrate growth in their social obligation to communicate with the public on scientific and technical issues.
5. Appreciation of the *aesthetic* attributes of nature, whether their studies are primarily in the field where entire ecosystems or biomes are investigated or in the laboratory where the microscope and biochemical techniques are used as tools for observing nature.

All students who are exposed to Botany courses should understand and appreciate, in addition to the core knowledge of Plant Biology and Plant Biotechnology, the nature of science, how science is applied to everyday problems, and significant botanical achievements.

COURSE STRUCTURE FOR B.Sc. BOTANY (2023-2024)

Sem	Part	Status	Course Code	Title of the Course	Hours	Credit
I	I	Language	23UGTL11	General Tamil-I	6	3
			23UGFL11	French-I		
			23UGHL11	Hindi-I		
	II	Language	23UGEL11	General English-I	6	3
	III	Core	23UBOC11	Plant Diversity I –Algae	5	5
	III	Core	23UBOC12	Plant Diversity I Algae - Practical-I	3	3
	III	EC	23UCHE11	Allied - I: Chemistry - I	4	3
	III	EC	23UCHE12	Allied - I : Chemistry- I - Practical	2	2
	IV	SEC-1	23UBON11	Gardening and Landscaping	2	2
	IV	FC	23UHER11 / 23UHEE11	Catholic Doctrine / Ethics	2	2
				Sub-Total	**30**	**23**
II	I	Language	23UGTL21	General Tamil-II	6	3
			23UGFL21	French-II		
			23UGHL21	Hindi-II		
	II	Language	23UGEL21	Communicative English-II	6	3
	III	Core	23UBOC21	Plant Diversity II – Viruses, Bacteria, Fungi, Lichens and Plant pathology	5	5
	III	Core	23UBOC22	Plant Diversity II – Viruses, Bacteria, Fungi, Lichens and Plant pathology - Practical II	3	3
	III	EC	23UCHE21	Allied – II : Chemistry- II	4	3
	III	EC	23UCHE22	Allied – II : Chemistry- II - Practical	2	2
	IV	SEC2	23UBON21	Herbal Technology	2	2
	IV	SEC3	23UHEI21	Integrated Personality Development	2	2
				Sub-Total	**30**	**23**
III	I	Language	23UGTL31	General Tamil-III	6	3
			23UGFL31	French-III		
			23UGHL31	Hindi-III		
	II	Language	23UGEL31	English-III	6	3
	III	Core	23UBOC31	Plant Diversity III - Bryophytes and Pteridophytes	5	5
	III	Core	23UBOC32	Plant Diversity III Bryophytes and Pteridophytes – Practical-III	3	2
	III	EC	23UZOE31	Allied – III : Zoology- I	4	3
	III	EC	23 UZOE32	Allied – III : Zoology - I - Practical	2	2
	IV	SEC-4	23UHEL31	Life Issues &Entrepreneurial Skill Development	2	2
	IV	SEC-5	23UBON31	Mushroom Cultivation	2	2
				Sub-Total	**30**	**23**
IV	I	Language	23UGTL41	General Tamil-IV	6	3
			23UGFL41	French-IV		
			23UGHL41	Hindi-IV		
	II	Language	23UGEL41	Communicative English-IV	6	3
	III	Core	23UBOC41	Plant Diversity IV - Gymnosperms, Paleobotany and Evolution	4	4

	III	Core	23UBOC42	Plant Diversity IV - Gymnosperms, Paleobotany and Evolution – Practical-IV	2	2
	III	EC	23UBOE41	Allied IV : Zoology - II	4	4
	III	EC	23 UBOE42	Allied IV : Zoology - II Practical	2	2
	IV	SEC-6	23UBON41	Environmental impact analysis	2	2
	IV	SEC-7	23UBOS42	Entrepreneurial opportunities in Botany	2	2
	IV	EVS	23UEVS41	Environmental studies	2	2
				Sub-Total	**30**	**24**
V	III	Core	23UBOC51	Taxonomy of Angiosperms and Economic Botany	5	5
	III	Core	23UBOC52	Plant Anatomy and Embryology	5	5
	III	Core	23UBOC53	Taxonomy of Angiosperms and Economic Botany - Practical-V	3	2
	III	Core	23UBOC54	Plant Anatomy and Embryology – Practical VI	3	2
	III	EC	23UBOE51	Cell Biology, Genetics and Plant Breeding	5	4
	III	EC	23UBOE52	Cell Biology, Genetics and Plant Breeding – Practical VII	3	2
	III	EC	23UBOE53	1. Bio-Analytical Techniques 2. Introduction to Bioinformatics	4	2
	IV	VE	23UVEH51	Human Rights and social analysis	2	2
	IV	Internship	23UBOI51	Carried out at summer vacation at the end of II year	-	2
				Sub-Total	**30**	**26**
VI	III	Core	23UBOC61	Plant Ecology and Phytogeography	5	4
	III	Core	23UBOC62	Plant Biotechnology and Molecular Biology	5	4
	III	Core	23UBOC63	Plant Physiology and Plant Biochemistry	5	4
	III	Core	23UBOC64	Plant Ecology and Phytogeography Practical VIII	2	2
	III	Core	23UBOC65	Plant Biotechnology and Molecular Biology – Practical – IX	2	1
	III	Core	23UBOC66	Part - III - Core -Plant Physiology and Plant Biochemistry – Practical X	3	2
	III	Core	23UBOC67	Project with Viva Voce	4	1
	III	EC	23UBOE61	1. Horticulture 2. Forestry	4	2
	V	Extension		STAND		1
				Sub-Total	**30**	**21**
					180	**140**
				Additional Compulsory Courses		
I UG		Add-On	23UBOAO1/ 23UBOAO2	Environmental Biotechnology / Forensic Botany		2
II UG		Value added	23UBOVA1/ 23UBOVA2	Mushroom Cultivation / Plant tissue culture and Gardening		2
III UG		**ECC**	23UBOEC1	Nursery and landscaping		2
			23UBOEC2	Herbal Medicine		
			23UBOEC3	Aquatic Botany		
			23UBOEC4	Organic Manures and Biopesticides		
			23UBOEC5	Global Climate Change		
			23UBOEC6	Fermentation Technology		
				Total	**180**	**146**

பொதுத்தமிழ்-1

Sub. Code : 23UGTL11

பருவம்: 1	தாள்: மொழிப்பாடம்	Hrs: 6	Credits: 3

LEARNING OBJECTIVES: கற்றலின் நோக்கங்கள்

1. முதலாமாண்டு பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ்மொழி இலக்கியங்களை அறிமுகம் செய்தல்.
2. தற்கால இலக்கியப் போக்குகளையும் இலக்கணங்களையும் மாணவர் அறியுமாறு செய்து அவர்களின் படைப்பாற்றலைத் தூண்டுதல்.
3. தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.
4. மொழித்திறன்களை மாணவர்கள் அறிந்துகொள்ள தூண்டுதல்.
5. நவின இலக்கிய வகைமைகளை அறிமுகம் செய்தல்.
6. சமூகச்சிந்தனைகளை உருவாக்க இலக்கியப்பாடுபொருள் காரணமாய் உள்ளது என்பதை அறியச் செய்தல்.

அலகு1: மரபுக்கவிதை

1. பெ. சுந்தரனார் - தமிழ்த் தெய்வவணக்கம்
2. பாரதிதாசன் - சிறுத்தையே வெளியே வா
3. கவிமணி - புத்தரும் சிறுவனும்
4. முடியரசன் - மொழி உணர்ச்சி
5. கண்ணதாசன் - ஆட்டனத்தி ஆதிமந்தி (ஆதிமந்தி புலம்பல்)
6. சுரதா - துறைமுகம் (வினாத்தாள்)
7. தமிழ் ஒளி - கடல்

அலகு2: புதுக்கவிதை

1. அப்துல் ரகுமான் - வீட்டுக்கொரு மரம் வளர்ப்போம்
2. ஈரோடு தமிழன்பன் - சென்ரியூ கவிதைகள் (ஏதேனும் ஐந்து கவிதைகள்)
3. வைரமுத்து - பிற்சேர்க்கை
4. மு.மேத்தா - வாழைமரத்தின் சபதம்
5. அறிவுமதி - வள்ளுவம் பத்து
6. நா. முத்துக்குமார் - ஆனந்த யாழை மீட்டுகிறாய்
7. சுகிர்தராணி - சபிக்கப்பட்ட முத்தம்
8. இளம்பிறை - நீ எழுத மறுக்கும் எனது அழகு

அலகு3: சிறுகதைகள்

1. வாய்ச்சொற்கள் - ஜெயகாந்தன் (மாலை மயக்கம் தொகுப்பு)
2. கடிதம் - புதுமைப்பித்தன்
3. கரு - உமா மகேஸ்வரி
4. முள்முடி - தி. ஜானகிராமன்
5. சிதறல்கள் - விழி. பா. இதயவேந்தன்
6. காகிதஉறவு - சு. சமுத்திரம்
7. வீட்டின் மூலையில் சமையலறை- அம்பை
8. (மொழிப்பெயர்ப்புக் கதை) நாய்க்காரச் சீமாட்டி – ஒரு குறும்புக்காரச் சிறுவன்

அலகு4: பாடம் சார்ந்த இலக்கிய வரலாறு

அலகு5 : மொழித்திறன் போட்டித் தேர்வு

1. பொருள் பொதிந்த சொற்றொடர் அமைத்தல்
2. ஓர் எழுத்து ஒரு மொழி
3. வேற்றுமை உருபுகள்
4. திணை, பால், எண், இடம்
5. கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு

COURSE OUTCOMES: பயன்கள்

இப்பாடங்களைக் கற்பதால் மாணவர் பின்வரும் பயன்களைப் பெறுவர்.

CO1– பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதையிலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன் பெறுதல். (K1,K2)

CO2– புதுக்கவிதை வரலாற்றினைஅறிந்துகொள்வர். (K2)

CO3- இக்கால இலக்கிய வகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுதல். (K4)

CO4– மொழி அறிவோடு சிந்தனைத் திறன் அதிகரித்தல். (K3)

CO5– தமிழ்மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச் சொற்களை

உருவாக்கவும் அறிந்துகொள்வர். (K4)

CO6– காலந்தோறும் சமூகச் சிந்தனைகள் மாறுவதை இலக்கிய வரலாற்றின்

மூலம் அறிந்து கொள்ளுதல். (K6)

TEXT BOOKS (பாடநூல்கள்)

1. தமிழ்த்துறை வெளியீடு - தூய சவேரியார் தன்னாட்சிக் கல்லூரி, பாளையங்கோட்டை.
2. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு– எ.ஃ.ப். பாக்கியமேரி

REFERENCE BOOKS (பார்வை நூல்கள்)

- தமிழ் இலக்கிய வரலாறு - சிற்பி. பாலசுப்பிரமணியன்
- புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு – தமிழண்ணல்
- தமிழ் இலக்கிய வரலாறு – சேதுராமன்

WEB SOURCES (இணையதளங்கள்)

- Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org>
- Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library
- Project Madurai - www.projectmadurai.org.
- Chennai Library- www.chennailibrary.com <http://www.chennailibrary.com>.
- Tamil Universal Digital Library- www.ulib.prg <http://www.ulib.prg>.
- Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
- Tamil Books on line- books.tamil cube.com
- Catalogue of the Tamil books in the Library of British Congress archive.org
- Tamil novels on line - books.tamilcube.com

பொதுத் தமிழ் - 2

Sub. Code : 23UGTL21

பருவம்: 2	தாள்:மொழிப்பாடம்	Hrs: 6	Credits: 3

LEARNING OBJECTIVES: கற்றலின் நோக்கங்கள்

1. சமய இலக்கியங்களையும் சிற்றிலக்கியங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
2. மொழித்திறனையும் சிறுகதை இலக்கிய வடிவத்தையும் மாணவர்களுக்கு உணர்த்துதல்.
3. தமிழ் இலக்கிய வரிசையில் சமய இலக்கியங்களின் முக்கியத்துவத்தை உணர்த்துதல்.
4. தமிழ் இலக்கிய வரிசையில் சிற்றிலக்கியங்களின் முக்கியத்துவத்தை அறிமுகம் செய்தல்.
5. தமிழ் இலக்கிய வளமைக்குப் பல்சமயங்கள் ஆற்றிய பங்கினை உணரச் செய்தல்.
6. சமய, சிற்றிலக்கியங்களின் இடத்தைத் தமிழ் இலக்கிய வரலாற்றின் வழி அறியச் செய்தல்.

அலகு 1:

- திருநாவுக்கரசர் - தேவாரம் - நாமார்க்கும் குடியல்லோம் எனத் தொடங்கும் பதிகம் (10 பாடல்கள்)
- ஆண்டாள் - திருப்பாவை (முதல் 20 பாசுரம்)

அலகு 2 :

- வள்ளலார் - அருள் விளக்கமாலை (முதல் 10 பாடல்கள்)
- எச்.ஏ.கிருட்டிணப்பிள்ளை - இரட்சணியமனோகரம் - பால்ய பிராத்தனை
- குணங்குடி மஸ்தான் சாகிபு – பராபரக்கண்ணி (முதல் 10 கண்ணி)

அலகு 3:

- தமிழ் விடுதூது (முதல் 20 கண்ணி)
- திருக்குற்றாலக் குறவஞ்சி – குறத்தி மலைவளம் கூறுதல்
- முக்கூடற்பள்ளு – நாட்டு வளம்

அலகு 4: பாடம் தழுவிய இலக்கிய வரலாறு

(பல்லவர் காலம், நாயக்கர் காலம்)

அலகு 5 : மொழித்திறன் - போட்டித் தேர்வுத்திறன்

1. தொடர் வகைகள்
2. மரபுத்தொடர், பழமொழிகள்
3. பிறமொழிச் சொற்களைக் களைதல்
4. வழுச்சொற்கள் நீக்குதல்
5. இலக்கணக் குறிப்பு அறிதல்.

COURSE OUTCOMES - பயன்கள்

CO1– பக்தி இலக்கியங்களைக் கற்பதன் மூலம் பக்தி நெறியினையும், சமய நல்லிணக்கத்தையும் தெரிந்து பின்பற்றுவர். (K1,K2)

CO2– சிற்றிலக்கியங்களின் வழி இலக்கியச் சுவையினையும் பண்பாட்டு அறிவினையும் பெறுவர். (K2)

CO3– பட்டப்படிப்பினைப் படிக்கும்போதே பெரும்பான்மையான தமிழ் இலக்கியங்கள் குறித்த அறிவினைப் பெறுவர். (K4)

CO4– தமிழ்ச் சமூகப் பண்பாட்டு வரலாற்றினை இலக்கியங்கள் வாயிலாக அறிவர். (K3)

CO5– போட்டித் தேர்வுகளில் வெற்றிப் பெறுவதற்குத் தமிழ்ப்பாடத்தினை பயன் கொள்ளும் வகையில் ஏற்ற பயிற்சி பெறுவர். (K4)

CO6– பல்சமய இலக்கியங்களை அறிவதன் மூலம் பல்சமய உரையாடல்களின் முக்கியத்துவத்தை அறிவர். (K3)

TEXT BOOKS (பாட நூல்கள்)

1. தமிழ்த்துறை வெளியீடு, தூய சவேரியார் தன்னாட்சிக் கல்லூரி, பாளையங்கோட்டை.
2. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு– எ.ஃ.ப். பாக்கியமேரி

REFERENCE BOOKS (பார்வை நூல்கள்)

- தமிழ் இலக்கிய வரலாறு - சிற்பி. பாலசுப்பிரமணியன்
- புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு – தமிழண்ணல்
- தமிழ் இலக்கிய வரலாறு – சி.சேதுராமன்

WEB SOURCES (இணையதளங்கள்)

- Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org>
- Tamil virtual University Library- www.tamilvu.org/ library http://www.virtualvu.org/library
- Project Madurai - www.projectmadurai.org.
- Chennai Library- www.chennailibrary.com <http://www.chennailibrary.com>.
- Tamil Universal Digital Library- www.ulib.prg <http://www.ulib.prg>.
- Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
- Tamil Books on line- books.tamil cube.com
- Catalogue of the Tamil books in the Library of British Congress archive.org
- Tamil novels on line - books.tamilcube.com

பொதுத் தமிழ் - 3
Sub Code: 23UGTL31

பருவம்: 3	தாள்: மொழிப்பாடம்	Hrs: 6	Credits: 3

Learning objectives: கற்றலின் நோக்கங்கள்

1. காலந்தோறும் எழுந்த காப்பியங்களின் போக்கையும், புதினத்தின் இலக்கிய வடிவத்தையும் மாணவர்கள் உணருமாறு செய்தல்
2. காப்பியம், புதினம், ஆகிய படைப்பியல் வகைகளைப் பற்றிய பரந்து பட்டபுலமையைப் பெருக்குதல்.
3. தமிழ் இலக்கியங்களின் உள்ளடக்கம், வெளியீட்டுநெறி, படைப்பியல் கொள்கை ஆகியவற்றை அறியச் செய்தல்.
4. இலக்கியக் கொள்கைகளின் அடிப்படையில் இலக்கியங்களைத் திறனாய்வுச் செய்யப் பயிற்சி அளித்தல்.
5. படைப்புத் துறையிலும் ஊடகத் துறையிலும் கல்விப் புலத்திலும் அயல்நாடுகளிலும் வேலைவாய்ப்பினைப் பெறுதற்குத் துணைசெய்தல்.
6. மதிப்புரை, திறனாய்வு அறிமுகப்படுத்துவதன் மூலம் சிறந்த திறனாய்வுகளை அடையாளம் காணுதல்

அலகு: 1

சிலப்பதிகாரம ˙- வழக்குரைகாதை, மணிமேகலை – ஆதிரை பிச்சையிட்ட காதை, சீவகசிந்தாமணி - பூமகள் இலம்பகம், வளையாபதி

அலகு: 2

பெரியபுராணம் - பூசலார் புராணம், கம்பராமாயணம் - மந்தரை சூழ்ச்சிப் படலம், வில்லிபாரதம் - மற்போர் சருக்கம், சீறாப்புராணம் - புலி வசனித்த படலம்.

அலகு: 3

வஞ்சிமாநகரம் வரலாற்றுப் புதினம் - நா.பார்த்தசாரதி

அலகு: 4

பாடம் தழுவிய இலக்கிய வரலாறு

அலகு: 5

மொழித்திறன்

1. நூல் மதிப்புரை
2. திறனாய்வுசெய்தல்
3. கடிதம் வரைதல்
4. விண்ணப்பம் எழுதுதல்

Course outcomes: பயன்கள்

CO1 – காப்பியங்களின் வழி வாழ்வியல் சிந்தனையைப் பெறுதல். (K1,K2)

CO2 – காப்பியங்கள் அறிமுகப் படுத்தப்படுவதால் தமிழ் மொழியின் உயர்வையும், சிறப்பையும் உணர்தல். (K2)

CO3 – தமிழ் புதினங்கள் வழி சமகாலப் படைப்புகளின் வாழ்வியல் சிந்தனைகளைஅறிதல் (K4)

CO4 – நாவல் இலக்கியம் அறிமுகப்படுத்தப்படுவதால் சிந்தனை ஆற்றல், படைப்பாற்றல், கற்பனைத் திறன் வளர்தல் (K3)

CO5 – தமிழ் இலக்கியம் சார்ந்தபோட்டித் தேர்வுகளை எதிர்கொள்ளும் ஆற்றல் பெறுதல் (K4)

CO6 - கடிதம், விண்ணப்பம் எழுதும் முறைகளைஅறிதல் (K6)

பாடநூல்கள் :

தமிழ்த்துறை வெளியீடு

பார்வை நூல்கள்

1. **தமிழ் இலக்கியவரலாறு- சிற்பிபாலசுப்பிரமணியன்**

இணையதளம்

1. Tamil Heritage Foundation – www.tamilheritage.org<http://www.tamilheritage. Org>.
2. Tamil Virtual University Library – www.tamilvw.org/libraryhttp://www. virtualvu.org/library
3. Project Madurai – www.projectmadurai.org
4. Chennai Library – www.chennailibrary.com<http://www.chennailibrary.com
5. Tamil Universal Library- www.ulib.prg<http://www.ulib.pig7
6. Tamil E-books downloads – tamilbooksdownloads.blogspot.com
7. Tamil Books online – books.tamilcube.com
8. Catalogue of the Tamil Books in the library of British congress archive.org
9. Tamil novels.online – books.tamil.cube.com

பொதுத்தமிழ் - 4
Sub Code: 23UGTL41

பருவம்: 4	தாள்: மொழிப்பாடம்	Hrs: 6	Credits: 3

Learning objectives: கற்றலின் நோக்கங்கள்

1. இலக்கியங்களின் சிறப்பினை உணர்த்துதல்
2. சங்க இலக்கியத்தின் மும் வாழிவயல நெறிகள உணர்தல்
3. தமிழ் இலக்கியங்களின் உள்ளடக்கம், வெளியீட்டுநெறி, படைப்பியல் கொள்கை ஆகியவற்றை அறியச் செய்தல்.
4. அகத்திணை, புறத்திணை இலக்கணங்களை மாணவர்கள் அறியச் செய்தல்
5. மொழிபெயர்ப்புத் திறனை வளர்த்தல்
6. நாடக இலக்கியங்களின் அமைப்பு முறையை அறிதல்

அலகு: 1

நற்றிணை 10, 14, 16, குறுந்தொகை - 16, 17, 19, 20, 25, 29, 38, 44, கலித்தொகை - 38, 51, அகநானூறு - 15, 33, 55, புறநானூறு - 37, 86, 112, பரிபாடல் - 55

அலகு: 2

நெடுநல்வாடை- நக்கீரர்

அலகு: 3

சபாபதிநாடகம் - பம்மல் சம்பந்த முதலியார்

அலகு: 4

பாடம் தழுவிய இலக்கியவரலாறு

அலகு: 5

மொழித்திறன்

1. மொழிபெயர்ப்புகலைச்சொற்கள்
2. கொடுக்கப்பட்டுள்ள ஆங்கிலப் பகுதியைத் தமிழில் மொழிபெயர்த்தல்
3. அலுவலகக் கடிதம்- தமிழில் மொழிபெயர்த்தல்

Course outcomes: பயன்கள்

CO1 – சங்க இலக்கியங்களில் காணப்படும் வாழ்வியல் சிந்தனைகளை அறிதல (K1,K2)
CO2 – தமிழின் தொன்மையையும் செம்மொழித் தன்மையையும் உணர்தல் (K2)
CO3 – நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும் கலைத்தன்மையையும வளர்த்தல (K4)
CO4 – நாடக இலக்கியம் அறிமுகப்படுத்தப்படுவதால் சிந்தனை ஆற்றல், படைப்பாற்றல், கற்பனைத் திறன் வளர்தல் (K4)
CO5 – தமிழிலிருந்து அலுவலகக் கடிதங்களை மொழிபெயர்க்கும் அறிவைபபெறுதல் (K3)
CO6 - மோழி அறிவோடு வேலைவாய்ப்பினையும் பெறுதல். (K4)

பாடநூல்கள் :

தமிழ்த்துறை வெளியீடு

பார்வை நூல்கள்

2. தமிழ் இலக்கிய வரலாறு- சிற்பிபாலசுப்பிரமணியன்

இணையதளம்:

1. Tamil Heritage Foundation – www.tamilheritage.org<http://www.tamilheritage. Org>.
2. Tamil Virtual University Library – www.tamilvw.org/libraryhttp://www. virtualvu.org/library
3. Project Madurai – www.projectmadurai.org
4. Chennai Library – www.chennailibrary.com<http://www.chennailibrary.com
5. Tamil Universal Library- www.ulib.prg<http://www.ulib.pig7
6. Tamil E-books downloads – tamilbooksdownloads.blogspot.com
7. Tamil Books online – books.tamilcube.com
8. Catalogue of the Tamil Books in the library of British congress archive.org
9. Tamil novels.online – books.tamil.cube.com

DEPARTMENT OF ENGLISH

UG – PART II - GENERAL ENGLISH

(The Seven-Tier Pattern recommended by UGC Curriculum Development Centre and Identified as Best Practice by NAAC)

	Stream A (For learners of high entry level proficiency)	**Stream B** (For learners of average entry level proficiency)	**Stream C** (For learners of low entry level proficiency)
Courses in Semester I	**IV 23UGEL14**	**III 23UGEL13**	**I 23UGEL11**
Courses in Semester II	**V 23UGEL25**	**IV 23UGEL24**	**II 23UGEL22**
Courses in Semester III	**VI 23UGEL36**	**V 23UGEL35**	**III 23UGEL33**
Courses in Semester IV	**VII 23UGEL47**	**VI 23UGEL46**	**IV 23UGEL44**

GENERAL COURSE OUTCOMES

CO1 Acquire the four language skills (Listening, Speaking, Reading and Writing)

CO2 Develop the skill of independent reading and interpreting of graded texts

CO3 Expand and consolidate active and passive vocabulary

CO4 Acquire the skills needed to participate in a conversation that builds knowledge collaboratively

CO5 Acquire a clear understanding of English Grammar to facilitate accuracy of communication

CO6 Develop the skills of formal written communication to be used in academic and career related contexts

TEXTS

Course I - *Spotlight I*

Course II - *Spotlight II*

Course III - *Spotlight III*

Course IV - *Spotlight IV*

Course V - *Spotlight V*

Course VI - *Spotlight VI*

Course VII - William Shakespeare's *Julius Caesar* &
Charles Dickens' *Oliver Twist*

All Courses - *Active English Grammar and Composition* by the Board of Editors

EXTERNAL EXAMINATION

- External Examination has two components.
  1) Written Examination and 2) Viva Voce
- A three-hour written examination will be conducted for 100 marks for all General English papers and the scores will be converted to 40 marks, with a pass minimum of 16 marks
- At the end of every semester, **Spoken English Viva Voce** will be conducted for all the students for 100 marks (four components) and the scores will be converted to 10 marks, with a required pass minimum of 4 marks
- To pass in any General English paper, a student must secure the pass minimum of 40 out of 100

Distribution of marks:	**Written Exam** (100 marks)		Converted to 40 marks
	Viva voce	(100 marks)	Converted to 10 marks
	TOTAL	**(40+10)**	**50 marks**

INTERNAL ASSESSMENT

- Two Internal Examinations shall be conducted for 50 marks each along with the Continuous Internal Assessments for the Core and Allied courses.
- The internal assessment for the courses may include assignments, seminars, projects, tests, viva (any oral presentation), communication activities etc., focusing on skill development or / and the course content

GENERAL ENGLISH

COURSE – I

Hours: 6	**Course Code: 23UGEL11**	**Credits: 3**

LEARNING OUTCOMES

LO1 To provide an ambience to acquire the basic language skills, listening, speaking, reading and writing
LO2 To make the learners learn the basic elements of grammar
LO3 To enable them to involve in basic communicative activities
LO4 To develop basic vocabulary
LO5 To help the learners comprehend and respond in English
LO6 To build confidence in using English to communicate

UNIT	**TOPICS**	
I	**POETRY** Maya Angelou Hilaire Belloc	 "Poor Girl" "The Justice of Peace"
II	**PROSE** A. P. J. Abdul Kalam Madhavan Kutty	 "My Early Days" "I Won't Let Him Go!"
III	**SHORT STORIES** Oscar Wilde Mulk Raj Anand	 "The Selfish Giant" "The Lost Child"
IV	**LANGUAGE COMPETENCY** 1. Use of Verbs: Verb Grid (Positive, Negative & Question), Regular Verbs, Irregular Verbs & Modals 2. Tenses: Active Voice Tenses & Passive Voice Tenses 3. Use of Nouns: Forms of Personal Pronouns, Use of Nouns as Subject, Object, Complement and Object of the Preposition 4. Sentence Patterns: SV, SVO, SVC, SVA, SVOA, SVIODO 5. Punctuation and Capitalisation 6. Reading Comprehension (5 Anecdotes and 5 Wisdom Stories)	
V	**SPOKEN ENGLISH** 1. Reading Aloud (From the text) 2. Introducing oneself 3. Describing a place (With hints) 4. Describing a picture(With hints)	

COURSE OUTCOMES

CO1 Use grammatical structures in meaningful constructions
CO2 Use oral communication for day-to-day activities
CO3 Use simple sentences for oral and written communication
CO4 Use punctuation and capitalisation accurately
CO5 Comprehend what they listen to, and respond to it at the primary level
CO6 Read and appreciate simple stories and anecdotes

TEXTBOOKS

1. Board of Editors. *Spotlight I.* India: Ponnsai Publishers & Distributors, 2015.
2. *Oxford Elementary Learner's Dictionary*. Ed. Angela Crawley. Phonetics Ed. Michael Ashby. United Kingdom: Oxford University Press, 2021.
3. Board of Editors. *Active English Grammar and Composition.* India: Trinity Press, 2022.

REFERENCE

- Bhatnagar, R. P. ,*English for Competitive Examinations,* India: Trinity Press, 2017.
- Joseph K. V. , *A Textbook of English Grammar & Usage,* India: McGraw Hill Education 2015.
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	3 Short essays (200 words each) out of 6 from Units I, II & III (3X10)	30
II	5 Match the following from Units I, II & III	05
III	5 Stating True or False from Units I, II & III	05
IV	Verb Grid (Positive, Negative & Question)	20
V	Tense Grid (Active & Passive)	10
VI	Noun as subject, object, complement & object of the preposition	10
VII	Sentence pattern	10
VIII	Punctuation & Capitalization	05
IX	Reading comprehension	05
	Total	**100**

GENERAL ENGLISH

COURSE – II

Hours: 6	**Course Code: 23UGEL22**	**Credits: 3**

LEARNING OUTCOMES

LO1 To provide an ambience to acquire the basic language skills, listening, speaking, reading and writing
LO2 To make the learners frame questions and answers
LO3 To enable them to involve in basic communicative activities
LO4 To develop a comprehensible use of adjectives and adverbs
LO5 To help the learners comprehend and respond in English
LO6 To develop oral communication for day-to-day activities

UNIT	**TOPICS**	
I	**POETRY** Rabindranath Tagore Gieve Patel	 "Leave this Chanting and Singing" " On Killing a Tree"
II	**PROSE** Leslie W. Leavitt Sister Nivedita	 "Mahatma Gandhi" "The Judgement Seat of Vikramaditya"
III	**SHORT STORIES** O. Henry Stephen Leacock	 "After Twenty Years" "With the Photographer"
IV	**LANGUAGE COMPETENCY** 1. Use of Adjectives 2. Use of Adverbs 3. Use of Conditional 'If' (Probable & Improbable Conditions) 4. Use of 'who', 'which', 'where' & 'that' in combining sentences 5. Framing questions – 'Wh -' &'Yes' / 'No' Questions 6. Prefixes and Suffixes 7. Developing Hints into a Paragraph	
V	**SPOKEN ENGLISH** 1. Reading Aloud (from the Prescribed Text) 2. Introducing Others 3. Describing a Personality (from Hints) 4. Narrating a Story(from Hints)	

COURSE OUTCOMES

CO1 Use grammatical structures in meaningful contexts
CO2 Use oral communication for day-to-day activities
CO3 Use simple sentences for oral and written communication
CO4 Use enhanced vocabulary
CO5 Comprehend and respond to what they listen to at the secondary level
CO6 Read and appreciate simple pieces of fiction and non-fiction

TEXTBOOKS

1. Board of Editors. *Spotlight II*.India: Ponnsai Publishers & Distributors, 2015.

2. *Oxford Elementary Learner's Dictionary*. Ed. Angela Crawley. Phonetics Ed. Michael Ashby.United Kingdom: Oxford University Press, 2021.

3. Board of Editors. *Active English Grammar and Composition.* India:Trinity Press, 2022.

REFERENCE

- Bhatnagar, R. P., *English for Competitive Examinations.* India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage,* India:McGraw Hill Education, 2015.
- Sinha, R. P. *Current English Grammar and Usage with Composition.* India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	3 Short Essays from Unit I, II and III	30
II	5 True or False (Units I, II and III)	05
III	5 Match the Following (Unit I, II and III)	05
IV	Adding appropriate adjectives	10
V	Adding appropriate adverbs	10
VI	Framing Probable & Improbable Conditional Sentences	10
VII	Combining Sentences with 'who', 'where', 'which' &'that'	10
VIII	Framing 'Wh' &'Yes/No' Qns.	10
IX	Prefixes & Suffixes	05
X	Developing Hints to a Paragraph (100 words)	05
	Total	**100**

GENERAL ENGLISH

COURSE - III

Hours: 6	**Course Code: 23UGEL13, 23UGEL 33**	**Credits: 3**

LEARNING OUTCOMES

LO1 To involve the learners in reading and interpreting English in poetry and prose (Fiction and Non-fiction)

LO2 To enable learners to write about prescribed literature

LO3 To help learners develop vocabulary register

LO4 To help learners learn the appropriate use of articles, prepositions and adverbs

LO5 To facilitate in learners, the ability to create a narration based on hints

LO6 To build confidence in the learners to speak English for specific purposes

UNIT	**TOPICS**	
I	**POETRY** William Shakespeare P. B. Shelley Oliver Goldsmith	"All the World's a Stage" "Ozymandias" "The Village Schoolmaster"
II	**SHORT STORIES** A. J. Cronin Stephen Leacock Ernest Hemingway	"Two Gentlemen of Verona" "The Conjuror's Revenge" "A Day's Wait"
III	**PROSE & SHORT STORIES** C. L. N. Prakash O. Henry Natsume Soseki	"Rethink Your Thinking" "The Gift of the Magi" "I am a Cat"
IV	**LANGUAGE COMPETENCY** 1. Homonyms, Homophones, Homographs 2. Articles 3. Prepositions 4. Adverbs 5. Constructing a story using hints	
V	**SPOKEN ENGLISH** 1. Reading aloud 3. Describing a picture 2. Describing a process 4. Personal Conversation (Habits, Hobbies, Future Plan)	

COURSE OUTCOMES

CO1 Read and understand English in poetry and prose (Fiction and Non-Fiction)

CO2 Write coherent essays about prescribed literature

CO3 Use words from acquired vocabulary register

CO4 Use articles, prepositions and adverbs appropriately

CO5 Create a narration from hints

CO6 Speak English confidently in a descriptive as well as expository style

TEXTBOOKS

1. Board of Editors. *Spotlight III,* India: Ponnsai Publishers & Distributors, 2015.

2. Board of Editors. *Active English Grammar and Composition.* India: Trinity Press, 2022.

REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations.* India: Trinity Press, 2017.
- Joseph. K. V, *A Textbook of English Grammar & Usage,* India:McGraw Hill Education, *2015*
- Sinha, R. P. *Current English Grammar and Usage with Composition.* India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	1 Essay (300 words) out of 2 from Unit III	15
IV	5 passages with 2 Qns. each (from Units I,II &III)	10
V	Homonyms, Homophones, Homographs	10
VI	Articles	10
VII	Prepositions	10
VIII	Adverbs	10
IX	Constructing a story	10
	Total	**100**

GENERAL ENGLISH

COURSE - IV

Hours: 6	**Course Code: 23UGEL14, 23UGEL24, 23UGEL44**	**Credits: 3**

LEARNING OUTCOMES

LO1 To make learners read and understand intermediate level poetry and prose

LO2 To encourage learners to continue building a vocabulary register as the students interpret, speak and write about prescribed literature

LO3 To enable learners fashion sentences to make paragraphs with unity of sense and structure

LO4 To enable learners plan, organise ideas and write an essay

LO5 To help learners learn the different types of letter, their structures and the use of appropriate language

LO6 To make learners use grammatical structures in meaningful constructions

UNIT	**TOPICS**	
I	**POETRY** William Shakespeare John Milton Lewis Carroll Nissim Ezekiel	 "Shall I Compare Thee" "On His Blindness" "The Walrus and the Carpenter" "The Professor"
II	**PROSE** Amitav Ghosh Desmond Morris Mark McCormack	 "The Town by the Sea" "A Little Bit of What You Fancy" "To Know When to Say It's None of Your Business"
III	**SHORT STORIES & DRAMA** Aldous Huxley Oscar Wilde Fritz Karinthy	 "The Portrait" "The Happy Prince" "The Refund"
IV	**LANGUAGE COMPETENCY** 1. Tenses (with Verb Grid) 2. Concord 3. Describing a thing / a place / an event 4. Spotting Errors (Tenses and Concord) 5. Letter Writing (Personal & Official)	
V	**SPOKEN ENGLISH** 1. Reading Aloud 2. Issue based conversation 2. Speaking about prescribed literature 4. Speaking on a given topic	

COURSE OUTCOMES

CO1 Read, interpret and analyse intermediate level of English in poetry, prose and fiction

CO2 Write coherent essays on prescribed literature

CO3 Use the various tense forms accurately with proper subject - verb agreement
CO4 Write descriptive paragraphs with unity of sense
CO5 Identify common errors in the usage of Tenses and Concord
CO6 Speak English fluently with confidence in an expository as well as analytical style

TEXTBOOKS

1. Board of Editors. *Spotlight IV*. India: Ponnsai Publishers & Distributors, 2015.
2. Board of Editors. *Active English Grammar and Composition.* India: Trinity Press, 2022.

REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations.* India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage,* India:McGraw Hill Education, *2015*
- Sinha, R. P. *Current English Grammar and Usage with Composition*, India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	1 Essay (300 words) out of 2 from Unit III	15
IV	5 passages with 2 Qns. each (from Units I, II & III)	10
V	Tenses	10
VI	Concord	10
VII	Describing a thing / a place / an event	10
VIII	Spotting Errors	10
IX	Letter Writing	10
	Total	**100**

GENERAL ENGLISH

COURSE – V

Hours: 6	Course Code: 23UGEL25, 23UGEL35	Credits: 3

LEARNING OUTCOMES

LO1 To introduce learners to intermediate level of English through prescribed d literature

LO2 To make learners read, interpret and write about prescribed pieces of literature

LO3 To make learners learn complex language structures and appropriate use of conjunctions

LO4 To help learners become familiar with the accurate use of language with an awareness of common errors in language use

LO5 To make learners understand the logical sequence of ideas within a paragraph

LO6 To make learners speak English fluently with confidence and accuracy for specific purposes

UNIT	TOPICS	
I	**POETRY** William Wordsworth Robert Frost Mina Assadi H.W. Longfellow Philip Larkin	 "The Solitary Reaper" "The Road Not Taken" "A Ring to Me Is Bondage" "A Slave's Dream" "Next Please"
II	**PROSE, DRAMA AND SHORT STORY**	
	Dr. Radhakrishnan Collins & Lapiere Oscar Wilde Somerset Maugham A. A. Milne	"Humanities Vs Sciences" "The Second Crucifixion" "The Model Millionaire" "The Ant and the Grasshopper" "The Boy Comes Home"
III	**LANGUAGE COMPETENCY (Grammar & Vocabulary)** 1. Words often confused 2. Synonyms and Antonyms 3. Synthesis and Transformation of Sentences (Simple, Compound & Complex) 4. Conjunctions 5. Active - Passive Voice	
IV	**LANGUAGE COMPETENCY (Composition)** 1. Expansion of Ideas / Proverbs 2. Sentence Arrangement 3. Dialogue Writing	
V	**SPOKEN ENGLISH** 1. Reading and Interpreting 2. Turncoat 3. Expand a Proverb 4. Issue Based Conversation	

COURSE OUTCOMES

CO1 Read, interpret and analyse poetic English to understand open possibility of inferences

CO2 Write logically planned essays to address specific questions concerning prescribed literature

CO3 Understand the forms and structural differences in different types of sentences and their specific purposes

CO4 Use complex language structures with appropriate conjunctions

CO5 Use vocabulary actively with an awareness of homonyms, homophones, synonyms and antonyms

CO6 Use Spoken English fluently with confidence and accuracy for specific purposes such as analytical, argumentative and expository talks

TEXT BOOKS

1. Board of Editors. *Spotlight V,* India:Ponnsai Publishers & Distributors, 2015.
2. Board of Editors. *Active English Grammar and Composition.* India:Trinity Press, 2022.

REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations*, India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage,* India: McGraw Hill Education*, 2015*
- Sinha, R. P. *Current English Grammar and Usage with Composition*, India: Oxford University Press, 2018

S. No.	QUESTION PATTERN	Marks
I	1 Short Essay (200 words) out of 2 from Unit I	10
II	1 Essay (300 words) out of 2 from Unit II	15
III	5 passages with 2 Qns. each (from Units I, II & III)	10
IV	Vocabulary	15
V	Synthesis of sentences	10
VI	Transformation of sentences	05
VII	Active - Passive Voice	10
VIII	Conjunction	05
IX	Expansion of Ideas / Proverbs (2x5=10)	10
X	Sentence Arrangement	05
XI	Dialogue Writing	05
	Total	**100**

GENERAL ENGLISH

COURSE - VI

Hours: 6	**Course Code: 23UGEL36, 23UGEL46**	**Credits: 3**

LEARNING OUTCOMES

LO1 To introduce learners to advanced level of poetic English through representative pieces, to make them understand oblique use of language

LO2 To make them read and understand modern English prose through samples of biography, autobiography, short story and one act play

LO3 To familiarise them with advanced language structures and the use of idioms and phrasal verbs

LO4 To make them understand and use different degrees for comparison and use language for reporting speech

LO5 To acquaint them with the skills of expanding or developing, and condensing ideas

LO6 To make them speak English fluently and accurately for specific purposes

UNIT	**TOPICS**	
I	**POETRY** Edwin Arnold Sylvia Plath John Keats John Donne Maya Angelou	 "Siddhartha" "The Mirror" "La Belle Dame Sans Merci" "Death Be Not Proud" "I Know Why the Caged Bird Sings"
II	**PROSE, SHORT STORY & DRAMA** Anne Frank C.P. Snow Chinua Achebe Hugh Chesterton	 "The Diary of a Young Girl" "Hardy and Ramanujan" "Marriage is a Private Affair" "The Pie and the Tart"
III	**LANGUAGE COMPETENCY (Grammar and Vocabulary)** 1. Degrees of Comparison 2. Direct- Indirect Speech 3. Cloze Test. 4. Idioms and Phrasal verbs 5. Spotting Errors	
IV	**LANGUAGE COMPETENCY (Composition)** 1. Précis Writing 2. Essay Writing	
V	**SPOKEN ENGLISH** 1. Reading and Interpretation 2. Issue Based Conversation 3. Public Speaking on subject topic 4. Extempore	

COURSE OUTCOMES

CO1 Read and interpret the oblique language of poetry and write appreciative essays on the prescribed literature

CO2 Read, interpret and write analytical essays about prescribed prose pieces

CO3 Use advanced grammar structures to report speech and use the three degrees of comparison for intended emphasis

CO4 Use advanced nuances of language such as idioms and phrasal verbs

CO5 Write reflective, descriptive, expository and imaginative essays with appropriate content, and condense material to a précis

CO6 Use English fluently and accurately for public speaking, extempore and other specific purposes

TEXT BOOKS

- Board of Editors. *Spotlight VI*, India: Ponnsai Publishers & Distributors, 2016.
- Board of Editors. *Active English Grammar and Composition*, India: Trinity Press, 2022

REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations,* India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage,* India: McGraw Hill Education, 2015
- Sinha, R. P. *Current English Grammar and Usage with Composition*. India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	1 short essay (200 words) out of 2 from Unit I	10
II	1 essay (300 words) out of 2 from Unit II	15
III	5 Passages with 2 Qns. each (from Units I & II)	10
IV	Degrees of Comparison	05
V	Direct Indirect Speech	10
VI	Making sentences – Idioms	05
VII	Phrasal verbs	05
VIII	Spotting errors (Multiple Choice)	10
IX	Correcting the errors (Rewriting)	05
X	Cloze Test	05
XI	Precis Writing	10
XII	Essay Writing	10
	Total	**100**

GENERAL ENGLISH

COURSE - VII

Hours: 6	Course Code: 23UGEL47	Credits: 3

LEARNING OBJECTIVES

LO1 To facilitate learners' reading advanced English through representative pieces of Literature

LO2 To help learners infer and interpret prescribed literature and write coherent, Analytical essays

LO3 To help learners acquire the advanced use of English for professional purposes

LO4 To help learners prepare resume and CVs for professional use

LO5 To encourage learners in using English skillfully and creatively to discuss, brainstorm or debate a topic, through active practice

LO6 To equip learners with the soft skills necessary for employability

I	**DRAMA** William Shakespeare *Julius Caesar*
II	**FICTION** Charles Dickens *Oliver Twist*
III	**SOFT SKILLS 1 (Theory and Practice)** 1.Interview skills* 2. Group Discussion* 3.Debate 4. Interpersonal Skills * Included for Spoken English Viva Voce also
IV	**SOFT SKILLS 2 (Theory and Practice)** 1. Time Management 2. Problem Solving Techniques 3. Teamwork 4. Leadership
V	**APPLICATION & RESUME** 1. Chronological Resume. 2. Functional Resume 3. Responding to the given advertisement

COURSE OUTCOMES

CO1 Read and understand advanced forms of English in Literature

CO2 Interpret and write analytical essays on topics concerning prescribed pieces of literature

CO3 Speak English fluently and accurately in professional contexts

CO4 Prepare application with appropriate Resume structure for employment

CO5 Use English effectively and creatively for interview, group discussion etc.,

CO6 Behave, react and handle situations connected to employability, using the acquired knowledge of soft skills

TEXT BOOKS

- Shakespeare, William. *Julius Caesar,* United Kingdom: Oxford University Press, 2008.
- Dickens, Charles. *Oliver Twist*, United Kingdom: Penguin Classics, 2003

REFERENCE

- Bhatnagar, R. P. *English for Competitive Examinations.* India: Trinity Press, 2017.
- Joseph K. V. *A Textbook of English Grammar & Usage,* India: McGraw HillEducation, 2015
- Sinha, R. P. *Current. English Grammar and Usage with Composition*, India: Oxford University Press, 2018.

S. No.	QUESTION PATTERN	Marks
I	5 Multiple Choice Questions from Unit I	05
II	5 Multiple Choice Questions from Unit II	05
III	1 Essay (400 words) out of 3 from Unit I	15
IV	1 Essay (400 words) out of 3 from Unit II	15
V	2 Annotations out of 3 from Unit I	10
VI	2 Paragraphs out of 3 from Unit II	10
VII	1 Essay out of 2 from Unit III	15
VIII	1 Essay out of 2 from Unit IV	15
IX	Responding to the given Advertisement	10
	Total	**100**

DEPARTMENT OF HUMAN EXCELLENCE

St. Xavier's College (Autonomous), Palayamkottai

Courses offered

Semester	Category	Course Code	Course Title
I	FC	23UHER11/ 23UHEE11	Religion: Catholic Doctrine / Ethics
II	SEC3	23UHEI21	Integrated Personality Development
III	SEC4	23UHEL31	Life Coping and Entrepreneurial Skills Management
IV	EVS	23UEVS41	Environmental Studies
V	VE	23UVEH51	Human Rights and Social Analysis

NME

Semester	Category	Course Code	Course Title
I	Library	23ULBN11	Foundations of Library Science
I	XRF	23UXRN11	Traditional Knowledge of Indian Medicinal Systems
II	Library	23ULBN21	Information Resources
II	XRF	23UXRN21	Indian Traditional Medicinal Foods
III	XRF	23UXRN31	Food Microbiology
IV	XRF	23UXRN41	Herbal Resources and Their Conservation
IV	MAX Forum	23UMXN41	Society, Economy and Politics in Contemporary India

Common Question Pattern

Internal Test

Part A	Answer ALL the questions in one or two lines	5 x 2 = 10
Part B	Answer ALL the questions, each in a paragraph	3 x 5 = 15
Part C	Write an essay on the following	1 x 10 = 10

Semester Exam

Part A	Answer ALL the questions in one or two lines	10 x 3 = 30
Part B	Answer ALL the questions, each in a paragraph	5 x 8 = 40
Part C	Write an essay on each the following	2 x 15 = 30

RELIGION: CATHOLICDOCTRINE
(23UHER11)

SEMESTER:I	VE	HOURS:2	CREDITS: 2	TOTALHOURS:30

Course Outcomes:

Upon completion of the course the students will be able to

1. Recite the Sacraments(K1)
2. Identify the challenges of the present day church(K1)
3. Associate Old and New testaments of the bible(K2)
4. Explain the Church history(K2)
5. Discuss the Marian worship (K2)
6. Summarize the catholic social teachings(K2)

Unit I: Introduction to Bible (6 Hours)

Bible as a Word of God, its inspiration, the Canon - Old and New Testaments and their interconnectedness - Traditional and modern interpretations

Unit II: Introduction to the Church history (6Hours)

The beginnings of the Church - Medieval period and its challenges - The importance of the Second Vatican Council and their decrees - Synodality

Unit III: Introduction to the Sacraments (6Hours)

The origin of the seven sacraments - Their practices and meanings - History of thesacraments

Unit IV: Introduction to Mariology (6Hours)

Mary, Mother of God and Jesus - Mary, our Mother and in the Gospels - Mariology in the history of the Church – Mary as a Prophet of revolution

Unit V: Church in the Contemporary World (6Hours)

The challenges of the present day Church – Casteism and Same sex marriage – Ecumenical unity and Inter Religious harmony - Catholic Social Teachings

REFERENCES:

1. Paul C. Jesuraj, Growing in Your Faith, July 2022.
2. Second Vatican Council Documents

ETHICS
(23UHEE11)

SEMESTER: I	VE	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcomes :

Upon completion of the course the students will be able to

- Describe the Ethical foundations and human history (K1)
- Identify Ethics and its relationship with Religions (K1)
- List the personal ethical codes to be practices in day to day life (K1)
- Associate ethics in family and society (K2)
- Summarize modern ethical issues and problems (k2)
- Discuss bio and environmental ethics (k2)

Unit I : Introduction to Ethics **(6 Hours)**

Meaning, Nature and Scope of Ethics - Challenges and Importance of ethics - Basic Ethical Foundations

Unit II : Ethics in Religions **(6 Hours)**

Ethical foundations and meanings in big and small traditions - Ethics and its relationship with Religions

Unit III : Personal Ethics **(6 Hours)**

Moral precepts - Dynamics of personal morality - Moral Conscience - Ethical aspects of Thirukural – Evils of Corruption – Gandhi's Seven Deadly Sins.

Unit IV : Family Ethics and Social Ethics **(6 Hours)**

Role of Family in ethical formulations- Respecting persons - Peace and Justice - Human Duties

Unit V : Modern Ethical Issues **(6 Hours)**

Bio Ethics - Media Ethics - Environmental Ethics –Cyber Ethics

REFERENCES:

1. Ethics prepared by School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University (MPYE 002)
2. Course material prepared by the Department of Human Excellence.

INTEGRATED PERSONALITY DEVELOPMENT
(23UHEI21)

SEMESTER: II	SEC3	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcomes:

Upon completion of the course the students will be able to

- Identify personal strengths and weaknesses (K1)
- Identify the means of self-esteem (K1)
- Identify the means of improving personal performance(K1)
- Explain the techniques of self-management(K2)
- Describe coping strategies of learning (K2)
- Discuss the traits of personal competence(K2)
- Summarize different dimensions of Personality (K2)

UNIT I: Self – Knowledge **(6 Hours)**

Exploring habits, attitudes, preferences and experience –SWOC analysis – Johari Window – Enhancing one's self image, self-esteem, self confidence

UNIT II: Self-Management **(6 Hours)**

Understanding of life story - Focusing on Internal narratives - Managing change, confusion and uncertainty –Goal setting – Personal Vision and Mission statements

UNIT III: Personal Competence and Maturity **(6 Hours)**

Motivation - Developing rapport - Giving and receiving constructive criticism - Assertiveness and negotiation skills – Leadership – Type of Leadership – Qualities of a good leader

Unit IV: Dimensions of Personality Development **(6 Hours)**

Recognizing the gradual growth in different dimension of one's personality such as (a) Physical (b) Intellectual (c) Emotional (d) Moral (e) Social and (f) Spiritual - Learning the Development process; Tools and Skills - Helping to maximize one's potentials

Unit IV: **Academic Learning Strategies** **(6 Hours)**

Memory - Art of generative listening, learning and writing - Note making - Presentation skills - Time management - Receptive skills - Classroom etiquettes - Cyber knowledge

REFERENCE BOOKS:

1. Dr. Xavier Alphonse S.J., We Shall Overcome, ICRDEC Publications, Chennai, 2004.
2. Personality Development, Harold R. Wallace and L. Ann Masters, South-Western, Cengage Learning India PL, New Delhi, 2006.
3. Course material prepared by the Department of Human Excellence

LIFE COPING AND ENTREPRENEURIAL SKILLS MANAGEMENT
(23UHEL31)

SEMESTER: III	SEC4	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcomes :

Upon completion of the course, the students will be able to

1. Identify the various challenges faced in adolescence (K1)
2. Tabulate healthy habits and lifestyle (K1)
3. Identify problem solving strategies (K1)
4. Discuss family and professional relationship(K2)
5. Explain cognitive, emotional and behavioural perspectives (K2)
6. Describe evils of addiction and the remedies available (K2)

Unit I: Physical AND Mental Wellbeing (6 Hours)

Adolescent Health and Holistic Health - Understand and appreciate physical Self - Personal hygiene and grooming - Balanced diet - Healthy habits and lifestyle - Sound body and mind - Nurturing health at home, in campus –Definition of Health - Women health – various medicine systems

Unit II: Interpersonal and Social Wellbeing (6 Hours)

Family Relationship: Values in family relationship, Nuclear, Joint Family, Dependence, Overdependence, Happy family, Broken Family - Caring Elders - Rapport Building with Peers/ Friends, Strangers, Transgenders - Professional Relationship : Officials, Mentors, Staff & Service Personnel- Other centeredness and others point of view and Empathy

Unit III: Problem-solving and Decision making skills (6 Hours)

Decision making processes - Lateral Thinking and problem-solving strategies - Select and apply problem-solving strategies to more complex tasks and problems - Gain familiarity with concepts such as performance indicators and benchmarking – Counseling.

Unit IV: Coping Strategies (6 Hours)

Conflict/Crisis Management –Stress Management – Emotional Management - Team, Task and Resource Management – Ignatian Discernment Process

Unit V: Overcoming Addiction (6 Hours)

Various stages of addiction- Gadgets addiction - Substance abuse - Media addiction – Internet addiction – Impact, prevention and remedies.

REFERENCE BOOKS:

1. Dr. Xavier Alphonse S.J., We Shall Overcome, ICRDEC Publications, Chennai, 2004.
2. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
4. Course Material prepared by the Department of Human Excellence.

ENVIRONMENTAL STUDIES
(23UEVS41)

SEMESTER: IV	EVS	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course objective:

To cater to students from diverse disciplinary backgrounds and to sensitise them about the commitment of our nation towards achieving sustainable development goals and addressing global environmental challenges.

Course outcomes:

The student will be able to:

1. Describe various natural resources and the need for sustainable development (K1).
2. Relate biodiversity and its conservation approaches (K2).
3. Solve the environmental issues of concern and discover prevention strategies (K3).
4. Sensitize and categorize the adverse health impacts of pollution (K3).
5. Assess environmental quality and risks for climate change mitigation (K4 & K5).
6. Recognize the major treaties to safeguard Earth's environment and resources (K2).

Unit I: Natural Resources and Sustainable Development (6 hours)

Overview of natural resources: definition, classification. Biotic resources: major types, status and challenges. Water resources: types, over-exploitation, issues, challenges, water scarcity, conflicts. Soil and mineral resources: important minerals, problems, soil as a resource. Energy resources: sources, conventional and non-conventional, implications. Introduction to sustainable development: SDGs, targets and indicators, challenges and strategies.

Unit II: Conservation of Biodiversity and Ecosystems (6 hours)

Biodiversity and its distribution: Levels and types, India and world, hotspots, threat categories. Ecosystems and ecosystem services: major types in India, basic characteristics, significance. Threats to biodiversity and ecosystems: land use, commercial exploitation of species and invasive species. Major conservation policies: in situ, ex situ, protected areas, traditional knowledge, community based conservation, gender and conservation.

Unit III: Environmental Pollution and Health (6 hours)

Understanding disaster and pollution: definitions, natural and man-made, point source and non-point source, kinds. Air and water pollution: criteria pollutants, sources, and adverse effects, quality standards. Soil and noise pollution: sources and health effects. Thermal and radioactive pollution: sources and impact on health and ecosystems.

Unit IV: Climate Change: Impacts, Adaptation and Mitigation (6 hours)

Understanding climate change: structure of atmosphere, natural and anthropogenic variations, importance of 1.5 °C and 2.0 °C limits to global warming, projections of climate change in Indian subcontinent. Impacts, vulnerability and adaptation to climate change. Mitigation of climate change: GHG reduction vs. sink enhancement, concept of carbon intensity, energy intensity and carbon neutrality; policy instruments, carbon capture and storage, climate justice.

Unit V: Environmental Treaties and Legislation (6 hours)

Overview of instruments of international cooperation: bilateral, multilateral, conventions and protocols, COPs. Major International Environmental Agreements: CBD, CITES, UNCCD, UNFCCC. Major Indian Environmental Legislations: acts, rules, sites, areas, zones and judgements. Major International organisations and initiatives: UNEP, IUCN, WCED, UNESCO, IPCC, MAB.

Reference books

1. Singh, J.S., Singh, S.P., Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.
2. Harris, Frances (2012). Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
3. Krishnamurthy, K.V. (2003). Textbook of Biodiversity, Science Publishers, Plymouth, UK.
4. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
5. Pittock, Barrie (2009). Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6. Ministry of Environment, Forest and Climate Change (2019). A Handbook on International Environment Conventions & Programmes.
7. KanchiKohli, Manju Menon (2021). Development of Environment Laws in India, Cambridge University Press.

HUMAN RIGHTS AND SOCIAL ANALYSIS
(23UVEH51)

SEMESTER: V	VE	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcomes :

Upon completion of the course, the students will be able to

- Describe Indian social scenario (K1)
- List the different kinds of fundamental rights (K1)
- Discuss major social problems in India (K2)
- Analyze critically society and its network of relationships (K4)
- Analyze local and global social problems (K4)
- Describe redressal mechanisms for human rights violations (K6)

Unit I: World trends today and Indian Scenario (6 Hours)
Some basic data – Globalization - World Social Forum vs World Economic Forum - The North South divide – Democracy - Types of Governance in the world – Demography and Basic Data of India

Unit II: IndianSocial System (6 Hours)
Social Analysis - Social system and its components - Interdependence of human being and society - A land of cultural linguistic and religious diversity - secularism-communalism-fundamentalism-Indian politics and religion-problems of the minority.

Unit III: Major Social Problems I (6 Hours)
Indian Economic inequality and Poverty; Manifestation and Measurement; Incidence and Magnitude; Causes, problems of poor and pains of poverty; the remedy - Ignorance in Governance and corruption: The Concept; Causes and Impact of Corruption; Combating Corruption - Illiteracy:Magnitude, Causes and Consequences

Unit IV: Major Social Problems II (6 Hours)
Caste Discrimination: caste discrimination and process of exclusion, Honour Killing, Untouchability, Caste Politics, Reservation policy –Dalit Empowerment - Child abuse, child labour - Effects of Abuse on Children - Violence against women: Harassment; Nature, Extent and Characteristics– Empowerment of Women - LGBTQIA+ – Currently pressing issues.

Unit V: Human Rights, Indian Constitutionsand Empowerment (6 Hours)
Universal Human Rights: The concept – Evolution – Organizations and Recent Developments – Indian Constitutions: Preamble - Political and Civil fundamental rights and duties. Empowerment Models: Communitarian and Local Models – Social Reformers: Ambedkar, Gandhi, Muthulakshmi Reddy and Periyar - Dreams and hopes for better India.

REFERENCE BOOKS:

1. P.N. Sharma, “Social problems and issues in India”, Bharat Book Centre, 2014
2. New India, The Reality Reloaded, Gurjot S. Kaler, Chandigarh, India, 2018
3. Course Material Prepared by the Department of Human Excellence

FOUNDATIONS OF LIBRARY SCIENCE
(23ULBN11)

SEMESTER: I	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

COURSE Outcomes: At the end of the course the students will be able to

CO1. Comprehend the Evolution, Significance, and Fundamental Operations of Libraries. (K2)
CO2. Develop Effective Reading Strategies and Critical Thinking Skills. (K3)
CO3. Differentiate and grasp the distinct roles and functions of various types of libraries. (K4)
CO4. Explore Modern Library Services and the Impact of Digital Resources. (K4)
CO5. Recognize the potential of VR, AI, and chatbots in enhancing user support within library environments. (K5)

UNIT 1 **(6 Hours)**

INTRODUCTION TO LIBRARY

The history and evolution of libraries - Need - Purpose - Functions - Five Laws of Library Science.

UNIT 2 **(6 Hours)**

TYPES OF LIBRARY

Public – Academic – Special - National. (Definition, purpose and functions of each type of library.

UNIT 3 **(6 Hours)**

LIBRARY SERVICES AND COLLECTION DEVELOPMENT

Reference services and reader advisory- Collection development and Management - E-books - E-journals Database - Bulletin Boards.

UNIT 4 **(6 Hours)**

EMERGING TECHNOLOGIES IN LIBRARIES

Virtual reality and augmented reality in libraries - AI and chatbots for user support - Internet of Things (IoT) applications in libraries.

UNIT 5 **(6 Hours)**

READING CULTURE FOR LIBRARY PRACTITIONERS

Value of Reading in Professional Development - Exploring Diverse Reading Materials - Effective Reading Techniques - Critical Thinking and Reflection.

Text Book

Kumar P S G, Foundations of Library and Information Science B. R. Publishing Corporation

Reference

1. Khanna J K, Library and Society, Kurukshetra University, Kurukshetra
2. Kumar P S G, Foundation of Library and Information Science Paper 1 of UGC Model Curriculum, B.R. Publishing Corporation

TRADITIONAL KNOWLEDGE OF INDIAN MEDICINAL SYSTEMS
(23UXRN11)

SEMESTER: I	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course outcomes: At the end of the course the students will be able to

CO1: Understand the concepts of ethno botany and its branches (K1).
CO2: Provide a strong foundation in the principles of ethno medicine and its applications (K2 & K4).
CO3: Inculcate knowledge and make the students aware of the commercial value of medicinal plants (K2 & K3).
CO4: Give an insight into the edible and medicinal plants in tribal medicine (K3).
CO5: Comprehend the advances made in the field of plant biotechnology in conservation of medicinal plant resources (K4).
CO6: Understand ethno botany of the Western Ghats, their medicinal and commercial values and conservation (K1- K4).

Unit I: Ethnobotany (6 hours)

History of Ethnobotany, concept, scope and objectives. The relevance of ethnobotany in the present context. Major ethnic groups in Tamil Nadu.

Unit II: Traditional medicines (6 hours)

Medicinal plants used by Tribals. Ethnobotanical formulations; Ethnobotanical uses of selected medicinal plants with a) *Azadiracthaindica b) Ocimumtenuiflorum c) Vitexnegundo. d) Gloriosasuperba e) Tribulusterrestris f) Pongamiapinnata g) Senna auriculata h) Indigoferatinctoria*. Importance and scope of medicinal plants used by *Paliyans*.

Unit III: Commercial value of traditional medicinal plants (6 hours)

Raw drugs from ethnomedicinal plants - Economic potentials of selected ethnomedicinal plants. Ethnobotany as a source of important drugs a) Reserpine b) Artemisin c) Gugulipid d) Cathranthin e) Strychnine. Export of medicinal plants and their products.

Unit IV: Collection, Utilization and Conservation of Traditional Medicinal Plants (6 hours)

The significance of wild medicinal plants – Collection and utilization of medicinal plants – Therapeutics uses of wild medicinal plants. Role of ethnic groups in the conservation of plant genetic resources. Participatory forest management.

Unit V: Conventional and modern aspects of medicinal plant propagation (6 hours)

Plant Propagation; Methods of propagation – conventional - vegetative cutting, layering grafting etc., Modern methods- Tissue culture; Micropropagation, isolation of secondary metabolites from *in vitro* culture

Textbooks:

1. P.C. Trivedi, Dr. Pravin Chandra 2011. Text Book of Ethnobotany, Pointer Publishers.
2. Bir Bahadur, K. V. Krishnamurthy, T. Pullaiah. 2021. Ethnobotany of India, 5-Volume Set. Apple Academic Press
3. Jain, A. and Jain, S.K. 2016. Indian Ethno botany - Bibliography of 21st Century Scientific Publishers (India).
4. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers Ltd. London & Sterling
5. Indian Medicinal Plants -An Illustrated Dictionary-C.P. Khare (Ed.) 2019, ©Springer Science+Business Media, LLC.

Reference Books

1. Paul E. Minnis 2000. Ethnobotany: A Reader. University of Oklahoma Press
2. Gary J. Martin, 2014. Ethnobotany A Methods Manual. Springer US.
3. T. Pullaiah, Bir Bahadur, K. V. Krishnamurthy. 2016. Ethnobotany of India Western Ghats and West Coast of Peninsular India. Apple Academic Press
4. Ministry of Environment and Forests. 1994. Ethno biology in India. A Status Report. All India Coordinated Research Project on Ethno biology. Ministry of Environment and Forests. New Delhi
5. Albuquerque, U.P., Ramos, M.A., Júnior, W.S.F., and De Medeiros, P.M. 2017. Ethnobotany.

Web Resources

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2816487/
- https://www.wipo.int/edocs/pubdocs/en/wipo_pub_tk_6.pdf
- https://main.ayush.gov.in/ayush-systems/ayurveda/faq
- https://www.who.int/news
- https://www.csir.res.in/documents/tkdl
- https://www.meity.gov.in/content/national-digital-library

INFORMATION RESOURCES
(23ULBN21)

SEMESTER: II	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcomes: Upon completion of the course, the students will be able to

CO1. learn all kinds of Secondary Sources. (K1)
CO2. Learn electronic reference materials. (K1)
CO3. Understand the concept and importance of Primary, Secondary and Tertiary sources (K2)
CO4. Analyze the different Non Documentary Sources (K4)
CO5. Assess electronic information sources, including e-books and e-journals. (K4)

UNIT-I : Introduction to Information Sources (6 Hours)

Definition, Type, Characteristics - Primary, Secondary, Tertiary –Evaluation of print Reference Sources

UNIT-II: Secondary Sources (6 Hours)

Definition, Types- Dictionaries, Encyclopedia, Directories, Manuals and Handbooks, Bibliographic sources

UNIT-III : Non – Documentary Source (6 Hours)

Formal and Informal – Human Sources, Institutional Information Sources, Technological Gate Keepers and Invisible Colleges.

UNIT-IV : Electronic Information Sources (6 Hours)

Meaning- Characteristics- Research database Open Access Resources-Audio resources

UNIT-V: Online Publishers (6 Hours)

Detailed study of E-books (Amazon, Sage Publication), E-journals (Springer, Verlog), Database (PROQUEST, EBSCO), Evaluation of E-Resources.

Reference Books:

- Singh, G. (2011).Digital libraries and digitization. EssEss Publications.
- 2. Baby M.D. (2000) Peter Clayton, G. E. Gorman. Managing Information Resources in Libraries. Cambridge Publishers.

INDIAN TRADITIONAL MEDICINAL FOODS
(23UXRN21)

SEMESTER: II	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course outcomes: At the end of the course the students will be able to

CO1: Know the foundational principles of health supplements such as functional foods, nutraceuticals, superfoods, etc., and assess their potential within the market context (K1).
CO2: Understand thecore principles of nutrition, including carbohydrates, proteins, lipids, vitamins, minerals, health-enhancing phytochemicals, and antinutritional factors (K2).
CO3: Get knowledge about the origins, traditional uses, nutritional composition, and health advantages of selected plant-based foods (K1).
CO4: Know the scientific rationale underlying the health benefits and potential adverse effects of various food substances (K3).
CO5: Identify the indigenous wild edible plants found in the Southern Western Ghats and their role in enhancing food security (K1).
CO6: Comprehend the fundamental concepts related to food and its significance in promoting health, specifically addressing contemporary health challenges, and demonstrate the ability to apply this knowledge in daily life (K1-K3).

Unit I: FOOD CULTURE (**6 Hours)**
Concept of food and its medicinal value - Food and health in Indian traditional medicine - Effect of globalization on food culture - Fast foods, Junk foods and their impact on the health of children and youth population - Emerging trends in health supplements

Unit II: MACRONUTRIENTS (**6 Hours)**
Carbohydrates and their role in health - Cereals, Millets, and Pseudo - Cereals - Proteins and their importance on health -Pulses and their health benefits - Lipids and their health impacts - Nuts and oil seeds

Unit III: MICRONUTRIENTS (**6 Hours)**
Vitamins, minerals and their health impacts - Hidden hunger - Greens, Vegetables and Fruits

Unit IV: PHYTOCHEMICALS (**6 Hours)**
Health promoting phytochemicals and antinutritional factors - Spices, and beverages - Lower plants as food sources - Mushrooms and their health benefits

Unit V: WILD EDIBLES & FOOD SECURITY (**6 Hours)**
Tribal knowledge of food plants - Seasonal foods and wild edible plants of *Kanikaran* and *Paliyan* tribes of Tamil Nadu - Sustainability, Food Security, and Health

Text books:

1. Begum, R.M. 2008. A Textbook of Foods, Nutrition & Dietetics, Sterling Publishers Pvt. Ltd.
2. Mudambi, S.R., Rajagopal, M.V. 2007. Fundamentals of foods, nutrition and diet therapy. New Age International.

References:

1. Gopalan, C., Sastri, B.V.R., Balasubramanian, S.C. 2014. Nutritive Value of Indian Foods, National Institute of Nutrition, Hyderabad
2. Dietary Guidelines for Indians – A Manual (English), National Institute of Nutrition, Hyderabad

FOOD MICROBIOLOGY
(23UXRN31)

SEMESTER: III	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course outcomes: Upon successful completion of this course, students should be able to:

CO1: Understand the fundamental principles of food microbiology and its importance in the food industry; Apply laboratory techniques for microbial analysis in food samples (K1).

CO2: Identify and characterize common food borne pathogens and their sources (K2).

CO3: Evaluate methods for food spoilage prevention and preservation (K2).

CO4: Describe the role of fermentation in food production and its health implications (K2).

CO5: Analyze emerging trends and ethical considerations in food microbiology; Apply regulatory guidelines and best practices for ensuring food safety and quality (K3).

CO6: Communicate effectively about food microbiology topics in both written and oral formats; Demonstrate critical thinking and problem-solving skills in food safety and quality assurance (K1-4).

Unit 1: Introduction to Food Microbiology (6 hours)

Overview of Food Microbiology; Historical Perspective; Microbial Classification and Taxonomy; Microbial Growth and Factors Affecting Growth; Laboratory Techniques in Food Microbiology

Unit 2: Food borne Pathogens (6 hours)

Common Food borne Pathogens (e.g., *Salmonella, Escherichia coli, Listeria, Campylobacter*); Sources of Food borne Pathogens; Detection and Control Strategies; Food borne Illness Outbreaks and Investigations; Food Safety Regulations

Unit 3: Food Spoilage Microorganisms (6 hours)

Types of Food Spoilage Microorganisms; Factors Influencing Food Spoilage; Spoilage Detection and Prevention; Food Preservation Methods; Food Packaging and Shelf-Life Extension

Unit 4: Food Fermentation (6 hours)

Fermentation in Food Production; Microorganisms Used in Fermentation; Fermented Food Products (e.g., yogurt, cheese, bread); Health Benefits of Fermented Foods; Quality Control in Fermentation

Unit 5: Food Safety and Quality Assurance (6 hours)

Food Safety Management Systems (HACCP); Good Manufacturing Practices (GMPs); Food Testing and Analysis; Risk Assessment and Management; Emerging Trends in Food Safety

Reference Books:

1. Food Microbiology: An Introduction by Thomas J. Montville and Karl R. Matthews, 2017
2. Foodborne Pathogens: Microbiology and Molecular Biology by Pina M. Fratamico, Arun K. Bhunia, and James L. Smith, 2005
3. Food Microbiology: Fundamentals and Frontiers by Michael P. Doyle, Robert L. Buchanan, and Vijay K. Juneja, 2019
4. Fermented Foods and Beverages of the World by Jyoti Prakash Tamang,2010
5. Food Safety Management: A Practical Guide for the Food Industry by Yasmine Motarjemi and HuubLelieveld, 2014

HERBAL RESOURCES AND THEIR CONSERVATION
(23UXRN41)

SEMESTER: IV	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course outcomes: At the end of the course the students will be able to

CO1: Understand the concepts in herbalism, medicinal plant trade and National policies (K2)

CO2: Recognize the threats and importance of conserving the medicinal plant resources (K2)

CO3: Explore the important medicinal plant resources of India, their scientific rationale and applications (K3)

CO4: Learn the good agricultural and collection practices of medicinal plants (K1)

CO5: Know the cultivation and post-harvest processing of selected medicinal plants cultivated Tamil Nadu (K2)

CO1: Understand the role of plant resources in global healthcare and its conservation (K1-K3)

Unit I: SCENARIO OF HERBALISM (**6 Hours)**

History of herbalism - Herbalism across the globe - Trade of herbals in ancient and contemporary India - Global herbal market and India's position

Unit II: UNSUSTAINABLE USE OF HERBAL RESOURCES (**6 Hours)**

Basics of endemism, IUCN categories of threat and CITES - Market demand - Negative impacts of collection from wild resources - Overexploited medicinal plants of India - *In situ* and *ex situ* conservation

Unit III: HIGHLY USED HERBALS OF INDIA (**6 Hours)**

Botany, identification, chemistry and applications of *Aswagandha, Seenthil, Nilavembu, Brahmi, Garcinia, Glycyrrhiza, Amla, Vilvam, Keelanelli*and*Satavari*

Unit IV: CULTIVATION & POST-HARVEST PROCESSING (**6 Hours)**

Good agricultural practices - Good collection practices - Storing medicinal plants – Post-harvest methods and value addition

Unit V: CULTIVATION OF SELECTED MEDICINAL PLANTS (**6 Hours)**

Good agricultural and collection practices for *Senkanthal, Senna, Vinca,Tulsi* and *Asogu*- Government schemes for cultivation of medicinal plants - Kitchen and home herbal gardens

Text book:

Wallis, T.E. 2018. Textbook of Pharmacognosy (Reprinted edition), CBS Publishers, New Delhi.

References:

1. Anonymous, Agro-techniques of selected medicinal plants Vols. I-III. 2014. National Medicinal Plants Board, Government of India.
2. Anonymous, WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. 2003. WHO, Geneva.
3. Ravikumar, K., Ved, D.K. 2000. Illustrated Field Guide to 100 Red Listed Medicinal Plants of Conservation Concern in southern India, FRLHT, Bangalore.
4. Ved, D.K., Goraya, G.S. 2007. Demand and Supply of Medicinal Plants in India. NMPB, New Delhi & FRLHT, Bangalore.

SOCIETY, ECONOMY AND POLITICS IN CONTEMPORARY INDIA
(23UMXN41)

SEMESTER: IV	NME	HOURS: 2	CREDITS: 2	TOTAL HOURS: 30

Course Outcome:

On completion of the course, the students will be able to

CO1: Relate the concept of state and government (K1)
CO2: Understand and evaluate different types of societies in India (K2 & K5)
CO3: Identify and compare role of market in different types of economy (K3)
CO4: Examine and compare ideas of Ambedkar with other social, economic and political reformers (K4 & K5).
CO5: Analyse and formulate the casteless society in India.

UNIT I: STATE AND GOVERNMENT (6 Hours)

State and Government: Meaning and concepts – Features, characteristics and Nature of State and its dynamics in India

UNIT II: DYNAMICS OF SOCIETY (6 Hours)

Society: concept, meaning and basic characteristics of society – different types of societies – stratification of societies in India – Rural-Urban Structures and social Institutions.

UNIT III: ECONOMY AND MARKET (6 Hours)

Economy and Market: Meaning and concept, basic characteristics and types of economies – dynamics of economy and market in new economic policy era.

UNIT IV: SOCIAL, ECONOMIC AND POLITICAL THINKERS IN INDIA (6 Hours)

JyotiraoPhule, Periyar, Gandhi, Ambedkar and Amartya Sen on interaction of society, economy and politics and its dynamics.

UNIT V: BUILDING CASTELESS SOCIETY (6 Hours)

Annihilation of Caste: Meaning and concept - Meaning of sati, childhood marriage, endogamous and exogamy of marriage - Status of Dalit and women in Indian society – Dalit and women emancipation.

References:

1. Jodhka, S. S. (2002). Nation and village: Images of rural India in Gandhi, Nehru and Ambedkar. *Economic and political weekly*, 3343-3353.
2. Jodhka, S. S. (2010). Dalits in business: Self-employed scheduled castes in North-West India. *Economic and Political Weekly*, 41-48.
3. Jodhka, S. S. (2016). Ascriptive hierarchies: Caste and its reproduction in contemporary India. *Current Sociology*, *64*(2), 228-243.
4. Jodhka, S. S., &Fazal, T. (2021). Religion and Politics in South Asia. Sociological Bulletin, 70(4), 447–452. https://doi.org/10.1177/00380229211062752
5. Mitra, S. K. (1993). Caste, democracy and the politics of community formation in India. *The Sociological Review*, *41*(1_suppl), 49-71.

6. Mosse, D. (2020). The modernity of caste and the market economy. *Modern Asian Studies*, *54*(4), 1225-1271.
7. Nayyar, D. (1998). Economic development and political democracy: interaction of economics and politics in independent India. *Economic and Political Weekly*, 3121-3131.
8. Robinson, R. (2014). Planning and economic development: Ambedkar versus Gandhi. *Invoking Ambedkar: Contributions, Receptions, Legacies*, 59-71.
9. Singh, A. (2014). Gandhi and Ambedkar: Irreconcilable Differences? *International Journal of Hindu Studies*, *18*(3), 413-449.
10. Stiglitz, J. E. (2016). *The state, the market, and development* (No. 2016/1). WIDER Working Paper.
11. Vikas, R. M., Varman, R., & Belk, R. W. (2015). Status, caste, and market in a changing Indian village. *Journal of Consumer Research*, *42*(3), 472-498.

PLANT DIVERSITY I – ALGAE
(SUB. CODE: 23UBOC11)

SEMESTER – I	CORE-T1	HOURS –5	CREDITS – 5

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 : To provide a comprehensive knowledge on the biology of algae. (K1)

CO2 : To provide a basis for better understanding of the evolution higher of plants.(K2)

CO3 : To understand reproductive biology, ecology of plants by studying the simpler systems in algae.(K3)

CO4 : To understand the role of algae in ecosystems as primary producers of nutrition.(K4)

CO5 : To understand importance of algae to animals and humans.(K5 & K6)

Unit I **(15 Hours)**

General Characters of Algae – Thallus organization, pigments, reserve food materials, reproduction and life cycle.Classification (Fritsch-1935-1945), criteria for classification, algal ecology.

Unit II **(15 Hours)**

Structure, reproduction and Life cycle of the following types: *Chlorella,Volvox*, *Nostoc* and *Oedogonium*.

Unit III **(15 Hours)**

Structure, reproduction and Life cycle of the following types:*Caulerpa*, *Gracilaria, Sargassumand* Diatoms.

Unit IV **(15 Hours)**

Algal cultivation methods (Micro and Macro Algae), Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.

Unit V **(15 Hours)**

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite.

Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phycoremediation.Role of algae in CO_2 sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence.

Text Books:

1. Dehradun. Edwardlee, R.2018. Phycology, 5th Ed., Cambridge University Press, London.
2. Kumar, H.D.1999. Introductory Phycology. Affiliated East-West Press, Delhi
3. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
4. Vashishta, P.C. 2014. S.Chand & Company Ltd, New Delhi.
5. Ian Morris. 1977. An introduction to the algae. Hutchinson & Co (Publishers) Ltd. London.

Reference Books:

1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.
2. Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi

3. Chapman V.J. and Chapman D.J, 2013. The Algae. AlphaNumera.
4. Fritsch, F.E. 1945. Structure and reproduction of Algae.Cambridge University press.
5. Round, FE. 1984.The Ecology of Algae. Cambridge University Press
6. Lee, R.D. 2008.Phycology 4th Edition, Cambridge University Press, New York.
7. Bold, H.C and Wynne, M.J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	1	3	2	1	2	2	2	1
CO2	3	3	2	2	3	3	2	`1	3	3
CO3	2	2	1	1	2	2	1	3	2	2
CO4	3	3	3	3	3	2	3	3	3	2
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

PLANT DIVERSITY I

ALGAE – PRACTICAL - I

SUB.CODE: 23UBOC12

SEMESTER – I	CORE-P1	HOURS –3	CREDITS – 3

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 **:** To develop skills to identify algae based on habitat, thallus structure and the internal organization.(K1)

CO2 **:** To identify microalgae in a mixture.(K2)

CO3 **:** To develop skills to prepare the microslides of algae.(K3)

CO4 **:** To study the economic importance of few species.(K4)

CO5 **:** To understand importance of algae to animals and humans (K5)

Experiments:

1. Micro-preparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of algal mixture.
4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
5. Field visit to study fresh water/marine water algal habitats.

Recommended Texts:

1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020.TextBook of Practical Botany-1(10th ed). Rastogi Publications, Meerut.
3. Round, FE. 1984.The Ecology of Algae. Cambridge University Press.
4. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.

Singh, Pandey an
d Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.

Reference Books:

1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying
2. manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Chapman, V.J and Chapaman, D.J. 1960.The Algae, ELBS & MacMillan, London.
4. Lee, R.D. 2008.Phycology 4th Edition, Cambridge University Press, New York.
5. Dehradun. Edwardlee,R.2018. Phycology,5th Ed., Cambridge University Press, London.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	3	2	1
CO2	3	3	2	2	3	3	2	3	3	3
CO3	2	2	3	3	1	2	1	3	1	2
CO4	3	3	3	3	3	2	3	3	3	2
CO5	3	3	2	2	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

CHEMISTRY FOR BIOLOGICAL SCIENCES I
SUB CODE.23UCHE11

SEMESTER I **EC- T1** **CREDITS – 2** **H/W : 4**

On completion of the course the students should be able to

CO 1 : State the theories of chemical bonding, nuclear reactions and its applications. (K1)
CO 2 :Evaluate the efficiencies and uses of various fuels and fertilizers. (K3)
CO 3 :Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.(K2)
CO 4: Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics andartificial sugars. (K4)
CO 5: Analyse various methods to identify an appropriate method for the separation of chemical components. (K5)
CO 6: Evaluate the efficiency of different fuels. (K3)

UNIT I Chemical Bonding **(12 Hours)**

Valency and valence electrons, electronic theory of valency, Electrovalency- conditions favouring electrovalency-illustrations, electrovalent compounds and their properties, Covalency-conditions favouring covalency-illustration, covalent compounds and their properties, coordinate covalency-conditions favouring it-illustration. Fajan's Rule.

Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Unit II Industrial Chemistry **(12 Hours)**

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).
Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.

UNIT III Fundamental Concepts in Organic Chemistry **(12 Hours)**

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6.
Polar effects: Inductive effect, elecromeric and Mesomeric effect.
Chromatography: principle and application of column, paper and thin layer chromatography

UNIT IV Drugs and Speciality Chemicals **(12 Hours)**

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

UNIT V: Analytical Chemistry-I **(12 Hours)**

Principles of volumetric analysis. Methods of expressing concentration of solution. Normality, Molarity, Molality, Mole fraction, Equivalent weights of acids bases, oxidizing agents and reducing agents. Primary standard, secondary standard, preparation of standard solution. Principles of Acid-base tratrations-theory of indicators, permanganimetry, Dichrometry, Iodometry, Indimetry.

Text books

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition,2012.
4. P.L.Soni, H.M. Chawla, Text Book of Inorganic Chemistry;Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B.K, Sharma, Industrial Chemistry; GOEL publishing house,Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

CHEMISTRY PRACTICAL FOR BIOLOGICAL SCIENCES
SUB CODE. 23UCHE12

SEMESTER I **EC- P1** **CREDITS – 2** **H/W=2**

On completion of the course the students should be able to

- Gain an understanding of the use of standard flask and volumetric pipettes, burette (K2)
- Design, carry out, record and interpret the results of volumetric titration. (K3)
- Apply their skill in the analysis of water/hardness. (K4)
- Analyze the chemical constituents in allied chemical products (K5)

VOLUMETRIC ANALYSIS

1. Estimation of sodium hydroxide using standard sodiumcarbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standardsodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator.

Reference Book

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principlesof Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

GARDENING AND LANDSCAPING
SUB.CODE: 23UBON11

SEMESTER – I	SEC-1	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1: To know about the fundamental concepts of gardening and landscaping.(K1)
CO2: To provide an overview of various gardening styles and its scope in recreation and bio-aesthetic planning.(K2)
CO3: To illustrate the significance of garden adornments and propagation structures.(K3)
CO4: To inculcate entrepreneurial skills in students for creative landscaping design using CAD software.(K4)
CO5: To create the design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.(K5)

Unit I **(6 Hours)**

Principles of gardening, Components of a garden – Lawn trees, shrubs, climbers, creepers, borders, edges.

Unit II **(6 Hours)**

Hedges, flower beds, carpet beds. Topiary – trophies. Constructed elements – drives, walkways, pathways, pergolas, gazebos.

Unit III **(6 Hours)**

Styles of garden - formal, informal and free style, special types of gardens – water garden, rock garden, marsh garden, vertical gardens, roof gardens.Indoor gardening – containers, care and maintenance.

Unit IV **(6 Hours)**

Therapeutic gardening, eco-tourism, Bonsai – culture and art. Flower arrangement – importance, production, constraints, post harvesting practices.

Unit V **(6 Hours)**

Basic principles of landscape design, components, xeriscaping, waterscaping, Landscaping of residential, public areas and Colleges.

Recommended Texts:

1. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
2. RaoManibhushan K. 1991. Textbook of horticulture.MaCMillan India Ltd.
3. Gangulee H. C. and Kar A. K. 2004. College Botany Vol II, New Central Book Agency
4. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I –IV, Deep And Deep Publ. Pvt. Ltd.
5. Singh, J. 2018. Fundamentals of Horticulture.Kalyani Publishers.

Reference Books:

1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide .Smithsonian Books.
2. Butts, E. and Stensson, K. 2012.Sheridan Nurseries: One hundred years of People,Plans,

and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands(Nature Guides).
4. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
5. EdmentSenn Andrews. 1994. Fundamentals of Horticulture.Tata. McGraw Hill Publishing Co., Ltd., Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	1	2	3	1
CO2	3	3	2	2	1	3	2	3	3	2
CO3	2	2	3	2	1	2	1	3	2	3
CO4	3	3	2	3	1	2	3	3	3	2
CO5	3	3	2	3	2	3	1	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT DIVERSITY II
VIRUSES, BACTERIA, FUNGI, LICHENS AND PLANTPATHOLOGY
SUB.CODE:23UBOC21

SEMESTER – II	CORE – T2	HOURS –5	CREDITS – 5

Course Outcomes:

CO1 : To describe the common characteristics of fungi as being heterotrophic, Unicellular / multi cellular.(K1)

CO2 : To understand the biology of fungi and to discuss the importance of fungi in various ecological roles (K2)

CO3 : To understand lichen structure, function, identification, and ecology; Comprehend the events of symbiosis and lichenization and to demonstrate the use of lichens as bioindicator species.(K3)

CO4 : To identify the main groups of plant pathogens, their symptoms.(K4)

CO5 : To understand the various types of plant diseases.(K5)

Unit I: FUNGI **(15 Hours)**

Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification, Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina (*Pilobolus*), Ascomycotina (*Peziza*), Basidiomycotina (*Agaricus*) and Deuteromycotina (*Cercospora*). Importance of mycorrhizal association.

Unit II: ECONOMIC IMPORTANCE OF FUNGI **(15 Hours)**

Cultivation of mushroom – *Pleurotus*(food).Fungi in agriculture application (biofertilizers): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), applications of fungi in pharmaceutical products (Penicillin).Importance of VAM fungi.Harmful effects of Fungi. Agriculture (Biofertilizers); Mycotoxins

Unit III: BACTERIA, VIRUS **(15 Hours)**

General characters of Bacteria.Classification (Bergey's, 1994), structure and reproduction of bacteria, Mycoplasma, Virology -Viruses general characters, structure and reproduction.

Unit IV: PLANT PATHOLOGY **(15 Hours)**

General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases..

Bacterial diseases – Citrus canker and Bacterial wilt of Banana

Viral diseases – Tobacco Mosaic and Vein clearing of Papaya

Fungal diseases – Blast disease in rice and Tikka disease

Unit V: LICHEN **(15 Hours)**

Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to *Usnea*.

Economic importance of Lichens: food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine

(Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens.

Recommended Texts:

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.
6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.
7. MahendraRai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.

Reference Books:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons (Asia) Singapore.
2. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
3. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
4. Burnett, J.H. 1971.The fundamentals of Mycology. ELBS Publication, London.
5. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.
6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology , Tata Ma Graw Hill Publishing House, New Delhi.
8. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
9. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.
   Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand & Company.

Mapping with Programme Outcomes:

COs	COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	1	2	1
CO3	2	2	3	3	1	2	1	3	1	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT DIVERSITY II
VIRUSES, BACTERIA, FUNGI, LICHENS AND PLANTPATHOLOGY - PRACTICAL-II

SUB.CODE:23UBOC22

SEMESTER – II	CORE – P2	HOURS –3	CREDITS – 3

Course Outcomes:

CO1 : To enable students to identify microscopic and macroscopic fungi.(K1)
CO2 : To prepare microslides of fungi and lichens. (K2)
CO3 : To know the presence of pathogen inside the plant tissues through microscopic sections.(K3)
CO4 : To identify the bryophytes based on the morphology, and microslides.(K4)
CO5 : To know the economic importance of the microbes studied.(K5)

EXPERIMENTS

1. Microscopic observation of vegetative and reproductive structures of types prescribed in the syllabus through temporary preparations and permanent slides.
2. Identifying the micro slides relevant to the syllabus.
3. Herbarium specimens of bacterial diseases/photograph.
4. Inoculation techniques for fungal culture (Demonstration only).
5. Study of economically important products obtained from fungi: Fungal biofertilizers,
6. Biopesticides, biofungicide (*Trichoderma*), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.
7. Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs)
8. Gram staining
9. Micro-preparation of *Usnea* to study vegetative and reproductive structures.
10. Study of thallus and reproductive structures (apothecium) through permanent slides.
11. Spotters

Recommended Texts:

1. Chmielewski, J.G and Krayesky,D. 2013.General Botany laboratory Manual. Author House, Bloomington, USA.
2. Das, Sand Saha,R.2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.
3. Webster, Jand Weber, R.2007. Introduction to Fungi, 3rd Ed. Cambridge University Press, Cambridge.
4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

Reference Books:

1. Alexopoulos, Jand Mims,W. 1985.Introductory Mycology,Wiley Eastern Limited NewDelhi.
2. Bendre, M. Ashok and Ashok Kumar,A. 2020. Text Book of Practical Botany 1 (10thed). Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern Mushroom Cultivation, 3d Edition Agrobios

(India), Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
5. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International

Mapping with Programme Outcomes:

COs	COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	1	2	2	2	1
CO2	2	3	2	2	3	3	2	3	3	3
CO3	2	2	3	3	1	2	1	3	1	2
CO4	3	3	3	3	3	2	3	3	3	2
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

Allied Chemistry II
(Subject code: 23UCHE21)

SEMESTER II EC- T1 CREDITS – 2 H/W=4

On completion of the course the students should be able to

- Explain fundamental thermodynamic properties (K1)
- list and explain several technological applications of colloids (K2)
- Summarize the roles carbohydrates, alkaloids and terpenoids play in biological systems.(K3)
- Figure out how many stereoisomers a compound has, and synthesis of a few heterocyclic molecules.(K4)
- Prepare and standard solutions and standardize an unknown solution.(K5)

Unit I Thermodynamics (12 hrs)

Introduction - Basic terminology and functional concepts- System, boundary and surrounding- Types of systems: open, closed and isolated- Properties of a system: extensive and intensive - State of a system and state variables (or state functions)-Thermodynamic equilibrium - Process and types: Isothermal, adiabatic, isochoric, isobaric, cyclic, reversible, and irreversible-comparison between isothermal and adiabatic processes, reversible and irreversible processes - Internal energy as a state function- components of internal energy- Work: Thermodynamic concept-types of work - Heat : Thermodynamic concept- Heat and work as path functions - First law of thermodynamics- Statement of the law of conservation of energy- Mathematical expression of the law- Application of the law- Heat capacity, specific heat capacity and molar heat capacity of asystem- Relation between molar hear capacities of gases- Enthalpy and enthalpy change- Enthalpy as a state function- Relation between ΔH and ΔE- Enthalpies of reaction, formation and combustion-Definition and illustration- standard state- Calculation of enthalpy change using Hess law- Bond enthalpies and bond dissociation enthalpies-Definition and illustration using CH_4 as example (Numerical problems not expected)- Spontaneous (natural) process- Entropy-it's meaning of disorder- Gibb's free energy-its meaning as available energy- Criteria for spontaneity

Self study: ideal gas, ideal gas equation, homogeneous reactions and heterogeneous reactions, heat.

UNIT II Surface Chemistry and Colloidal Chemistry (12 hrs)

Adsorption chemistry-introduction-definition-distinction from adsorption- Adsorption and adsorbate-definition and explanation- Types of colloidal systems- Classification of colloids-Lyophilic and lyophobic sols-a comparison- Stability of colloids-origin of charge-electrical double layer-salvation- Electrical properties-electrophoresis and electro-osmosis- Gels- gelation-classificatio-properties of gels-hydration, swelling or inhibition, syneresis and thixotropy-Emulsions-types of emulsion-identification of emulsion-dilution test, dye test, spreading test, viscosity and electrical conductivity-de-emulsification- Application of colloid in food, medicine, industry, purification of water, artificial rain, blue colour of the sky and cleaning action of soap.

Self study: Adsorbent, adsorbate, molecular interactions.

UNIT III Carbohydrates, Alkaloids and Terpenoids (12 hrs)

Introduction- Monosaccharide- Reaction of glucose- Open chain structure and ring structure of glucose (elucidation not expected)- Epimers, mutarotation- Interconversion of glucose into fructose and vice versa- Disaccharides- Reactions and structure of sucrose (elucidation nor expected)- Structure of maltose and lactose (elucidation not expcted)- Polysaccharide- Starch- amylase and amyl pectin-type of glycosidic linkage- Reaction of starch-action of heat-, hydrolysis and with iodine- Alkaloids- Definition, classification, (based on structure) occurrence and extraction- General methods of identification-functional nature of oxygen-functional nature of nitrogen-unsaturation-exhaustive methylation- Structure of conine- Terpenoids- Introduction, classification of terpenoids-Isoprene rule- Structure of citral (synthesis not included)

Self study: Examples for food contains carbohydrates

UNIT IV Stereoisomerism and Heterocyclic Compounds (12 hrs)

Optical isomerism- Plane polarized light - Optical activity - Asymmetric carbon-chirality - Elements of symmetry-plane of symmetry- axis of symmetry-centre of symmetry-dissymmetric- Van't Hoff-le Bel theory- Optical isomerism of tartaric acid- Racemization - Resolution of racemic-mixture-biochemical method, chemical method and chromatographic method- Geometrical isomerism- Cause for geometrical isomerism- Illustration of compounds containing C-C double bond - Heterocyclic compounds- Pyrrole- Introduction-aromatic character- Basic and acidic character of pyrrole- Pyridine- Electronic interpretation of electron-rich centers- Reaction of pyridine- Quinoline- Skaraup synthesis - Reactions of quinoline

Self study: Isomers, cyclic compounds, practice to draw the structure of simple molecules like H_2O, NH_3 etc.

UNIT V Analytical Chemistry-II (12 hrs)

Types of reactions relevant to qualitative analysis - Displacement reaction – Decomposition - Double decomposition- Hydrolysis- redox reaction- Complex formation- Interfering anions and their elimination- Group reagents and analytical group classification- Explanation and application of the following principles in qualitatiive analysis- Solubility and solubility product- Common ion effect- pH- Buffer.

Self study: Anions , cations, saturated solution, unsaturated solution, acids and bases.

Note: Course materials will be supplied to the students.

ALLIED CHEMISTRY PRACTICAL-II

Inorganic qualitative analysis

Subject code: 23UCHE22

SEMESTER II **EC- P2** **CREDITS – 2** **H/W=2**

Course Outcomes:
On completion of the course the students should be able to

- explain and demonstrate the techniques of elimination of interfering radicals (K2)
- Apply the physical and chemical properties of various ions in the identification if unknown samples (K3)
- Categorize the metal ions into different groups. (K3)
- identify the presence of inorganic salts in biological samples. . (K4)
- separate ions using common ion effect and solubility product (K5)
- Analyze samples using microscale techniques (K4)

Qualitative analysis of a simple salt containing one anion and one cation

Anions : Carbonate, Borate, Fluoride, Oxalate and Phosphate

Cations : Lead, Bismuth, Copper, Cadmium, Cobalt, Nickel, Manganese, Zinc, Barium, Strontium and Ammonium

Note: Laboratory manual will be supplied.

HERBAL TECHNOLOGY
SUB.CODE: 23UBON21

SEMESTER – II	SEC-2	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1 **:** To provide students with knowledge of herbaldrug industry, the quality of raw material, and guidelines for quality maintenance.(K1)
CO2 **:** To gain an insight into the commercially important secondary products and significance of bioprospecting.(K2)
CO3 **:** To understand various plants based drugs used in ayurvedha, unani, homeopathy, siddha etc.(K3)
CO4 **:** To apply the knowledge to cultivate medical plants. (K4)
CO5 **:** To know the pharmacological importance of medicinal plants.(K5)

Unit I: Herbal Technology: (6 Hours)

Definition and scope; Herbal medicines: history and scope; Traditional systems of medicine, and overview of AYUSH (Traditional Indian Systems of Medicine); Cultivation - harvesting - processing - storage of herbs and herbal products.

Unit II: Value added plant products (6 Hours)

Herbs and herbal products recognized in India; Major herbs used as herbal medicines, nutraceuticals, cosmeticals and biopesticides, their Botanical names, plant parts used, major chemical constituents.

Unit III: Pharmacognosy (6 Hours)

Systematic position, botany of the plant part used and active principles of the following herbs: Tulsi, Ginger, Curcuma, Fenugreek, Indian Gooseberry, Catharanthus roseus, Withania somnifera, Centella asiatica, Achyranthes aspera, Kalmegh, Giloe (Tinospora), Saravar. Herbal foods, future of pharmacognosy.

Unit IV: Analytical pharmacognosy (6 Hours)

Morphological and microscopic examination of herbs, Evaluation of drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

Unit V (6 Hours)

Plant gene banks, Cultivation of Plants and their value added processing / storage / quality control for use in herbal formulations, Introductory knowledge of Tissue culture and Micro propagation of some medicinal plants (*Withania somnifera*, neem and tulsi),

Recommended Texts:

1. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
2. Evans, W.C. 2009: Trease and Evans Pharmacognosy. 16th Edition, Saunders / Elsevier.
3. Sivarajan, V.V. and India, B. 1994. Ayurvedic Drugs and Their Plant Sources.. Oxford & IBH Publishing Company, 1994 - Herbs - 570 pages.

4. Miller, L. and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. MotilalBanarsidass,; Fourth edition .
5. Kokate, C.K. 2003. Practical Pharmacognosy.VallabhPrakashan, Pune.

Reference Books:

1.Agarwal, P., Shashi, Alok., Fatima, A. and Verma, A. 2013. Current scenario of Herbal Technology worldwide: An overview. Int J Pharm Sci Res; 4(11): 4105-17.
2. Arbe r, Agnes. 1999. Herbal Plants and Drugs. Mangal Deep Publications, Jaipur.
3. Varzakas, T., Zakynthinos, G, and Francis Verpoort, F. 2016. Plant Food Residues as a Source of Nutraceuticals and Functional Foods. Foods 5 : 88.
4. Aburjai, T. and Natsheh, F.M. 2003. Plants Used in Cosmetics. Phytotherapy Research 17 :987-1000.
6. Patri, F. and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	3	1	3	1
CO3	3	3	3	3	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	1	3	1
CO5	3	3	3	3	3	3	3	1	3	1

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT DIVERSITY III
BRYOPHYTES AND PTERIDOPHYTES
SUB.CODE:23UBOC31

SEMESTER – III	CORE – T3	HOURS –5	CREDITS – 5

Course Outcomes:
Upon completion of the courses, the students will be able to
C1: To enable the students to have an overview of Non-vascular and Vascular cryptogams.(K1)
C2: To understand the morphological diversity of Bryophytes and Pteridophytes (K2)
C3: To know the evolution of Bryophytes and Pteridophytes (K3)
C4: To understand the economic importance of the Bryophytes and Pteridophytes (K4)
C5: To understand anatomy and reproduction of Bryophytes and Pteridophytes (K5)

Unit I: BRYOPHYTES **(15 Hours)**

General characters of Bryophytes, classification (Watson, 1971) (up to family). Economic importance of Bryophytes – Ecological importance (Pollution indicators and monitoring), Medicinal uses, horticulture, industrial uses and absorbent bandages.

Unit II **(15 Hours)**

Structure, reproduction and life histories of the following classes each with a suitable example: Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Polytrichum*). Evolution of Bryophytes

Unit III: PTERIDOPHYTES **(15 Hours)**

General Characters of Pteridophytes - Classification (Reimer, 1954). Apogamy and Apospory, homospory and heterospory.

Unit IV **(15 Hours)**

Morphology, anatomy and reproduction of reproduction of the taxa belonging to each of the following classes: Psilotopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*).

Unit V **(15 Hours)**

Origin and evolution of Pteridophytes. Stelar Evolution. Economic importance of Pteridophytes.

Recommended Texts:

1. Sharma,O.P.2017. Bryophyta, Mac Millan India Ltd. Delhi.
2. Alam, A. 2020. Contemporary Research on Bryophytes Book Series: Recent Advances in Botanical Science. 10.2174/97898114337881200101.
3. Alain Vanderpoorten. 2009. Introduction to Bryophytes, 1st Edition, Cambridge University Press.
4. Chopra, R. N. 2005. Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.
5. PremPuri. 2001. Bryophytes– morphology growth and differentiation. Atma Ram & Sons. Lucknow, India.

Reference Books:

1. Eames, A. 1963. Morphology of lower vascular plant, McGraw Hill, Chennai.
2. Parihar. N.S. 1967. An introduction of Embryophyta, Vol.III – Pteriodophyta, Central book depot, Allahabad.
3. Smith, G.M. 1955. Cryptogamic Botany, Volume-II– McGraw Hill, Chennai
4. Sporne, K.L. 1976. Morphology of Pteridophytes, 4th edition, B.I. Publication. Chennai.
5. Watson, E.V. 1963. The structure and Life of Bryophytes. Hutchinson & Co, UK.
6. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
7. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	1	2
CO2	3	3	3	2	3	2	2	3	2	2
CO3	2	2	3	3	1	2	2	1	2	2
CO4	3	3	3	3	3	2	3	3	2	3
CO5	3	3	2	2	2	1	3	3	1	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT DIVERSITY III
BRYOPHYTES AND PTERIDOPHYTES
PRACTICAL-III
SUB.CODE:23UBOC32

SEMESTER – III	CORE – P3	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
C1: To enable students gain expertise in hand sectioning technique (K1)
C2: To study diversity of Bryophytes and Pteridophytes. (K2)
C3: To understand the anatomical structure of the Bryophytes and Pteridophytes (K3)
C4: Develop comprehensive skills in sectioning and micro preparation.(K4)
C5: Describe the structure of fossil forms prescribed in the syllabus.(K5)

Bryophytes
1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophytes genera included in the theory syllabus.
2. Hepaticopsida(*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Polytrichum*)

Pteridophytes
3. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophytes genera and fossils included in the theory syllabus.
   Psilotopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*).
4. Identifying the micro slides relevant to the syllabus.

Recommended Texts:

1. Sharma,O.P.2017. Bryophyta,MacMillanIndiaLtd,NewDelhi.
2. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,NewDelhi.
3. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany, Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany. Revised edition.Published by Rakesh Kumar Rastogi publication.
5. PremPuri. 2001. Bryophytes– morphology growth and differentiation. Atma Ram & Sons.Lucknow, India.
6. Tuba Z., Slack N.G. and Stark L.R. 2011. Bryophyte Ecology and Climate Change.Cambridgeuniversity press, Cambridge.

Reference Books:

1. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany, Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany. Revised edition. Published by Rakesh Kumar Rastogi publication.
2. Mohammed Gufran Khan, Shite Gatew and BediluBekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
3. Puri, P. 1980. Bryophytes. Atma Ram and Sons, New Delhi.
4. Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd. Chennai.
5. Vashista.P.C. 1971. Botany for Degree students: Pteridophyta. S.Chand& Co. New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	2
CO2	3	3	2	2	3	3	2	3	3	2
CO3	2	2	3	3	1	2	1	3	2	1
CO4	3	3	3	3	3	2	3	2	2	3
CO5	3	3	2	3	2	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ALLIED ZOOLOGY - I
ANIMAL STRUCTURE AND FUNCTION
Subject Code: 23UZOE31

Semester: III Allied: Theory 1 Credit: 4 Hours: 4

Objectives: To provide basic and advanced knowledge of animals on taxonomy, morphology and physiology of animals

Course Outcomes: At the end of the course the students will be able to

1. Identify and classify animals
2. Distinguish the structural organization of an invertebrate from a vertebrate
3. Examine the process of digestion, respiration and excretion in humans
4. Illustrate circulatory and nervous system of human body
5. Summarize the role of hormones in reproduction.
6. Integrate animal structure with its functions.

Unit I: Invertebrata (12 Hours)

Salient features of invertebrates, classification up to phyla with diagnostic features and examples. Type study: Cockroach

Unit II: Chordata (12 Hours)

Classification up to classes of Vertebrata with diagnostic features and examples; Type study: Frog – External morphology, digestion, respiration and circulation, reproductive systems

Unit III: Digestion, Respiration and Excretion in man (12 Hours)

Digestion – structure of alimentary canal, Physiology of digestion and absorption; Respiration – structure of lungs, respiratory pigments, transport of oxygen and carbon dioxide, respiratory quotient; Excretion - structure of kidney and nephron, mechanism of urine formation.

Unit IV: Circulation, Nervous system and Receptors in man (12 Hours)

Circulation – structure of heart, composition and functions of human blood, cardiac cycle, blood pressure; Nervous system - structure of neuron, nerve impulse conduction, reflex action; Receptors - Structure of eye and physiology of vision.

Unit V: Endocrine Glands and Reproductive System (12 Hours)

Structure and hormones of endocrine glands - Pituitary, thyroid, adrenal, islets of Langerhans; Human reproductive system, female reproductive cycle, contraceptives.

Text books:

1. Jordan, E.L., Verma, P.S. 2012. Invertebrate Zoology, S. Chand and Company.
2. Verma, Tyagi, Agarwal, 1997. Animal Physiology, S. Chand and Company.
3. Ayyar, E. 2009. A manual of Zoology, Volume 11, S. Visvanathan P Ltd., Chennai.

Reference books:

1. EkambaranathaAyyar M., Ananthakrishnan, T.N. 1995. A Manual of Zoology, Vol. I (Invertebrata) Part I & II. Viswanathan Pvt. Ltd.
2. Kotpal, R.L. 2000. Invertebrates, Rastogi Publications.

3. Rastogi, S.C. 2001. Essentials of Animal Physiology, New Age International Publications.

E-resources:

1. https://www.pmfias.com/classification-animalia-animal-kingdom/
2. http://www.biologydiscussion.com/invertebrate-zoology/21-general-characteristics-of-invertebrates/28088
3. http://biology.tutorvista.com/organism/vertebrates.html
4. http://www.arvindguptatoys.com/arvindgupta/human-body-systems.pdf
5. https://www.wsfcs.k12.nc.us/cms/lib/NC01001395/Centricity/Domain/8472/Body%20Systems%20Interactions%20chart.pdf
6. http://www.cabrillo.edu/~jtice/HSERV%20162/FUNCTIONALOrganization%20of%20the%20Human%20Body.pdf
7. http://samples.jbpub.com/9781449652609/99069_ch05_6101.pdf
8. https://www.saylor.org/site/wp-content/uploads/2010/11/The-Endocrine-System.pdf
9. https://www.scarsdaleschools.k12.ny.us/cms/lib5/NY01001205/Centricity/Domain/214/BRGT0390.pdf

ALLIED ZOOLOGY – I PRACTICAL
ANIMAL STRUCTURE AND FUNCTION - PRACTICALS

Subject Code:23UZOE32

Semester: III Allied: 1 Credit: 1 Hours: 30

Course outcomes:

- It covers the connection between structure and function at the organ- and organism level.
- Animal physiology will explain how the organs work together to ensure survival of the animal and to enable the animal to adapt to different environments.
- The course will provide current physiological knowledge of general physiological principles, organ physiology and regulatory mechanisms and key physiological mechanisms involved in animal adaptations to different environments.
- The animal groups covered will range from invertebrates to vertebrates and the habitats discussed will include aquatic, terrestrial and aerial.
- In addition to the lectures, the student will also participate in laboratory practicals that
- involve animal physiology experiments.
- These practicals will be related to the information in the lectures and will help the
- students to understand the important concepts.

1. Virtual dissection of cockroach (Digestive system, Nervous system and Reproductive system).
2. Mounting of Cockroach, mosquito, houseful mouthparts
3. Mounting of prawn appendages
4. Collection, isolation of soil nematodes
5. Virtual dissection of frog (Digestive system, Nervous system and Reproductive system).
6. Effect of temperature on salivary amylase activity.
7. Qualitative estimation of excretory products.
8. Observation of cellular constituents of human blood.
9. Quantitative Estimation of haemoglobin using haemoglobin meter.
10. Demonstration of blood pressure.
11. Slide mounted specimens: *Paramecium, Leucosolenia*
12. Preserved specimens: *Hydra, Taenia solium, Ascaris, Megascolex, Palaemon, Pila globosa, Asterias, Amphioxus, Balanoglossus, Ascidian,Anguilla, Rhacophorous, Chamaeleon, Naja naja*, Pelican, Parrot, Rabbit, Bat, *Manis* (pangolin),
13. 3-D Models: Human system / organs: – digestive system, lungs, kidney, nephron, heart, neuron, eye, thyroid.

MUSHROOM CULTIVATION
SUB.CODE:23UBON31

SEMESTER – III	SEC-5	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
C1: To learn and develop skills in mushroom cultivation. (K1)
C2: To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.(K2)
C3: To cultivate mushroom cultivation in small scale industry. (K3)
C4: To learn about diseases and post-harvest technology (K4)
C5: To study new methods and strategies to contribute to mushroom production.(K5)

Unit I **(6 Hours)**

Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.

Unit II **(6 Hours)**

Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.

Unit III **(6 Hours)**

Life cycle of *Pleurotus spp* and *Agaricus spp.*

Unit IV **(6 Hours)**

Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.

Unit V **(6 Hours)**

Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.

Recommended Texts:

1. Handbook of Mushroom Cultivation. 1999. TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
5. Verma, 2013.Mushroom: edible and medicinal: cultivation conservation, strainimprovementwith their marketing.DayaPublishingHouse

Reference Books:

1. Handbook of Mushroom Cultivation. 1999. TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford & IBH

publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	3	2	1	2	2
CO2	3	1	1	2	1	3	2	3
CO3	2	1	1	3	1	2	1	3
CO4	3	3	3	3	1	2	3	3
CO5	3	3	2	1	1	1	3	3

S-Strong (3) M-Medium (2) L-Low(1)

PLANT DIVERSITY - IV
(GYMNOSPERMS, PALEOBOTANY AND EVOLUTION)
(SUB.CODE: 23UBOC41)

SEMESTER – IV	CORE–T4	HOURS – 4	CREDITS – 4

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1 : Relate to the general characteristics of Gymnosperms and fossil forms (K1).
CO2 : Explain about the morphology and anatomy of Gymnosperms (K2).
CO3 : Compare and contrast the reproductive structures of Gymnosperms and fossil forms (K3).
CO4 : Analyze the anatomy and reproduction of Gymnosperms along with their ecological and economical importance (K4).
CO5 : Determine the various fossilization methods and their significance in paleobotany (K5).

Unit I: GYMNOSPERMS (12 Hours)

Classification of Gymnosperms (Sporne, 1954) (up to family). General characteristics, Economic importance of Gymnosperms with special reference to oil, resin, timber, etc.

Unit II GYMNOSPERMS (12 Hours)

Morphology, anatomy and reproduction of the taxa belonging to each of the following orders: Cycadales (*Cycas*), Coniferales (*Pinus*). Gnetales (*Gnetum*).

Unit III: PALEOBOTANY (12 Hours)

Introduction to fossils and fossilization processes such as compression, casts, molds, petrification, impressions and coal balls. Geological time scale. Radiocarbon dating. Contribution of Birbal Sahni.

Unit IV: PALEOBOTANY (12 Hours)

Study of the following fossils: *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Williamsonia sewardiana*.

Unit V: EVOLUTION (12 Hours)

Evolution - origin of life, chemosynthetic theory - evidences. Theories of evolution - Darwin, Lamark and De veries, modern synthetic theory. Variation - analysis and sources, adaptive radiation, Concept of species - Allopatric and sympatric.

Text Books

1. Gupta, M.N. 1972. The Gymnosperms (2nd Edition) Shiva LalAgarwala& Co., Agra.
2. Vashista, P.C. 1976. Gymnosperms, S.Chand& Co. New Delhi.
3. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India.
4. Anil Kumar. 2006. Gymnosperms. S. Chand & Company Pvt. Ltd. New Delhi.
5. Bhatnagar S.P and AlokMoitra. 2013. Gymnosperms. Publisher: New Age International PvtLtd Publishers. New Delhi.

Reference Books

1. Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi.
2. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi.
3. Stewart, W.N and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
4. Raup, D.M and Steven, M. Stanley. 2004. Principles of paleontology. San Francisco: W.H. Freeman, 1971.
5. Bhatnagar S.P and AlokMoitra. 2013. Gymnosperms. Publisher: New Age International PvtLtd Publishers. New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	1	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	3	3	2	2	1	2	1	3	1	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	2	1	3	1	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT DIVERSITY IV
GYMNOSPERMS, PALEOBOTANY AND EVOLUTION PRACTICAL-IV
SUB.CODE: 23UBOC42

SEMESTER – IV	CORE–P4	HOURS – 2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1: Analyze and observe and record the morphological features of selected species of Gymnosperms (K1).
CO2: Describe the structure of fossil forms prescribed in the syllabus (K2).
CO3: Identify and illustrate the morphological and anatomical features of gymnosperms(K3).
CO4: Develop comprehensive skills in sectioning and micro preparation (K4).
CO5: Interpret the significance of reproductive structures in gymnosperms (K5).

EXPERIMENTS
GYMNOSPERMS
1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of *Cycas, Pinus* and *Gnetum.*
2. Identifying the micro slides relevant to the syllabus.

PALEOBOTANY
1. Study the following fossil members: *Rhynia*, *Lepidodendron*, *Lepidocarpon, Calamites* and *Williamsonia sewardiana* through permanent slides.
2. Photograph of evolution scientists.

Recommended Texts

1. Sharma O.P and S, Dixit.2002.Gymnosperms.PragatiPrakashan.
2. Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand.
3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.
5. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India.

Reference Books

1. Smith, G.M. 1955. Cryptogamic BotanyVol.II.Tata McGraw Hill. New Delhi.
2. James.W. Byng. 2015. The Gymnosperms practical hand book. A practical guide to extant families and genera of the world. Published by plant Gateway, Tol Bot Street, Herford, SG137BX, United Kingdom.
3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.
5. Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	2	3
CO2	3	3	2	2	3	3	2	3	2	2
CO3	2	2	3	3	1	2	1	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3
CO5	3	3	2	2	3	3	2	3	2	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ALLIED – ZOOLOGY –II
IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY
Sub code: 23UZOE41

Semester: IV Allied : Theory 2 Credits: 4 Hours: 3

Objective: To inculcate the fundamental aspects of the immune system, antigen antibody reaction as well as techniques involved in animal cell culture and gene manipulation.

Course Outcomes: At the end of the course the students will be able to

1. Describe the concepts, components and principles of immune system
2. Explain primary and secondary lymphoid organs
3. Demonstrate antigen and antibody interactions and their techniques
4. Classify hypersensitivity and autoimmune disorders
5. Summarize animal cell culture techniques.
6. Design techniques in gene manipulation

Unit I: Immune system (12 Hrs)

Concepts, components and principles of innate and adaptive immune systems; Haematopoiesis; Cells of immune system - B cells, T cells and macrophages; Primary and secondary lymphoid organs.

Unit II: Antigen and Antibodies (12 Hrs)

Antigens – properties, types and determinants; Antibody (Immunoglobulin) – classes, structure, mechanism of action, functions; Monoclonal and polyclonal antibodies; ELISA and RIA techniques and their applications.

Unit III: Immuno-prophylaxis, Hypersensitivity and Autoimmunity (12 Hrs)

Vaccines – definite, types, mechanism of action, immunization schedule; Hypersensitivity - Definition, types, treatment of type I anaphylactic hypersensitivity; Autoimmunity – classification, disorders and therapy.

Unit IV: Animal cells culture (12 Hrs)

Characteristic features of animal cells in growth; Requirement - culture media, Equipments; Isolation of animal tissue- physical and chemical methods; Establishment of cell culture - primary, secondary cell culture and cell lines; Organ and embryo culture.

Unit V: Technique of gene manipulation in animals (12 Hrs)

Strategies of r-DNA technology; DNA finger printing ;Gene transfer methods; Cloning methods-Dolly; Transgenic animals; causes of infertility in male and female *; in vitro* fertilization (IVF) and embryo transfer.

Text Books:

1. Chakravarthy Ashik, K. 1996. Immunology – Tata Mc Graw-Hill Publishing Company Ltd., New Delhi.
2. Purohit, S. S. 2000. Biotechnology Fundamentals and Applications, Agrobios, Jodhpur, India Roitt I.M. 2000. Essential Immunology. Blackwell Scientific Publishers, London.

Reference Books:

1. Kuby, J. 1999. Immunology W.H. Freeman and Company, New York.
2. Roitt, Brostoff and Male, 1993. Immnunology, Mosby, London.
3. Gupta, P. K. 1999. Elements in biotechnology, Rastogi Publication, Meerut, India.

E-resources

1. https://microbiologyinfo.com/antigen-properties-types-and-determinants-of-antigenicity/
2. http://www.kean.edu/~jfasick/docs/Fall%2009%20&%20SP10%20%20A&PII/Chapter%2021b.pdf
3. http://jeeves.mmg.uci.edu/immunology/CoreNotes/Chap04.pdf
4. http://cdrwww.who.int/immunization/documents/Elsevier_Vaccine_immunology.pdf
5. http://www.lab.anhb.uwa.edu.au/hb313/main_pages/timetable/lectures/2007%20Tissue%20Culture%20Lecture%202%20combinedBjanka.pdf

ALLIED – ZOOLOGY -II – PRACTICAL

IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY - PRACTICAL

(Sub. Code: 23UZOE42)

Semester: IV Allied: 4 Credit: 1 Hours: 2

Course outcomes:

- This course gives an overview on the immune system including organs, cells and receptors
- The students learns about the molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions
- The course develops in the student an appreciation for the principles of immunology and its applications in treating human diseases
- Students learn about the transgenic animal, their application in the pharmaceutical industry, cloning and its importance.
- This course prepares the students to appreciate its benefits and applications in the biotechnological, pharmaceutical, medical and agricultural field

1. ABO Blood grouping and Rh factor.
2. WBC count in humanblood
3. Double immunodiffusion technique
4. Radial immuno diffusion
5. Separation of lymphocytes
6. Haemagglutination test
7. Cell viability test
8. Blood coagulation/ Clotting time
9. Rat lymphoid organs
10. Extraction of protein from animal tissue
11. Extraction of genomic DNA from human blood
12. Tissue culture media preparation
13. Spotters: Immunoglobulins, Thymus, Bone marrow, Lymphnode, Macrophage, Spleen, Bursa of fabricious, Antigen and antibody reaction,Engineered vaccine, Transgenic mice, Animal cloning – Dolly, Monoclonal antibodies, Cell growth curve, Embryo culture –*invitro* fertilization.

ENVIRONMENTAL IMPACT ANALYSIS
SUB.CODE: 23UBON41

SEMESTER – IV	SEC – 6	HOURS – 2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1 : Enumerate the fundamental concepts and significance of environmental impact assessment (K1).
CO2 : Explain the important steps of EIA process (K2).
CO3 : Interpret the environmental appraisal and procedures in India (K3).
CO4 : Decipher how to prepare the various documents required by state and federal regulations (K4).
CO5 : Develop their own perspectives on impact assessment and be able to solve problems related to environment (K5 &K6).

Unit I **(6 Hours)**

Origin and Development Purpose and aim, core values and principles, History of EIA development, Environmental Management Plan, Environmental Impact Statement, Scope of EIA in Project planning and Implementation.

Unit II **(6 Hours)**

EIA Process Components of EIA, EIA Methodology- Screening, Scoping, Baseline data, Impact Identification, Prediction, Evaluation and Mitigation, Appendices and Forms of Application.

Unit III **(6 Hours)**

Techniques of Assessment-Cost-benefit Analysis, Matrices, Checklist, Overlays, Impact on Environmental component: air, noise, water, land, biological, social and environmental factors. EIA Document

Unit IV **(6 Hours)**

Main participants in EIA Process Role of Project proponent, environmental consultant, PCBs, PCCs, public and IAA. Public participation.

Unit V **(6 Hours)**

Environmental Appraisal and Procedures in India and EIA Methodology, indicators and mitigation, Environmental Audit of different environmental resources, Risk Analysis, Strategic environmental assessment, ecological impact assessment: legislation.

Recommended Texts

1. Morris, P. and Therivel, R. 1995. Methods of Environmental Impact Assessment, UCL Press, London.
2. Petts, J. 1999. Handbook of Environmental Impact Assessment, volume 1 and 2, Blackwell Science, Oxford.
3. Therivel, R. and Partidario, M.R. 1996. The Practice of Strategic Environmental Assessment, Earthscan, London.
4. Vanclay, F. and Bronstein, D.A. 1995. Environmental and Social Impact Assessment, Wiley & Sons, Chichester.
5. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

Reference Books

1. Kulkarni, V. and Ramachandra, T.V. 2006. Environmental Management, Capital Pub.Co. New Delhi.
2. Petts, J. 2005. Handbook of Environmental Impact Assessment- Volume 1 and 2.Blackwell Publishers, UK.
3. Glasson, J. Therivel, R. and Chadwick. 2006. A. Introduction to Environmental Impact Assessment. Routledge, London.
4. Canter, W.L. 1995. Environmental Impact Assessment, McGraw-Hill Science/ Engineering/ Math, New York.
5. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	2	2	1	3	1	1	2	3	2	3
CO4	3	3	3	3	2	2	3	3	3	3
CO5	3	2	2	3	1	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ENTREPRENEURIAL OPPORTUNITIES IN BOTANY
SUB.CODE: 23UBOS42

SEMESTER – IV	SEC-7	HOURS-2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 :Recognize the significance of government agencies for entrepreneurship development (K1).
CO 2 :Explain about entrepreneurial values, risk assessment and solutions (K2).
CO 3 :Make use of entrepreneurial opportunities (K3).
CO 4 :Analyze and decipher the significance of bioventure and value added products (K4).
CO 5: Devise innovative methods for making value added products (K5&K6).

Unit I :INTRODUCTION (6 Hours)

Need - definition and concept - Types and characterization - entrepreneurial values-motivation and barriers-entrepreneurship as innovation, risk assessment and solutions

Unit II: BIOVENTURE (6 Hours)

Industry - overview of *Spirulina*, *Pleurotus*, Natural dyes, Banana fibers, Wine, Hydroponics, Drumstick and coconut - Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO) - methods and marketing - fresh and dry flowers for aesthetics.

Unit III :VALUE ADDED PRODUCTS (6 Hours)

Canning of fruits - process and equipment, fruit and vegetable based products (squash) - ready to serve (RTS) (syrup, pulp, paste, ketchup, soup, vegetable sauces, jam and jellies), Palmyrah Palm products, Perfumes from Rose/Jasmine - Bamboo and cane based products-virgin coconut oil, jasmine oil production, nutraceuticals, standards and quality management.

Unit IV: ORGANIZATIONS AND AGENCIES (6 Hours)

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

Unit V: ENTREPRENEURIAL OPPORTUNITIES (6 Hours)

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

Recommended Texts

1. Taneja,S.and Gupta,S.L.2015. Entrepreneurship development, New venture creation, Galgeha publication company, New Delhi.ISSN: 2321-8916.
2. Desai,V.,2015. Entrepreneurship development, First edition.Himalaya publication house, Mumbai. ISBN:9789350973837.
3. Khanna,S.S. 2016. Entrepreneurial development.S.Chand company limited, New Delhi.ISBN:9788121918015.
4. Bendre, M.Ashok and Ashok Kumar,A. 2020.Text Book of Practical Botany 1 (10thed).Rastogi Publications, Meerut.

5. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.

Reference Books

1. Manohar, D.1989. Entrepreneurship of small scale industries, vol.III. Deep and deep publication, New Delhi. ISSN: 09735925.
2. Lal,G.,Siddhapa,G.S.andTandon,G.L.,1988.Preservation of fruits and vegetables. Indian Council of Agricultural Research (ICAR). ISSN:0101-2061.
3. Ranganna,S.,2001.Handbook of analysis and quality control of fruits and Vegetable products, Second edition, Tata Mc Graw hill, New Delhi.ISBN: 780074518519.
4. Gupta. P.K.,1998. Elements of Biotechnology. Rastogi publications, Meerut.
5. Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co.New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	2
CO2	3	1	3	2	1	3	1	3	3	1
CO3	2	2	3	3	1	1	2	3	1	2
CO4	3	3	2	2	3	2	3	3	2	3
CO5	3	3	2	3	1	2	3	3	2	3

S-Strong (3) M-Medium (2) L-Low(1)

TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY
SUB.CODE: 23UBOC51

SEMESTER – V	CORE -T5	HOURS – 5	CREDITS – 5

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 : Define the concepts in plant morphology and rules of IUCN in botanical nomenclature(K1).
CO2 :Classify systems of plant classification and recognize the importance of herbarium and virtual herbarium (K2).
CO3 : Describe the core concepts of economic Botany and relate its applications in human life (K3).
CO4 : Analyze the characters of the families according to the Bentham and Hooker's system of classification (K4).
CO5 : Assess terms and concepts related to Phylogenetic Systematics (K5).

Unit I **(15 Hours)**

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-Types-simple and compound- phyllotaxy, modifications (phyllode, pitcher), tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - classification.

Unit II **(15 Hours)**

History of Angiosperm classification – Artificial, Natural and Phylogenetic system of classification.An outline of Bentham and Hooker system of classification, an overview of APG Classification.Herbarium technique–collection, pressing, drying, mounting and preservation of plant specimens, digital herbarium.Botanical Survey of India.Botanical nomenclature–rules, typification and author citation.

Unit III **(15 Hours)**

Study of the following families based on the Natural system and their economic importance: Anonaceae,Nymphaeaceae, Capparidaceae, Rutaceae, Caesalpinaceae, Cucurbitaceae, Asteraceae, Apocynaceae and Asclepiadaceae.

Unit IV **(15 Hours)**

Study of the following families based on the natural system and their economic importance: Convolvulaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Unit V **(15 Hours)**

Source, cultivation method (brief) and the extraction/processing of the economically important products of the following – Cereal (Rice), Pulses (Black gram), Sugar (Sugarcane), Beverage (Coffee), Oil seed (Groundnut), spices (Cardamom), essential oil (Rose), natural rubber and timber plants (Teak) and Fibre (Cotton).

Recommended Texts

1. Lawrence, G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.

2. Porter, C.L. 1982. Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
3. Solbrig, O.T. 1970. Principles and Methods of Plant Biosystematics. The MacMillan Co-collier-MacMillan Ltd., London.
4. Solbrig, O.T and Solbrig, D.J. 1979. Population Biology and Evolution, Addison-Weslley Publicating Co. Ind USA.
5. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
6. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
7. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.

Reference Books

1. Hutchinson, J. 1973. The Families of Flowering plants , Oxford University press, London.
2. Gamble, J.S., Fisher, L.E.F.1967. The Flora of The presidency of Madras (Vol-III) BSI, Calcutta
3. Davis, P.H and Heywood, V.M. 1965. Principles of Angiosperm Taxonomy, Oliver and Boyd Edinburgh.
4. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
5. Harborne, J.B and Turner, B.L. 1984. Plant Chemosystematics, Acad. Press, London.
6. Lawrence, G.H. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
7. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-HilI Book Co., New York.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	2
CO2	3	3	2	2	3	3	2	3	3	2
CO3	2	2	3	3	1	2	1	3	2	1
CO4	3	3	3	3	3	2	3	2	2	3
CO5	3	3	2	3	2	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT ANATOMY AND EMBRYOLOGY
SUB.CODE: 23UBOC52

SEMESTER – V	CORE -T6	HOURS –5	CREDITS – 5

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 : Relate to the fundamental concepts of plant anatomy and embryology (K1).
CO 2 :Describe the internal tissue organization of various plant organs (K2).
CO 3 : Elucidate the stages of normal and abnormal secondary growth (K3).
CO 4 : Compare the structural organization of flower in relation to the process of pollination and fertilization (K4).
CO 5: Access the various anatomical adaptations in plants (K5).

Unit – I **(15 Hours)**

Cell wall - structure, and function. Tissues - Definition, types - Simple tissue system - parenchyma, collenchyma and sclerenchyma (fibers and sclereids). Complex tissue system - xylem and phloem. Meristem: definition, structure, function and classification. Apical organization and theories: Apical cell theory, Histogen theory and Tunica-Corpus theory. Root apex: Histogen theory and Korper-Kappe theory.

Unit – II **(15 Hours)**

Primary structure of root and stem (Dicot and monocot). Epidermal tissue system: epidermis, cuticle, trichome, bulliform cells, periderm and silica cells. Ground tissue systems: cortex, endodermis, pericycle, pith and pith rays. Vascular tissue systems: different types of vascular bundles and their arrangement in root and stem. Nodal anatomy: leaf trace, leaf gap, branch trace and branch gap-types

Unit – III **(15 Hours)**

Secondary thickening in monocots and dicots, Secondary thickening in monocot and dicot root.Anomalous secondary growth of stem- *Boerhaavia, Nyctanthes*and *Dracaena*. Leaf - anatomy of dicot and monocot leaf. Periderm structure and development: Phellem, Phellogen, Phelloderm, Rhytidome and lenticels. Stomatal types.

Unit – IV **(15 Hours)**

Structure and development of anther - development of male gametophyte.Ovule: Structure of mature ovule**,** types of ovules; female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (*Polygonum*type); Organization and ultra structure of mature embryo sac.

Unit – V **(15 Hours)**

Double fertilization and triple fusion.Endosperm and its types - free nuclear, cellular, helobial, endosperm haustoria.Polyembryony - types, apomixis, parthenogenesis and parthenocarpy. Seed structure and its importance.

Recommended Texts

1. Bhojwani, S.S and Bhatnagar, S.P. 1994. Embryology of Angiosperms, Vikas.

2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
4. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
5. Vimla Singh and AlokAbhishek. 2019. Plant Embryology and Experimental Biology. Educational Publishers and Distributors. New Delhi.
6. Pandey, B.P.2015. Plant Anatomy S. Chand Publ. New Delhi.
7. Bhatnagar,S.P., Dantu, P.K, Bhojwani, S.S. 2014. The Embryology of Angiosperms 6th edition Vikas Publishing House. Delhi.
8. Waisel, Y., Eshel, A and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York

Reference Books

1. Esau, K. 1985. Anatomy of Seed Plants –John Willey.
2. Cutter, E.G. 1989. Plant Anatomy – Part I – Addison – Wesley Publishing Co..
3. Maheswari, P.1991. An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
4. Swamy, B.G.L and Krishnamoorthy. K.V.1990. From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
5. Dickison, W.C. 2000. Integrative Plant Anatomy. Harcourt Academic Press, USA.
6. Fahn, A. 1974. Plant Anatomy. Pergmon Press, USA.
7. Mauseth, J.D. 1988. Plant Anatomy. The Benjammin/Cummings Publisher, USA.
8. Evert, R.F. 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. Any local/state/regional flora published by BSI or any other agency.
9. Swamy, B.G.L and Krishnamurthy,K.V.1980. From flower to fruit .Tata McGraw Hill Co. Pvt. Ltd, New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO2	3	3	2	2	3	3	2	3	3	3
CO3	2	2	3	3	1	2	1	3	1	2
CO4	3	3	3	3	3	2	3	3	3	2
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY-PRACTICALV
SUB.CODE: 23UBOC53

SEMESTER – V	CORE - P5	HOURS –3	CREDITS – 2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1: Recognize the distinguishing plant morphological characters (K1).
CO 2: Identify locally available plants to their respective families (K2).
CO 3: Develop comprehensive skills in field identification, collection of specimens, writing technical description, botanical drawings and herbaria preparation. (K3).
CO 4: Construct floral diagram and write floral formula for a given flower (K4).
CO 5:Validate the plant specimen by analyzing and dissecting the vegetative and floral characters (K5).

EXPERIMENTS

1. Morphology of root, stem and leaf modification, types of inflorescence.
2. Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.
3. Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.
4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
5. Twenty (20) Herbarium sheets, field notebook and bonafide record to be submitted.
6. Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.

Recommended Texts

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. Nirali Prakashan, 1st Edition. ISBN: 9351642062.
3. Rendle, A.B. 1980. The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4. Pandely, B.P. 1987. Taxonomy of Angiosperms.
5. Nordenstam, B., EI Gazaly, G and Kassas, M. 2000. Plant Systematics for 21st Century. Portlant Press Ltd., London.

ReferenceBooks

1. MannJ. Davidson, R.S and J.B.Hobbs, D.V.Banthorpe, J.B.Harborne.1994.*Natural Products*. Longman Scientific and Technical Essex.
2. Gopalan,C., B.V. Ramasastri and S.C.Balasubramanian.1985.NutritiveValueofIndianFoods. National Institute of Nutrition, Hyderabad.
3. Grant, W.E. 1984. Plant Biosystematics. Academic Press, London.
4. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.

5. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO2	3	3	2	2	3	3	2	3	2	2
CO3	2	2	3	3	1	2	1	2	3	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) M-Medium (2) L-Low(1)

PLANT ANATOMY AND EMBRYOLOGY – PRACTICAL VI
SUB.CODE: 23UBOC54

SEMESTER – V	CORE - P6	HOURS –3	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 : Acquire basic knowledge of various kinds and organization of plant tissues (K1).
CO2 : Classify the types of stomata and ovules (K2).
CO3 : Comparethe functions of various ergastic substances present in plant tissues.
CO4 : Perform free hand sectioning of plant materials and decipher the internal tissue organization (K4).
CO5: To comprehend the structural organization of flower with relevance to the process of pollination fertilization.

Experiments

Anatomy

1. Study of simple and complex (Primary and Secondary) tissues by maceration.
2. Study the internal structure of primary (young) and secondary (old) stems. Internal structure of dicot and monocot stem. Internal structure of dicot and monocot root.
3. Anomalous secondary growth in the stems of *Boerhaavia, Nycthanthes* and *Dracaena*.
4. T.S of dicot and monocot leaves.
5. Study of stomatal types.

Embryology

1. T.S of (young and mature) anther (section from *Datura* or *Cassia* flower).
2. Observation of pollinia (slide only).
3. Types of ovules- Anatropous, Orthotropous, Circinotropous, Amphitropous, Campylotropous (Permanent slides).
4. Types of Endosperm - Nuclear, cellular and helobial.
5. Dissection and display of any two stages of embryo in *Tridax.*

Recommended Texts

1. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.
2. Panshin, A.J and C. de Zeeuw.1980.Textbook of wood technology. Structure, identification and uses of the commercial woods of the United States and Canada. Fourth Edition. New York: McGraw-Hill Book Company.
3. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental, Bombay Popular Prakashan, ISBN-8173199698, 9788173199691.

Reference Books

1. Sundara Rajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.
2. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.
3. Allen, Sarah et al., 2016. Plant Anatomy Lab Manual, Fall.

CELL BIOLOGY, GENETICS AND PLANT BREEDING
SUB.CODE: 23UBOE51

SEMESTER – V	EC -T5	HOURS – 5	CREDITS –4

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1 : Enumerate the structure and functions of cells, cellular structures and organelles. Identify the structure of cell organelles and stages of cell division (K1).
CO 2 : Explain about cell cycle, cell division and laws of inheritance with examples (K2).
CO 3 : Elucidate concepts of sex determination and sex linked inheritance (K3).
CO 4 : Analyze the importance of genes interactions at population and evolutionary levels (K4).
CO 5: Develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool (K5).

Unit – I **(15 Hours)**

Introduction- scope- cell organisation- Ultra structure of Prokaryotic cell and Eukaryotic cell.Plant cell structure and function. Cell boundaries- cell wall- gross layer i.e. middle lamella, primary wall, secondary wall- Structure, chemistry and functions of cell wall, pits- (simple and bordered), Plasmodesmata. Plasma membrane- occurrence, structure (fluid mosaic model) chemistry, function and origin. Properties of Cytoplasm Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Unit – II **(15 Hours)**

Occurrence, structure, function and origin of Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Mitochondria, Chloroplast and Micro bodies. Semi genetic autonomy of Mitochondria and Chloroplast. Ultrastructure and functions of Nucleus, nuclear envelope, nuclear pore complex, nucleolus, chromosomes structure molecular organization of chromatin, Euchromatin, heterochromatin, Polytene and Lampbrush chromosomes-, Centromere: types. Cell inclusion. Cell cycle, Cell division, Mitosis and Meiosis- their significance.

Unit – III **(15 Hours)**

Mendeliangenetics – monohybrid, dihybridcrosses. Laws of Mendel, Reciprocal cross - Back cross and Test cross. Incomplete dominance –*Mirabilis jalaba.* Interaction of factors– Complementary genes, Supplementary genes, inhibitory genes, Epistasis (dominant and recessive), duplicate genes and multiple alleles. Multiple alleles. ABO Blood grouping in Human. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Sex determination in plants.

Unit – IV **(15 Hours)**

Sex linked inheritance Haemophilia and colourblindness. Polyploidyorigin, types and significance. Mutation-types and significance. chromosomal aberration addition, deletion, inversion, duplication and translocation . Extranuclear inheritance and itssignificance-Malesterility incorn, Maternal inheritance – Plastid Inheritance in *Mirabilis jalaba*. Genetics of *Neurospora*. Population genetics–Hardy–Weinberg principle.

Unit –V **(15 Hours)**

Principles involved in plant breeding. Plant introduction and acclimatization. Methods of crop improvement: selection (mass, pure line and clonal), hybridization techniques. Heterosis – Interspecific and intergeneric, causes and effects. Mutation in plant breeding, polyploidy in

plant breeding and its applications. Breeding for crop improvement for paddy and sugarcane.Biotechnology in crop improvement: Transgenics – scope and limitations; Bt-Cotton.

Recommended Texts

1. Verma, P.S and V.K. Agarwal. 2002. Cytology. S. Chand & Co. Ltd., New Delhi-55.
2. Sinnott, EW., Dunn, L.L and Dobzhansky, T. 1997. Principles of Genetics, Tata McGraw Hill Publishing Co. New Delhi.
3. Cohn.N.S.1979, Elements of Cytology, Freeman Book Co.
4. Singh, R. J. 2016. Plant Cytogenetics, 3rd Edition. CRC Press, Boca Raton, Florida, USA.
5. Singh, R.J. 2017. Practical Mannual on Plant Cytogenetics. CRC Press, Boca Raton, Florida, USA.

Reference Books

1. De Robertis and De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
2. Gardner, E.J., Simmons, M.J and Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8thEdn., New York.
3. Hackett, P.B., Fuchs, J.A and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
4. Cooper, G.M and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C. Sinauer Associates, MA.
5. Becker, W.M., Kleinsmith, L.J., Hardin. J and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. 2009. Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A.
7. Lewin. 2007. Gene IX. Jones and Barlett Pub. ISBN. O 7637 52223.
8. Strickberger, M.W. 1999.Genetics.Prentice Hall of India Pvt Ltd, New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	1
CO2	3	3	2	2	3	3	2	3	3	2
CO3	3	3	2	3	1	2	1	3	3	2
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

CELL BIOLOGY, GENETICS AND PLANT BREEDING
PRACTICAL VII
SUB.CODE: 23UBOE52

SEMESTER – V	EC- P5	HOURS –3	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 : Recall the key structures and functions of cell organelles by examining photomicrographs (K1).
CO 2 : Compare the functions of various ergastic substances present in plant tissues(K2).
CO 3 : Design and execute emasculation techniques in plant breeding experiments, demonstrating proficiency in controlled pollination (K5).
CO 4 : Interpret the given genetic data to develop genetic map based on the principles of Mendelian inheritance and gene interaction (K4).
CO 5: Utilize the three-point test cross method to construct chromosome maps and understand gene linkage and recombination (K3).

EXPERIMENTS
Cell biology

1. Study of the photomicrographs of cell organelles.
2. Ergastic substances - starch grains, aleurone grains, crystals – cystolith and raphide.
3. Study the polytene and lamp brush chromosome structure through photograph.
4. Identification of different stages of mitosis by using squash and smear techniques – Onion root tip.

Genetics

1. Genetic problems – test cross, back cross and allelic interaction.
2. Construction of chromosome map – three point test cross
3. Multiple alleles problems.

Plant Breeding

1. Emasculation technique.
2. To test the viability of seeds using Tetrazolium chloride.
3. Genetic models of heterosis.
4. Phenotype of heterosis (Maize).

Recommended Texts

1. Gupta P.K. 2017. Cell and Molecular Biology (5th ed.), Rastogi Publications, Meerut.
2. Krebs J.E., Goldstein E.S and Kilpatrick S.T. 2017. Lewin's GENES XII (12thed.). Jones & Bartlett Learning.
3. Jackson, S.A., Kianian, S.F., Hossain, K.G and Walling, J.G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York.

Reference Books

1. Gardener, J, Simmons, H.J and Snustad, D.P. 2006. Principle of Genetics, John Wiley & Sons, New York.
2. De Robertis E.D.P. and De Robertis E.M.P. 2017. Cell and Molecular Biology (8thed.) (South Asian Edition), Lea and Febiger, Philadelphia, USA.
3. Jackson, S.A., Kianian, S.F., Hossain, K.G., and Walling, J. G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York, NY.

Web resources

1. https://www.amazon.in/Cell-Biology-Dr-Renu-Gupta/dp/8193651219
2. https://www.amazon.in/Practical-Handbook-Genetics-Vikas-Pali/dp/932727248X
3. https://www.amazon.in/Practical-Handbook-Plant-Breeding-Vikas/dp/9327272498

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO2	3	3	2	2	3	3	2	3	2	2
CO3	2	2	3	3	1	2	1	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

BIO-ANALYTICAL TECHNIQUES
SUB.CODE: 23UBOE53

SEMESTER – V	EC-T6	HOURS – 4	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 :Relate to the various biological techniques and its importance (K1).
CO 2 :Explain the principles of Light microscopy, compound microscopy, Fluorescence microscopy and electron microscopy(K2).
CO 3 :Apply suitable strategies in data collections and disseminating research findings (K3& K6).
CO 4 :Compare and contrast the significance of different types of chromatography techniques (K4).
CO 5: Develop methodologies for extraction and analysis of biochemical compounds (K5).

Unit I- MICROSCOPY: (12 Hours)

Principles of microscopy; Light microscopy; compound microscopy, bright field microscope, dark field microscope, phase-contrast microscope, Fluorescence microscopy; Transmission and Scanning electron microscopy. Microscopic measurements-micrometry, Microscopy drawing: Camera Lucida.

Unit II- CHROMATOGRAPHIC PRINCIPLES AND APPLICATIONS: (12 Hours)

Principle; Paper chromatography, Thin Layer Chromatography (TLC), Column chromatography, Gas chromatography – Mass spectrometry (GCMS), High Performance Liquid Chromatography (HPLC).

Unit III- ELECTROPHORESIS AND PH METER (12 Hours)

Basic principle, construction and operation of pH meter. Polyacrylamide gel electrophoresis (PAGE), Agarose Gel Electrophoresis.

UnitIV-SPECTROPHOTOMETRY AND CENTRIFUGATION TECHNIQUE: (12 Hours)

Principle and law of absorption, construction, operation and uses of colorimeter and UV–Visible spectrophotometer, Principles, methods of centrifugation, types of centrifuge and applications.

Unit V – BIOSTATISTICS (12 Hours)

Data collection methods, population, samples, parameters; Representation of Data: Tabular, Graphical– Histogram – frequency curve – Bar diagram–measures of central tendency – Mean, Median and Mode; Standard deviation, Standard error, Chi-square test and goodness of fit –t–test.

Recommended Texts

1. Sharma, V.K. 1991. Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.
2. Sawhney, S.K and Randhir Singh. 2000. Introductory practical biochemistry, Narosa Publishing House.
3. Asokan, P. 2001. Basics of analytical biochemistry. Chinna Publications.

4. Bajpai, P.K. 2006. Biological instrumentation and methodology. S. Chand & Company, New Delhi.
5. Veerakumari, L. 2009. Bioinstrumentation. MJP Publications.
6. Palanivelu, P. 2013. Analytical Biochemistry and Separation techniques, 20th century publications, Palkalainagar, Madurai.

Reference Books

1. Rana, S.V.S. 2009. Biotechniques: Theory and Practice. Rastogi Publications.
2. Zar, J.H. 2012. Biostatistical Analysis.4th edition.Pearson Publication. U.S.A.
3. SundarRao, P.S.S and Richard, J. 2011. Introduction to Biostatistics and research methods, PHI learning Private Ltd., New Delhi.
4. Johansen, D.A. 1940. Plant Micro technique, TATA McGraw Hill Book Co., Ins., New Delhi.
5. Peter Gray. 1964. Handbook of Basic Micro technique. McGraw hill publication, New York.
6. Cooper, T.G. 1991. The Tools of Bio - chemistry, John Wiley & sons, London.
7. Dey, P.M and Harborne, J.B. 2000. Plant Biochemistry Harcourt Asia Pvt. Ltd.
8. Plummer, D.T. 2003. An introduction to practical Biochemistry.3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
9. Zar, J.H. 1984. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersy.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2	1	2	2	3	2
CO2	3	3	2	2	1	3	2	3	3	3
CO3	2	2	3	2	1	2	1	3	2	2
CO4	3	2	1	1	3	2	1	3	3	2
CO5	3	2	1	3	2	2	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

INTRODUCTION TO BIOINFORMATICS
SUB.CODE: 23UBOE53

SEMESTER – V	EC-T6	HOURS – 4	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1:Understand the basic principles and applications of bioinformatics in biology and biotechnology.
CO2:Learn how to retrieve, analyze, and interpret biological data using bioinformatics tools and databases.
CO3:Develop computational skills for sequence analysis, genome analysis, and structural bioinformatics.
CO4:Apply bioinformatics methods to solve biological problems and address research questions.
CO5:Gain insight into the ethical considerations and challenges in bioinformatics research.

UNIT-1 : INTRODUCTION TO BIOINFORMATICS (12 Hours)

Definition and scope of bioinformatics-Importance and applications in biological research-Overview of key bioinformatics databases and resources.

UNIT-2 : BIOLOGICAL DATA RETRIEVAL (12 Hours)

Introduction to sequence, structure, and functional databases-Tools for data retrieval and analysis- searching and retrieving data from biological databases

UNIT -3 : SEQUENCE ANALYSIS (12 Hours)

Sequence alignment algorithms and applications-Sequence similarity searching using BLAST- sequence alignment and BLAST searches

UNIT-4: GENOME ANALYSIS (12 Hours)

Genome sequencing technologies and methods-Genome assembly and annotation-Comparative genomics and phylogenetic analysis- genome assembly, gene prediction, and phylogenetic analysis

UNIT-5:STRUCTURAL BIOINFORMATICS (12 Hours)

Protein structure prediction methods-Protein structure databases and visualization tools-Protein-ligand docking and molecular dynamics simulations- protein structure prediction and visualization

Recommended Texts

1. P.K. Gupta. Biotechnology and Henomics. 2016-2017. Rastogi Publications, 7th Reprint (1st Edition.
2. Ghosh, Z., Mallick, B. 2008. Bioinformatics – Principles and Applications, 1st edition. New Delhi, Delhi: Oxford University Press.

Reference Books:

1. Gibas, C and Jambeck, P. 1999. Developing Bioinformatics Skills. O'Reilly Shroff Publishers and Distributors Pvt, Ltd., New York, US.
2. David W. Mount. 2004. Bioinformatics Sequence and Genome Analysis. 2nd Edition, Cold Spring Harbor Laboratory Press, New York, US.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	1	3	3		
CO2	3	3	3	2	1	3	3	2		
CO3	3	3	3	1	2	1	3	2		
CO4	3	3	3	1	2	1	3	2		
CO5	3	3	3	1	2	1	3	2		

S-Strong (3) M-Medium (2) L-Low(1)

INTERNSHIP

SUB.CODE: 23UBOI51

SEMESTER – V	INTERNSHIP	CREDITS – 2

- All UG students will undergo internship during the summer holidays of the second year after completing IV semester.
- Two credits will be given for internship.
- Minimum Days: 21
- Minimum working time per day: 3 Hrs. & Maximum working Time: 5 Hrs.
- The places of internship can be government offices, Panchayats, MP, MLA offices, private institutions, companies, production units etc.
- The HoD of the departments will give a letter of introduction to each student.
- The students will identify the company / institution for internship.
- The students will be divided equally based on the number of professors available in the departments. Each professor will serve as a guide to the assigned students.
- The students will finalize the institutions / companies for the internship in consultation with the guides.
- The students shall maintain a work diary which will be countersigned by the managers / authorities of the company in which the students do the internship on daily basis.
- The work diary, Work completion certificate obtained from the company and a comprehensive report on the learning outcomes will be submitted to the guides at the end of the internship.
- Viva will be conducted based on the experience of the internship in the month of August. The guide will be the internal examiner and another faculty from the same department will serve as the external examiner.

PLANT ECOLOGY AND PHYTOGEOGRAPHY
SUB.CODE: 23UBOC61

SEMSTER – VI	CORE -T7	HOURS- 5	CREDITS –4

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 : Relate to the significance of the biotic and abiotic components of the ecosystems and energy flow (K1).

CO 2 : Summarize the phytogeographical division of India(K2).

CO 3 : Explain the implication of pollution on the environment(K3).

CO 4 :Analyze the implications of functional and behavioral ecology in natural and man-made areas, biodiversity and conservation(K4).

CO 5:Develop mitigations for the effective conservation of biodiversity and disaster management products (K5).

Unit –I **(15 Hours)**

Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rainfall, and fire.Autecology and Synecology – Vegetation – Units of Vegetation – Formation, Association, Consociation, Society – development of vegetation. Migration – ecesis, colonization, Methods of study of vegetation (Quadrat and transect). Plant succession –Hydrosere and Xerosere. Ecological classification of plants: Morphological and anatomical features of plants and their correlation to the habitat factors.

Unit –II **(15 Hours)**

Structure, trophic organization; food chains and food web, energy flow in an ecosystem. Types of ecosystems: pond, forest and grassland. Ecological pyramids and Biogeochemical cycles of carbon and nitrogen and phosphorus.

Unit –III **(15 Hours)**

Plant Biodiversity and its importance. Definition, levels of biodiversity-genetic, species and ecosystem. Biodiversity: Ecosystem/community, species and genetic diversity. Endemism and hotspots, Natural resources and its conservation (*In situ* and *ex situ*). Biodiversity hotspots-Criteria, Biodiversity hotspots of India.

Unit –IV **(15 Hours)**

Pollution: Types of pollution: Primary and secondary and their impacts: Air - Green house effect, global warming, ozone depletion, acid rain, Water, soil-causes and consequences. Remedial measures – Green building. Disaster management.

Unit – V **(15 Hours)**

Phytogeography: Introduction, continuous and discontinuous distribution, Phytogeography of India, Vegentational regions of India, Plant indicators. Diversification of land plants. Speciation Changing Earth.Island Biogeography. Forest conservation, Social forestry and Participatory Management of Forest. Concept of degeneration and regeneration of plants.

Recommended Texts

1. Singh, J.S., Singh, S.P., Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
2. Sharma, P.D. 2010. Ecology and Environment. Rastogi Publications, Meerut, India.8th edition.
3. Krishna Iyer.V.R. 1992. Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,
4. Shukla, R.S and Chandel,PS.1990. Plant Ecology, S.Chand& Co. Pvt. Ltd.,
5. Krishnamurthy, K.V. 2003. An advanced text book on Biodiversity - Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publications.

Reference Books

1. Odum, E.P. 2005. Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
3. Kumar,H.D. 1990. Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
4. Smith,W.H. 1981. Air pollution and forest : Interactions between air contaminants and forest ecosystems.
5. Vickery, M.L. 1984. Ecology of Tropical plants, John Wiley and Sons.
6. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
7. Asthana, D.K and MeeraAsthana. 2006. A text book of Environmental studies. S.Chand and Company Ltd. New Delhi.
8. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
9. IUCN. 1985. The World Conservation Strategy, IUCN, Switzerland.
10. Ambasht, R.S. 2017. A textbook of plant ecology 15ed (pb 2019). CBS Publishers Distributors.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO2	3	3	2	2	3	3	1	3	3	3
CO3	2	2	3	3	1	2	1	3	1	2
CO4	3	3	3	3	3	1	3	3	3	1
CO5	3	3	2	3	1	2	3	1	1	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT BIOTECHNOLOGY AND MOLECULAR BIOLOGY
SUB.CODE: 23UBOC62

SEMSTER – VI	CORE -T8	HOURS- 5	CREDITS –4

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1 : Recognize the fundamentals concepts of plant biotechnology and genetic engineering (K1).
CO 2 : Explain various steps in transcription, protein synthesis and protein modification (K2).
CO 3 : Elucidate gene cloning and evaluate different methods of gene transfer(K3).
CO 4 : Analyze the major concerns and applications of transgenic technology(K4).
CO 5: Develop their competency on different types of plant tissue culture (K5).

Unit – I **(15 Hours)**

Biotechnology – definition, history and scope. Application of plant biotechnology in various fields.Agriculture - Biofertilizers, Biopesticides. Medicine – Antibiotics (Penicillin) Recombinant vaccines, insulin and interferons. Environment – Bioremediation and Biofuel. Industry – ethanol production (yeast), citric acid production (*Aspergillusniger*) and Proteases production (*Bacillus sps*).

Unit –II **(15 Hours)**

Plant tissue culture - introduction, scope and importance, concept of totipotency, aseptic techniques in plant tissue culture. Composition of media, types of media, sterilization, explant preparation and inoculation. Callus induction and micropropogation. Application of plant tissue culture in agriculture, horticulture and forestry.Synthetic seed technology.

Unit –III **(15 Hours)**

Vectors; plasmid, bacteriophage, viral vectors, cosmids. Restrictionenzymes. Recombinant DNA technology, gene transfer – indirect method, *Agrobacterium* mediated gene transfer. Direct method – Biolistic method. Development of transgenic plants with reference to insect resistance, Pros and cons of GM food.

Unit – IV **(15 Hours)**

Nature and function of genetic materials, Nucleic acid – base paring – Chargaff's rule, DNA – structure. Types, denaturation - renaturation.Replication of DNA in prokaryotes.RNA structure and types. DNA repair mechanism.

Unit –V **(15 Hours)**

Transcription – Enzymology – RNA polymerase – classes of RNA molecules – transcription in prokaryotes. Protein synthesis – Genetic code – characters – codons and anticodons. Gene regulation in Prokaryotes – *lac* operon and *trp* operon

Recommended Texts

1. Bhajwani, S and Razdan, 1984. Plant tissue culture.Theory and practice.
2. Verma P.S and Agarwal V.K. 2010.Molecular Biology.S Chand Publishers.
3. Ignacimuthu, S.J. 2003. Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
4. Bhojwani, S.S and Razdan, M.K. 2004. Plant Tissue Culture, Read Elsevier India Pvt. Ltd.
5. Purohit, S.S. 2010. Plant tissue culture, Student edition, Jodhpur.

6. Bajaj, Y.P.S. 1987. Biotechnology in agriculture and forestry.Springer – Verlag.

Reference Books

1. Bernard R Glick and Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishing House, New Delhi.
3. Ernst L. Winnaccker. 2002. From Genes to Clones-introduction to gene technology, VCR Pub., Weintein.
4. James, D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
5. Maniatis and Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III, Coldspring Harbor Laboratory Press, New York.
6. Old, RW and Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.
7. Halder, T and Gadgil, V.N.1981. Plant cell culture in crop improvement.Plenum, New York.
8. Neuman, K.H., Barz, W and E. Reinhard. 1985. Primary and secondary metabolism of plant cell cultures – Springer – Verlag, Berlin.
9. Barz, W., Reinhard, E and Zenk, M.H. 1977. Plant tissue culture and its biotechnology application – Springer – Verlag, Berlin.
10. Hu, C.Y and P.J.Wang. 1984. Handbook of plant cell culture Vol.1. Mac million, New York.
11. Hammond, J.C. McGarvey and V. Yusibov. 2009. Plant Biotechnology, Springer Verlag. New York.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO2	3	3	2	2	3	3	2	3	2	2
CO3	3	2	3	3	2	1	2	1	3	3
CO4	3	3	3	3	3	2	3	2	3	3
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY
SUB.CODE: 23UBOC63

SEMSTER – VI	Core-T9	HOURS- 5	CREDITS –4

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 : Relate to water relation of plants with respect to various physiological phenomenon (K1).
CO 2 : Explain the process and significance of photosynthesis and respiration (K2).
CO 3 : Elucidate properties of nutrients and their deficiency symptoms in plants(K3).
CO 4 : Analyze the biological role of plant growth regulators, carbohydrates, proteins, lipids, nucleic acids and enzymes(K4).
CO 5: Decipher the phenomenon of seed dormancy and germination in plants (K5).

Unit I- WATER RELATIONS (15 Hours)

Properties of water—imbibition, diffusion, osmosis and plasmolysis - ascent of sap, mechanism of water absorption – active and passive, apoplast and symplast pathway. Transpiration – types and factors affecting transpiration and significance. Opening and closing of stomata- mechanisms and theories of transpiration.

Unit II – PHOTOSYNTHESIS (15 Hours)

Radiant energy,Photosynthetic unit, photosynthetic pigments and their role, photo systems, path of carbon in photosynthesis - Light reaction, electron transport system in the chloroplast (Z-Scheme). Dark reaction - C3 cycle, C4 cycle, CAM pathway, Photorespiration

Unit III –RESPIRATION&NITROGEN METABOLISM (15 Hours)

Aerobic, Glycolysis, Krebs Cycle, Electron Transport System, oxidative phosphorylation, respiratory quotient, Anaerobic- fermentation - Respiratory quotient. Nitrogen Metabolism **-** Biological nitrogen fixation, nitrogen cycle.

Unit IV- GROWTH&STRESS PHYSIOLOGY (15 Hours)

Growth – plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscisic acid) - Practical applications - Photo morphogenesis – photoperiodism – vernalization – dormancy- phytochromes.Stress Physiology**:** Concepts of plant responses to stress (water, salt, temperature).

Unit V- BIOCHEMISTRY (15 Hours)

Classification, properties and biological role of carbohydrates, proteins, lipids and nucleic acids. Enzyme – properties – classification – nomenclature of enzymes – mode of enzyme action – factors influencing enzyme action.

Recommended Texts

1. Noggle and Fritz. 1976. Introductory Plant Physiology, Prentice Hall, New Delhi.
2. Pandey, SN and Sinha, BK. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi.
3. Robert M. Devlin. 1970. Plant Physiology, East West Press, New Delhi.
4. Westhoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK. Jain, JL. 1979. Fundamentals of Biochemistry, Chand & Co. Ltd., New Delhi.

5. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
6. Conn, E and Stumpf, PK. 1979. Outline of Biochemistry NileyEasdtern Ltd., New Delhi.
7. Metz, E.T. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay.
8. Verma,V. 2008. Textbook of plant Physiology, Ane's student edition, New Delhi.

Reference Books

1. Buchanan, B.B., Gruissem, W and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A and Libbenga, K.R. (eds). 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, NewYork, USA.
7. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
8. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
9. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D and Govindjee. 1999. Concepts in Photobiology: Photosynthesis and Photo morphogenesis. Narosa Publishing House, New Delhi.
10. Taiz, L and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc. Publishers, Massachusetts, USA.
11. Thomas, B and Vince-Prue, D. 1997. Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	2
CO2	3	3	2	2	3	3	2	3	2	3
CO3	2	2	3	3	1	2	1	3	1	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT ECOLOGY AND PHYTOGEOGRAPHY – PRACTICAL VIII
SUB.CODE: 23UBOC64

SEMSTER – VI	CORE – P7	HOURS- 3	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1 :Relate to the distribution and adaptions of plants pertaining to their habitat(K1).

CO 2 :(K2).Analyze the implications of functional and behavioral ecology in natural and man-made areas, biodiversity and conservation.

CO 3 : (K3).Develop mitigations for the effective conservation of biodiversity and disaster management.To know implication of pollution on the environment.

CO 4 : (K4).To understand the energy flow in ecosystem.

CO 5: (K5).To familiarize with the phytogeography of southern India.

EXPERIMENTS

1. Study of morphological and anatomical adaptations of locally available hydrophytes, xerophytes, mesophytes and halophytes and correlate to their particular habitats.

   Hydrophytes :*Nymphaea, Hydrilla*
   Xerophytes : *Nerium, Casuarina*
   Mesophytes :*Tridax, Vernonia*
   Halophytes : *Avicennia, Rhizophora*
   Epiphytes : *Vanda*
2. Map of the phytogeographical regions of India.
3. Quadrate study and line transect.

Recommended Texts

1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
2. Bendre, A.M. and Ashok Kumar, 2009. A text book of practical Botany.Vol.I & II. Rastogi Publication. Meerut.9th Edition.

Reference Books

1. Mick Crawley. 1996. Plant Ecology, 2nd Edition Wiley-Blackwell.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO2	3	3	2	2	3	3	1	3	3	3
CO3	2	2	3	3	1	2	1	3	1	2
CO4	3	3	3	3	3	1	3	3	3	1
CO5	3	3	2	3	1	2	3	1	1	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PLANT BIOTECHNOLOGY AND MOLECULAR BIOLOGY PRACTICAL -IX
(SUB.CODE: 23UBOC65)

SEMSTER – VI	CORE – P8	HOURS- 3	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 :Recognize the fundamentals concepts of plant biotechnology and genetic engineering(K1).
CO 2 : Demonstrate skills in green planning and callus culture (K2).
CO 3 :Elucidate gene cloning and evaluate different methods of gene transfer.(K3).
CO 4 :Analyze the major concerns and applications of transgenic technology.(K4).
CO 5: Develop their competency on different types of plant tissue culture. (K5).

Demonstration

1. Sterilization techniques in plant tissue culture.
2. MS - Media preparation.
3. Explant sterilization, Callus induction, Plantlet, hardening.

Photographs

1. DNA Structure
2. tRNA
3. DNA – Replication
4. DNA – Repair
5. Genetic code etc.

Recommended Texts

Bhojwani, S.S and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam.The Netherlands.

Reference Books

Gamborg, O.L and G.C. Phillips (eds). 1995. Plant cell, tissue and organ culture. Springer Lab Manual.

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY – PRACTICAL X
SUB.CODE: 23UBOC66

SEMSTER – VI	CORE-P6	HOURS- 3	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1 :Relate to water relation of plants with respect to various physiological phenomenon.(K1).

CO2 :Explain the process and significance of photosynthesis and respiration.(K2).

CO3 : Elucidate the basic principles involved in the plant physiology and biochemistry experiments (K3).

CO4 :Analyze the biological role of plant growth regulators, carbohydrates, proteins, lipids, nucleic acid (K4).

CO5: Estimate the biochemical components and determine the factors controlling photosynthesis and transpiration of plants (K5).

EXPERIMENTS

1. Determination of water potential by plasmolytic method.
2. Effect of chemicals on membrane permeability.
3. Effect of environmental factors on rate of transpiration by gravimetric method.
4. Separation of plant pigments by paper chromatography.
5. Study of rate of photosynthesis under different wavelengths (red & blue) of light.
6. Comparison of rate of respiration of different respiratory substrates.
7. Measurement of pH of expressed cell sap and different soils using pH meter.
8. Biochemical test for carbohydrates, proteins and lipid, pigments, proteins, phenols, lipids**.**

Demonstration – Experiments

1. Study the rate of transpiration by using Ganong's photometer
2. Demonstration of stomatal movement.
3. Induction of roots in leaves by auxins.

Recommended Texts

1. Plummer, D.1988.An introduction to Practical Biochemistry, TataMcGraw–HillPublishing Company Ltd., New Delhi.
2. Palanivelu, P.2004. Laboratory Manual for analytical biochemistry and separation Techniques, School of Biotechnology, Madurai Kamaraj University, Madurai.
3. Jayaraman.J.1981.Laboratory Manual in Biochemistry.Whiley Eastern Limited,NewDelhi.
4. Bendre, A.M. and Ashok Kumar, 2009.A text book of practical Botany.Vol.I&II.Rastogi Publication. Meerut. 9th Edition.

Reference Books

1. Bala, M., Gupta, S., Gupta, N.K and Sangha, M.K. 2013. Practicals in plant physiology and biochemistry. Scientific Publishers (India).
2. Wilson, K and J.Walker (Eds).1994.Principles and Techniques of Practical Biochemistry (4th Edition) Cambridge University Press, Cambridge.
3. Bendre,A.Mand Ashok Kumar.2009.A text book of practical Botany.Vol.I & II.Rastogi Publication. Meerut.9th Edition
4. .Manju Bala,Sunita Gupta, Gupta, N.K.2012. Practicals in Plant Physiology and Biochemistry. Scientific Publisher.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	1
CO2	3	3	2	2	3	3	2	3	3	2
CO3	2	2	3	3	1	2	1	2	2	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

PROJECT WITH VIVA VOCE
SUB.CODE: 23UBOC67

SEMESTER – VI	PROJECT	HOURS- 4	CREDITS – 1

Structure of the Project Report

1. Cover Page
2. Certificate
3. Declaration
4. Acknowledgement
5. Chapter-I Introduction
6. Chapter-II
7. Chapter-III
8. Chapter-IV
9. Chapter-V Conclusion and Scope for further research

Assessment

Internal : 100 Marks

External : 100 Marks

HORTICULTURE

SUB.CODE: 23UBOE61

SEMSTER – VI	EC-T6	HOURS- 4	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1: Enumerate the concepts in horticulture and nursery management. (K1)

CO 2: Demonstrate a working knowledge on biology of soil, compost making, designing and planning of garden, pest, diseases and nutrient management practices. (K2)

CO 3: Appraise the importance of floriculture and evaluate the contribution of spices and condiments on economy.(K3)

CO 4: Analyze different methods of weed control in horticultural crops.(K4)

CO 5: Develop their competency on pre and post-harvest technology in horticultural crops.(K5 & K6)

Unit I **(12 Hours)**

Importance and scope of horticulture. Classification of horticultural crops –fruits and vegetables. Essentials of nursery Management **-** Soil management: Garden soil, Physical and chemical properties of soil, Organic matter, Compost, Cultural practices; Water management: Water quality, Irrigation, Mulching. Nursery structures**:** Protected cultivation (greenhouses), environment controls.

Unit II **(12 Hours)**

Hydroponic culture**-**types of container. Use of manures and fertilizers in Horticultural crop production. Principles of organic farming. Environmental factors influencing vegetable and fruit production.

Unit III **(12 Hours)**

Horticultural crop protection; physical control - pruning. Chemical control- pesticides, fungicides. Plant propagation **-** cutting, layering, budding, grafting. Types of gardens: formal, informal, kitchen and Terrace. Indoor gardening-bottle garden. Floriculture, ornamental gardening.

Unit IV **(12 Hours)**

A brief account of annual, biennials and perennials with reference to ornamental gardens. Green house, terrarium, water garden, rockery plants, bonsai techniques. Landscaping, principles and basic components.

Unit V **(12 Hours)**

Technology of horticultural crops **-** market preparation: harvesting and handling, packaging and transport, storage; chemical treatment. Economics of cultivation Crops: Cardamom, pepper, clove. Food processing - freezing, bottling and canning, drying and chemical preservation.

Recommended Texts

1. Hartmann, H.T and D.E. Kester. 1989. Plant propagation – principles and practices. Half of India. New Delhi.
2. Bose, T.K and Mitra and Sadhu. 1991. Propagation of tropical and subtropical horticultural crops. Naya Prakash.

3. Singh, S.P. 1989. Mist propagation Metropolitan book Co., New Delhi.
4. Chadha, K.L. 1986. Ornamental horticulture in India ICAR, Krishi Bhavan, New Delhi.
5. Bose, T.K and Mukharjee, D. 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
6. Gopalswamy Iyyangar. 1970. Complete gardening in India, Kalyan Printers, Bangalore.
7. Rangaswami, G and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi

Reference Books

1.Arditti, A. 1977. Orchid biology, Gornell Univ., Press. Ithaca.
2. Bailey, S. 1971. Perpectual flowering carnation, Fabner and Fabner, London.
3. Laurie, A., Kiplingr, D.D and Nelson, K.S. 1968. Commercial flower forcing. Mc Graw-Hill Book, London.
4. Cumming, R.W. 1964. The chrysanthemum Book. D.Van., Nostrand Inc.
5. Biswas, T.D. 1984. Rose growing – Principles and Practices – Assoc., Pub., Co., New Delhi.
6. Hartman, H.T and Kester, D.E. 1989. Plant propagation. Printice Hall Ltd., New Delhi.
7. Abraham, A and Vatsala, P. 1981. Introduction to Orchids. Trop. Bot. Garden, Trivandrum.
8. Bose, T.K and Yadav, L.P. 1989. Commercial flowers. Naya Prakash, Calcutta.
9. Mc Daniel, G.L. 1982. Ornamental horticulture. Reston Publ., London. Helleyer, A. 1976. The Collingridge Encyclopedia of gardening Chartwell Book, Inc., New Jercy.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	2	1	2	2	2	1
CO2	3	3	2	1	1	3	1	3	1	3
CO3	2	2	3	3	1	2	2	3	1	2
CO4	3	3	2	2	3	2	3	1	3	2
CO5	3	3	2	3	1	3	2	3	1	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

FORESTRY

SUB.CODE: 23UBOE61

SEMSTER – VI	EC-T6	HOURS- 4	CREDITS –2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1: Relate to the basic concepts related to forest distribution, degradation, protection, management and resource utilization. (K1)

CO 2: Understand complex interactions of humans and forest ecosystems in a global context. (K2)

CO 3: Demonstrate skills for ecological measurements and interpretation of forest ecology management. (K3)

CO 4: Examine and decipher the factors influencing forest vegetation, forest degradation and methods of wood preservation. (K4)

CO 5: Develop new strategies and apply the knowledge gained for problem-solving analysis in the conservation and management of forest ecosystems.(K5 & K6)

Unit I **(12 Hours)**

SILVICULTURE: Forests - definition. Extent of forests in India and other countries. Forest types of India and Tamil Nadu - revised classification - pure and mixed stands - even and uneven aged stands. Role of forests. Factors of locality - climatic - edaphic - topographic - biotic - interaction of forest with the environment. Silviculture - objectives - scope - general principles. Regeneration - natural and artificial. Nursery techniques - containerized seedling production - techniques and methods. Vegetative and clonal propagation techniques and methods - macro and micro propagation techniques.

Unit II **(12 Hours)**

FOREST MENSURATION AND MANAGEMENT: Forest Mensuration - Definition and objectives. Measurement of diameter, girth, height, crown and volume of trees - methods and principles - tree stem form - form factor. Volume estimation of stand - age - basal area determinations Stem and Stump Analysis. Forest inventory - sampling techniques and methods - measurement of crops - sample plots. Yield calculation - CAI and MAI - volume, yield and stand tables preparation.

Unit III **(12 Hours)**

FOREST UTILIZATION AND WOOD TECHNOLOGY: Logging - extraction of timber - felling rules and methods - conversion methods - conversion season. Implements used - cross cutting system - sawing - different types - extraction methods. Grading of timbers. Transportation of timbers - major and minor transportation methods Storage and sales of logs - sales depot - management of depots. Recent trends in logging - Ergonomics and RIL. Forest products - Timber - timber, fuel, pulp, paper, rayon and match. Wood Composites - plywood, particle board, fiber boards, MDF, hardboard, insulation boards - production technology. Non timber forest products (NTFP) - collection - processing and storage of NTFP - fibres and flosses - bamboos and canes - katha and bidi leaves - essential oils and oil seeds - gums and resins - tans and dyes - drugs - insecticides - lac and shellac - tassar silk - role of tribal co-operative societies.

Unit IV **(12 Hours)**

FOREST BIOLOGY AND BOTANY: Forest ecology - definition - biotic and abiotic components - forest ecosystem - forest community - concepts - succession - primary productivity - nutrient cycling. Composition of forest types in India - classification of India's forests - species composition - association and diversity. Restoration ecology - global warming - green house effects - ozone layer depletion - acid rain - role of trees in environmental conservation. Biodiversity - Definition, origin, types - factors endangering biodiversity - biodiversity hotspots - endemism - Red Data Book. Biodiversity assessments - principles and methods.

Unit V **(12 Hours)**

AGRO FORESTRY AND SOCIAL FORESTRY: Agro forestry - definition, concept and objectives. Classification of agro forestry systems - primary systems and subsystems - inheritance effects. Tree-crop interactions - above and below ground - competition for space, water, light and nutrients. Microclimatic modifications - nutrient cycling and soil fertility improvement - Allelopathy and allelochemicals. - JFM - principles, objectives and methodology - choice of species for agro forestry and social forestry. Urban Forestry - definition and scope - benefits - choice of tree species - planting techniques and management.

Recommended Texts

1. Manikandan, K and S. Prabhu. 2013. Indian forestry, a breakthrough approach to forest service. Jain Bros.
2. Roger Sands. 2013. Forestry in a global context, CAB international.
3. Balakathiresan. S.1986. Essentials of Forest Management. Natraj Publishers, Dehradun.
4. Agarwala, V.P. 1990. Forests in India, Environmental and Protection Frontiers. Oxford & IBH Publishing Co. New Delhi.
5. Chundawat, B.S. and Gautham, S.K. 1996. Text book of Agro forestry. Oxford and IBH publisher, New Delhi.
6. Singhi, G.B. 1987. Forest Ecology of India, Publisher: Rawat.
7. Ramprakash. 1986. Forest management. IBD Publishers, Debra Dun.
8. Tiwari, K.M. 1983. Social forestry in India. Nataraj Publishers, Dehra Dun.
9. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, New Delhi.
10. Nair, N.C and Henry, A.N. 1983. Flora of Tamilnadu, India. Series: 1, Analysis, Vol.1. BSI, Coimbatore, India.

Reference Books

1. Donald L. Grebner.Jacek P. Siry and Pete Bettinger. 2012. Introduction to forestry and Natural resources Academic press
2. West, P.W. 2015. Tree and forest measurement, Springer international publishing Switzerland.
3. Kollmann, F.F.P and Cote, W.A. 1988. Wood science and Technology. Vol. I & II Springer Verlag, New York.
4. Agarwala,V.P.1990.Forests in India, Environmental and Protection Frontiers. Oxford IBH Publishing Co.,New Delhi.
5. Belcher,B.M.1998.Aproduction-to-consumption systems approach: Lessons from the bambooandrattansectorsinAsia.In:Wollenberg,EandA.Ingles(Eds.).Incomes from the forest: methods for the development and conservation of forest products for local communities. Center for International Forestry Research (CIFOR), Bogor, Indonesia.

6. Chomitz, K.M., with P. Buys, G. De Luca, T.S. Thomas, and S. WertzKanounnikoff.2007.Incentives and constraints shape forest outcomes. In: Atloggerheads? Agricultural expansion, poverty reduction and environment in tropical forests. The World Bank, Washington, DC.
7. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	3	2	3	3	2
CO2	3	3	3	3	2	3	1	1	3	1
CO3	3	3	3	2	3	3	3	3	3	3
CO4	3	2	3	1	2	3	1	2	3	1
CO5	3	2	1	3	1	1	2	3	1	2

S-Strong (3) M-Medium (2) L-Low(1)

NURSERY AND LANDSCAPING

SUB.CODE: 23UBOEC1

SEMESTER – I	ECC - 1	CREDITS – 2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1: Recognize the basic principles and components of gardening.(K1)

CO 2: Explain about bio-aesthetic planning and conceptualize flower arrangement.(K2)

CO 3: Apply techniques for design various types of gardens according to the culture and art of bonsai.(K3 & K6)

CO 4: Compare and contrast different garden styles and landscaping patterns. (K4)

CO 5: Establish and maintain special types of gardens for outdoor and indoor landscaping.(K5 & K6)

UNIT I

Introduction, prospects and scope of nursery and landscaping.

UNIT II

Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

UNIT III

Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

UNIT IV

Nursery structures – Green house – Shade house, Mist chamber – Topiary, Bonsai culture.

UNIT V

Manures, composting – vermicomposting

Reference books

1. Amarnath V. 2006. Nursery and Landscaping, M/s IBD Publishers, New Delhi.
2. Butts, E and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
5. Butts, E. and Stensson, K. 2012.Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	3
CO2	3	3	2	2	3	3	2	2	2	2
CO3	2	2	3	1	1	1	1	3	3	1
CO4	3	2	2	1	3	2	1	3	2	1
CO5	3	3	2	3	2	1	2	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

HERBAL MEDICINE
SUB.CODE:23UBOEC2

SEMESTER – II	ECC -2		CREDITS – 2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO 1: Define and describe the principle of cultivation of herbal products. (K1)
CO 2: Explain about the phytochemistry of economically important medicinal herbs (K2)
CO 3: Apply techniques for evaluation of drug adulteration through biological testing.(K3)
CO 4: Formulate the value added processing / storage / quality control for the better use of herbal medicine.(K4)
CO 5: Develop the skills for cultivation of plants and their value added processing/storage/quality control. (K5 & K6)

UNIT - I

Importance and Relevance of Herbal drugs in Indian System of Medicine, Pharmacognosy – Aim and scope.

UNIT - II

Medicinal gardening – Gardens in the Hills and plains; House gardens; plants for gardening – Poisonous plants – Types of plant poison; action of poisons; treatment for poisons, some poisonous plants; their toxicity and action.

UNIT - III

Adulteration of crude drugs and its detection – methods of adulteration; types of adulteration.Medicinal plants of export values; rejuvenating herbs; Medicinal uses of Non-flowering plants.

UNIT - IV

Botanical description and active principles of Root drugs; Rhizomes woods and bark drugs (Two examples for each plant organs).

UNIT - V

Botanical description and active principles of leaves; Flowers; Fruits seed and entire plants as drugs. Taxonomic study of some selected herbals (Two examples for each plant organs).

Recommended Texts

1. Somasundaram, S. 1997. Medicinal botany (Maruthuvar Thavaraviyal) – (Tamil Medium Book).
2. Wallis, T.E. 1967. Text Books of Pharmacognosy. J. & A. Churchill Ltd., London,
3. Jains, S.K.. 1996. Medicinal Plants. Deep Publications, New Delhi.
4. Srivastava, A.K. 2006, Medicinal Plants, International Book Distributors, Dehradun.
5. Agarwal,O.P. 1985, Vol. II, Chemistry of organic – natural products. S Chand & Company, New Delhi.
6. Gamble, J.S. and Fisher, 1921, CEC I, II, III Flora of the Presidency, Madras Volumes. Mathew K.M., 1988, Flora of the Tamilnadu and Carnatic.

Reference Books

1. Nair, N.C and Henrry, A.N. 1983, Flora of Tamil Nadu, India, Botanical Survey of India.
2. Chopra, R.N., Nagar S.L., and Chopra, I.C. 1956, Glossary of Indian Medicinal Plants.
3. Chopra, R.N., Chopra, I.C., Handa, K.L., and Kapur L.D., 1994, Indigenous drugs of India.
4. Chopra, R.N., Badhuvar R.L and Gosh, G. 1965. Poisonous plants in India.
5. Miller, L and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. *Motilal Banarsidass*, *Fourth edition.*
6. Patri, F and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	2	1	2	1	3	2	1
CO2	3	3	2	1	1	2	2	2	2	2
CO3	2	2	1	3	1	2	1	3	2	1
CO4	3	2	1	2	1	2	3	3	2	3
CO5	3	3	2	2	1	1	3	3	1	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

AQUATIC BOTANY
SUB.CODE:21UBOEC3

SEMESTER – III	ECC - 3		CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO 1: Recognize aquatic plants and their ecological importance.(K1)
CO 2: Explain about commonly occurring marine and limnetic algae of the Indian coasts.(K2)
CO 3: Apply techniques for conservation of aquatic plants for value addition.(K3)
CO 4: Analyze and decipher the significance and properties of mangroves, other aquatic Angiosperms and microalgae.(K4)
CO 5: Develop new strategies to conserve mangroves and device innovative methods for cultivation of aquatic plants.(K5 & K6)

UNIT - I
MARINE AND LIMNETIC MACRO ALGAE: Common seaweeds of Indian subcontinent: *Ulva, Caulerpa, Sargassum, Gracilaria,* etc. Common terrestrial algae, including cyanobacteria and lichen photobionts of Indian subcontinent and its life cycle, ecology and taxonomy: *Anabaena, Chlorella*, *Scenedesmus.*

UNIT - II
MANGROVES: Mangrove forests of India, including Sundarbans, Pichavaram, Kerala mangroves, Rathnagiri mangroves. Common species of mangroves and mangrove associated plants, including *Avicennia, Rhizophora, Acanthus* and*Aegiceras*. Ecological significance of mangroves.

UNIT - III
PHYTOPLANKTONS, CYANOBACTERIA, DINOFLAGELLATES AND DIATOMS: Common marine microalgae of India, including phytoplanktons and picoplanktons, Common diatoms and dinoflagellates of Indian Ocean, Common limnetic and terrestrial cyanobacteria of India.

UNIT - IV
AQUATIC ANGIOSPERMS: Common aquatic angiosperms of India, including Lotus, Water Lilly, Water hyacinth.Ecology, life cycle, taxonomy and economic importance of aquatic angiosperms.

UNIT - V
VALUES AND USES OF AQUATIC PLANTS: Economic importance of aquatic plants, Ecosystem services of aquatic plants, including biogeochemical cycles, oxygen production and carbon sequestration and so on, edible seaweed and algal resources of India, aesthetic, cultural, spiritual importance of aquatic plants.

Recommended Texts

1. Lee, R.E. 2008. Phycology. 4th edition. Cambridge University Press, Cambridge.
2. Wile, J.M, Sherwood, L.M and Woolverton, C.J. 2013.. Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.

4. Hoek, C. Van, D. 1999. An Introduction to Phycology. Cambridge University Press.
5. Daubenmire, R.F.1973. Plant and Environment. John Willey.
6. Sharma, J.P.2004. Environmental Studies, Laxmi Publications (P) Ltd. New Delhi.
7. Bast, F. 2014. Seaweeds: Ancestors of land plants with rich diversity. Resonance, 19(2) 1032-1043 *ISSN*: 0971-8044.

Reference Books

1.Kathiresan, K and S.Z. Qasim 2005. Biodiversity of Mangrove Ecosystems. Hindustan Lever Limited.
2. Allan, J.D. and Castillo, M.M. 2009. Stream Ecology (Second Ed.).Springer, Netherlands.
3. Barnes, R.S.K. 1974. Fundamentals of Aquatic Ecosystems, (R.S.K. Barnes & K.H. Mann, eds.), Blackwell Sci. Publ., London, 229 pp.
4. Bennet, G.W. 1971 Management of Lakes and Ponds. Von Nostrand Reinhold Co.,NY.375 pp.
5. Goldman, C.R. & A.J. Horne 1983. Limnology. McGraw Hill Internat.Book.Co.Tokyo,464 pp.
6. Boney, A.D., 1975. Phytoplankton. Edward, Arnold, London.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	2	1
CO2	3	2	1	1	2	3	2	3	2	3
CO3	2	2	3	1	1	2	1	3	1	2
CO4	3	3	3	3	3	2	1	2	3	2
CO5	3	2	1	1	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ORGANIC MANURES AND BIOPESTICIDES
SUB.CODE:23UBOEC4

SEMESTER – IV	ECC - 4	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO 1: Understand the scope and concepts of organic farming in India
CO 2: Experiment various methods of preparation of organic manures and biofertilizers
CO 3: Manage indigenous pest and weed for organic farming.
CO 4: Understand the certification process for organic farm produces
CO5: Develop entrepreneur skills and ideas to practice organic farming

Unit-I

Definition – Principle, Aims and objectives of organic farming. History – organic farming concepts – Needs of organic farming and sustainable agriculture. SWOT analysis of organic farming. Organic farming in India – PKVY.

Unit-II

Composting: Organic manure, Farmyard manure (FYM) preparation. Compost process, phase, requirements and microorganism in composting, Methods of composting (Bangalore, Indore, Coimbatore, NADEP methods).

Unit-III

Vermicompost and vermiculture, Importance, benefits, Methods of vermicomposting, Preparation and management of vermicompostunit.Vermiwash Preparation and its uses.Biofertilizers, Importance, classification and benefits of biofertilizers (*Azospirillum, Azotobacter, Rhizobium*, PSB, VAM etc.,)

Unit-IV

Green manuring, Classification of green manures (GM), advantages of GM, Desirable characteristics of leguminous GM crops.; Organic liquid manure - Beejamrita, Jivamrit, Panchakavya and Dasakavya. Biodynamic manure – cow horn manure – cow horn silica – preparation of cow pat pit manure (CPP).

Unit-V

Biopesticides and Bioherbicides (mycoherbicides).Weed management in organic farming,Different methods of weed management, Biological weed control. Organic certification:Types of certification, Certification process and procedure.

Text Books

1. Palaniappan, S.P and Annadurai, K. (1999) Organic Farming – Theory and Practice. Scientific Publ.
2. Sharma, A. (2002) Hand Book of Organic Farming. Agrobios.
3. Dushant G. 2012. Organic farming – components and management, Bharat printers, Jodhpur

References

1. Ananthakrishnan, T. N. (ed.) (1992) Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.

2. Gaur, A.C. (1982) A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
3. Lampkin, N. (1990) Organic Farming. Press Books, lpswitch, UK.
4. Veeresh, G. K, Shivashankar, K. and Singlachar, M. A. (1997) Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
5. Dahama AK. 2005. Organic Farming for Sustainable Agriculture. 2nd Ed. Agrobios.
6. Gehlot G. 2005. Organic Farming; Standards, Accreditation Certification and Inspection.Agrobios.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	3	1	3	1
CO3	3	3	3	3	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	1	3	1
CO5	3	3	3	3	3	3	3	1	3	1

S-Strong (3) M-Medium (2) L-Low(1)

GLOBAL CLIMATE CHANGE

SUB.CODE:23UBOEC5

SEMESTER – V	ECC - 5	CREDITS – 2

Course Outcomes:

Upon completion of the courses, the students will be able to

CO1: To gain insights on the impact of greenhouse effect on global climate change and mitigation measures.(K1)

CO2: To understand the implications of carbon and ecological footprint.(K2)

CO3: To apply the knowledge to green house effects.(K3)

CO4: To know the rain and its effects on plants.(K4)

CO5: To know about Global Environmental change issues.(K5)

Unit I

Global Environmental change issues. UNFCC, IPCC, Koyoto protocol, CDM, Carbon footprint and ecological footprint.

Unit II

Stratospheric ozone layer: Evolution of ozone layer; Causes of depletion and consequences; Effects of enhanced UV-B on plants, microbes, animals, human health and materials; Global efforts for mitigation ozone layer depletion.

Unit III

Climate change: Green house effects; causes; Green house gases and their sources; Consequences of climate, oceans, agriculture, natural vegetation and humans; International efforts on climate change issues.

Unit IV

Atmospheric deposition: Past and present scenario; Causes and consequences of excessive atmospheric deposition of nutrients and trace elements; Eutrophication.

Unit V

Acid rain and its effects on plants, animals, microbes and ecosystems.

Recommended Texts:

1. Adger, N. Brown, K and Conway, D. 2012. Global Environmental Change: Understanding the Human Dimensions. The National Academic Press.
2. Turekian. K. K. 1996. Global Environmental Change-Past, Present, and Future.Prentice-Hall.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. NeerajNachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.

Reference Books:

1. Matthew. R.A. 2009. Jon Barnett, Bryan McDonald. Global Environmental Change and Human Security.MIT Press., USA.
2. Hester, R.E and Harrison, R.M. 2002. Global Environmental Change.Royal Society of Chemistry.

3. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences.2nd ed. Cambridge University Press.ISBN.978-1107114234.
4.Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
Kormondy, E.J. 2017.Concepts of Ecology.Prentice Hall, U.S.A. 4th edition.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO2	3	2	1	2	3	3	2	3	1	2
CO3	2	2	3	1	1	2	3	2	3	1
CO4	3	3	3	2	1	1	3	2	3	2
CO5	3	2	2	3	2	3	1	2	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

FERMENTATION TECHNOLOGY
SUB.CODE: 23UBOEC6

SEMESTER – VI	ECC – 6	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1	**:**	Enumerate the significance of industrially useful microbes (K1).
CO2	**:**	Explain the design and operation of industrial practices in mass production of fermented products (K2).
CO3	**:**	Explain the process of maintenance and preservation of microorganisms (K3).
CO4	**:**	Analyze the various aspects of the fermentation technology and apply for fermentative production. (K4).
CO5	**:**	Validate the experimental techniques for microbial production of enzymes: amylase and protease, bio product recover (K5).

Unit I
Preparation of microbial culture, Preparation and sterilization of fermentation media.Isolation and improvement of industrially important microorganisms.

Unit II
Maintenance and preservation of microorganisms, Metabolic regulations and overproduction of metabolites. Kinetics of microbial growth and product formation.

Unit III
Scope and opportunities of fermentation technology. Principles of fermentation: Submerged, solid state, batch, fed-batch and continuous culture.

Unit IV
Fermentative production of vinegar, alcohol (ethanol, wine, beer), acids (citric acid and gluconic acid), amino acids (lysine and glutamic acid) and antibiotics (penicillin and streptomycin).

Unit V
Microbial production of enzymes: Amylase and Protease. Bioproduct recovery.

Recommended Texts

1. Waites M.J. 2008. Industrial Microbiology: An Introduction, 7th Edition, Blackwell Science, London, UK.
2. Prescott S.C., Dunn C.G., Reed G. 1982. Prescott & Dunn's Industrial Microbiology, 4th Edition, AVI Pub. Co., USA.
3. Reed G. 2004. Prescott & Dunn's industrial microbiology, 4th Edition, AVI Pub. Co., USA.
4. JR Casida L.E. 2015. Industrial Microbiology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, India.
5. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. 2001. Industrial Microbiology: An Introduction. 1st Edition, Blackwell Science, London, UK.
6. Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books

1. Peter F Stanbury, Allan Whitaker, Stephen J Hall. 2016. Principles of Fermentation Technology. Butterworth-Heinemann Press. UK.
2. Peppler, H. J. D. Perlman. 2014. Microbial Technology: Fermentation Technology. Academic Press.
3. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. Second Edition. 2006. CRC Press, USA.
4. Hongzhang Chen. Modern Solid State Fermentation: Theory and Practice. 2013. Springer Press, Germany.
5. John E. Smith. Biotechnology. 2009. Cambridge University Press.UK.
6. Celeste M. Todaro, Henry C. Vogel. 2014. Fermentation and Biochemical Engineering Handbook. William Andrew Press. Norwich, NY.
7. Lancini, G. R. Lorenzetti. 2014. Biotechnology of Antibiotics and other Bioactive Microbial Metabolites. Springer publications, Germany.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	2
CO2	3	3	2	2	1	2	3	2	2	3
CO3	2	2	3	1	1	1	2	3	1	2
CO4	3	3	2	1	3	2	1	3	2	1
CO5	3	3	2	1	2	2	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

MUSHROOM CULTIVATION
SUB.CODE:23UBOVA1

SEMESTER – II	VA -1	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to

CO1 : To learn and develop skills in mushroom cultivation in scientific way (K1)
CO2 : To understand and appreciate the role of mushrooms in Nutrition, Medicine and health and the importance of embarking on self-employment (K2)
CO3 : To cultivate mushroom cultivation in small scale industry and work out the economics of mushroom cultivation (K3).
CO4 : To learn about diseases and post-harvest technology and identify business opportunities in chosen sector (K4).
CO5 : To study new methods and strategies to contribute to mushroom production and plan and market value added products (K5).

Unit I

Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms. History of mushroom cultivation.

Unit II

Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry. Present status of the mushroom industry in India. Nutritional and medicinal values of mushrooms.

Unit III

Cultivation techniques of *Pleurotus* spp. (Oyster mushroom), *Volvariella* volvacea (Paddy straw mushroom), *Calocybe indica* (Milky mushroom) and *Agaricus*spp.(Button mushroom). Construction of mushroom shed and preparation of mushroom bed.

Unit IV

Spawn production, growth media, spawn running and harvesting of mushrooms and marketing. Costs benefit analysis of mushroom cultivation.

Unit V

Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases. Preservation of mushrooms – freezing, dry freezing, drying, canning, quality assurance and entrepreneurship. Value added products of mushroom.

Recommended Texts:

1. Handbook of Mushroom Cultivation. 1999. TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
5. Verma, 2013.Mushroom: edible and medicinal: cultivation conservation, strain improvement with their marketing. Daya Publishing House.

Reference Books:

1. Handbook of Mushroom Cultivation. 1999. TNAU publication.
2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4. Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
6. Singh, R. and Singh, U.C. 2020. Modern mushroom cultivation, 3rd Edition, Agrobios (India), Jodhpur.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	3	2	1	2	2
CO2	3	1	1	2	1	3	2	3
CO3	2	1	1	3	1	2	1	3
CO4	3	3	3	3	1	2	3	3
CO5	3	3	2	1	1	1	3	3

S-Strong (3) M-Medium (2) L-Low(1)

PLANT TISSUE CULTURE AND GARDENING
SUB.CODE:23UBOVA2

SEMESTER – II	VA -2	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO:1 To familiarize with the tools and techniques of plant tissue culture (K1)
CO:2 To understand the possibility for the production of elite plants (K2 & K3)
CO:3 To apply the technique in micropropagation of plants (K3 & K4)
CO:4 Learn how to prepare potting soil, seedgermination (K4)
CO:5 Learn to grow vegetables and herbs in garden (K5)
CO:6 Provide technical support to other enthusiasts promote sustainable production and consumption(K6)

UnitI

Definition, brief history, principle and significance of tissue culture; Cellular totipotency – Cytodifferentation Media preparation, sterilization and storage room, transfer area for aseptic manipulations, Culture rooms, and observation/data collection areas. Labwares, Good laboratory practices, Good safety practices

Unit II

Working principle, maintenance and management of following instruments: Laminar air flow, autoclave, distillation unit, pH meter, orbital shaker, microscope, deep freezer, growth chamber Sterilization, Role of plant harmones in plant development

Unit III

Micro propagation, Callus culture, Organ culture, Somatic embryogenesis, Synthetic seed technology and Suspension culture.

Unit IV

Gardening tools, size of kitchen garden, purpose, kitchen garden site, preparation, containers, Soil types, Types of Soil, Soil pH, Water holding capacity, soil pH. Loam, farmyard manure, vermicompost, compost, cocopeat, vermiculite, perlite, clay balls, potting mixture

Unit V

Seed, structure types, seed viability, seed germination, nursery, transplanting, study of cultivation of different vegetables tomato, green chillies. Acclimatization of *in-vitro* plants in the garden.

Recommended Texts

1. Indoor Gardening – Elizebeth Millard
2. Keshava chandran R & Peter KV (2008) Plant Biotechnology: Methods in Tissue Culture and Gene Transfer. Orient & Longman (Universal Press)
3. S SBhojwani, M K Razdan (1996). Plant tissue culture: Theory and Practice. Elsevier.
4. L Gamborg, G C Philips (Eds.) (2005). Plant cell, tissue and organ culture: Fundamental methods. Narosa Publishing House.

Reference Books

1. Kitchen gardening for beginners – Mathews Holmes and Roger Markham
2. S Ignacimuthu (2006). Biotechnology: An introduction. Narosa Publishing House.
3. Edwin F George (1993)plant propagation by tissue culture part I and II The technology. Exegetics ltd.
4. Kalyan Kumar De (2003)An introduction to plant tissue culture, New central book agency pvt. Ltd.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	3	2	1	2	2
CO2	3	1	1	2	1	3	2	3
CO3	2	1	1	3	1	2	1	3
CO4	3	3	3	3	1	2	3	3
CO5	3	3	2	1	1	1	3	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ENVIRONMENTAL BIOTECHNOLOGY
SUB.CODE:23UBOAO1

SEMESTER – I	AOC - 1	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1: To introduce the student to the various developed and applications of environmental biotechnology.(K1)
CO2: To provide knowledge about the scope of bioremediation and bioleaching using GMOs.(K2)
CO3: To study about pollution of water bodies.(K3)
CO4: To know about bioremediation.(K4)
CO5: To study about biomineralization.(K5)

Unit I: Introduction:
The environment-soil, water and air, Pollution and its causes (outline only)

Unit II: Source and treatment of polluted waters and effluents:
Pollution of water bodies by heavy metals and pesticides – removal of heavy metals and pesticides by Biosorption. Removal of oil spills by using microbes. Biological treatment of sewage – characteristics of sewage and objectives in sewage treatment – Anaerobic digestion.

Unit III: Soil and air pollution and their treatment:
Soil pollution by Xenobiotics. Degradation of Xenobiotics – pathways of phenol, pentachlorophenol and polychlorinated biphenyl degradation.

Unit IV: Bioremediation:
Introduction to bioremediation, *ex situ* and *in situ* bioremediation.

Unit V: Biometallurgy and related topics:
Biomineralization – bioleaching - Biofilms and biocorrosion.

Recommended Texts:

1. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited.
2. Dubey R.C. 2004. A text book of Biotechnology aspects of microbiology, British Sun Publication.
3. Joseph C. Deniel. 1996. Environmental aspects of microbiology, British Sun Publication.
4. KeeshavThehan. 1997. Biotechnology, New age international)P) Limited, New Delhi.
Chandra, A.M and Ghosh, S.K. 2010.Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

Reference Books:

1.Sharma, P.D. 2005. Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Raina Maier M. Iran Pepper L., Charles P. Gerba, 2000, Environmental Microbiology, Academic press, U.K.
3. Alexander N. Glazer and Hiroshi Nikaido. 1994. Microbial Biotechnology.
4. Special issue on Bioremediation and biodegradation. Indian Journal of Experimental Biology, September 2003. Vol. 41(9).National Institute of Science Communication and Information

Resources, CSIR New Delhi.
5. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences.2nd ed. Cambridge University Press.ISBN.978-1107114234.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	1	3
CO2	3	3	2	2	2	3	2	3	2	2
CO3	2	2	3	3	1	2	1	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	2	3	2	3	3	3	2	3

S-Strong (3) **M-Medium (2)** **L-Low(1)**

FORENSIC BOTANY
SUB.CODE:23UBOAO2

SEMESTER – I	AOC - 2	HOURS –2	CREDITS – 2

Course Outcomes:
Upon completion of the courses, the students will be able to
CO1: Recognize morphological and anatomical features of plants, which could be useful for forensic investigations.(K1)
CO2: Summarize the forensic importance of different parts of plants. (K2)
CO3: Apply techniques for the collection and preserve of botanical evidences of crime.(K3)
CO4: Analyze and decipher the significance of classic and DNA based forensic botany cases.(K4)
CO5: Interpret and deduce new methods for the detection of plant poisons used in crime. (K5 & K6)

UNIT I

General plant classification schemes, Sub specialization of forensic botany- plant morphology, plant anatomy, plant systematic, palynology, plant ecology, limnology, Plant architecture- roots, stems, flowers, leaves. Practical plant classification schemes: vegetables and herbs, fruits bearing trees and plants, landscaping plants: trees, shrubs and vines, grasses, plant cell structure and functions.

UNIT II

Various types of woods, timbers, seeds and leaves and their forensic importance, Identification and matching of various types of wood, timber varieties, seeds and leaves. Types of fibers – forensic aspects of fiber examinations, Identification and comparison of man–made and natural fibres. Various types of planktons and diatoms and their forensic importance. Study and identification of pollen grains, Identification of starch grains, powder and stains of spices etc. Paper and Paper Pulp identification.

UNIT III

Various types of poisonous plants: *Abrus precatorius*, *Aconitum napellus*, *Anacardium occidentale*, *Argemone mexicana*, *Cannabis sativa*, *Claviceps purpurea*, *Croton tiglium*, *Atropa belladonna*, *Gloriosa superba*, *Jatropha curcas*, *Lathyrus sativus*, *Nerium indicum*, *Nicotiana tabacum*, *Strychnos nux vomica*, *Thevetia nerifolia*. Types of plants yielding drugs of abuse – opium, cannabis, coco, tobacco, datura, *Psilocybin* mushrooms.

UNIT IV

Collection and preservation of botanical evidences: Botanical samples, outdoor crime sceneconsideration.

UNIT V

Analysis of samples, DNA analysis, plant DNA typing, Classic forensic botany cases: Case histories by using Plant anatomy and systematic, Palynology, Plant ecology, Limnology, Plant Molecular Biology and DNA, Drug enforcement and DNA.

Recommended Texts

1. Coyle, H.M. 2005. Forensic Botany: Principles and Applications to Criminal Casework.

CRC Press.
2. James, S.H., Nordby J.J., Bell, S. 2015. Forensic Science: An Introduction to Scientific and Investigative Techniques. CRC Press; 4 edition.
3. David W. Hall, Dr. Jason H. Byrd. 2012. Forensic Botany. Wiley-Blackwell; United Kingdom.
4. Jane H Bock, David Norris.2015. Forensic Plant Science. Elesvier.
5. Patricia E. J. Wiltshire.2012. Forensic Ecology, Botany, and Palynology: Some Aspects of Their Role in Criminal Investigation. Criminal and Environmental Soil Forensics pp 129–149.

Reference Books

1. Hall, D.W and Byrd, J. 2012. Forensic Botany: a practical guide. Wiley-Blackwell, 1edition.
2. Bock, J.H and Norris, D.O. 2016. Forensic Plant Science, Academic Press.
3. Nicholas Marquez Grant, John Wiley. 2012. Forensic Ecology Handbook. Wiley Backwell.
4. David W. Hall, Jason Byrd.2012. Forensic Botany: A Practical Guide. Wiley-Blackwell.
5. Heather Miller Coyle.2007.Forensic Botany: Principles and Applications to Criminal Casework is packed with details — David M. Jarzen, Florida Museum of Natural History, University of Florida, in AASP Newsletter, Vol. 40, No. 2.

M**apping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	1
CO2	3	3	2	1	1	3	2	3	1	3
CO3	2	1	2	3	1	2	1	3	1	2
CO4	3	3	3	3	2	1	3	3	2	1
CO5	3	3	2	3	2	3	1	2	2	3

S-Strong (3) M-Medium (2) L-Low(1)

ALLIED BOTANY-III
PLANT SCIENCE – I
SUB.CODE: 23UBOE31

SEMESTER – III	EC – T3	HOURS –4	CREDITS – 3

Course outcomes:
On completion of this course, the students will be able to:
CO1: To study morphological and anatomical adaptations of plants of various habitats.(K1)
CO2: To demonstrate techniques of plant tissue culture.(K2)
CO3: To familiarize with the structure of DNA, RNA. (K3)
CO4: To carryout experiments related with plant physiology.(K4)
CO5: To perform biochemistry experiments (K5)

Unit I- Virus and Bacteria **(12 Hours)**

Virus - general characters, structure of TMV, structure of bacteriophage. Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria.

Unit II–Algae and Fungi **(12 Hours)**

General characters of algae - Structure, reproduction and life cycle of the following genera of *Anabaena* and *Sargassum* and economic importance of algae.
General characters of fungi, structure, reproduction and life cycle of the following genera – *Penicillium* and *Agaricus* and economic importance of fungi.

Unit III -Bryophytes, Pteridophytes and Gymnosperms **(12 Hours)**

General characters of Bryophytes, Structure and life cycle of *Marchantia.*
General characters of Pteridophytes, Structure and life cycle of *Lycopodium.*
General characters of Gymnosperms, Structure and life cycle of *Cycas*.

Unit IV –Plant Physiology **(12 Hours)**

Photosynthesis overview, C3 and C4 cycle; Nitrogen metabolism. Transpiration - ; Photoperiodism, Vernalization & Seed germination.

Unit V- Plant Biotechnology **(12 Hours)**

Plant tissue culture – Media preparation - *In vitro* culture methods – direct & indirect organogenesis. Plant tissue culture and its application in biotechnology.

Recommended Texts:

1. Singh,V.,Pande, P.Cand Jain,D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and AlokMoitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma,O.P.2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras

Reference books:

1. Parihar, N.S. 2012. An introduction to Embryophyta – Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	2	3	2	3
CO5	3	2	2	2	2	2	2	1	2	1

S-Strong (3) M-Medium (2) L-Low(1)

ALLIED BOTANY-III
PLANT SCIENCE – I - PRACTICAL
SUB.CODE: 23UBOE32

SEMESTER – III	EC – P3	HOURS –2	CREDITS – 2

Course outcomes:

On completion of this course, the students will be able to:

CO1: To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.(K1)

CO2: To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.(K2)

CO3: To be familiar with the basic concepts and principles of lower group of plants.(K3)

CO4: Understanding of laws of inheritance, genetic basis of loci and alleles. (K4)

CO5: To learn about basic cell biology (K5)

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

2.Demonstration experiments

a) Ganong's potometer
b) Ganong's respiroscope
c) Ganong's light screen experiment
d) Clinostat

3. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm and Plant Biotechnology.

Recommended Texts:

1. Sharma,O.P.2017. Bryophyta, Mac Millan India Ltd, New Delhi.
2. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd, New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.

Reference Books:

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and BediluBekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	1	3
CO4	3	3	2	3	3	3	3	2	3	3
CO5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ELECTIVE
ALLIED BOTANY-IV
PLANT SCIENCE - II
SUB.CODE: 23UBOE41

SEMESTER – IV	EC – T4	HOURS –4	CREDITS – 4

Course outcomes:

On completion of this course, the students will be able to:

CO1: To be familiar with the basic concepts and principles of plant systematics.(K1)
CO2: Learn the importance of plant anatomy in plant production systems.(K2)
CO3: Understand the mechanism underling the shift from vegetative to reproductive phase.(K3)
CO4: To learn about the physiological processes that underlie plant metabolism.(K4)
CO5: To know the energy production and its utilization in plants. (K5)

Unit I- MORPHOLOGY OF FLOWERING PLANTS (12 Hours)

Plant and its parts.Structure and function of root and stem.Leaf and its parts.Leaf types-simple and compound.Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

Unit II- TAXONOMY (12 Hours)

Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae.

Unit III- ANATOMY (12 Hours)

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

Unit IV-EMBRYOLOGY (12 Hours)

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

Unit V – PLANT BREEDING (12 Hours)

Plant Breeding – scope & importance, introduction, acclimatization, types of selection, hybridization – procedure, heterosis. Role of polyploidy in crop improvement.

Recommended Texts:

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines

Reference books:

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.

4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand& Co., New Delhi.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	2
CO5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) **M-Medium (2)** **L-Low(1)**

ALLIED BOTANY
PRACTICAL – IV
PLANT SCIENCE – II PRACTICAL
SUB.CODE: 23UBOE42

SEMESTER – IV	EC – P4	HOURS –2	CREDITS – 2

Course outcomes:
On completion of this course, the students will be able to:
CO1: To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology (K1)
CO2: To comprehend the fundamental concepts and methods used to identify angiosperms through morphological changes and evolution, anatomy, Embryology and reproduction.(K2)
CO3: To be familiar with the basic concepts and principles of plant systematics.(K3)
CO4: Understanding of physiology in plants. (K4)
CO5: To learn about the physiological processes that underlie plant metabolism(K5)

EXPERIMENTS

1. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
2. To dissect a flower, construct floral diagram and write floral formula.
3. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
   Hybridization techniques – emasculation
4. Spotters – Anatomy and Embryology

Recommended Texts:

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy.Vikas Publishing House Pvt. Ltd., New Delhi.
2. 5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Reference Books:

1. Aler Gingauz.2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
2. Steward, F.C. 2012. Plant Physiology Academic Press, US

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	1	3	3	1	3
CO4	3	3	2	3	3	3	3	2	3	3
CO5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) M-Medium (2) L-Low(1)