A.VEERIYA VANDAYAR MEMORIAL

SRI PUSHPAM COLLEGE (AUTONOMOUS)

POONDI-613 503, THANJAVUR (DT)

SYLLABUS

B.Sc., Botany

(From 2020 - 2021 onwards)

B.Sc. BOTANY

Programme specific outcome

The students on successful completion of B.Sc. Botany, they will acquire knowledge about medicinal plants, pharmacognosy, pharmacology, economic importance of useful plants, phytogeography, etc. This knowledge will be helpful to get an employment opportunity in various governmental and non-governmental sectors. The students are able to become entrepreneur and they can also start small scale industries like algal, fungal and bacterial biofertilizers unit, edible mushroom cultivation technology unit, nursery management, etc. The graduates will be able to identify and analyse the morphological and anatomical features of plants, their structures and learn evolutionary history of plants.

Programme Outcome

Students are able to understanding of plant diversity and its importance in the maintenance of ecological balance. Apply the knowledge of basic science, life sciences and fundamental process of plants and also implement the knowledge gained from the studies for the upliftment of society.

SEM No.	Part	Category	Course Code	Title of the course	Maximum Marks			Minimum Marks			Hours /Week	Credits
					C.I.A.	E.E.	Total	C.I.A	E.E.	Total		
I	**Part** I	Language	20U1BOT1/H1	Tamil – I / Hindi – I	25	75	100	10	30	40	6	3
	Part II	Language	20U1BOE1	English - I	25	75	100	10	30	40	6	3
	Part III Core	Major	20U1BOC1	Algae, Fungi and Bryophytes	25	75	100	10	30	40	7	6
			20U1BOCP1	Practical – I	40	60	100	16	24	40	3	3
		Allied	20U1BOZOA1	Allied Zoology–I	25	75	100	10	30	40	5	3
			20U2BOZOAP	Allied Zoology Practical (NS)	-	-	-	-	-	-	3	-
	Part IV	ESE	20U1BOES	Environmental Studies	25	75	100	10	30	40	SS	1
II	**Part** I	Language	20U2BOT2/H2	Tamil – II / Hindi – II	25	75	100	10	30	40	6	3
	Part II	Language	20U2BOE2	English – II	25	75	100	10	30	40	6	3
	Part III Core	Major	20U2BOC2	Fundameltals of Industrial Microbiology	25	75	100	10	30	40	6	5
			20U2BOCP2	Practical – II	40	60	100	16	24	40	3	3
		Allied	20U2BOZOA2	Allied Zoology– I	25	75	100	10	30	40	3	4
			20U2BOZOA2	Allied Zoology Practical (NS)	25	75	100	10	30	40	5	3
	IV	VBE	20U2BOV	Value Based Education	25	75	100	10	30	40	SS	0
		SBE	20U2BOS1	Skill Based Education I Culture of Microorganisms	25	75	100	10	30	40	1	1
	Part I	Language	20U3BOT3/H3	Tamil – III / Hindi – III	25	75	100	10	30	40	6	3

III **Sem**	**Part** II	Language	20U3BOE3	English – III	25	75	100	10	30	40	6	3
	Part III	Major	20U3BOC3	Anatomy and Embryology	25	75	100	10	30	40	8	5
			20U4BOCP3	Practical – III	40	60	100	16	24	40	2	5
		Allied	20U3BOA1	Allied Chemistry – I	25	75	100	10	30	40	5	4
			20U4BOCHAPL	Allied ChemistryPractical (N.S.)	-	-	-	-	-	-	3	-
	Part IV	GS	20U1BOGS	Gender Studies		100	100	-	40	40	-	-
		Extra credit	-	MOOC (**M**assive **O**pen **O**nline **C**ourse)	--	-	-	-	-	-	-	-
IV **Sem**	**Part** I	Language	20U4BOT4/H4	Tamil – IV / Hindi – IV	25	75	100	10	30	40	6	3
	Part II	Language	20U4BOE4	English – IV	25	75	100	10	30	40	6	3
	Part III Core	Major	20U4BOC4	Pteritophytes and Gymnosperms	25	75	100	10	30	40	7	5
			20U4BOCP4	Practical – IV	40	60	100	16	24	40	2	5
		Allied	20U4BOCHA2	Allied Chemistry – II	25	75	100	10	30	40	5	4
			20U4BOCHAPL	Allied Chemistry Practical (N.S)	40	60	100	16	24	40	3	2
	Part IV	SBE	20U4BOS2	Skill Based Education II Compost Preparation	25	75	100	10	30	40	1	1
		Extra credit	-	MOOC (**M**assive **O**pen **O**nline **C**ourse)	-	-	-	-	-	-	-	-
V **Sem**	**Part** III Core	Major	20U5BOC5	Taxonomy and Economic Botany	25	75	100	10	30	40	5	5
			20U5BOC6	Cytogenetics and Molecular Biology	25	75	100	10	30	40	5	5
			20U5BOC7	Basics of Bioinformatics and Computer Applications	25	75	100	10	30	40	5	4
			20U5BOCP5	Practical - V	40	60	100	16	24	40	4	4

		ME I	20U5BOEL1A 20U5BOEL1B	Biofertilizer / Biological Control	25	75	100	10	30	40	4	4
		ME II	20U5BOEL2A 20U5BOEL2B	Applied Microbiology/ Laboratory Techniques	25	75	100	10	30	40	4	3
	Part IV	LSD	20U5BOLSD	Life Skill Development	-	-	-	-	-	-	1	-
		NME	20U5BONME	Non - Major Elective – Herbal Technology	25	75	100	10	30	40	2	1
VI **Sem**	**Part** III	Core	20U6BOC8	Plant Physiology	25	75	100	10	30	40	6	5
			20U6BOC9	Environmental Botany and Biostatistics	25	75	100	10	30	40	5	5
			20U6BOC10	Forest Botany and Wood Science	25	75	100	10	30	40	5	4
			20U6BOCP6	Practical – VI	40	60	100	16	24	40	4	4
		ME III	20U6BOEL3A 20U6BOEL3B	Biotechnology/ Environmental Biotechnology	25	75	100	10	30	40	4	4
		ME IV	20U6BOEL4A 20U6BOEL4B	Plant Tissue Culture/ Preservation of Fruits and Vegetables	25	75	100	10	30	40	4	3
	Part IV	GK	20U5BOGK	General Knowledge for Competitive Examination	-	100	100	-	40	40	1	-
		Comp Test	20U6BOCN	Comprehensive Test	-	100	100	-	40	40	1	1
	Part V	EA	20U6BOEA	Extension Activities	-	-	-	-	-	-	-	1

Abbreviations

ESE: Environmental studies	SSD: Soft Skill Development
VBE: Value Based Education	GK : General Knowledge
SBE: Skill Based Elective	NME: Non – Major Elective
GS: Gender Studies	EA: Extension Activities
ME: Major Elective	SS: Self Study
CC:Certificate Course	
MOOC-Massive open online course	

Parts	Total No. of course	Total Marks	Total Credits
Part – I	**04**	**400**	**12**
Part – II	**04**	**400**	**12**
Part – III		**2600**	
Core Major	16		76
Core Allied	06		20
Major	04		14
Elective	……..		……
	26		**110**
Part – IV			
E.S	01	100	01
VBE	01	100	00
SBE	02	200	02
SSD	01	100	00
NME	01	100	01
G.S	01	100	00
G.K	01	100	00
Comp Test	01	100	01
	……..	**…….**	**…..**
	09	**900**	**05**
Part – V EA			**01**
	43	**4300**	**140**

MOOC: Massive open online course is introduced in the third and fourth semester as an extra credit course from this academic year 2020-2021. Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves

Field Visit / Industrial Visit / Hands on training programme having minimum 15 hours of contact time as Extra Credit course is introduced for II year UG students to gain experiential learning

Evaluation of the visit report will be held at the end of IV Semester.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Project is introduced for III year students to cater for the needs of advanced learners as extra credit course

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Soft skill development course prescribed in V semester is changed as Life Skill Development.

This course will be handled by both Internal Staff and External Experts.

Mode of Assessment for this course is oral examination.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Skill Based Elective Offered by the Botany Department

1. Culture of Microorganisms
2. Compost Preparation

Certificate Course Offered by the Botany Department:

Herbal Botany will be conducted for III UG students as an Extra Credit Course

MOOC online course - Extra Credit Course

Non – Major Elective paper offered by the Botany Department

Herbal Technology

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Question Pattern for UG and PG Programmes for students to be admitted during 2020 – 2021 and afterwards.

Total Marks: 75

QUESTION PATTERN

SECTION – A

(Question 1 to 10)

10 x 2 = 20 Marks

1. Short Answer Questions.
2. Two Questions from each unit (All are answerable)

SECTION – B

(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C

(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
I	**20U1BOT1**	**இக்கால இலக்கியம்** **(செய்யுள் , உரைநடை, சிறுகதை, புதினம், நாடகம் இலக்கிய வரலாறு)**	**6**	**3**

நோக்கம்

1. இக்கால இலக்கிய வகைகளைக் கண்டறிவர்
2.எழுத்து,சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிவர்.
3.புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக,அரசியல்விழுமியங்களை மதிப்பிடுவர்.
4. இக்கால இலக்கியத்தின் மீதான விருப்பத்தை மிகுவித்தல்.

கூறு: 1 செய்யுள் ***நேரம்:18***

1. பாரதியார் : கண்ணன் என் காதலன்,கண்ணம்மா என் காதலி (முதல்பாடல் மட்டும்)
2. பாரதிதாசன் : தமிழின் இனிமை,தமிழ் உணர்வு
3. கவிமணி : ஒற்றுமையே ,உயர்நிலை-நாட்டுக்குழைப்போம்
4. சுரதா : சிக்கனம்

கூறு: 2 செய்யுள் ***நேரம்:18***

1. பட்டுக்கோட்டை கல்யாணசுந்தரம்:நாட்டுக்கொரு வீரன்
2. கண்ணதாசன் : காலக்கணிதம்
3. மு.மேத்தா: கண்ணீர் பூக்கள் ,ஊர்வலம்,தாய் ,வெளிச்சம் வெளியே இல்லை
4. அப்துல் ரகுமான் : தேவகானம் - தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்

கூறு: 3 சிறுகதை ***நேரம்:18***

1. கேட்டிவி : குரல்கொடுக்கும் வானம்பாடி (1-10)
2. கேட்டிவி : மனோரஞ்சிதம் (1-10)

கூறு: 4 புதினம் ***நேரம்:18***

புதினம் : துணிந்தவன் - வல்லிக்கண்ணன்

கூறு:5 நாடகம் ,இலக்கிய வரலாறு ***நேரம்:18***

1.நாடகம் : மாமன்னன் இராசராசன் - கு.வெ.பாலசுப்பிரமணியன்
2.இலக்கிய வரலாறு : இருபதாம் நூற்றாண்டு இலக்கியங்கள்

பயன்கள்

1. தமிழ் இலக்கியத்தின் மீதான ஆர்வம் மிகும்.
2. புதிய இலக்கிய வளங்களை அறிவர்.
3. கவிதை, சிறுகதை ஆகியவற்றைப் படைக்க முயல்வர்.
4. போட்டித் தேர்வுகளுக்குச் செல்பவர்கள் பயன் பெறுவர்.
5. நாடகக் கலைத்திறனை அறிவர்

Semester	Course Code	Title of The Course	Hours of Teaching/ Week	No. of Credits
I	**20U1BOE1**	**PART – II - Prose, Poetry and Communication Skills**	**6**	**3**

Objective

- **To initiate the students to understand English through Prose, Poetry and Basic Communicative Grammar.**

Unit – I

Shakespeare - Shall I Compare Thee to a Summer's Day?
John Milton – On His Blindness
William Wordsworth – The Solitary Reaper
P.B.Shelley – Song to the Men of England
Robert Frost – The Road not Taken
Nissim Ezekiel - Night of the Scorpion

Unit – II

1) The Running Rivulets of Man, 2) Parliament is Marking Time
3) The Lady in Silver Coat, 4) Mr. Applebaum at Play

Unit – III

1) The Feigning Brawl of an Impostor, 2) Thy Life Is My Lesson
3) Solve the Gamble, 4) The Stoic Penalty

Unit – IV

1) Nobility in Reasoning, 2) Malu the Frivolous Freak
3) Bharath! Gird Up Your Loins! 4) Honesty is the Cream Of Chastity

Unit – V

Parts of Speech, Nouns, Pronouns, Conjunctions, Adjectives, Articles, Verbs, Adverbs, Interjection – sentence.

Course outcomes:

After the completion of this course, students will be able to

- **understand and appreciate the English Prose, Poetry and basic functional communicative Grammar and study on style and substance.**
- **develop interest in appreciation of literature**
- **integrate the use of the four language skills: LSRW.**
- **communicate appropriately and use English effectively**
- **imbibe ethical, moral, national and cultural values**

Prescribed Texts:

K.T.V. *A Melodious Harmony.* Thanjavur: Rajendra Publishing House, 2017.
Natarajan, K. *FlyingColours.* Chennai: New Century Book House (P) Ltd., 2017.
Advanced Grammar and Composition. Chennai: New Century Publishing House, 2017.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20U1BOC1**	**Algae, Fungi and Bryophytes**	**7**	**5**

Objectives:

- To study the classification of various types of Algae
- To learn the form, occurrence, cell structure and reproduction of various types of algae.
- To know the general characteristics of main classes of fungi.
- To understand in detail about classification of bryophytes and their economic importance

Unit I

Algae–General Characters-Classification (Fritsch, 1953). A detailed study of the occurrence, morphology, structure, reproduction and life cycle of *Spirulina, Ulva, Volvox* and *Caulerpa*.

Unit II

A detailed study of the occurrence, morphology, structure, reproduction and life cycle of *Ectocarpus* and *Polysiphonia*. Economic importance of algae.

Unit III

Fungi - General characteristic features–Classification (Alexopolous, 1962). Occurrence, structure, reproduction and life cycle of *Albugo, Saccharomyces* and *Aspergillus*.

Unit IV

Structure, reproduction and life cycle of *Peziza, Puccinia* and *Polyporus*. Economic importance of fungi. Lichens – morphology, structure, reproduction and economic importance.

Unit V

Bryophytes–General characters - Classification (Rothmaler, 1951).Morphology, internal structure, reproduction and life cycle of following genera: *Riccia, Anthoceros* and *Funaria* – (excluding developmental details) - Economic importance of Bryophytes.

Outcome:

After completion of this course, students would be able to

- get identification knowledge of Algae from the classification.
- learn more idea about the life cycle of algae.
- acquire more awareness on the general characteristics of fungi.
- gain the knowledge on the importance of fungi.
- get more information of characteristics of bryophytes and their economic importance.

Books for Reference:

- B.P.Pandey(1988). College Botany, Vol. I,S.Chand and Company, New Delhi.
- Gangulee Das and Kar (1989). College Botany, Vol. II,New Central Book Agency, Calcutta.
- Vashista (1985). Text of Book of Botany Published by S. Chand and Company.New Delhi, India

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20U1BOCP1**	**Algae, Fungi and Bryophytes**	**2**	**5**

Objectives:

- To know the vegetative and reproductive structure of various types of algae, fungi and lichens.
- To observe the morphological and anatomical features of bryophytes.

Algae

A study of the vegetative and reproductive structures of the following genera: *Spirulina, Ulva, Volvox, Caulerpa, Ectocarpus* and *Polysiphonia*.

Fungi and Lichens

A study of the vegetative and reproductive structures of the following genera: *Albugo*, Yeast, *Aspergillus, Peziza, Puccinia, Polyporus* and *Lichens*

Bryophytes:

A study of the vegetative and reproductive structures of the following genera: *Riccia, Anthoceros* and *Funaria.*

Outcome:

After completion of this course, students would be able to

- get more idea about the morphological features of algae.
- gain more information about fungi and their reproductive characteristic of features.
- acquire many knowledge on the reproductive stages of lichens.
- understand the uses of lichens and become an entrepreneur in marketing of lichens.
- obtain idea about to identify bryophytes based on anatomical characters.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	**20U1BOZOA1**	**ALLIED ZOOLOGY – I**	**5**	**4**

Objectives:

1. To acquire a basic knowledge of animal diversity and organization.
2. To study the general aspects of Invertebrates and Parasites.
3. To study the general aspects of Chordata animals and their anatomy.
4. To learn the general principles.

Unit I **Hrs15**

Phylum Protozoa : Detailed study of Plasmodium - Protozoan Parasites of Man
Phylum Porifera: cellular structure of Leucoslinia
Phylum Coelenterata: Obelia – Detailed study.

Unit II **Hrs15**

Phylum Platyhelminthes: *Taeniasolium* - Organisation and Life history.
Phylum Aschelmintus: Ascaris- Organisation and Life history

Unit III **Hrs15**

Phylum Annelida: Details study of Earthworm
Phylum Arthropoda: External characters of Prawn and life history of Prawn

Unit IV **Hrs15**

Phylum Mollusca: Fresh water Mussel – external characters only.
Phylum Echinodermata: Detailed study of Sea star.

Unit V **Hrs15**

General characters and outline classification of Chordata Rat: External characters, Digestive system, Respiratory system, Circulatory system, Urinogenital system.

References

1. EkambaranathaIyer, M and Anatha Krishnan, T.N – Outlines of Zoology
2. Nair, N.C., Leelavathy, L. SoundaraPandian, N., Murugan, T and Arumugam, N. 2009. A Text book of Vertebrates. Saras Publications. Nagerkoil.
3. Rastogi, V.B. 1984. Invertebrate Zoology. KedarNath Ram Nath Publications, Meerut.

Web Link:

https://oeb.harvard.edu/oeb-courses (Harvard) (Biology of Invertebrates)
https://www.studocu.com/ph/document/notre-dame-of-dadiangas-university/vertebrate-structure-function-and-morphology/lecture-notes/bio-23-syllabus-edited-2019/5423920/view (Notre Dame of daldiangas University)

Outcome:

- Learn about the classification and evolution of Invertebrates and Vertebrates
- Study on Anatomy of Invertebrates and Vertebrates.
- Develop the knowledge on Physiology of Invertebrates and Vertebrates.
- Enhance the economic importance of Invertebrates and Vertebrates.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I & II	**20U2BOZOAPL**	**Allied Zoology Practical (NS)**	**3**	**--**

Objectives:

1. To know the Digestive system, Nervous system of Earthworm and Cockroach.
2. To dissect and study the circulatory of Calotes.

Dissection

Earth worm-Nervous system.

Cockroach – Digestive and Nervous system.

Freshwater – Mussel – Digestive system.

Calotes - Arterial and Venous system –Virtual Lab .

Mounting:

Earthworm - Body setae and penial setae.

Freshwater mussel Pedal ganglion.

Cockroach and Honey bee - Mouth parts

Shark - Placoid scales

Spotters:

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephyra larva, Physalia, *Fasciola hepatica*, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, *Taenia solium* entire, Scolex, Nereis entire, T.S. of Nereis, Parapodium, Leech entire, T.S of leech, Glochium larva, Starfish entire, Bipinnaria larva. Amphioxus entire, Shark, Salamander, Calotes, Pigeon and Rat.

A record of lab work should be maintained and submitted at the time of practical examination for valuation.

Reference

1. Ekambaranatha Iyer, M and Ananthakrishna, T.N. Outlines of Zoology.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
II	**20U2BOT2**	**இடைக்கால இலக்கியம் – பயன்முறைத் தமிழ் –இலக்கண இலக்கிய வரலாறு,**	**6**	**3**

நோக்கம்

1. தமிழிலக்கிய வரலாற்றில் பக்தி இலக்கியங்கள் பெறும் சிறப்பை உணர்வர்.
2. சமய வழிச் சமூக மாற்றத்திறன் பெறுவர்.
3. சமய நல்லிணக்க உணர்வை மாணவர்கள் பெறுவர்.

கூறு: 1 ***நேரம்:18***

1. திருஞானசம்பந்தர் தேவாரம் : சீகாழி திருப்பதிகம்—
அடலேற அமருங்கொடி அன்ன (பா.எ.360—370)
2. திருநாவுக்கரசர் தேவாரம் : திருவையாற்றுப் பதிகம்
விடகிலேன், அடிநாயேன்; வேண்டியக் கால் யாதொன்றும் (பா.எ.124—133)
3. சுந்தரர் தேவாரம் : திருமழபாடி பதிகம்
பொன் ஆர் மேனியனே! புலித்தோலை அரைக்கு அசைத்து,(பா.எ.1-10 பாடல்கள்)
4. மாணிக்கவாசகர் : திருவாசகம் - பிடித்த பத்து

கூறு: 2 ***நேரம்:18***

1. பெரியாழ்வார் : திருமொழி - தாய்ப்பால் உண்ண அழைத்தல் 129—138 வரை 10 பாசுரங்கள்
2. குலசேகர ஆழ்வார்: பெருமாள் திருமொழி- இராமர் தாலாட்டு - 719—729 11 பாசுரங்கள்
3. ஆண்டாள் நாச்சியார்: நாச்சியார் திருமொழி - திருமணக்கனவை உரைத்தல்
4. திருப்பாணாழ்வார் : அமலனாதிபிரான் - 10 பாசுரங்கள்

கூறு: 3 ***நேரம்:18***

1. குமரகுருபரர் : வருகைப் பருவம் - 10 பாடல்கள்
2. திரிகூடராசப்பக்கவிராயர் :குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறல்
3. வீரமாமுனிவர் : தேம்பாவணி - காட்சிப்படலம் முழுவதும்
4. உமறுப்புலவர் : சீறாப்புராணம்-விலாதத்துக் காண்டம்-கதீஜா கனவு கண்ட படலம்

கூறு: 4 பயன்முறைத்தமிழ் ***நேரம்:18***

எழுத்தியல்: உயிரெழுத்து, மெய்யெழுத்து, உயிர்மெய்யெழுத்து,முதலெழுத்து, சார்பெழுத்து, மொழிக்கு முதலாகவும் இறுதியாகவும் வரும்எழுத்துக்கள்,போலி.
சொல்லியல்: இலக்கண, இலக்கிய வகையிலான சொற்கள்.
பொதுவியல் : எழுத்துப் பிழைகளை நீக்குதல்,எழுத்துப் பிழைகளும் திருத்தங்களும்,வலி மிகுதல்,வலிமிகாமை ,வாக்கிய அமைப்புக்கள், நிறுத்தற் குறியீடுகள்.

கூறு;5இலக்கணஇலக்கிய வரலாறு ***நேரம்:18***

1. இலக்கண வரலாறு (தமிழ்த்துறை வெளியீடு)
2. தமிழ் இலக்கிய வரலாறு: இடைக்கால இலக்கியம்

பயன்கள்

1. பல்வகை சமய இலக்கியப் போக்குகளை அறிந்து கொள்வர்.
2.சமயவழித் தமிழரின் வாழ்வியலை அறிவர்.
3. பல்வகை சமயக் கோட்பாட்டினை அறிந்துகொள்வர்.
4. பிழையின்றி எழுதப் பழகுவர்.
5. சமயங்களின் இன்றியமையாமையை உணர்வர்

Semester	Course Code	Title of The Course	Hours of Teaching/ Week	No. of Credits
II	**20U2BOE2**	**PART – II- Extensive Readers and Communicative Skills**	**6**	**3**

Objective

- **To impart language and communicative skills through short stories, one- act plays and communicative grammar.**

Unit – I

Shakespeare – The Seven Stages of Man
Longfellow – A Psalm of Life
Nissim Ezakiel – Enterprise
William Wordsworth – The world is too much with us

Unit – II

Anton Chekhov - The Bear
Cedric Mount - The Never-Never Nest
Farrell Mitchell - The Case of the Stolen Diamonds
M.V. Rama Sharma - The Mahatma

Unit - III

Fyodor Dostoyevsky - The Christmas Tree and the Wedding
The Duchess - The Jewelry
O. Henry - The Romance of a Busy Broker

Unit – IV

Tense, Question Tag, Dialogue Writing, Paragraph Writing, Adjectives, Adverb

Unit – V

Voices, Degrees of Comparison, Direct and Indirect

Course outcomes

After the completion of this course students will be able to

- **promote the linguistic and communicative objectives through the study of poems, short stories and the communicative grammar.**
- **gain language and communicative skills through short stories**
- **identify and differentiate different forms of literature.**
- **engage in reflective writing after learning the prescribed lessons.**
- **enhance the communicative skills through LSRW**

Prescribed Texts:

- *Voices of Vision*, Board of Editors, NCBH, Chennai, 2016.

Communicative Grammar, The Department of English Course Material.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2BOC2**	**Fundamentals of Industrial Microbiology**	**7**	**5**

Objectives:

- To understand the various concepts of Industrial Microbiology.
- To study the classification, characteristics and structure of industrially important microbes.
- To learn the techniques of isolation, identification and production of microbes used in industries.
- To know the various methods of culture preservation and an mutant selection

Unit I

Study of several types of microorganisms, cultural characteristics and ultra structure of Bacteria, Mycoplasma and Viruses(Preliminary studies on Dengue, SARS, H1N1 and Corona). Classification of bacteria (Bergey's manual of determinative bacteriology, IX Ed.).

Unit II

Isolation, purification, identification and inoculum production of Bacteria and Fungi– Methods of sterilization and preparation of media (PDA and NA) -Methods of staining of Bactria and Fungi.

Unit III

Microbial culture preservation and stability – Preservation of microbes: Serial subculture - Preservation by overlaying culture with mineral oil – Lyophilisation (freeze drying) -Cryopreservation.

Unit IV

Methods for selection of mutants – Direct selection method for resistant mutants - Penicillin selection technique - Replica plating technique– lethality and its use in mutant selection. Industrial applications of microbes (Fundamental aspects).

Unit V

History, scope and development of industrial microbiology. Experiments of Louis Pasteur – discovery of microbes, production of strain – Screening techniques.

Outcome:

After completion of this course, students would be able to

- know the concepts of Industrial Microbiology
- understand industrially important microbes and its role in industry.
- gather clear cut idea about the mass production of industrially important microbes and its application in future life.
- know the steps involved in culture preservation and mutant selection techniques.
- learn the discovery of microbes and the experiments of Louis Pasteur.

Books for Reference

- P.D.Sharma (1998). Microbiology, Rastogi & Company, Meerut.
- A.H.Patel (1994). Industrial Microbiology, McMillan, India.
- F.G.Mott and Foster, J.W.(1988). Microbial Physiology, John Wiley Sons.
- Powar and Dognivala (2004). General Microbiology Vol-II 2nd Edition Himalaya Publishing House.
- R.C. Dubey and D.K. Maheswari (1999). Text Book of Microbiology 1st Edition. S.Chand Publishing.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2BOCP2**	**Practical – II (Fundamentals of Industrial Microbiology)**	**2**	**5**

Objectives:

- To know the various aspects like preparation of media.
- To learnthe methods of autoclaving and sterilization of glassware.
- To understand the isolation and maintenance of different microbial groups

Fundamentals of Microbiology

- Preparation of media, autoclaving and sterilization of glasswares.
- Maintenance of culture room.
- Pure culture technique (Spread plate, pour plate and streak plate).
- Isolation and maintenance of different groups of microbes.
- Aseptic transfer techniques of Bacteria and Fungi. (Santa Monica College, California).
- Methods of analytical techniques for identification of microbes with emphasis to Gram's staining technique.
- Standard plate count method.
- Cell counting by using Haemocytometer
- Isolation of *Rhizobium* from root nodules of leguminous plants.
- Isolation of BGA from fresh water

Outcome:

After completion of this course, students would be able to

- know how to prepare microbiological media for microbial growth.
- learn the methods of sterilization and culturing techniques.
- get Knowledge on the isolation and maintenance of microbes.
- observe the characteristic features of *Rhizobium* from root nodules.
- analyse the role of BGA from fresh water form and its employability

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
II	**20U2BOZOA2**	**ALLIED ZOOLOGY –II**	**5**	**4**

Objectives:

1. To acquire basic knowledge about the beneficial role of animals.
2. To study the various types cultures.

Unit-I **Hrs15**

Cell biology: Structure and functions of Eukaryotic cells - Plasma membrane – Fluid Mosaic model – Mitochondria – Molecular structure – Kreb'scycle.

Embryology: Types of vertebrate eggs and patterns of cleavage**.**

Unit-II **Hrs15**

Genetics: Mendelian Principles – Monohybrid and Dihybrid experiment with examples – Multible alleles (ABO blood group – Rh Factor).

Evolution: Lamarckism and Darwinism.

Unit- III **Hrs15**

Physiology: Physiology of digestion in man – structure and functions of human Kidney.

Ecology: Food chain, Food web and Energy flow.

Unit-IV **Hrs15**

Vermiculture: Types of earthworm - Earthworm Feed Stocks- rearing technology; Types of Vermicomposting System–economic importance- Earthworm related Opportunities for Farmers.

Sericulture –Types of silkworm; Biology and Life cycle of silkworm (*Bombyx mori*),- Role of sericulture in the farming systems - Silkworm rearing management- Economic importance of silkworm.

Unit-V **Hrs15**

Apiculture: Species of Honeybee – Types of bee hive – nutritive and medicinal value of honey – Bee wax- Export market and Foreign currency earnings.

Aquaculture: Scope of Aquaculture – Freshwater cultivable fishes – Water quality management –Fish preservation – Economic importance of fishes.

References

1. Agarwal, W.C. – Economic Zoology
2. Pradip V. Jabde – Applied Zoology.
3. T.V.R.Pillai, (1988) Aquaculure: Principles and practices. Fishing News Books.
4. Aquaculture and Fisheries Biotechnology, Genetic Approaches, 2nd Edition: Rex. A. Dunham: Department of Fisheries and Allied Applications Auburn University, Alabama USA.
5. Ethiopian Institute of Agricultural Research Livestock and Fisheries Research Strategies © EIAR, July 2017›=ÓU›=' 2009 Website: http://www.eiar.gov.et Tel.: +251-11-6462633 Fax: +251-11-6461294 P.O.Box 2003 Addis Ababa, Editing and design: GetnetAssefa.
6. Manual of On-Farm Vermicomposting and VermicultureBy Glenn Munroe Organic Agriculture Centre of Canada.
7. P.S.Verma and V.K.Agarwal(1996) – Cytology and Genetics.
8. Lewis Wolpert, 2011. Developmental Biology – A very short introduction, Oxford University Press Inc, New York.
9. Guy B Radley Smith, Salley Hope, Helen V. Firth and Jane A. Hurst, 2010. Oxford handbook of Genetics - Oxford University Press Inc, New York.
10. P.S.Verma and V.K.Agarwal(1996) Animal Physiology and Ecology
11. Balinsky, B.J. (1981) An introduction to embryology, CBS College Publishing.
12. Arumugam. N. Evolution, Saras Publications

Web Link:

http://sbs.ntu.edu.sg/prospective/undergraduate/Curriculum%20and%20Course%20Descriptions/Pages/Major-PE/Table%20A/BS2012.aspx (NUS)
https://canvas.harvard.edu/courses/63060/assignments/syllabus (Hardvar University)

Outcome:

- Gain knowledge on Culture techniques of aquatic organisms
- Learn about the Sericulture Technology
- Develop the knowledge on Apiculture Technology
- Study on vermicomposting Technology
- Get employability on Poultry farming techniques.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I & II	**20U2BOZOAPL**	**Allied Zoology Practical (NS)**	**3**	**2**

Objectives:

1. To know the Digestive system, Nervous system of Earthworm and Cockroach.
2. To dissect and study the circulatory of Calotes.

Dissection

Earth worm-Nervous system.

Cockroach – Digestive and Nervous system.

Freshwater – Mussel – Digestive system.

Calotes - Arterial and Venous system –Virtual Lab .

Mounting:

Earthworm - Body setae and penial setae.

Freshwater mussel Pedal ganglion.

Cockroach and Honey bee - Mouth parts

Shark - Placoid scales

Spotters:

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephyra larva, Physalia, *Fasciola hepatica*, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, *Taenia solium* entire, Scolex, Nereis entire, T.S. of Nereis,

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2BOS1**	**Skill Based Elective – I Culture of Microorganisms (Theory)**	**1**	**1**

Objectives:

- To know the different types of microbial culture medium
- To understand the methods of sterilization
- To learn the methods of isolating pure culture

Unit I

Culture Medium – Types – Preparation (PDA and NA). Composition of some important culture media. Sterilization - Heat sterilization, Chemical sterilization, Filtration and Radiation.

Unit II

Isolation of microorganisms from soil, manure pits, water and air.

Methods of isolating pure culture: Streak plate, pour plate, spread plate and micromanipulator method.

Preservation of microbial cultures: Culture tubes – Drying in gelatin discs – preservation in oil – Lyophilization.

Books for Reference

- Joseph C. Daniel (2009). Environmental Microbiology
- V.Kumaresan (2011). Biotechnology. Saras Publication

Outcome:

After completion of this course, students would be able to

- study the preparation of types of microbial culture medium.
- obtain more idea about the methods of sterilization.
- learn the methods of isolation of pure culture.
- inculcate the knowledge on methods of Preservation of microbial cultures.
- become an entrepreneur to preserve microbial cultures by lyophilization methods.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
III	**20U3BOT3**	**காப்பியங்கள், கட்டுரைகள், இலக்கிய வரலாறு**	**6**	**3**

நோக்கம்

1. காப்பியங்களின் உள்ளடக்கம், உத்திகளைக் கற்றுக்கொடுத்தல்.

2. காலந்தோறும் காப்பியங்களில் காணலாகும் பாடுபொருள்களின் மாற்றங்களை எடுத்துரைத்தல்.

3. காப்பியச்சுவையை மாணவர்கள் அறிந்து கொள்ளச் செய்தல்.

கூறு: 1 காப்பியங்கள் ***நேரம்:18***

1. சிலப்பதிகாரம்: மதுரைக்காண்டம்-வழக்குரைகாதை
2. மணிமேகலை; மலர்வனம் புக்ககாதை
3. சீவக சிந்தாமணி: சுரமஞ்சரியார் இலம்பகம்
4. கம்பராமாயணம்: கங்கைப் படலம்

கூறு: 2 காப்பியங்கள் ***நேரம்:18***

1. பெரியபுராணம் : மெய்ப்பொருள் நாயனார் புராணம்-முழுவதும்
2. அரிச்சந்திரபுராணம்: மயான காண்டம்
3. தேம்பாவணி: திருமணப் படலம்-1-10 பாடல்கள்
4. சீறாப்புராணம் : நபி அவதாரப் படலம்-1-10 பாடல்கள்

கூறு: 3 கட்டுரைத் தொகுப்புகள் ***நேரம்:18***

1. கேட்டிவி - இராகபாவம் (1-10)
2. கேட்டிவி - பயணங்கள் தொடரும்

கூறு:4 கட்டுரைக் கடிதங்கள் மொழிபெயர்ப்புப் பயிற்சிகள் ***நேரம்:18***

பயிற்சிக்கட்டுரைகளும் கடிதங்களும் -பாவை வெளியீடு
கட்டுரைப் பயிற்சி - 10 மதிப்பெண்கள்
மொழிபெயர்ப்புப் பயிற்சி - 5 மதிப்பெண்கள்

கூறு:5 இலக்கிய வரலாறு ***நேரம்:18***

காப்பிய இலக்கியங்கள் - சிற்றிலக்கியங்கள்

பயன்கள்

1. காப்பியங்கள் வாயிலாக அக்காலச் சமுதாயச் சூழலை அறிவர்.
2. பல்வேறு காப்பியங்களையும் ஒப்பிட்டு அவற்றின் தனித்தன்மைகளை அறிந்துகொள்வர்.
3. மீட்டுருவாக்கச் சிந்தனைகளை அறிவர்.
4. கட்டுரை எழுதும் திறன் பெறுவர்.
5. கடிதங்கள் எழுதும் பயிற்சி பெறுவர்.

Semester	Course Code	Title of The Course	Hours of Teaching /Week	No. of Credits
III	**20U3BOE3**	**PART - II Shakespeare, Extensive Readers And Communicative Skills**	**6**	**3**

Objective

- **To introduce the language and creativity of the world-renowned dramatists and novelists to enhance the communicative skills of the learners.**

Unit – I

Julius Caesar
The Merchant of Venice

Unit – II

Macbeth
Twelfth Night

Unit – III

Romeo and Juliet
Tempest

Unit – IV

Thomas Hardy – The Mayor of Casterbridge

Unit – V

Note making, Hints Developing, Expansion of Ideas and Proverbs, Clauses and Sentence, Structure: Simple, Compound and Complex.

Course outcomes

After the completion of this course students will be able to

- **promote their communicative skills through the study of Shakespeare and modern communicative methods.**
- **expand their perception interacting with the culture across the world**
- **imbibe moral and ethical prescriptions**
- **appreciate the creative genius and affluent expressions of Shakespeare**
- **develop the creative and analytical faculty**

Prescribed Texts:

Natarajan, K.ed. *Selected Scenes from Shakespeare*. Chennai: NCBH, 2017.
Hardy, Thomas.*The Mayor of CasterBridge*.(abridged)Chennai: Macmillan Publishers,2012.
Communicative Grammar.Department of English Edition. 2017..

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
III	**20U3BOC3**	**Anatomy and Embryology**	**8**	**5**

Objectives:

- To study the classification of tissues and its functions.
- To learn the classification of meristems and their distribution.
- To know the various aspects of roots and stems indicots and monocots.
- To study the structure of anther, ovule and embryo.
- To understand the mechanism of endosperm formation and their development in dicots and monocots.

Unit I

Anatomy: Tissues - Classification, meristems. General account – classification and distribution of meristematic tissues. various concepts of apical organization of shoot and root - apex

Unit II

Permanent tissues **-** Structure and functions of parenchyma, collenchyma, sclerenchyma, xylem and phloem –Epidermal, Ground and Vascular tissue systems– Primary structure of normal dicot and monocot stem, leaf and root.

Unit III

Normal secondary growth of dicot stem and roots – annual rings, heart wood and sap wood – periderm formation – lenticels – wound healing. Anomalous secondary thickening in stems of dicots (*Achyranthes* and *Boerhaavia*) and secondary growth in monocot stems (*Dracaena*).

Unit IV

Structure of microsporangium – wall layers (Tapetum) – microsporogenesis and microspores. Development of male gametophyte, types of ovules. Structure and development of megasporangia and megasporogenesis – development of female gametophyte (Polygonum type). Endothelium - Process of double fertilization and triple fusion.

Unit V

Endosperm formation - nuclear, cellular and helobial types - Ruminate endosperm (haustoria not included). Development of dicot (*Capsella bursa-pastoris*type) and monocotembryo (*Luzulaforsteri* type) - Polyembryony and apomixis.

Outcome:

After completion of this course, students would be able to

- get knowledge about the tissues and its functions.
- learn the difference of monocot and dicot stem.
- observe the structure and function of anther, ovule and embryo.
- learn the micro and megasporangial development of angiosperms.
- analyse the development of endosperm formation.

Books for Reference

- Anatomy: (2006). A text book of Plant Anatomy – E.John Jothi Prakash, Emkay Pub., Delhi.
- Embryology: Developmental Botany –Annie Regland, Saras Publications.
- Gangulee Das & Kar (1992). College Botany, Vol. II, New Central Agency, Calcutta.
- Pandey, B.P. (2012). Plant Anatomy, S.Chand& Co., New Delhi.
- Bhojwani and Bhatnagar–Embryology of Angiosperms. (2014). Vikas Publishing House (P) Ltd, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20U3BOCP3**	**Practical – III (Anatomy and Embryology)**	**2**	**5**

Objectives:

- To understand and observe the structure of meristems in stem and root.
- To know the process of secondary thickening.
- To study the different stages of anthers, ovules, endosperms and embryos.

Anatomy

1. Simple tissues and Complex tissues – Permanent slides
2. Shoot apical meristem, root apical meristem – Permanent slides
3. T.S of the Dicot stem – *Tridax*, *Cucurbita*, *Leucas*
4. T.S of the Monocot stem – Maize and *Asparagus*
5. T.S of the dicot root – *Cicer* and *Achyranthes*
6. T.S of the Monocot root – *Canna*
7. Cross section of Dicot lesf – *Mangifera*, *Nerium*
8. Cross section of Monocot leaf – *Zea mays*
9. Anomalous secondary growth in Dicot – *Boerhaavia*, *Achyranthes*
10. Anomalous secondary growth in Monocot - *Dracaena*
11. Stomatal types.

Embryology

1. Study of the different stages of microsporangial development - T.S. of mature anther eg., *Datura metal*
2. Study of the different kinds of pollens from locally available plants.
3. Study of various types of ovules - Permanent slides.
4. Study of the endosperms – Endosperm mounting eg., *Trichosanthes cucumerina* (Snake gourd), *Momordica charantia* (Bitter gourd).
5. Dicot and monocot embryos – Stages of development (diagrams only)
6. Embryo mounting in dicot plants (*Tridax*and *Cleome*)

Outcome:

After completion of this course, students would be able to

- get idea for the structure of meristems in stem and root.
- know the information of the process of secondary thickening.
- learn the information about the process of anomalous secondary growth in angiosperms.
- gain the clear idea for anthers, ovules and endosperms.
- observe the development of monocot and dicot embryos.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**20U3BOCHA1**	**Allied chemistry – I**	**5**	**4**

OBJECTIVE

- To acquire a basic knowledge of animal diversity and organization.
- To study the general aspects of Invertebrates and Parasites.
- To study the general aspects of Chordata animals and their anatomy
- To learn the general principles.

UNIT I Fundamental concepts

Bonding – nature of bonds – ionic, covalent, coordinate and hydrogen bonds - Cleavage of covalent bonds – homolytic and heterolytic fission – electrophiles, nucleophiles and free radicals . Types of organic reactions – substitution, addition, elimination, rearrangement – definition and examples. Hybridisation – states of hybridization of carbon in methane, ethane, ethylene, acetylene.

UNIT II Fuel gases, Plant nutrients and Fertilizers

Fuel gases – natural gas, water gas, semi water gas, carburetted water gas, producer gas, LPG and oil gas – composition, manufacture (elementary idea) and uses. Plant nutrients – major nutrients – role of nitrogen, phosphorus and potassium in plant life, micro nutrients. Fertilizers – definition, urea, ammonium sulphate, superphosphate of lime, triple superphosphate and potassium nitrate – preparation and uses.

UNIT III Industrial Organic Chemistry

Pesticides – DDT, BHC – preparation and uses. Refrigerant – freon 12 – preparation, properties and uses. Polymers – definition, classification – natural and synthetic, homo and copolymers, natural polymers – cotton, silk and wool, preparation and applications of the synthetic polymers – polythene, PVC, teflon and nylon. Synthetic dyes – classification, preparation and uses of methyl orange and indigo, food colours.

UNIT IV Colloidal State and Chromatography

Colloidal system – definition, types -Emulsions– definition, types – o/w and w/o emulsions – tests for identification, properties and applications. Gels – definition, classification, preparation and properties – syneresis, imbibition and thixotropy. Electrophoresis – applications. Chromatography–column and paper chromatography – experimental procedures only.

UNIT V Pharmaceutical chemistry

Antiseptic & disinfectants – phenolic compounds – Dettol, phenyle & Lysol – Definition – differences – medicinal uses and side effects. Anaesthetics – general anaesthetics and local anaesthetics – Definition, examples, uses and side effects. Analgesics – narcotic– morphine & pethidine, non-norcotic – salicylic acid & its derivatives–medicinal uses and side effects. Organic pharmaceutical aids – Preservatives, antioxidants, colouring, flavouring and sweetening agents – Definition, examples and uses.

Text Books:

1. Text Book of Ancillary Chemistry, **V.Veeraiyan** et al,revised edition, 1997.
2. Allied Chemistry, **R. Gopalan** and **S. Sundaram,** , S. Chand & Sons, 2nd edition, 1993.

Course Outcomes

After completion of this course, students will be able to

- Acquire a basic knowledge of animal diversity and organization.
- Gain knowledge on general aspects of Invertebrates and Parasites.
- Learn the general aspects of Chordata animals and their anatomy

Reference Books:

1. Text Book of Organic Chemistry**, P.L. Soni** and **H.M. Chawla**, S.Chand & Sons, , 29th edition, 2014 (Unit III).
2. Principles of Inorganic Chemsitry, **B.R. Puri, L.R. Sharma** and **K.C. Kalia** Vishal Publishing Co, Reprint 2016 (Unit I & II).
3. Principles of Physical Chemistry, **B.R.Puri, L.R. Sharma,** Vishal Publishing Company, Jalandhar, 44th edition 2009. (Unit IV)
4. A text book of pharmaceutical chemistry, **Jayashree Ghosh**, S.Chand and Company Ltd., New Delhi, 1st edition, 2004. (Unit V)
5. Pharmaceutical Chemistry, **S. Lakshmi**, S.Chand & Company Ltd., New Delhi, 3rd edition, 2004. (Unit V)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III & IV	**20U4BOCHAPL**	**Allied chemistry practical (Non – semester)**	**3+3**	**--**

Objectives

- To introduce the concepts of numerical solution of ordinary differential equation and 3 dimensional analytical geometry.

A. Volumetric Analysis

1. Estimation of HCl (or H_2SO_4) by NaOH using a standard oxalic acid solution
2. Estimation of NaOH by H_2SO_4 (or HCl) using a standard Na_2CO_3 solution
3. Estimation of oxalic acid by $KmnO_4$ using a standard Mohr's salt solution
4. Estimation of Ferrous sulphate by $KmnO_4$ using a standard oxalic acid solution.
5. Estimation of Mohr's salt by $KmnO_4$ using a standard oxalic acid solution.
6. Estimation of KMnO4 by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of $K_2Cr_2O_7$ by thio using a standard $CuSO_4$ solution
8. Estimation of $CuSO_4$ by thio using a standard $K_2Cr_2O_7$ solution

B. Organic qualitative analysis

Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds.

The following substance are prescribed:

Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline , Toludine, Urea, Benzaldehyde, Glucose.

Course Outcomes

After completion of this course, students will be able to

- How to calculate a limiting reagent, yield, and percent yield
- How to maintain a detailed scientific notebook
- How to critically evaluate data collected to determine the identity, purity, and yield of products.
- How to summarize findings in writing in a clear and concise manner
- How to use the scientific method to create, test, and evaluate a hypothesis

Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
IV	**20U4BOT4**	**சங்க இலக்கியம் – அற இலக்கியம் – செம்மொழி தமிழ்– இலக்கிய வரலாறு**	**6**	**3**

நோக்கம்:

1.பழந்தமிழ் இலக்கியங்களின் திணைத்துறைக் கோட்பாடுகளை அறிதல்.
2.திணைசார் சமுதாய வாழ்வின் பல்வேறுபட்டப் பரிமாணங்களைப்
3.புலவர்கள் வாயிலாகவும் திணை இலக்கியத்தின் வாயிலாகவும் அறிதல்.
4.பழந்தமிழ் இலக்கியங்களின் உயர்தனித்தன்மை வாய்ந்த சிறப்பியல்புகளை அறிதல்.

கூறு: 1 எட்டுத்தொகை நேரம்:18

குறுந்தொகை

1.குறிஞ்சி : தலைவன் கூற்று-யாயும் ஞாயும் யாராகியரோ - பா.எ.-40
2.முல்லை : தலைவி கூற்று-கருங்கால் வேம்பின் ஒண்பூ யாணர் - பா.எ.-24
3.மருதம் : தோழி கூற்று-யாய் ஆகியளே விழவு முதலாட்டி - பா.எ.-10
4.நெய்தல் : தலைவி கூற்று :நள்ளன் றன்றே யாமம் - பா.எ.-6
5.பாலை: செவிலி கூற்று-பறைபடப் பணிலம் - பா.எ.-15

நற்றிணை

1. குறிஞ்சி-நின்ற சொல்லர் பா.எ. 1
2. முல்லை:இறையும் அருந்தொழில் -பா.எ.161
3. மருதம்:அறியாமையின் அன்னை - பா.எ.50
4. நெய்தல்:இவளே கானல் நண்ணிய - பா.எ.45
5. பாலை:புணரில் புணராது பொருளே-பா.எ.16

கலித்தொகை

1. பாலை: எறித்தரு கதிர் தாங்கி- பா.எ.9
2. குறிஞ்சி : காமர் கடும்புனல்- பா.எ.39

அகநானூறு

1. குறிஞ்சி:நீர்நிறம் கரப்ப-பா.எ.18
2. முல்லை: வந்துவினை- பா.எ.44

கூறு: 2 எட்டுத்தொகை நேரம்:18

1. ஐங்குறுநூறு : குறிஞ்சி -அன்னாய் வாழிப்பத்து -பா.எ.201-210
2. புறநானூறு : பாடல் எண்கள் - 9,16,20,51,109
3. பதிற்றுப்பத்து:ஆறாம் பத்து-
பா.எ.1 வடுவடு நுண்ணுயிர், பா.எ.2.கொடி நுடங்கு நிலைய
4. பரிபாடல் : ஏழாம்பாடல் - வையை

கூறு: 3 பத்துப்பாட்டு நேரம்:18

1. குறிஞ்சிப்பாட்டு: முழுவதும்

கூறு: 4 அறநூல்கள் ***நேரம்:18***

1. திருக்குறள்: செய்ந்நன்றியறிதல் ,வினைத்திட்பம்,நெஞ்சொடு கிளத்தல்
2. மூதுரை: 1-10 பாடல்கள்
3.நல்வழி: 11-20 பாடல்கள்
4.நீதிநெறி விளக்கம்: 51-60 பாடல்கள்

கூறு: 5 ***நேரம்:18***

அ. செம்மொழித் தமிழ்— இலக்கிய வரலாறு :

செம்மொழி வரலாறு : மொழி விளக்கம்-மொழிக்குடும்பங்கள்-உலகச் செம்மொழிகள் - இந்தியச் செம்மொழிகள் — செம்மொழித் தகுதிகள் - வரையறைகள் - தமிழின் தொன்மை - தமிழ்ச் செம்மொழி நூல்கள்.

ஆ. இலக்கிய வரலாறு: சங்க இலக்கியங்கள் ,பதினெண் கீழ்க்கணக்கு நூல்கள்

பயன்கள்

1.பழந்தமிழ் இலக்கியங்களை ஆய்வியல் நோக்கில் அணுகுவதற்கான வழிமுறைகளை உணர்த்துதல்.
2.பண்டைத்தமிழரின் அக, புற வாழ்வியலை மாணவர்கள் அறியச் செய்தல்
3.அறத்தின் பெருமையை உணர்வர்
4.ஒழுக்க நெறிகளைப் பின்பற்றுவர்
5.தமிழ் செம்மொழியின் பண்புகளை உணருதல்
6.சங்க இலக்கியத்தின் தொன்மை உணர்தல்

Semester	Course Code	Title of The Course	Hours of Teaching/ Week	No. of Credits
IV	**20U4BOE4**	**PART - II English For Competitive Examinations**	**6**	**3**

Objective

- **To prepare the learners for competitive examinations and to teach the fundamentals of practical communication.**

Unit – I

Grammar – Number, Subject, Verb, Agreement, Articles, Sequence of Tenses, Common Errors

Unit – II

Word Power - Idioms & Phrases, one-word substitutes, Synonyms, Antonyms, Words we often confuse, foreign words & phrases, spelling.

Unit – III

Reading & Reasoning – Comprehension, Jumbled Sentences.

Unit – IV

Writing Skills – Paragraph, Précis Writing, Expansion of an idea, Report Writing, Essay, Letters, Reviews (Film & Book)

Unit – V

Speaking- Public speaking, Group Discussion, Interview, Spoken English.

Course outcomes

After the completion of this course students will be able to

- **develop English language skills by equipping themselves to face competitive exams**
- **improve English language abilities and gain the skills of writing and vocabulary building**
- **gain confidence to face competitive exams**
- **assimilate grammatical rule clearly and precisely**
- **hone their presentation and public speaking skills**

Prescribed Text:

English for Competitive Examinations, NCBH, Chennai, Dec. 2019.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	**20U4BOC4**	**Pteridophytes and Gymnosperms**	**7**	**5**

Objectives:

- To study the classification of Pteridophytes.
- To learn the morphology, anatomy and reproduction of sporophytes and gametophytes of Pteridophytes.
- To understand the classification, morphology and reproductive structures of various types of Gymnosperms
- To study the reproductive structures of male and female gametophytes of Gymnospersms.

Unit I

Pteridophytes–Classification (Reimer, 1954), Origin of Pteridophytes-General characters of Pteridophytes - Stelar evolution in Pteridophytes - Alternation of generations-Heterospory and seed habit.

Unit II

External morphology, anatomy, reproduction and life cycle of *Psilotum, Lycopodium* and *Selaginella*(development details need not be studied).

Unit III

External morphology, anatomy, reproduction and life cycle of *Equisetum, Ophioglossum* and *Dryopteris* (development details need not be studied). Economic importance of Pteridophytes.

Unit IV

Gymnosperms **–** General characters - Classification of Gymnosperms (Sporne, 1965). Morphology and vegetative structures, anatomy of root, stem and leaf of following genera: *Cycas, Pinus* and *Gnetum.*

Unit V

Study of male and female reproductive structures of *Cycas, Pinus* and *Gnetum* (Cones, sporophylls, micro and megasporangia, male and female gametophytes)– Economic importance of Gymnosperms - Introduction to Paleobotany, Types of fossils and fossilization.

Outcome:

After completion of this course, students would be able to

- get the knowledge about the classification of Pteridophytes.
- learn the morphology, anatomy and reproduction of sporophytesand gametophytes of Pteridophytes.
- understand the classification, morphology and reproductive structures of various types of Gymnosperms.
- discuss and gain the knowledge of male and female gametophytes of Gymnospersms
- know the importance of fossils and fossilization and get employment opportunity in Arceyology.

Books for Reference

- V.Singh, B.P.Pandey and V.K.Jain (2009). A text book of Botany–Rastogi Publication, Meerut, India.
- Pandey, B.P. (2005). A text book of Botany (Bryophytes, Pteridophytes and Gymnosperms)
- Gangulee Das & Kar(1970). College Botany, Vol. II, Central Book Depot, Calcutta.
- P.C. Vashista (1976). Text Book of Pteridophytes and Gymnosperms. S.Chand Publications.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	**20U4BOCP4**	**Practical – IV (Pteridophytes and Gymnosperms)**	**2**	**5**

Objectives:

- To study the morphology, anatomy and reproductive structures of different species of Pteridophytes and Gymnosperms.
- To understand about geological timescale of fossils.

Pteridophytes

Study of the morphology, anatomy and reproductive structures of following genera:

Psilotum, Lycopodium, Selaginella

Equisetum, Ophioglossum, Dryopteris

Types of steles

Gymnosperms

Study of the morphology, anatomy and reproductive structures of following genera:

Cycas, Pinus, Gnetum

Geological time scale

Fossil slides:

Rhynia, *Lepidodendron*

Lyginopteris, *Medullosa*

Outcome:

After completion of this course, students would be able to

- know the information of morphology, anatomy and reproductivestructures of different species of Pteridophytes and Gymnosperms.
- study the stelar variations by taking sections in Pteridophytes.
- understand about geological timescale of fossils.
- analyse the variation in fossil forms of Gymnosperms during geological era.
- study the cone variations in Gymnosperms and become an entrepreneur in collection and marketing of specimens.

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No. of Credits
IV	**20U4BOCHA2**	**Allied chemistry-II (For Biologists)**	**5**	**4**

Objective:

- To study ordinary Differential equation and partial differential equation
- To study Fourier series and Laplace transforms.
- To acquire basic knowledge about the beneficial role of animals.
- To study the various types cultures.

UNIT I Acids, Bases and Catalysis

Acids and bases – Arrhenius and Lewis theories of acids and bases, pH scale, buffer solutions – definition – examples of acidic and basic buffer solutions, importance of pH and buffer in living systems. Hardness of water – types and determination of hardness by EDTA titration. Catalysis – types of catalysis, characteristics of catalysts, promoters and catalytic poison, biocatalysts – enzyme catalysis, industrial applications of catalysts.

UNIT II Carbohydrates, Vitamins and Cosmetics

Carbohydrates – classification, glucose and fructose – sources, manufacturing method, reactions of glucose, derivatives of starch and cellulose – applications. Vitamins – classification, sources and deficiency diseases of vitamins A, D, E, K, C, B_1, B_2, B_5, B_6, and B_{12}.

UNIT III Amino acids, Proteins and Nucleic acids

α-Amino acids – essential and non essential amino acids, α-amino acid-preparation by Gabriel-phthalimide reaction and Strecker's method, isoelectric point, zwitter ion formation, action of heat, ninhydrin test. Peptides – definition only, proteins – classification, characteristics and biological functions, elementary treatment of primary and secondary structure. Nucleic acids – DNA & RNA – composition and structure (elementary treatment), differences between DNA & RNA.

UNIT IV Biochemsitry

Metabolism – anabolism and catabolism. Digestion and absorption of carbohydrates, glycolysis, TCA cycle, glycogenesis, glyconeogenesis, maintenance of blood sugar level. Digestion and absorption of proteins, urea biosynthesis. Digestion and absorption of lipids - β-oxidation of fatty acids.

UNIT V Food Chemistry

Food additives – sweetners, preservatives, emulsifying and stabilizing agents, flavouring agents, antioxidants and colouring agents. Food adulteration – definition and types of adulterations – adulterants in soft drinks, milk and milk products, edible oils and fats. Packaging hazards – prevention and control. Simple tests for common adulterants in coffee powder, tea leaves, cane sugar, honey, turmeric, common salt, dhals, and ice creams.

Text Books

1. Text Book of Organic Chemistry, **P.L. Soni and H.M. Chawla**, S. Chand & Sons, 27th edition, 1997.
Principles of Physical Chemistry, **B.R.Puri, L.R. Sharma,** Vishal Publishing Company, Jalandhar, 44th edition 2009. (Unit IV)

Course Outcomes

After completion of this course, students will be able to

- To study ordinary Differential equation and partial differential equation
- To study Fourier series and Laplace transforms.
- To acquire basic knowledge about the beneficial role of animals.

Reference Books:

1. Elements of Physical Chemistry, **B.R. Puri, L.R. Sharma, M.S. Pathania,** Vishal Publishing Co. 43rd edition, 2008-09. (Unit I)
2. TextBook of Biochemistry, **O.P. Agarwal and G.R. Agarwal,** , Goel Publishing House, 7th edition, 1993. (Unit III & IV)
3. Chemistry for Changing Times, **John W.Hill,** St. edition, subject Publishing House, 1986 (Unit II)
4. Food Science, **B.Srilakshmi**, New Age International (P) Ltd., Publishers, 3rd edition ,2003 (Unit V).
5. Food Additives – Characteristics, Detection and Estimation, **S.N. Mahindru** Tata McGraw Hill Publishing Company Limited. (Unit V).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III & IV	**20U4BOCHAPL**	**Allied chemistry practical (Non – semester)**	**3+3**	**2**

C. Volumetric Analysis

1. Estimation of HCl (or H_2SO_4) by NaOH using a standard oxalic acid solution
2. Estimation of NaOH by H_2SO_4 (or HCl) using a standard Na_2CO_3 solution
3. Estimation of oxalic acid by $KmnO_4$ using a standard Mohr's salt solution
4. Estimation of Ferrous sulphate by $KmnO_4$ using a standard oxalic acid solution.
5. Estimation of Mohr's salt by $KmnO_4$ using a standard oxalic acid solution.
6. Estimation of KMnO4 by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of $K_2Cr_2O_7$ by thio using a standard $CuSO_4$ solution
8. Estimation of $CuSO_4$ by thio using a standard $K_2Cr_2O_7$ solution

Organic qualitative analysis

Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds.

The following substance are prescribed:

Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline , Toludine, Urea, Benzaldehyde, Glucose

Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	**20U4BOS2**	**Skill Basted Elective – II Compost Preparation**	**1**	**1**

Objectives:

- To know the nature of different substrates used as wealth from waste.
- To learn the methods of compost preparation
- To know the significance of Panchakavya and Dasakavya

Unit I

Composting – substrate – composting process – salvage – Grinding, pulping and homogenization – Biological degradation –Mushroom compost preparation. Microbiology of composting – anaerobic process - Advantages of composting.

Unit II

Compost making – Methods– Indoor method – Bangalore method – Vermicompost – Preparation – Requirements – Decomposition of natural waste – Preparation of worm pit – Bedding – Organic layer – Introduction of Earth worm – Harvesting – Collection of vermicompost –Advantages of vermicompost - preparation and uses of Panchakavya and Dasakavya.

Outcome:

After completion of this course, students would be able to

- understand the nature of different substrates used as wealth fromwaste.
- learn to know the preparation methods of vermin compost.
- understand the characteristics of Panchakavya and Dasakavya.
- learn the reclamation of wasteland by adding compost to improve the soil fertility.
- develop an entrepreneur skill by learning this compost and vermin compost preparation technique.

Books for Reference

- Joseph C. Daniel (1996). Environmental Microbiology. Brightsun Publications.
- Gupta, P.K. (2005). Vermicomposting -for Sustainable Agriculture. Agrobio. Jodhpur.
- Renuka Sharma (2014). Fertilizer and Manures. Discovery publishing House Pvt.Ltd New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOC5**	**Morphology, Taxonomy and Economic Botany**	**5**	**5**

Objectives

- To study the morphology, vegetative and reproductive characters of Angiosperms.
- To know the different types of taxonomical classification.
- To learn about the herbarium techniques.
- To observe in detail about systematic position, family characters and economic importance of selected angiosperms.
- Mandatory botanical cum educational tour programme to biodiversity rich regions.

Unit I

Morphology of flowering plants: Root, Stem and Leaf – types and modifications; Inflorescence – Cymose, Racemose, mixedand Special types; Flower – Calyx, Corolla, Androecium and Gynoecium -Floral formula and floral diagram. Fruit – simple, fleshy and dry fruits, Aggregate and composite fruit.

Unit II

Systems of classification-Artificial, Natural and phylogenetic. Outline of Natural System - Bentham and Hooker -Merits and demerits. Herbarium techniques -botanical nomenclature - Principles of Priority and its limitations. Types and typification.

Unit III

A detailed study of the vegetative and floral characters and economic importance ofthe following families: Annonaceae, Capparidaceae, Tiliaceae, Rutaceae, Papilionaceae, Caesalpiniaceae, Mimosaceae, Cucurbitaceae, Asteraceae, Apocynaceae and Asclepiadaceae.

Unit IV

A detailed study of the vegetative and floral characters and economic importance of Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae Orchidaceae, Liliaceae, Cannaceae and Poaceae.

Unit V

Economic Botany – Cereals – Pulses - Fiber yielding plants -Timber yielding plants - Sugar yielding plants - Non-Timber forest products (NTFPS) -Gums, Resins.

Outcome:

After completion of this course, students would be able to

- get vast knowledge in the area of morphological features of flowering plants.
- gain the basic knowledge on the taxonomical classification of angiospermic plants
- learn the technique involved in preparation of herbarium.
- understand about the systematic position, family characters and economic importance of selected angiosperms.
- inculcate the knowledge on economic importance of morphological part of Phanerogams.

Books for Reference:

- Rao, K.N. and Krishnamoorthy, K.V.(1984). Angiosperms, Viswanathan & Col.
- Sharma, O.P.(2009). Plant Taxonomy, Tata McGraw Hill Company.
- Gurucharansingh (2006). Plant Systematics, Oxford & IBH Publishing Co Pvt.Ltd
- Ramasamy, S., Lakshminarayana, N. and Venkateswaralu, V., (1976). Taxonomy of systematic Botany, New Central Book, Depot, Calcutta.
- Gangulee Das and Kar (2011). College Botany, Vol. III, Central Book Agency, Calcutta.
- Gangulee, Das and Dutta (2012). College Botany, Vol. I, New Central Book Depot, Calcutta.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOC6**	**Cytogenetics and Molecular Biology**	**5**	**5**

Objectives

- To understand the modern concept of cell structure, component and function.
- To know the modern concepts of prokaryotic and eukaryotic DNA structure and its expression.
- To learn the basis of Mendelian Genetics.
- To study the various factors for various mechanisms of sex determination in plants.
- To apply the knowledge gained from plant molecular biology in agriculture.

Unit I

Structure of Prokaryotic and eukaryotic cells – Ultra structure and function of plasma membrane, Plastids, Mitochondria, Ribosomes, Golgibodies, Microbodies – Peroxisomes and Glyoxysomes.

Unit II

Nucleus – Nucleolus. Morphology and Structure of Eukaryotic chromosomes. Special types of chromosomes – Lamp brush chromosome and Polytene chromosome – Cell cycle -Stages of Mitosis and Meiosis.

Unit III

History of Gregor John Mendel – Mendelian laws of heredity (Law of segregation and law of independent assortment). Deviations from Mendelian ratios. Simple interaction – complementary factor – Supplementary factor. Sex linked inheritance (human); Sex determination in plants.

Unit IV

Translation- Genetic code -Protein synthesis - Gene regulation - lac operon model, post translational modifications.

Unit V

DNA: structure and types, DNA as a genetic material. Transformation and Transduction Replication-semi conservative. Structure of RNA and its types.

Outcome:

After completion of this course, students would be able to

- understand the modern concept of cell structure, components and function.
- know the modern concepts of prokaryotic and eukaryotic DNA structure and its expression.
- get more information of Mendelian Genetics.
- know the factors which affect the sex determination in plants.
- gain knowledge about the plant molecular biology in agriculture

Books for Reference:

- Gupta, R.K.,(2015) A text book of Cytology, Genetics and Evolution. Rastogl Publications.
- Sharma, N.S., (2005). Molecular Cell Biology. International Book Distributors, Dehradun.
- Sinha and Sinha.(1980). Cytogenetics, Plant breeding and Evolution. Vikas Publishing House.
- Verma, P.S. and Agarwal, V.K., (1986). Cell Biology and Molecular Biology (Cytology) S.Chand and Company, New Delhi.
- Grierson, D. and Convey, S.N., (1989). Plant Molecular Biology, Blackie Publishers.
- Power, C.B., (1984). Cell Biology, Himalaya Publishing Col. Mumbai.
- De Roberts and De Roberts, (1998). Cell and Molecular Biology. K.M.Verghese and Company.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOC7**	**Fundamentals of Bioinformatics**	**5**	**4**

Objectives:-

- To acquire the basic knowledge on computer operation.
- To learn about various websites and internet for biological study.
- To understand the nucleic acid and protein sequence databases

Unit I

Introduction to computers -Role of computers in Bioinformatics - Types of hardware and software - operating systems - Fundamentals of networking, World wide web (www) – e-mail and its importance.

Unit II

Biological Research on the Web - Using search engines -Finding scientific articles, Biological databases -Nucleic acid and protein data banks - NCBI, EMBL, DDBJ, SWISS-PROT.

Unit III

Multiple sequence alignment- Sequence analysis - Pair wise alignment. Phylogenetic analysis- Protein structure – Visualizing, prediction and function from a sequence.

Unit IV

Chemical composition – Nucleic acids, DNA, RNA. Structure of DNA -Development of DNA sequence methods -Genefinder and feature detection in DNA.

Unit V

Gene finding, pair wise sequence comparison, sequence queries in biological databases – drug designing and drug delivery.

Outcome:

After completion of this course, students would be able to

- obtain the basic knowledge on computer, operation methods and its role in bioinformatics.
- learn about various websites and internet for biological study.
- acquire the information about the nucleic acid and protein sequence databases.
- get an employability in medical coding and bar coding.
- formulate a protocol for drug designing and drug delivery.

Books for Reference:

- Baldi, P. and Brunak, (2001). Bioinformatics, A Machine Approach, MIT press.
- KhanimtiyazAlam, (2006). Elementary Bioinformation (HB), Dehradum.
- Gibas and Jamback, (2001). Developing Bioinformatics Computer Skills, O'Reily Associates.
- Misenes, S. and Cravetes, S.A.,(1999).Methods in molecular biology Vol. 132, Bioinformatics methods and protocols.
- Harshitha, D., (2006). Techniques of Teaching Computer Science, International book Distribution, Dehradun.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOEL1A**	**Major Elective – I Biofertilizer**	**4**	**4**

Objectives

- To know the basic aspects of biofertilizers
- To study the symbiotic association of various microbes
- To study in detail about various types of biofertilizers
- To know about production and mass multiplication of various microbes used as biofertilizers.

Unit I

General account on microbes used as biofertilizers. *Rhizobium* – taxonomy, physiology, host – *Rhizobium* interaction – isolation -, identification, mass multiplication, carrier based inoculum and field application methods. Actinorrhizhal symbiosis - *Frankia*.

Unit II

Azospirillum– rhizosphere competence and host plant specificity, taxonomy and physiology, isolation and mass multiplication – carrier based inoculum, associative effect of different microorgnaisms. *Azotobacte*r – classification, characteristics, ecology, physiology – crop response to *Azotobacter*inoculum, maintenance and mass multiplication and field application methods.

Unit III

Cyanobacteria (Blue Green Algae) –*Azolla* and *Anabaena azolla* association - Nitrogen fixation -Factors affecting growth of Blue Green Algae and *Azolla* in rice cultivation.

Unit IV

Phosphate Solubilizing Microorganisms - Phosphobacterium, fungi, VA-Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, colonization of VAM – isolation and inoculum production of VAM.

Unit V

Production and identification of different nitrogen fixing microbes. Assessment of nitrogen fixing ability of different strains under controlled and field conditions, culture production (fermentor). Quality control and marketing of biofertilizers.

Outcome:

After completion of this course, students would be able to

- knowing the basic aspects of biofertilizers production.
- study detailed information about the symbiotic association of various microbes.
- get more idea about types of biofertilizers and its role in enrich the soil fertility.
- learn the importance of actinomycorrhizal symbiosis in soil biology.
- understand the role of entrepreneur in biofertilizer production.

Books for Reference:

- N.S.Subba Rao (2013).Biofertilizers in Agriculture and Forestry.
- Norris, J.R., Read, D.J. and Verma, A.K. (1992). Methods in Microbiolog, Vol. XXIV.
- Whitton and Carr(1982). Biology of Cyanobacteria Sprent and Sprent Nitrogen fixation. Springer, Dordrecht

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOEL1B**	**Major Elective – I Biological Control**	**4**	**4**

Objectives:
- To understand the importance of biological control.
- To understand the role of microorganisms in various types of interaction.
- To enable the students to acquire knowledge on bio-control agents**.**

Unit : I

Biological control in plant pathology -Inoculum, historical background, phyllosphere phylloplane, rhizosphere, rhizoplane regions. Tests with individual antagonists. Methods for isolation of microorganisms- isolation from soil by dilution plates.

Unit : II

Interactions between microorganisms- Definition – Factors involved in Biological control –Host - pathogen or parasite -physical environment –Antagonists – Applications.

Unit : III

Biological control of pathogens on aerial parts – Microorganism on aerial parts – Pathogens on aerial parts – Infection through unbroken plant surfaces or natural opening, wounds, dead plant parts – Latent infection.

Unit : IV

Role of antagonists in biological control-Kinds of antagonists-Bacteria, Fungi, Actinomycetes, Viruses – Forms of Antagonism – Ammensalism -Competition -Predation –Parasitism -Mycoparasitism-Nematophage-Mycophage.

Unit : V

Role of hosts in Biological control- Root dynamics – structure, root hairs, mycorrhizal, relationship, uses - Root exudation and the rhizosphere effect –Microbial pesticides – Bacterial, Viral and Fungal– Insects as bio-control agent.

Outcome:

After completion of this course, students would be able to
- understand the importance of biological control in disease management.
- get more idea on the role of microorganisms in various types of interaction.
- acquire knowledge on Mycoparasitism in agricultural fields.
- learn about the role of microorganisms in biological control methods.
- analyse the role of antagonist and its applications.

Books for Reference:

- Kenneth F.Baker and R.James Cook(1979). Biological control of plants pathogens S.Chand&company Ltd,Ram Nagar New Delhi-110055.
- S.C. Bhandari and L.Somani(2006).Ecology and biology of soil organism Agrotech publishing Academy, Udaipur.
- Debajit Borah, (2012). Biotechnology Lab Practices, Global vision publishinghouse,20.Ansari Road,Darayagani, New Delhi.
- C.B Paun and A.F.Daginawala(2017). General Microbiologyvol.II Himalaya publishing house New Delhi.
- G.Prabakaran (2004). Introduction to soil and agriculture microbiology – Himalaya publishing house –Mumbai.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOEL2A**	**Major Elective – II Applied Microbiology**	**4**	**3**

Objectives

- To understand the fundamental of fermentation process.
- To know the microbial based industries
- To gain knowledge about industrial fermentations and products

Unit I

Introduction – general information on microbe based industries – Substrate for industrial fermentation.

Unit II

Food and Dairy Industries: Single Cell Protein (SCP) advantages – Microbes as source of SCP (Algae, Fungi and Bacteria) – Mass production of SCP (*Spirulina*, Bacterial SCP) – Yogurt and Cheese production.

Unit III

Pharmaceutical and related industries -Antibiotics – Sources and types – Production of Penicillin and Streptomycin - Recombinant drugs and vaccines – Insulin and Hep-B Vaccine - Vitamin B_{12}- Advantages of vaccines.

Unit IV

Industrial production of Alcohol (Ethanol) - Organic acids - Citric acid and Acetic acid production – Vinegar production - Lactic acid production.

Unit V

Microbial Enzymes – Amylases, Proteases - Microbes used for aminoacid production – Production of hormones. Commercial production of L-glutamic acid-Application of enzymes.

Outcome:

After completion of this course, students would be able to

- gain knowledge about the fundamental aspects of fermentation process.
- know the production procedures of microbial based food industries.
- get more information about fermentations and its products.
- acquire knowledge on the industrial production of alcohol.
- create an entrepreneur in the microbial production of amylase enzyme.

Books for Reference:

- Adams, M.R. and Moss, M.O., (1995). Food Microbiology Tata McGraw Hill.
- Agarwal, (2006). Industrial Microbiology: Fundamentals and Application. M/S. IBP Publishers and Distributes, New Delhi.
- Crueger, F. and Anneliese Cruger, (2000). Biotechnology: Industrial Microbiology, Panima Publications.
- Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
- Kumaresan, V., (2001). Biotechnology Saras Publications, Nagarcoil.
- Purohit, (2005). Microbiology Fundamentals and Applications. 6th Ed., International Book Distributors, Dehradun.
- Ratledge and Kristenson, (2001). Basic Biotechnology. Oxford University Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOEL2B**	**Major Elective – II Laboratory Techniques**	**4**	**3**

Objectives

❖ To make the students to understand various techniques and engage themselves in self-employment.

Unit I

Preservation of plant materials – Fixation, Stains, preparation of medium for culture, PDA, MS Media.

Unit II

Sectioning of plant material – Hand sectioning, microtome sectioning. Double staining, Permanent and semi-permanent mounts.

Unit III

Extraction and purification methods – Batch extraction, solvent extraction, filtration - Electrophoresis – principles and techniques of Agarose and , SDS-PAGE.

Unit IV

Cytochemical test for identification of proteins, lipid, starch & sugar in plant tissues. Suspension culture, callus culture use of rotary shakers.

Unit V

Biostatistics - Mean, Median, Mode, Standard deviation, Standard error, Student test, Chisquare test.

Outcome:

After completion of this course, students would be able to

- ❖ conduct the awareness programme of self-employment for students.
- ❖ learn the method of taking section of plant materials by permanent and semi permanent mounts.
- ❖ study the techniques for identification of some macro molecules.
- ❖ obtain knowledge on the preparation methods of various microbial media.
- ❖ analysis the statistical data of plant population through biostatistical tool.

Books for Reference:

- Berlyn, G.P., (2006). Botanical Microtechniques and Cytochemical, M/S. IBD Publisher and Distribution.
- Khanirjan, A., (1967). Fundamentals of Biostatistics, M/S. IBD Publishers, New Delhi.
- Srivastava Meena, (2007). Principles of Laboratory Techniques and Methods, IBD Publishers, New Delhi.
- Jayaram, J., (1988). Techniques in Biology – A College level study.
- Johansen, Laboratory Techniques.
- Jensen, W.A., (1962). Botanical Histochemistry, Tata McGraw Hill.
- Harborne, J.B., (1985). Phytochemical Methods, International Book Dist., Dehradum.
- Sass, J.E., (1958). Botanical Microtechnique, State College Press Amer. IOWA.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BOCP5**	**Practical – V (Taxonomy, Cytogenetics and Molecular Biology)**	**4**	**4**

Objectives

- To identify the locally available plants.
- To study the various cell organelles using slides and electron micrographs
- To study the floral biology of some important crops
- To know the various aspects of Mendelian genetics and molecular biology
- Compulsory botanical tour / Submission of Herbarium of 20 sheets and Tour report
- To study the economic importance of plants and submission of charts

I. Taxonomy

Study of the following families with emphasis on identification

Dicot -Polypetalae:	**Gamopetalae:**	**Manochlamydeae:**	**Monocotyledon:**
Annonaceae	Asteraceae	Amaranthaceae	Arecaceae
Capparidaceae	Apocynaceae	Euphorbiaceae	Poaceae
Rutaceae	Asclepiadaceae		
Fabaceae	Scrophulariaceae		
Caesalpiniaceae	Acanthaceae		
Mimosaceae	Varbenaceae		
Cucurbitaceae	Lamiaceae		
Apiaceae			

B- Study the economic important of plants and submission of charts.

C-Submission of Herbarium and Tour report

III. Cytogentics:

1. Cell division: Mitosis and Meiosis – Squash technique in Onion root tips and Tradeschantia / Rheo flower bud respectively.
2. Simple problems on Monohybrid and dihybridratios- Interaction of gene factors - Inheritance (Charts).
3. Ultra structure of cell organelles (Charts).

II. Molecular Biology

1. Structure and types of chromosomes, DNA and RNA.

Outcome:

After completion of this course, students would be able to

- easily identify the locally available plants.
- perform the cell structure in microscopic slide and electron micrographs
- understand the floral biology of some important crops
- get more idea about Mendelian genetics and molecular biology
- gain taxonomical knowledge by visiting the botanical garden and submission of herbarium and tour report.
- know the economic importance of plants and submission of charts.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5BONME**	**Non-Major Elective – Herbal Technology**	**2**	**1**

Objectives

- To enrich the knowledge about the systematic botany and crude drugs.
- To study the important locally available medicinal taxa.
- Tolearn the major phyto constituents of medicinal plants

Unit I

Importance of herbal drugs in Indian Systems of Medicine – Siddha, Ayurveda, Unani and Homeopathy - Pharmacognosy and its branches – Phytochemicals of some locally available medicinal plants medicinal gardening – House garden plants.

Unit II

Adulteration of crude drugs – methods and types of adulteration and detection – Botanical description and active principles of crude drugs; Rhizome; wood and bark drugs (Ginger, Sandal and Chincona) – Taxonomic study of some selected herbs (*Eclipta, Adathoda, Solanum* and *Centella*).

Outcome:

After completion of this course, students would be able to

- enrich the knowledge about systematic botany with reference to herbal technology.
- study the important locally available medicinal taxa.
- obtain the knowledge on major phytoconstituents of medicinal plants.
- learn the traditional uses of medicinally important herbs.
- create an entrepreneur in the field of siddha, ayurveda, unani and homeopathy
- gain knowledge on the adulteration and detection process.

Books for Reference

- Somasundaram, S., (1997). Medicinal Botany (Maruthvath Thavaraviyal) – (Tamil Medium Book).
- Wallis, T.E., (1967). Text Book of Pharmacognosy. Fifth edition. By T. E. Wallis. J. & A. Churchill Ltd., London, England.
- Srivastava, A.K., (2006). Medicinal Plants. International Distributors, Dehradun.
- Balu, S., Murugan, R. and Pandiyan, P., (2004). Herbal Technology.
- N.C.Kumar (2004). Text Booker – Medical Botany and pharmacognosy EMKAY PUBICATIONS.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	**20U5STLSD**	**Life skill development**	**1**	

Course objectives

- To enhance one's ability to be fully self aware by helping oneself to overcome all fears and insecurities and to grow fully from inside out and outside in.
- To increase one's knowledge and awareness of emotional competency and emotional intelligence at place of study/work.
- To provide opportunity for releasing one's potential through practical experience.
- To develop interpersonal skills and adopt good leadership behaviour for empowerment of self and others.
- To set appropriate goals, manage stress and time efficiently.
- To manage competency- mix at all levels for achieving excellence with ethics.

Unit – I (30 hrs)

Communication and Professional skills

1. Writing and different modes of writing. (4 hrs)
2. Digital Literacy. (4 hrs)
3. Effective use of social media. (3 hrs)
4. Non verbal communication. (2 hrs)
5. Resume skills. (3 hrs)
6. Presentation skills. (4 hrs)
7. Listening as a Team skill. (2 hrs)
8. Brainstorming. (2 hrs)
9. Social and cultural Etiquettes. (4 hrs)
10. Internal communication. (2 hrs)

Unit – II (30 hrs)

Leadership, management and Universal Human Value

1. Leadership skills. (4 hrs)
2. Managerial skills. (4 hrs)
3. Entrepreneurial skills. (4 hrs)
4. Innovative Leadership and Design thinking. (4 hrs)
5. SWOT Analysis (4 hrs)
6. EQ (2 hrs)
7. Love and Compassion. (4 hrs)
8. Truth. (1 hr)
9. Non Violence. (1 hr)
10. Righteousness. (1 hr)
11. Ethic and Integrity. (1 hr)

Course outcomes

At the end of the programme learners will be able to:

- Gain Self Competency and Confidence.
- Practice Emotional Competency.
- Gain Intellectual Competency.
- Gain an edge through Professional Competency.
- Aim for high sense of Social Competency.
- Be an integral Human Being.

References:

1. Bailey, Stephen, Academic Writing : A handbook for International Students, 2010 Rourlege.
2. Shlpa Sablok Bhardwaj (2018). Computer Applications for Class 9 MS Office Blueprint Education (Contributor).
3. http:// WWW.lyfemarketing.com / blog / how-digital – marketing – works/
4. http:// WWW.thoughtco.com/what-is-nnverbasl - communication - 1691351
5. http:// WWW.wikihow.com/Write-a-Neat-Resume
6. http:// WWW.gildabonanno.com/presentation-skill-coaching-videos
7. http:// blog.vantagecircle.com/active-listening/
8. Osborn, A.F. (1963) Applied imagination: Principles and procedures of creative problem solving (Third Revised Edition). New Yok, NY: Charles Scribner's Sons.
9. http:// WWW.thespruce.com/what - is - etiquette – and – why – is- it- important – 1216650
10. http:// WWW.talkfreely.com/blog/internal-and-eternal-communication

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOC8**	**Plant Physiology**	**7**	**4**

Objectives

- To study in detail about diffusion, osmosis and water potential.
- To understand the various aspects of enzymes
- To learn about the light and dark reactions of photosynthesis
- To learn in detail about respiration and growth mechanisms.

Unit I

Diffusion – Osmosis - water potential -Osmotic potential – Plant cell as an osmotic system – Plasmolysis – Imbibition - Absorption of water – Mechanism – Active and passive absorption - Absorption of mineral salts -Mechanism – Ion exchange – Passive and active absorption -Carrier concept -Traspiration-Guttation.

Unit II

Enzymes classification – New system – Structure of enzymes – Cofactors – Mode of action – Induced fit theory – Mechanism of enzyme action – Michaelis-Menton equation – Properties of enzymes – Factors affecting enzyme action – Enzyme inhibition (allosteric) and regulation - Nitrogen metabolism -Sources of nitrogen – Molecular, inorganic and organic.

Unit III

Absorption and utilization of light energy - Two pigment system – PS I and PS II - Mechanism of photosynthesis – Light reaction – Photolysis of water – Electron transport (Z-Scheme) – Cyclic and non-cyclic-photophosphorylation - Dark reaction – Calvin cycle (C_3 pathway) - Hatch-Slack pathway (C_4 dicarboxylic acid pathway) – NAD – Malate dependent- CAM pathway - Photorespiration.

Unit IV

Respiration - Mechanism – Glycolysis (EMP pathway) – Anaerobic respiration – Alcoholic and lactic acid fermentation -Kreb's cycle (TCA cycle) - Electron Transport system - Mechanism of oxidative phosphorylation - Pentose phosphate pathway and its significance - Difference between oxidative and photophosphorylation - Factors affecting respiration – Internal and External - Electron transport systems (ETS).

Unit V

Growth hormones – Auxins, gibberellins and cytokinins – Discovery, bioassay, chemical nature and physiological effects - Ethylene and florigen – Phytochrome – Photoperiodism- Vernalization -Seed dormancy.

Outcome:

After completion of this course, students would be able to

- learn in detail information about the diffusion, osmosis and water potential.
- understand the various aspects of enzymes and mechanism of enzyme action.
- get detailed information about the light and dark reactions of photosynthesis.
- enrich knowledge on mechanism of respiration, the role of growth hormones and seed dormancy.
- formation of a scientist in the field of stress physiology.

Books for Reference:

- Jain, V.K., (1974). Fundamental of Plant Physiology, S. Chand & Co. New Delhi
- Pandey, S.N. and Sinha, B.K.Plant Physiology, Vikas Publishing House (p) Lid,Newdelhi.
- Noggle and Fritz Introduction to Plant Physiology, PranticeHall of India.
- Malik, C.P. (2006). Plant Physiology, Oxford IBH.
- Salisbury F.B and Ross C.W.(1999). Plant Physiology CBS publishers and printers, Newdelhi.
- Jain, J.L., (1998). Fundamentals of Biochemistry. S.Chand& co., New delhi.
- Lehninger, A.L (1984). Biochemistry (2 nd Edition). Kalyani publisher, Ludhina, New delhi

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOC9**	**Environmental Botany and Bio-statistics**	**7**	**4**

Objectives

- To study the various aspects of ecology and vegetation.
- To know about the ecological pyramids, food chain and food webs
- To learn about the impact of pollution on biodiversity
- To study the importance of statistical tools in biology

Unit I

Approaches to the study of ecology – Autecology – Synecology – Population - Community – Units of vegetation - Ecosystem concept -Components –Abiotic and Biotic

Unit II

Factors in ecological pyramids influencing vegetation- Climatic, edaphic and biotic factors - Food chain -Food web - Ecological pyramids - energy flow in an ecosystem – pond ecosystem - productivity in aquatic ecosystem.

Unit III

Ecological succession of hydrosere– Xerosere - Ecological classification hydrophytes, xerophytes, mesophytes, halophytes and epiphytes -Morphological and anatomical adaptations of hydrophytes and xerophytes.

Unit IV

Phyotogeography-Botanical region of India - Remote sensing and its applications-GIS. Atmospheric pollution –Land pollution-Noise pollution – Water pollution – Radiation pollution - Control methods.

Unit V

Importance of statistics in biology – Population – census and sampling methods – presentation of data (graphical and diagrammatic) - frequency distribution, measures of central tendency (mean, median and mode) - Standard deviation – Standard error.

Outcome:

After completion of this course, students would be able to

- learn various aspects of ecology and vegetational types India.
- acquaint with vast knowledge on the ecological pyramids, food chain and food webs.
- learn the impact of pollution on global biodiversity.
- analyse in detail on the importance of statistical tools in biology.
- gain knowledge on the botanical provinces of india.

Books for Reference:

- Sharma, P.D., (1992). Ecology and Environment, Rastogi Publications, Meerut, UP.
- David N. Sen. (1978). Concept in Indian Ecology, ShobanLalin Chand &Co., M 5, Industrial Area, Jalankhar City 144 004, India.
- Sakal and Rohif Introduction to Bio-statistics, Freeman-Sanfrancisco.
- Idaikkandan, N.M.(1979). Agricultural Statistics, Pergamon Press, Oxford.
- Khan and Khanum (1994). Fundamentals of Biostatistics, International Book Dept.
- Ramakrishnan, P., (2001). Biostatistics, Saras Publications.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOC10**	**Forest Botany and Wood Science**	**7**	**4**

Objectives:
- To study the age of tree using annual rings
- To study the communities by quadrat method and to determine the percentage of frequency, density and abundance
- To know the importance of forest resources

Unit I

History of forests – General introduction of forests - Different types of forests – Tropical, Temperate, Evergreen, Semi-evergreen and Deciduous (with few examples).

Unit II

Agroforestry – Definition, need and scope - Agroforestry systems under different agro-ecological zones. Social / Urban forestry- Scope and necessity -People's participation.

Unit III

Forest environment – Major biotic and abiotic components. Nutrient cycles (nitrogen, carbon and phosphorous) and its importance. Silviculture - concept and scope - Ethnobotany and its significance.

Unit IV

Wood science – kinds of wood – Hardwood and Softwood -Heart wood and sap wood - Physical properties of wood - Chemical constituents of wood - Cellulose, hemicellulose and lignin.

Unit V

Forest resources and its utilization - Direct benefits from forests – fuelwood, timber, food, shelter and paper. Indirect benefits - soil improvement, reduction of atmospheric pollution and control of climate.

Outcome:

After completion of this course, students would be able to
- studying the age of tree of by using annual rings or by counting number of growth rings.
- know the communities by quadrate method and to determine the percentage of frequency, density and abundance.
- learn more information on the importance of forest resources in Tamil Nadu.
- understand the economically importance of forest plant species.
- analyze the protocol for conservation of agroforestry and silviculture.

Books for Reference:

- Champion HG and Seth SK, (1968). A revised survey of forest types of India. Govt. of India, New Delhi.
- Dwiyedi AP, (1992). Agroforestry principles and practices. Oxford and IBH publications, New Delhi.
- MehtaT.,(1981). A handbook of forest utilization. Periodical Expert Book Agency, New Delhi.
- GrebnerD, Bettinger P, Siry J (2003). Introduction to forestry and natural resources (1st edition). Academic press, USA.
- Manikandan K and Prabhu S, (2013). Indian Forestry: A break-though approach to forest service – 6th edition. Jain Brothers, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOEL3A**	**Major Elective – III Biotechnology**	**4**	**4**

Objectives

- To know the basics and importance of biotechnology in the current scenario
- To understand the application of genetic engineering
- To learn the mechanism of biological nitrogen fixation
- To know the various aspects of fermentation and biofuels

Unit I

Scope and importance of biotechnology - Basic of genetic engineering – Foreign DNA –Preparation, Insertion of DNA into vectors. Enzymes used in genetic engineering - Restriction endonucleases and ligases. Gene cloning – Vectors – Plasmids (pBR322) and cosmids (PLFR5).

Unit II

Selection of recombinants using antibiotic markers -Radio labeling – Replica plating – Transgenic plants for herbicide resistant – Phytoremediation - Applications of genetic engineering.

Unit III

Biological nitrogen fixation – Mechanism -Use of *Azotobacter, Anabaena* and *Rhizobium* as biofertilizer organisms.

Unit IV

Biological waste management – Sewage and reuse of wastes -Primary and secondary treatments - Oxidation ponds - Anaerobic digestion and reuse of sewage.

Unit V

Fermentation - Types of fermentor -Media and its types – Production of enzymes (proteases), alcohol(ethanol) and antibiotics (Penicillin).

Outcome:

After completion of this course, students would be able to

- gain information on the basic aspect and importance of biotechnology in thecurrent scenario.
- know the values of genetic engineering in biotechnology.
- analyze the mechanism of biological nitrogen fixation in plants.
- learn the techniques involved in biominerlization.
- observe the working mechanisms and applications of fermentor.

Books for Reference:.

- Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
- Ratledge and Kristenson, (2001). Basic Biotechnology, Oxford University Press.
- Dr.RitaSingh(2004). Plant Biotechnology Global vision publishing House, New Delhi – 110002.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOEL3B**	**Major Elective – II Environmental Biotechnology**	**4**	**5**

Objectives

- To give an insight into environmental pollution and microbial processes in environment.
- To provide knowledge on the use of microbes for safe environment
- To treat hazardous wastes using biotechnological processes.

Unit I Introduction

The environment – soil, water and air. Pollution and its causes (Outline only) – Nonconventional energy sources – biogas production, methane and hydrogen production. Recycling of solid waste products – composting and silaging.

Unit II Source and treatment of polluted water and effluents

Biological treatment of sewage – characteristics of sewage and objectives in sewage treatment – Activated sludge process – trickling filters –Anaerobic digestion. Treatment of industrial effluents using bioreactors.

Unit III Soil and air pollution and their treatment

Soil pollution by Xenobiotics. Degradation of Xenobiotics – pathways of phenol, pentachlorophenol and polychlorinated biphenyl degradation. Purification of polluted air.

Unit IV

Introduction to bioremediation -*ex situ* and *in situ* bioremediation. Types of reactors used in bioremediation.

Unit V

Biomineralization – bioleaching – Metal transformation – biofilms and biocorrosion. Pollution by radionuclides – uptake of radio nucleotides from polluted sites. Future prospects.

Outcome:

After completion of this course, students would be able to

- gather the knowledge on the use of microbes for safe environment.
- get an idea about how to treat the hazardous wastes using biotechnological processes.
- understand the importance of environmental biotechnology in society.
- analyse the role of various reactors in bioremediation
- learn the role of uptake of radio nucleotides from polluted sites and its future prospects.

Books for Reference:

- Alan Scragg, (1999). Environmental Biotechnology, Pearson Education Limited.
- Dubey, R.C., (2004). A text Book of Biotechnology aspects of Microbiology, British sun Publication.
- Joseph, C. Deniel, (1996). Environmental aspects of Microbiology, British Sun Publication.
- Keeshav Thehan, (1997). Biotechnology, New age International (P) Limited, New Delhi.
- Sharma, P.D., (2005). Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
- Raina Maier, M., Iran Pepper, L., Charles, P. and Gerba, (2000). Environmental Microbiology, Academic Press UK.
- Alexander, N., Glazer and Hiroshi Nikaido, (1994). Microbial Biotechnology.
- 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.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOEL4A**	**Major Elective – IV Plant Tissue Culture**	**4**	**3**

Objectives:
- To know the scope and importance of plant tissue culture
- To learn about the art of the techniques in organ culture and protoplast culture
- To understand the conservation of rare and endangered plants

Unit I

Introduction - History, scope and concepts of basic techniques in plant tissue culture - Laboratory requirements – Sterilization -Media preparation - Inorganic nutrients -Organic supplements -Carbon source -Gelling agents -Growth regulators -Composition of MS medium -Biotechnological Industries in India.

Unit II

Cell, tissue and organ culture - Explants and organs for culture - Cell suspension cultures - Batch, continuous and chemostat culture-Production of secondary metabolites by immunolized plant cells.

Unit III

Organogenesis –Direct and indirect - Role of growth regulators –Somaclonal and gametoclonal variations - Somatic embryogenesis - Factors affecting embryogenesis.

Unit IV

Haploid production - Anther culture - Haploids in plant breeding -*In vitro* pollination - Ovule and embryo culture and its importance.

Unit V

Protoplast culture - Isolation and production of protoplasts-Viability. Protoplast fusion - Spontaneous, mechanical, induced and electro-fusion–Importance of protoplast culture.

Outcome:

After completion of this course, students would be able to
- concern the scope and importance of plant tissue culture.
- get more information and gain the art of the techniques in organ culture and protoplastculture.
- get awareness regarding the conservation of rare and endangered plants.
- understand the knowledge the role of haploids in plant breeding.
- learn the knowledge on the isolation protoplast and its importance.

Books for Reference

- Bhojwani, S. S. and Razdan, M. K. (1983). Plant Tissue Culture: Theory and Practice. Elsevier Science Publishers, Netherlands.
- Dodds, J. H. and Roberts, I. W. (1985). Experiments in Plant Tissue Culture. Cambridge University Press, UK.
- Hammoond, J., McGarvey, P. and Yusibov, V. (2000). Plant Biotechnology. Springer Verlag, New York.
- Johri, B. M. (1982). Experimental Embryology of Vascular Plants. NaroshaPublishing House, New Delhi.
- Ramawat, K. G. (2000). Plant Biotechnology. S. Chand & Co., New Delhi.
- Reinert, J. and Bajaj, Y. P. S. (1977). Plant Cell Tissue and Organ Culture: A Laboratory Manual, Narosa Publishing House, New Delhi.
- K.Karthikeyan.C.Chandran and S.Kulothungan(2007). Plant Biotechnology

- Dr.Ritesingh (2004). Plant Biotechnology , Global vision publishers, New Delhi –
- 110002.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
VI	**20U6BOEL4B**	**Major Elective – IV Preservation of Fruits and Vegetables**	**4**	**5**

Objectives

- To understand the fundamentals of food processing
- To know the fruits and vegetable products from microbial based industries.
- To gain knowledge about the preservation of fruits and vegetable.

Unit I

Principles of preservation - Methods of preservation – Refrigeration, freezing, canning, drying and dehydration -Chemical preservatives.

Unit II

Food spoilage – causes and factors. Causes – physical, chemical and biological factors – pH, temperature, available moisture.

Unit III

Canning of fruits: mango, apple and banana. Canning of vegetables: bean, carrot and tomato.

Unit IV

Processing of fruits - Banana, dates, grape, fig and mango. Preparation of jam, jelly, juice, squash and pickles.

Unit V

Asepsis – packing and packing materials, metal, glass, papers, plastics and films, laminates, Edible films and wooden packaging.

Outcome:

After completion of this course, students would be able to

- understand the fundamental aspects of food processing.
- discuss about canning of fruits and vegetable products produced from microbes by industries.
- prepare the various methods of processing of fruits.
- know about the factors which are affecting the food product.
- obtain basic knowledge on the preservation of jams and pickles.

Books for Reference:

- Siddappa, G.S. and Tandon, G.L., (1998). Preservation of Fruits and Vegetables Lal G., Indian Council of Agricultural Research, New Delhi.
- Preservation and Canning of Fruits and Vegetable (EIRI), (2006). M/S. IRD Publishers, New Delhi.
- Frazier, W.C. and West Holf, D.C., (1995). Food Microbiology. Tata McGraw Hill Publishing Col. Ltd., New Delhi.
- Kulshrestha, S.K., (1994). Food Preservation, Vikas Publishing House, New Delhi.
- Swaminathan, M., (1992). Handbook of food Science and Experimental foods, the Bangalore printing and Publishing Col. Ltd., Bangalore.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOCP6**	**Practical – V (Plant Physiology Environmental Botany and Biostatistics)**	**4**	**4**

Objectives

- To know the principle and mechanism of plant physiological experiments
- To study the morphological and anatomical features of ecological habitats
- To study the vegetation by quadrat method
- To work out the biostatistical problems
- To demonstratethe experimental aspects in microbial physiology

Plant Physiology

1. Demonstration of OP by plasmolytic method.
2. Effect of environmental factors on the rate of transpiration by Ganong's potometer.
3. To correlate total transpiration with transpiring surface.
4. Transpiration and absorption balance.
5. Study of transpiration index by cobalt chloride method
6. Separation of leaf pigments by paper chromatography method.
7. Separation of amino acids by paper chromatography method.
8. Effect of monochromatic light on photosynthesis
9. Effect of temperature on photosynthesis
10. Growth hormone (auxin,gibberlin and cytokinin)

Environmental Botany and Biostatics

1. Study of morphological and anatomical features of hydrophytes, mesophytes and xerophytes.
2. Study of morphological features of epiphytes, parasites and halophytes
3. Study of vegetation by quadrat methods and estimation of frequency of distribution of the plant species.
4. Determination of soil and water pH
5. Workout the problems in biostatistics (mean,mode and standard deviation)

Forest Botany & wood science

1. Study of percentage frequency and density abundance quardrat method in forest species.
2. Estimation of age forest trees.
3. Estimation of cellulose from wood sample.

Outcome:

After completion of this course, students would be able to

- know the principle and mechanism of plant physiological experiments.
- get more knowledge on morphological and anatomical features of ecological habitats.
- study in detail about the vegetation of plain and forest plant species by quadrate method.
- learn how to solve biostatistical problems in plant diversity.
- get first hand information on the experimental aspects in plant physiology.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
I	**20U1BOCOP1**	**Core Optional - Medical Botany**	**-**	**-**

Objectives:
- To know the importance of herbal drugs in human beings
- To learn the significance of herbal gardening
- To learn the botanical description and active principles of common medicinal plants

Unit I

Importance and relevance of herbal drugs in Indian system of Medicine, Pharmacognosy – Aim and scope- Branches of Pharmacognosy – Phytochemicals – Reserve materials- Secretory materials. Excretory materials.

Unit II

Herbal gardening – Gardens in the Hills and plains- Home gardens, plants for gardening – Poisonous plants – Types of plant poison: action of poisons- treatments 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. Taxonomic study of some selected herbals (Two examples for each plant organs).

Outcome:

After completion of this course, students would be able to
- know the importance of herbal drugs in human beings.
- learn about the significance of herbal gardening in human population.
- get knowledge about botanical description and active principles of common medicinal plants.
- know the adulteration methods of crude drugs.
- understand the uses of folk lore medicine in trible and nomad villages.

Books for Reference:

- Somasundaram S. (1997), Medicinal Botany (Maruthuvath Thavaraviyal) – (Tamil Medium Book)
- Wallis, T.E. (1967). Text Books of Pharmacognosy. Copyright Wiley-Liss, Inc., A Wiley Company
- SrivastaveA.K.(2006). Medicinal Plants, International Book distributiors, Dehradun
- Agarwal, O.P. (1985). Vol. II Chemistry of Organic – Natural products
- Gamble, J. S. and Fisher, (1921). CEC I, II, III Flora of the Presidency of Madras Volumes
- Mathew K.M., (1988), Flora of the Tamilnadu and Carnatic.
- Nair N.C. and Henry A.M., (1983). Flora of Tamil Nadu, India Botanical Survey of India
- Chopra R.N. Nagar S.L. and Chopra I.C.,(1956).Glosary of Indian Medicinal Plants
- Chopra R.N., Chopra I.C., Handa K.L. and Kapur L.D., (1994). Indigenous drugs of India
- Chopra R.N. Badhuvar R.L. & Gosh G. (1965). Poisonous plants of India

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	**20U2BOCOP2**	**Core Optional - Seed Pathology**	**-**	**-**

Objectives:
- ❖ To know the seed borne microbes and diseases.
- ❖ To know the methods of seed health testing.
- ❖ To learn the process of seed borne disease development.
- ❖ To know the quarantine for seed and organization for plant protection at various levels.

Unit I

History of Seed Pathology-Importance in agriculture –losses caused by seed borne diseases. Seed health testing for fungi, bacteria and viruses: Principles and methods.

Unit II

Seed borne fungi, bacteria and viruses and diseases caused by fungi – blast of paddy, red rot of sugarcane; bacteria – Blight of paddy, black arm of cotton; viruses: leaf roll of potato, bean, Mosaic virus.

Unit III

Seed infection and establishment – avenues, factors and its establishment – location in seed –Epiphytotics due to seed borne inoculums.

Unit IV

Controls of seed-borne diseases – physical, chemical and biological treatment; post-entry control. Storage fungi and mode of seed deterioration. Mycotoxins, plant variety protection act, legal protection of crop varieties and seed legislation in developing countries.

Unit V

Seed Quarantine, history and importance, principles and regulations of plant quarantine in India. Seed certification – history, scheme, eligibility procedure – (Organization, Economic Co-operation and Development) – Changing concepts, Applying quarantine provisions for seed.

Outcome:

After completion of this course, students would be able to

- ❖ get awareness on seed borne microbes and causing diseases.
- ❖ know the methods of seed health testing in microbial infections.
- ❖ learn the process of seed borne disease development.
  know the quarantine for seed and organization for plant protection at various levels.
- ❖ apply the quarantine provisions for seeds in seed pathology.
- ❖ observe the role of mycotoxin in seed deterioration.

Books for Reference

- Agrios, Geroge, N., (1998). Plant Pathology, Academic Press, San Diego, London.
- Bilgrami, K.S. and Dubey, H.C., (1980). A text book of modern Plant Pathology, Vikas Publishing House, New Delhi.
- Mehrotra, R.S., (1980). Plant Pathology, Tata McGraw Hill Publishing Company Limited New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20U3BOCOP3**	**Major Elective – III Fermentation Technology**	**-**	**-**

Objectives

- To train the students
- To understand and apply the protocols for primary fermentation processes.

Unit I

A general account on microbial biomass, enzymes, metabolites and recombinant products – Range of fermentation processes -Transformation processes.

Unit II

Strain isolation, preservation of industrially important microorganisms – Media for industrial fermentation and their sterilization – Microbial growth, fed, batch and continuous cultures.

Unit III

Fermentor - basic function – body construction – aerators, agitators (impellers and spargers) asepsis – containment – Valves and steam traps – types of fermentors.

Unit IV

Methods of measuring, process variables – temperature, pressure and flow rate control – online analysis of chemical factors and control systems (pH, DO, foaming etc) – computerized control systems - biosensors.

Unit V

Foam separation, precipitation, filtration, centrifugation, cell disruption, liquid – liquid extraction, chromatography membrane process.

Outcome:

After completion of this course, students would be able to

- learn the techniques involved in fermentation technology.
- apply the protocols for primary fermentation processes.
- learn the computerized control system of fermentation.
- understand the preservation of industrially important microorganisms.
- analyse the basic functions and body constructions of fermentor.

Books for Reference:

- Agarwal, (2006). Industrial Microbiology: Fundamental and Application, M/S. IBD Publishers and Distributors, New Delhi.
- Patel, A.H., (2003). Industrial Microbiology, MacMillan.
- Stanley, P.F.A., Whilttaker and Hall, S.J., (1995). Principles of Fermentation Technology, 1st Ed. Pergamon Press, U.K.
- Alexander, N. Glazer and Hiroshi nikaido, (1994). Microbial Biotechnology, Fundamentals and Applied Microbiology W.H.Freeman and Co., New York.
- Rajak, (2005). Microbial Biotechnology for sustainable Development and Productivity, M/S. IBD Publishers and Distributors, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
IV	**20U4BOCOP4**	**Core Optional - Plant Pathology**	**-**	**-**

Objectives:

- To know the history and principles of plant pathology.
- To learn the laboratory and analytical techniques
- To know the fungal bacterial and viral diseases of crop plants
- To know the management of plant diseases.

Unit I

History and Principles of Plant Pathology – Classification of plant diseases. Koch's postulates. Growth, reproduction, survival and dispersal of plant pathogens. Factors influencing infection, colonization and development of symptoms. Survey, surveillance (including through remote sensing), and prediction and forecasting of diseases.

Unit II

Laboratory and Analytical Techniques – Preparation and sterilization of common media. Methods of isolation of pathogens and their identification. Preservation of microorganisms in pure culture. Methods of inoculation. Measurement of plant disease. Molecular detection of pathogens in seeds and other planting materials.

Unit III

Fungal diseases of crop plants – Fungal diseases of cereals, millets, oilseeds, pulses, fruits, vegetables, plantation, fiber, spices and ornamental crops with special reference to etiology, disease cycle, perpetuation, epidemiology and management. Post harvest diseases in transit and storage; alfatoxins and their integrated management.

Unit IV

Bacterial and Viral diseases of crop plants- Crop diseases of cereals, pulses, oilseeds, vegetables, fruits, plantation and fiber crops caused by bacteria, viruses, viroids, mycoplasmas and other fastidious prokaryotes. Mode of transmission and pathogen vector relationships. Epidemiology and management.

Unit V

Management of Plant diseases – Chemical nature and classification of fungicides and antibiotics. Important cultural practices and their role in disease management, solarisation, integrated disease management. Microorganisms antagonistic to plant pathogens in soil, rhizosphere and phyllosphere and their use in the control of plant diseases. Plant growth promoting rhizobacteria.

Outcome:

After completion of this course, students would be able to

- study in detail on the life cycle patterns of plant pathology.
- learn the laboratory and analytical techniques in isolation and identification of pathogens.
- Observe the infection of fungal, bacterial and viral diseases of crop plants.
- know the plant diseases management system.
- learn the control measures of plant diseases.

Books for Reference:

- Dr. D.V. Singh. (2007). Plant Pathology. Introductory Plant Pathology. Ex-Head and Emeritus Scientist Division of Plant Pathology. IARI, New Delhi-110012.
- George Agrio (2004). Plant Pathology. 5th Ed., Academic Press.
- P.N. Sharma (2010). History of Plant Pathology, Dept. of Plant Pathology, CSK HPKV, Palampur.
- John.W.H.Harshberger, (1917). Mycology and Plant Pathology. Philadelphia. P.Blakiston's son & Co.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
V	**20U5BOCOP5**	**Core Optional - Landscaping and plant Breeding**	**-**	**-**

Objectives:

- To Know the basic principle and various Landscaping features
- To study about lawn making and nursery managements
- To understand the breeding technique for crop improvement

Unit I

Introduction – Definition, Basic principles of land scaping . Garden feature Avenue, Trophy, Carpet beds. Shrubs and Shrubbery, Arboretum- flowers beds and Bordens, Grounds cover, climbers and creepens.

Unit II

Plant componends- Annyals, Biennials and Herbaceous perenmials. Types of Garden – Landscaping of institute ,Landscaping of industry, Root Garden.

Unit III

Nursery management of ornamental plants. Lown and Lawn making – Methods. Flower arrangements, Kitchen Gardenning.

Unit IV

Introduction to plants Breeding – Scope and History of plants breeding Achievements in plants Breeding – Breeding Agricalture crops

Unit V

Crop improvement – methods, selection, Hybridization, Heterosis and hybrids vigour Hybridization, Heterosis crops seed certification Breeding of selected crops.

Outcome:
After completion of this course, students would be able to

- get more idea about the breeding technique for crop improvement.
- learn basic principles and various landscaping features.
- study the lawn making and nursery managements of ornamental plants.
- know the importance of plant breeding techniques in horticulture.
- understand the role of heterosis and hybrid vigour in crop improvements.

Books for Reference:

- Modern text book of Botany VOl-IV Dr.//D.TIAGI & Dr.S.B.Agarval.
- Dr.N.Kumar (1997). Introduction to Horticulture –. Rajalakshmi Publication.
- Indian Horticulture Dr.Sathiyamoorthy Asst Prof.Dept. of Vegetables. TNAU-Coimbatore.
- Arora J. S. (2016). Introductory Ornamental Horticulture Hardcover. Kalyani Publications.
- V.Kumaresan (2011). Horticulture and plant breeding. Saras publication

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**20U6BOCOP6**	**Core Optional - Economic Botany**	**-**	**-**

Objectives:
- ❖ To learn the cultivation technique of cereal crops
- ❖ To learn the cultivation technique of some fruit crops
- ❖ T0 know the values of medicinal aromatic plants

Unit I

Origin of Plants – Cultivation, production and use of Cereals: Wheat, rice, maize, sorghum, pearl millet and minor millets.

Unit II

Pulses: Pigeon pea, black gram, green gram, lab-lab bean. Oil seeds: Groundnut, sesame, castor, sunflower and coconut.

Unit III

Economic plants of the following groups such as Fibres: cotton, jute, sunhemp, agave. Sugars: sugarcane, sugar beet, Tuber crops potato, sweet potato, tapioca etc.

Unit IV

Origin, production and utilization of fruits: Mango, banana, citrus, guava and grapes. Vegetables: tomato, brinjal, cucumber, gourds etc.

Unit V

Medicinal aromatic plants: Sarpagandha, Cinchona, Vinca, Mentha. Narcotics: Cannabis, Opium, dye, tannin, gum and resin yielding plants.

Outcome:

After completion of this course, students would be able to
- ❖ learn the cultivation technique and practice of cereal crops.
- ❖ get knowledge on the cultivation technique of some fruit crops.
  enrich knowledge on the values of medicinal aromatic plants.
- ❖ analyse the cultivation techniques of commercially important crops.
- ❖ inculcate the knowledge on the importance of dye yielding plants and its role in dye industry.

Books for Reference:

- Pooja, (2010). Economic Botany. Discovery Publishing House.
- Sampat Nehra, (2007). Economic Botany, Pointer Publishers.
- Sambhamurty, A.V., Subrahmanyam, N.S. (1989). A textbook of economic botany, Wiley Eastern.
- Pandey, B.P., (1999). Economic Botany. S. Chand Limited,
- Albert Frederick, (1937). Economic Botany. Hill McGraw-Hill Book Company.