ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A^{+}' Grade by NAAC)

Thoothukudi-628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

B.Sc. Zoology

School of Biological Sciences

Outcome Based Curriculum

(W.e.f.2023)

Preamble

Zoology is a vital stream of science, it gives an insight into the essence of life. It helps for the betterment of human race through various fields. It unravels the magic of co-existence and ecological balance by creating awareness of conservation of biodiversity. After completing the graduate degree the candidates have tremendous opportunities for higher studies and lots of job opportunities both in public and private sectors.

Vision: To prepare young women face the challenges of life through education, an ideal weapon for empowerment.

Mission: To impart knowledge and skills in Zoology through specialization in recently emerging technologies and thereby to produce quality graduates capable of contributing to the development of knowledge based society.

Programme Outcome:

PO. No.	**After completion of the Undergraduate programme, the students of St. Mary's College will be able to**
PO-1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO-2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem solving skills
PO-3	gain potential skills to excel indigital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO-4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO-5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

Programme Specific Outcome:

PSO. No.	After completion of the B.Sc Zoology Degree programme, the graduates will be able to
PSO-1	exhibit an extensive comprehension of zoological principles, structure, functions, interactions integrating knowledge from various basic and applied fields to analyse and solve complex biological challenges
PSO-2	communicate scientific findings across various courses, employing creative, numerical, analytical, and problem-solving skills to interpret and convey related concepts effectively
PSO-3	acquire proficiency in utilizing digital tools for data analysis, scientific attitude, entrepreneurial skills to drive innovation in research and exhibit leadership qualities within the academic and scientific community
PSO-4	cultivate a deep sense of environmental consciousness and uphold social responsibility by integrating ethical considerations into their research and conservation efforts
PSO-5	emerge as empowered, economically independent individuals with a holistic perspective and actively contributing to the human welfare and society

St. Mary's College (Autonomous), Thoothukudi

Department of Zoology

UG Course Structure (w.e.f.2023)

Semester– I

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil/ French	23ULTA11 23ULFA11	இக்கால இலக்கியம் : (செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை) Foundation Course French I	6	3	25	75	100
II	General English	23UGEN11	Poetry, Prose, Extensive Reading and Communicative English	6	3	25	75	100
III	Core I	23UZOC11	Invertebrata	5	5	25	75	100
	Core Practical I	23UZOCR1	Invertebrata Practical I	3	3	40	60	100
	Generic Elective I	23UCHE12	Chemistry for Biological Sciences I	4	4	25	75	100
	Generic Elective Practical I	23UCHER1	Chemistry Practical I	2	1	40	60	100
IV	Skill Enhancement Course I (Discipline Specific)	23UZOSE1	Ornamental Fish Farming and Management	2	2	20	30	50
	Foundation Course	23UZOF11	Basics of Zoology	2	2	20	30	50
Total				**30**	**23**			

Semester II

Part	Components	Course Code	Course Title	Hours /Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil/ French	23ULTA21/ 23ULFA21	சமய இலக்கியங்கள் : (செய்யுள், இலக்கணம், இலக்கிய வரலாறு) Foundation Course: French II	6	3	25	75	100
II	General English	23UGEN21	Poetry, Prose, Extensive Reading and Communicative English II	6	3	25	75	100
III	Core II	23UZOC21	Chordata	5	5	25	75	100
	Core Practical II	23UZOCR2	Chordata Practical II	3	3	40	60	100
	Generic Elective II	23UCHE22	Chemistry for Biological Sciences II	4	4	25	75	100
	Generic Elective Practical II	23UCHER2	Chemistry Practical II	2	1	40	60	100
IV	Skill Enhancement Course II (Discipline Specific)	23UZOSE2	Biocomposting for Entrepreneurship	2	2	20	30	50
	Skill Enhancement Course III (Discipline Specific)	23UZOSE3	Apiculture	2	2	20	30	50
Total				**30**	**23**			

Semester III

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil/ French	23ULTA31 23ULFA31	காப்பிய இலக்கியங்கள் : செய்யுள், இலக்கணம், இலக்கிய வரலாறு, புதினம் French Literature and Grammar I	6	3	25	75	100
II	General English	23UGEN31	English Poetry, Prose, Extensive Reading and Communicative English III	6	3	25	75	100
III	Core III	23UZOC31	Developmental Zoology	5	5	25	75	100
	Core Practical III	23UZOCR3	Developmental Zoology	2	2	40	60	100
	Generic Elective III	23UBOE31	Fundamentals of Botany I	4	3	25	75	100
	Generic Elective Practical III	23UBOER3	Fundamentals of Botany Practical I	2	1	40	60	100
	NME I	23UZON31	Basic Biotechnology	2	2	20	30	50
IV	Skill Enhancement Course IV (Discipline Specific)	23UZOSE4	Poultry Farming	2	2	20	30	50
	Ability Enhancement Course I	23UAYM31	Yoga and Meditation	1	1	20	30	50
	Self -Study/ MOOC/ Internship (Compulsory)	23UZOSS1	Wildlife Conservation and Management		+2	--	50	50
Total				**30**	**22+2**			

Semester IV

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil/ French	23ULTA41 23ULFA41	சங்க இலக்கியங்கள் : செய்யுள், இலக்கணம், இலக்கியவரலாறு, நாடகம் French Literature and Grammar II	6	3	25	75	100
II	General English	23UGEN41	English Poetry, Prose, Extensive Reading and Communicative English IV	6	3	25	75	100
III	Core IV	23UZOC41	Biochemistry	5	5	25	75	100
	Core Practical IV	23UZOCR4	Biochemistry	2	2	40	60	100
	Generic Elective IV	23UBOE41	Fundamentals of Botany II	4	3	25	75	100
	Generic Elective Practical IV	23UBOER4	Fundamentals of Botany Practical II	2	1	40	60	100
	NME II	23UZON41	Applied Biotechnology	2	2	20	30	50
IV	Skill Enhancement Course V (Discipline Specific)	23UZOSE5	Medical Laboratory Techniques	2	2	20	30	50
	Ability Enhancement Course II (Entrepreneurial Based)	23UAZO41	Value Added Fishery Products	1	1	20	30	50
V	NCC/NSS/Sports				1			
	CDP Extension Activity				+1			
Total				**30**	**23+1**			

Note : Ability Enhancement course 23UAZO41
Evaluation 20 : 30 will be done only by the department.
Internal and External examinations will be in the form of Practical / Presentation of models / Reports.

Semester V

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core V	23UZOC51	Cell Biology	4	4	25	75	100
	Core VI	23UZOC52	Genetics	4	4	25	75	100
	Core VII	23UZOC53	Animal Physiology	4	4	25	75	100
	Core VIII	23UZOC54	Animal Biotechnology	4	4	25	75	100
	Core Practical V	23UZOCR5	Cell Biology, Genetics	4	2	40	60	100
	Core Practical VI	23UZOCR6	Animal Physiology, Animal Biotechnology	4	2	40	60	100
	Discipline Specific Elective I	23UZOE51/ 23UZOE52	**Commercial Aquaculture**/ Animal Behaviour	4	4	25	75	100
IV	Ability Enhancement Course III	23UAEV51	Environmental Studies	2	1	20	30	50
	Self -Study/ MOOC/ Internship (Optional)	23UZOSS2	Dairy Farming		+2	--	50	50
Total				**30**	**25+2**			

Semester VI

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core IX	23UZOC61	Marine Biology	4	4	25	75	100
	Core X	23UZOC62	Immunology and Microbiology	4	4	25	75	100
	Core XI	23UZOC63	Biostatistics and Bioinformatics	4	4	25	75	100
	Core Practical VII	23UZOCR7	Marine Biology	2	1	40	60	100
	Core Practical VIII	23UZOCR8	Immunology and Microbiology, Biostatistics and Bioinformatics	4	2	40	60	100
	Core XII (Project)	23UZOP61	Project and Viva Voce	6	4	40	60	100
	Discipline Specific Elective II	23UZOE61/ 23UZOE62	**Introduction to Research/** Evolutionary Biology	4	3	25	75	100
IV	Skill Enhancement Course VI (Discipline Specific)	23UZOSE6	Sericulture	2	2	20	30	50
Total				**30**	**24**			

Semester	Hours	Credits	Extra Credits
I	30	23	--
II	30	23	--
III	30	22	2
IV	30	23	1
V	30	25	2
VI	30	24	--
Total	180	140	5

Courses	Number of Courses	Hours / week	Credits	Extra Credits
Tamil / French	4	24	12	--
English	4	24	12	--
Core Theory	11	48	48	--
Core Practical	8	24	17	
Generic Elective Theory	4	16	14	--
Generic Elective Practical	4	8	4	--
Discipline Specific Elective	2	8	7	--
Group Project	1	6	4	--
Skill Enhancement Course	6	12	12	--
Ability Enhancement Course	3	4	3	--
Foundation Course	1	2	2	--
NME	2	4	4	--
Extension Activities (CDP)				+1
NCC, NSS & Sports		--	1	
Self Study Papers (Optional)	1	--	--	+2
Self Study Papers (Compulsory)	1	--	--	+2
Total		**180**	**140**	**5**

SEMESTER - 1			
Part – 1 பொதுத்தமிழ் தாள் - 1 இக்கால இலக்கியம் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை			
Course Code: 23ULTA11	**Hrs/Week:6**	**Hrs/Semester: 90**	**Credits: 4**

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	காலந்தோறும் வளர்ந்துவரும் தமிழ்க் கவிதைகளின் வடிவினையும், கருத்தோட்டத்தினையும் மாணவியர் அறிந்துகொள்வர்.
2	தமிழ் மொழியைப் பிழையின்றி எழுதவும் பேசவும் முடியும்.
3	படைப்பாற்றலை வளர்த்துக் கொள்வர்.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர். துறைதோறும் தமிழ் மொழியின் வளர்ச்சியை அறிவர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	**இப்பாடத்திட்டம் - மாணவியரிடம்**	**அறிவாற்றல் திறன்**
CO-1	பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதை இலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன் பெறுதல்	K1
CO-2	புதுக்கவிதை வரலாற்றினை அறிந்து கொள்வர்	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்	K3
CO-4	இக்கால இலக்கிய வகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுவர். தமிழ் மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச் சொற்களை உருவாக்கவும் அறிந்து கொள்ளுதல்	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொள்ளும் நிலையை உருவாக்குகிறது.	K5

அலகு - 1

மரபுக் கவிதை **(18 மணி நேரம்)**

1. தமிழ்த் தெய்வ வணக்கம் - பெ.சுந்தரனார்
2. பெண்கள் விடுதலைக் கும்மி - பாரதியார்
3. சிறுத்தையே வெளியே வா - பாரதிதாசன்
4. புத்தரும் சிறுவனும் - கவிமணி
5. ஆதிமந்தி புலம்பல் - கண்ணதாசன்
6. துறைமுகம் - சுரதா
7. கடல் - தமிழ் ஒளி

அலகு - 2

புதுக்கவிதை **(18 மணி நேரம்)**

1. வீட்டுக்கொரு மரம் வளர்ப்போம் - அப்துல் ரகுமான்
2. சென்ரியூ கவிதைகள் - ஈரோடு தமிழன்பன்
3. பிற்சேர்க்கை - வைரமுத்து
4. வாழைமரம் - மு.மேத்தா
5. வள்ளுவம் பத்து - அறிவுமதி
6. ஆனந்த யாழை மீட்டுகிறாய் - நா. முத்துக்குமார்
7. சபிக்கப்பட்ட முத்தம் - சுகிர்த ராணி
8. நீ எழுத மறுக்கும் எனது அழகு - இளம்பிறை

அலகு – 3

சிறுகதை **(18 மணி நேரம்)**

1. வாய்ச் சொற்கள் - ஜெயகாந்தன்
2. கடிதம் - புதுமைப்பித்தன்
3. கரு - உமாமகேஸ்வரி
4. முள்முடி - தி.ஜானகிராமன்
5. சிதறல்கள் - விழி.பா.இதயவேந்தன்
6. வீட்டின் மூலையில் சமையல் அறை - அம்பை
7. ராசப்பா - முனைவர் மி.சு.எழிலரசி
8. ஆண்டன் செக்காவ் - நாய்க்காரச் சீமாட்டி (மொழிபெயர்ப்புக் கதை)

அலகு - 4

இலக்கிய வரலாறு **(18 மணி நேரம்)**

1. 20 –ஆம் நூற்றாண்டு கவிஞர் பெருமக்கள்
2. கவிதையின் வகையும் வளர்ச்சியும்
3. தமிழ்ச் சிறுகதையின் தோற்றமும் வளர்ச்சியும்
4. மொழிபெயர்ப்புகள் தோற்றமும் வளர்ச்சியும்

அலகு - 5

மொழித்திறன் **(18 மணி நேரம்)**

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

துணைநின்ற நூல்கள்

1. பாரதியார் படைப்புகள் - சீனி.விசுவநாதன் (பதிப்பாசிரியர்)
   அலயன்ஸ் கம்பெனி
   64, ராம கிருஷ்ணா சாலை
   மயிலாப்பூர்
   சென்னை -4.

2. பாரதிதாசன் கவிதைகள் - பேரா. இ. சுந்தரமூர்த்தி
   142, ஜானி ஜான் கான் சாலை,
   இராயப்பேட்டை, சென்னை – 17

3. வைரமுத்து கவிதைகள் - வைரமுத்து
   திருமகள் நிலையம்
   55, வெங்கட்நாராயணா சாலை
   தி.நகர் சென்னை – 17.

4. ரகசியப்பூ - அப்துல் ரகுமான்
   நேஷனல் பப்ளிகேஷன்
   2, தியாகராய நகர்
   சென்னை – 17

5. நன்னூல் - பவணந்தி முனிவர்
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

6. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
   தூய மரியன்னை கல்லூரி (தன்னாட்சி), தூத்துக்குடி.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

2 தமிழ் இலக்கிய வரலாறு - ச.வே.சுப்பிரமணியன்
   மணிவாசகர் பதிப்பகம்
   31, சிங்கர் தெரு
   பாரிமுனை, சென்னை – 18.

3. சிறுகதைக் களஞ்சியம் - அ.சிதம்பரநாதச் செட்டியார் (தொகுப்பாசிரியர்)
   புக்ஸ் (இந்தியா) பிரைவேட்.,
   சென்னை – 1.

இணைய ஆதாரங்கள்

1. Project Madurai –www.projectmadurai.org
2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>
3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – I			
Part I French	**Foundation Course: Paper I – French – I**		
Course Code: 23ULFA11/ 23ULFB11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- Identify the basic French sentence structure
- Comprehend various grammatical tenses and use them to communicate in French
- Review various documents and discuss them to understand the vocabulary
- Analyze and interpret expressions used to convey the cause, the effect, the purpose, and the opposition in French
- Perceive the French culture and system.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	Remember the usage of grammatical tenses in constructing sentences.	K1
CO-2	Apply the grammar rules and vocabulary to produce grammatically correct sentences.	K2
CO-3	Appreciate the French culture and civilization.	K3
CO-4	Demonstrate knowledge of various expressions used to express opinions, emotions, cause, effect, purpose, and hypothesis in French	K4
CO-5	Evaluate and summarize with thorough understanding the given texts.	K5

SEMESTER – I			
Part I French	**Foundation Course: Paper I – French - I**		
Course Code: 23ULFA11/ 23ULFB11	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Salut, Enchante

1.1 - Saluer
1.2 - Se présenter
1.3 - Présenter quelqu'un
1.4 - En France et ailleurs
1.5 - L'Europe

Unit II – J'adore

2.1 - Exprimer ses gouts
2.2 - Echanger sur ses projets
2.3 - Compléter une fiche d'inscription
2.4 - Remplir un chèque bancaire
2.5 - La famille en France

Unit III – Tu veux bien ?

3.1 - Demander à quelqu'un poliment
3.2 - Parler des actions passées
3.3 - Comprendre le récit d'actions passées
3.4 - Ecrire un message électronique
3.5 - Animaux et compagnie

Unit IV – On se voit quand ?

4.1 - Proposer, accepter ou refuser une invitation
4.2 - Indiquer l'heure et la date
4.3 - Fixer un rendez-vous
4.4 - Comprendre les informations de cartons d'invitation
4.5 - Les français cultivent leur temps libre

Unit V – Bonne idée !

5.1 - Exprimer son point de vue
5.2 - S'informer sur le prix et la quantité
5.3 - Faire des achats dans un magasin
5.4 - Comprendre des offres des cadeaux
5.5 - Quel cadeau offrir ?

Textbook: Régine Mérieux & Yves Loiseau, *Latitudes* -1- (A1 /A2), méthode de français, Didier, 2017 (units 1 - 6 only)

Books, Journals and Learning Resources

- J.Girardet & J.Pécheur avec la collaboration de C.Gibble, Echo A1, CLE international, Paris, 2012.
- Carlo Catherine, Causa Mariella, Civilisation Progressive du Français – I, Paris : CLE International, 2003.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, Dupleix Dorothée, Cocton Marie-Noëlle, *Saison 1 Niveau 1, Méthode de français et cahier d'exercices*, Paris : Didier, 2015

Web Resources:

https://www.lawlessfrench.com/faq/lessons-by-level/

https://bonjourdefrance.com/

www.francaisfacile.com/exercices /

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	1	1	3	3	2	1	1
CO-2	2	3	2	1	1	3	3	2	1	1
CO-3	2	2	1	3	3	1	2	3	3	3
CO-4	3	3	1	3	2	2	3	3	2	3
CO-5	3	2	1	1	2	2	2	2	2	2
Ave.	2.6	2.4	1.4	1.8	1.8	2.2	2.6	2.4	1.8	2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER-I			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English-I**		
Course Code: 23UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Learning Objectives:

- To enable learners to acquire self-awareness and positive thinking required in various life situations.
- To help them acquire the attribute of empathy
- To assist them in acquiring creative and critical thinking abilities
- To enable them to learn the basic grammar
- To assist them in developing LSRW skills

Course Outcomes			
Course Outcomes	**Upon completion of the course, the students will be able to**	**PSOs Addressed**	**K Level**
CO 1	acquire self-awareness and positive thinking required in various life situations	1,2,3	1
CO 2	acquire the attribute of empathy.	2,3,5	2
CO 3	acquire creative and critical thinking abilities.	2,3,4	3
CO 4	learn basic grammar	4,5	4
CO 5	development and integrate the use of four language skills i.e., listening, speaking, reading and writing.	2,3,4,5	5

SEMESTER- I			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English –I**		
Course Code: 23UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

I SELF-AWARENESS(WHO) & POSITIVE THINKING(UNICEF)

Life Story

1.1 MalalaYousafzai - Chapter 1 from I am Malala

1.2 M.K.Gandhi - An Autobiography or The Story of My Experiments with Truth (Chapters 1, 2 & 3)

Poem

1.3 Rabindranath Tagore - Where the Mind is Without Fear – Gitanjali 35

1.4 Chinua Achebe - Love Cycle

II EMPATHY

Poem

2.1 David Roth - Nine Gold Medals

2.2 William Wordsworth - Alice Fell or poverty

2.3 E.V. Lucas - The School for Sympathy

2.4 William Faulkner - Barn Burning

III CRITICAL & CREATIVE THINKING

Poem

3.1 Edgar Guest - The Things That Haven't Been Done Before

3.2 Robert Frost - Stopping by the Woods on a Snowy Evening

Readers Theatre

3.3 A Tale of China - The Magic Brocade

3.4 Aaron Shepard - Stories on Stage – (Three Sideway Stories from Wayside School" by Louis Sachar)

IV Part of Speech

4.1 Articles

4.2 Noun

4.3 Pronoun

4.4 Verb

4.5 Adverb

4.6 Adjective

4.7 Preposition

V Paragraph and Essay Writing

5.1 Descriptive

5.2 Expository

5.3 Persuasive

5.4 Narrative Reading Comprehension

Textbook:

Units I-III, V – To be compiled by the PG and Research Department of English

Unit – IV - Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Reference Books:

Martin Hewings. *Advanced English Grammar*. Cambridge University Press, 2000.

Web Resources:

1. MalalaYousafzai. I am Malala (Chapter 1) https://archive.org/details/i-am-malala
2. M.K Gandhi. An Autobiography or The Story of My Experiments with Truth(Chapter-1)- Rupa Publication, 2011 https://www.indiastudychannel.com/resources/146521Book-Review-An-Autobiography-or-The-story-of-my-experiments-withTruth.aspx
3. Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings)https://www.poetryfoundation.org/poems/45668/gitanjali-35
4. Aaron Shepard.Stories on Stage, Shepard Publications, 2017 https://amzn.eu/d/9rVzlNv
5. J C Nesfield. Manual of English Grammar and Composition. https://archive.org/details/in.ernet.dli.2015.44179

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	2	3	2	3	2	3	3	3	3	3
CO-3	3	3	3	2	3	3	3	3	3	3
CO-4	3	3	2	3	3	3	3	2	3	2
CO-5	3	3	3	2	3	3	3	2	2	3
Ave.	2.8	3	2.6	2.6	2.8	3	3	2.6	2.8	2.8

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER I			
Core I	**Invertebrata**		
Course Code: 23UZOC11	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives:

- To understand the basic concepts of lower animals and observe the structure and functions.
- To examine the systemic and functional morphology of various group of invertebrates.

Course outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	describe the basic concepts of invertebrate animals and recall its structure and functions.	K1
CO-2	differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	K2
CO-3	illustrate and demonstrate the systemic and functional morphology of various groups of invertebrata.	K3
CO-4	to compare and distinguish the various physiological processes and organ systems in lower animals.	K4
CO-5	evaluvate and critique the parasitic and economic importance of invertebrate animals.	K5

Unit I Protozoa and Porifera (15 Hrs)

Protozoa: Introduction to classification, taxonomy and nomenclature. General characters and classification of phylum Protozoa up to classes. Type study: *Paramecium* and *Plasmodium* - Parasitic protozoans *Entamoeba*, *Trypanasoma and Leishmania* - Economic importance Nutrition in protozoa - Host-parasitic interactions in *Entamoeba* and *Plasmodium*-Locomotion in protozoa

Porifera: General characters and classification up to classes. Type study: Sycon- Canal system in sponges. Reproduction in sponges

Unitt II Coelenterata and Platyhelminthes (15 Hrs)

Coelenterata : General characters and classification up to classes – Type study: *Obelia* - Corals and coral reefs - Economic importance of corals and coral reefs - Polymorphism in Hydrozoa.

Platyhelminthes: General characters and classification up to classes. Type study: *Fasciola hepatica*. parasitic adaptations. Host-parasitic interactions of Helminthine parasites

Unit III Aschelminthes and Annelida (15 Hrs)

Aschelminthes : General characters and classification of up to classes - Type study: *Ascaris lumbricoides.* Nematode parasites and diseases - *Wuchereria bancrofti, Enterobius vermicularis, Ancylostoma duodenale*. Parasitic adaptations.

Annelida: General characters and classification up to classes. Type study: *Nereis* , Metamerism- Modes of life in Annelids.

Unit IV Arthropoda (15 Hrs)

Arthropoda: General characters and classification of phylum Arthropoda up to classes. Type study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea. Economic importance of Insects. Insect pests of Agricultural Importance- Pest of rice: Rice stem borer (*Scirpophaga incertulas*) – Pest of Sugarcane: Shoot borer (*Chilo infuscatellus*) – Pest of coconut: Rhinoceros beetle (*Oryctes rhinoceros*).Principles of Integrated Pest Management.

Unit V Mollusca and Echinodermata (15 Hrs)

Mollusca: General characters and classification of Phylum Mollusca up to classes. Type study: *Pila globosa*. Foot and torsion in Mollusca. Economic importance-Cephalopods

Echinodermata: General characters and classification of Phylum Echinodermata up to classes. Type study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.

Text Books

1. Ekambaranatha Iyer, 2000. *A Manual of Zoology*, 10th edition, Viswanathan, S., Printers & Publishers Pvt Ltd1
2. Jordan, E.L. and P.S, Verma *Invertebrate Zoology*, 12th edn. S. Chand& Co1995.
3. Kotpal, R.L, *Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata.*1992.

Books for Reference

1. Ruppert and R.D. Barnes, *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition2006

Web Resources

1. https://www.nationalgeographic.com/animals/invertebrates/
2. https://bit.ly/3kABzKa
3. https://www.nio.org/
4. https://greatbarrierreef.org/
5.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	**3**	3	**3**	3	2
CO-2	1	**1**	1	1	1	2	2	2	**1**	2
CO-3	1	2	2	3	**2**	1	1	**2**	2	2
CO-4	2	2	2	3	3	3	3	3	3	3
CO-5	2	2	2	2	3	2	2	**2**	3	**3**
Ave.	1.8	2.0	2.0	2.4	2.4	2.2	2.2	2.4	2.6	2.4

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

PRACTICALS **Course Code: 23UZOCR1**

Hrs/Week: 3 **Credits: 3**

I. **Major Dissection :** Cockroach:, Nervous system, Reproductive system.

II. **Minor Dissection:** Cockroach: Digestive system

III. **Mounting :** Cockroach: Mouth parts - Honey Bee/ House fly/ Mosquito.
Prawn: Appendages

IV. Record / Observation Note (SUBMISSION IS MANDATORY)

V. **Spotters :(i) Protozoa:** Amoeba, Paramecium, Paramecium Binary fission and Conjugation, *Entamoeba histolytica*, *Plasmodium vivax* **(ii) Porifera:** *Sycon,Gemmule* **(iii) Coelenterata:** *Obelia* – Colony & Medusa, *Aurelia*, *Physalia, Gorgonia,* **(iv) Platyhelminthes:** *Planaria, Fasciola hepatica*, *Fasciola* larval forms – Miracidium, Redia, Cercaria, *Taenia solium* **(v) Nemathelminthes:** *Ascaris* (Male & Female),**vi) Annelida:** *Nereis*, *Chaetopteurs, Hirudinaria, Trochophore* larva **(vii) Arthropoda:** *Cancer*, *Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus*, Larvae - *Nauplius, Mysis, Zoea* **(viii) Mollusca:** *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus,* **(ix) Echinodermata:** *Asterias, Ophiothrix,Cucumaria*, *Antedon, Bipinnaria* larva.

Books for Reference:

1. Boradale, L.A. and E.A. Potts, . *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.1961
2. Lal, S.S. *A Text Book of Practical Zoology: Invertebrate*, Rastogi, Meerut. 2005.
3. Sinha, Chatterjee and Chattopadhyay, *Advanced Practical Zoology*, Books & Allied Ltd; 3rd Revised edition, 1070 pp. 2014

SEMESTER I			
Generic Elective I	**Chemistry For Biological Sciences I**		
Code: 23UCHE12	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits: 3**

Objectives

This course aims at providing knowledge on

- Basics of atomic orbitals, chemical bonds, hybridization andfundamentals of organic chemistry
- Nuclear chemistry and industrial chemistry
- Importance of speciality drugs and separation and purification techniques.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	gain in-depth knowledge about the nuclear reactions, fuels, hybridization, drugs and chromatographic techniques.	K1
CO-2	evaluate the theories of chemical bonding, efficiencies of fertilizers, mechanism involved in the organic reactions, the structure of antibiotics, anesthetics, antipyretics and artificial sugars, and separation techniques.	K2
CO-3	explain the nuclear chemistry, silicones, electronic effect uses of drugs and analytical techniques.	K3
CO-4	apply carbon and rock dating, gaseous fuels, Heterocyclic compounds, uses of antibiotics, anesthetics, antipyretics and artificial sugars and purification techniques.	K4
CO-5	evaluate molecular orbital diagram, role of fertilizers, types of reactions, the effect of drugs, various methods to identify an appropriate method for the separation of chemical components.	K5

UNIT I Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. MO diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

Unit II Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG - oil gas (manufacturing details not required).

Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea-ammonium sulphate-potassium nitrate- NPK fertilizer-superphosphate-triple superphosphate.

UNIT III Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6.Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric-mesomeric-hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution- nitration-halogenation-Friedel-Craft's alkylation and acylation.

Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT IV Drugs and Specialty Chemicals

Definition, structure and uses: Antibiotics-Penicillin-Chloramphenicol- Streptomycin Anesthetics -Chloroform and ether-Antipyretics –aspirin-paracetamol –ibuprofen

Artificial Sweeteners –saccharin-Aspartame -cyclamate

Organic Halogen compounds –Freon-Teflon.

UNIT V Analytical Chemistry

Introduction to qualitative and quantitative analysis.

Principles ofvolumetric analysis. Separation and purification techniques- extraction-distillation -crystallization.

Chromatography: principle and application of column, paper and thin layer chromatography.

RecommendedText

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

Reference Books

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

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	1	2	1	3	2	3	2	1
CO-2	1	3	2	2	2	2	3	3	1	1
CO-3	3	1	1	2	2	3	2	3	2	3
CO-4	3	3	2	2	2	1	3	3	2	2
CO-5	1	3	3	3	1	3	1	3	2	3
Ave.	2.2	2.2	1.8	2.2	1.6	2.4	2.1	3	1.8	2.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER I			
Generic Elective Practical I	**Chemistry Practical I**		
Code :23UCHER1	**Hrs./Week:2**	**Hrs/ Sem: 30**	**Credits:1**

Objectives

This course aims to provide knowledge on the

- Basics of preparation of solution.
- Principles and practical experience of volumetric analysis

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	gain an understanding of the use of standard flask and volumetric pipettes, burette.	K1
CO-2	design, carry out, record and interpret the results of volumetric titration.	K2
CO-3	apply their skill and identify the end point of various titrations.	K3
CO-4	analyze the chemical constituents in allied chemical products	K4
CO-4	estimate the concentration of given solution.	K5

VOLUMETRIC ANALYSIS

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

Reference Books

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

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER I			
Skill Enhancement Course I Ornamental Fish Farming and Management			
Course Code: 23UZOSE1	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

Objectives

- To enable the identification, culture and maintenance of commercially important ornamental fishes and to generate technically skilled manpower for entrepreneurship development
- To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO - 1	find the commercially important ornamental fishes	K1
CO - 2	interpret competencies to become an entrepreneur in ornamental fish culture	K2
CO - 3	apply the knowledge and skills in aquarium management	K3
CO - 4	analyse the taxonomy, biology and different breeding techniques employed for varieties of ornamental fish	K4
CO - 5	evaluate the National and International export process and income generation	K5

Unit I **Benefits of Ornamental fish rearing** **(6 Hrs)**

Introduction to ornamental fish keeping.

Scope and importance of ornamental fish culture.

Domestic and global scenario of ornamental fish trade and export potential.

Commercially important ornamental fishes - Indigenous and exotic varieties.

Unit II **Fish Feeding and Nutrition** **(6 Hrs)**

Biology of egg layers and live bearers.

Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture.

Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).

Unit III **Aquarium Fabrication** **(6 Hrs)**

Aquarium design and construction; Accessories - aerators, filters and lighting.

Aquarium plants and their propagation.

Maintenance of aquarium and water quality management.

Ornamental fish diseases, their prevention, control and treatment methods.

Unit IV **Fish Transport** **(6 Hrs)**

Conditioning, packing, transport and quarantine methods.

Economics, trade regulations, domestic and export marketing strategies.

Practical **(6 Hrs)**

1) Identification of locally available ornamental fishes - Egg layers and live bearers.

2) Identification of locally available live feed organisms.

Books for Reference:

1. Swain SK, N. Sarangi. and S. Ayyappan. Ornamental Fish Farming. ICAR, New Delhi. 2010

2. Living Jewels – A Handbook on Freshwater Ornamental Fish, MPEDA, Kochi.

3. Dey V.K.A. A Handbook on Aquafarming Ornamental Fishes. MPEDA, Kochi. 1997.

4. Ahilan, B, N. Felix and Santhanam R. Text Book of Aquariculture. Daya Publishing House, New Delhi. 2008.

Web links:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=297
2. https://www.ofish.org/
3. https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/
4. https://99businessideas.com/ornamental-fish-farming/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	2	3	2	3	3	3
CO-2	3	2	3	2	3	3	2	3	2	3
CO-3	3	2	3	3	3	2	2	2	2	3
CO-4	3	1	2	2	3	3	2	3	2	2
CO-5	2	2	3	3	3	3	3	1	2	3
Ave.	2.8	1.8	2.8	2.4	2.8	2.8	2.2	2.4	2.2	2.8

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER I			
Foundation Course	**Basics of Zoology**		
Course Code: 23UZOF11	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

- To facilitate the basic knowledge of animal taxonomy and diversity of life forms
- Develop an understanding of the organismal biology

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	explain the structure and function of cells and tissues	K1
CO-2	interpret the functional significance of nutrients	K2
CO-3	apply techniques to visualize and understand the cellular structures	K3
CO-4	categorize the animals in various taxonomic hierarchy	K4
CO-5	Evaluate the functional anatomy of human organ systems	K5

Unit I Diversity of Life Forms **(6 hrs)**

Systematics-Biological nomenclature –Classification and salient features of Invertebrates upto classes and chordates upto orders-viruses-bacteria

Unit II Structure of Cell **(6 hrs)**

Cell as basic unit of life-prokaryotic and eukaryotic cell-Light microscope and electron microscope- Ultrastructure of animal cell

Unit III Human Tissue Biology **(6 hrs)**

Structure and function of basic type of tissue- Connective tissue, epithelial tissue, muscle tissue, nervous tissue

Unit IV Functional significance of Nutrients **(6 hrs)**

Structure and function of carbohydrates, proteins, lipids and vitamins

Unit V Human Physiology **(6 hrs)**

Functional anatomy and physiology of digestive system, respiratory system, excretory system and neuromuscular system

Text Books

1. Kotpal R.L. Modern Text Book of Zoology: Invertebrates. Meerut: Rastogi Publications 2009.
2. Mudambi SR and MV Rajagopal. *Fundamentals of Foods, Nutrition and Diet Therapy*. 6th ed. New Delhi: New Age International. 2012.
3. Powar, C.B. Cell Biology. Mumbai: Himalaya Publishing House. 8th Edition. 2015.
4. Sembulingmam K, and PremaSembulingam -*Essentials of Medical Physiology* Jay Pee Brothers New Delhi. 2006.
5. Sawant .S.C. *A Textbook of Human Physiology* Wisdom Press ,New Delhi. 2015.

Mapping of Course Outcomes with POs and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	2	1	1	3	1	2	2	1
CO-2	3	2	2	2	3	2	3	1	2	2
CO-3	3	2	2	2	1	3	2	2	2	3
CO-4	3	2	2	1	1	3	2	1	3	1
CO-5	3	3	2	3	2	3	2	2	2	3
Ave.	3	2	2	1.8	1.6	2.8	2	1.6	2.2	2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER - II			
Part -1 Tamil பொதுத்தமிழ் - தாள் 2 - சமய இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு			
Code :23ULTA21	**Hrs/Week:6**	**Hrs/ Semester : 90**	**Credits :4**

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	இறை ஆற்றலை உணர்ந்துகொள்ள உதவுகிறது
2	தமிழ் மொழியைப் பிழையின்றி எழுதவும் பேசவும் முடியும்.
3	அன்பு, இரக்கம், நற்சொல், நற்செயல் போன்ற நற்பண்புகளோடு வாழ வழி வகுக்கிறது.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர். துறைதோறும் தமிழ் மொழியின் வளர்ச்சியை அறிவர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	இப்பாடத்திட்டம் - மாணவியரிடம்	அறிவாற்றல் திறன்
CO-1	தமிழரின் சமய தத்துவங்களை அறிந்து தெளிவு பெறுவர்	K1
CO-2	பல்வேறு சமய கருத்துகளை அறிவதன் மூலம் சமய ஒற்றுமை உணர்வு பெறுவர்.	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்	K3
CO-4	இறைவன் முன் அனைவரும் சமம் என்ற சிந்தனையை உருவாக்குகிறது.	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொள்ளும் நிலையை உருவாக்குகிறது.	K5

அலகு – 1 **(18 மணி நேரம்)**

பக்தி இலக்கியம்

1. திருநாவுக்கரசர் தேவாரம் - நாமார்க்கும் குடியல்லோம் எனத் தொடங்கும் வரிகள் - 10 பாடல்கள்
2. ஆண்டாள் - திருப்பாவை (முதல் 10 பாசுரம்)

அலகு – 2 **(18 மணி நேரம்)**

1. வள்ளலார் - அருள் விளக்கமாலை (முதல் 10 பாடல்கள்)
2. எச்.ஏ. கிருட்டிணப்பிள்ளை - இரட்சணிய மனோகரம் - பால்ய பிரார்த்தனை
3. குணங்குடி மஸ்தான் சாகிபு – பராபரக்கண்ணி (முதல் 10 கண்ணிகள்)

அலகு – 3 **(18 மணி நேரம்)**

சிற்றிலக்கியங்கள்

1. தமிழ்விடு தூது - (முதல் 20 கண்ணிகள்)
2. திருக்குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறுதல்
3. முக்கூடற்பள்ளு - நாட்டு வளம்

அலகு – 4 **(18 மணி நேரம்)**

இலக்கணம்

1. சொல்லின் பொது இலக்கணம்
2. ஓரெழுத்து ஒரு மொழிகள், சொல்லின் வகைகள்
3. பெயர்ச்சொல் - அறுவகைப் பெயர்கள்
4. வினைச் சொல் - இலக்கணம் - வகைகள்
5. இடைச்சொல் - இலக்கணம் - வகைகள்
6. உரிச்சொல் - இலக்கணம் - வகைகள்

அலகு - 5 **(18 மணி நேரம்)**

இலக்கிய வரலாறு

1. பன்னிரு திழுமுறைகள்
2. நாலாயிர திவ்யப் பிரபந்தம்
3. திருமடங்களின் தமிழ்ப்பணி
4. சைவ சித்தாந்த சாத்திரங்கள்

துணைநின்ற நூல்கள்

1. பன்னிரு திருமுறைகள் - பேரா. அ. மாணிக்கம் (உரையாசிரியர்)
   வர்த்தமானன் பதிப்பகம்
   21, இராமகிருஷ்ணா தெரு
   தியாகராய நகர்
   சென்னை – 17.

2. திருக்குறள் - பரிமேலழகர் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

3. நாலடியார் - தி.சு. பாலசுந்தரம் பிள்ளை
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

2. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
தூய மரியன்னை கல்லூரி (தன்னாட்சி),
தூத்துக்குடி.

3. பதினெண் கீழ்க்கணக்கு நூல்கள் - எம். நாராயண வேலுப்பிள்ளை
நர்மதா பதிப்பகம், தியாகராய நகர், சென்னை.

இணைய ஆதாரங்கள்

1. Project Madurai –www.projectmadurai.org
2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>
3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER - II			
Part I French	**Foundation Course: Paper II – French – II**		
Course Code: 23ULFA21/ 23ULFB21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Learning Objectives:

- To revise basic French sentence structure and vocabulary.
- To enumerate the various grammatical tenses and use them to communicate better in French.
- To develop the language proficiency of the learners by practising all for competencies: Reading, writing, listening, and speaking.
- To analyse and interpret verbal expressions of cause, effect, purpose, and opposition in French
- To comprehend text passages and use them to express their opinions.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	Identify the purpose of using various tenses and effectively employ them in speaking and writing	K1
CO-2	Summarize a French document such as posters, bulletins, and infographics	K2
CO-3	Discuss the French culture and the differences.	K3
CO-4	Analyse and utilize the grammatical concepts in drafting sentences and paragraphs	K4
CO-5	Demonstrate knowledge of various expressions used to convey opinion, emotions, cause, effect, purpose, and hypothesis in French	K5

SEMESTER - II			
Part I French	**Foundation Course: Paper II – French - II**		
Course Code: 23ULFA21/ 23ULFB21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Unit I – C'est où ?

1.1 - Demander et indiquer une direction
1.2 - Localiser
1.3 - Comprendre des indications de direction et de lieu
1.4 - Se repérer sur un plan de ville
1.5 - Architecture et nature

Unit II – N'oubliez pas

2.1 - Exprimer l'obligation ou l'interdit
2.2 - Conseiller
2.3 - Comprendre une chanson
2.4 - Comprendre un récit de vacances
2.5 - La France d'Outre-mer

Unit III - Belle vue sur la mer

3.1 - Décrire un lieu
3.2 - Se situer dans le temps
3.3 - Comprendre la description d'un lieu
3.4 - Comprendre des pictogrammes
3.5 - L'Union européenne

Unit IV – Quel beau voyage, Oh Joli

4.1 - Raconter un souvenir
4.2 - Exprimer l'intensité et la quantité
4.3 - Comparer
4.4 - Francophonie
4.5 - Mode et société

Unit V – Les compétences communicatifs

5.1 - Les lettres formelles
5.2 - Les lettres informelles

Textbook: Régine Mérieux & Yves Loiseau, *Latitudes* -1- (A1 /A2), méthode de français, Didier, 2017 (units 7-11 only)

Books, Journals and Learning Resources

- J.Girardet & J.Pécheur avec la collaboration de C.Gibble, Echo A1, CLE international, Paris, 2012.
- Carlo Catherine, Causa Mariella, Civilisation Progressive du Français – I, Paris : CLE International, 2003.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, Dupleix Dorothée, Cocton Marie-Noëlle, *Saison 1 Niveau 1, Méthode de français et cahier d'exercices*, Paris : Didier, 2015

Web Resources:

https://www.lawlessfrench.com/faq/lessons-by-level/
https://bonjourdefrance.com/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	1	1	3	3	2	1	1
CO-2	2	3	2	1	1	3	3	2	1	1
CO-3	2	2	1	3	3	1	2	3	3	3
CO-4	3	3	1	3	2	2	3	3	2	3
CO-5	3	2	1	1	3	3	3	3	3	3
Ave.	2.6	2.4	1.4	1.8	1.8	2.4	2.8	2.6	2	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER - II			
Part II English	**Poetry, Prose, Extensive Reading, and Communicative English - II**		
Course Code: 23UGEN21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Learning Objectives:

- To assist the learners to interpret the literary pieces to identify elements of resilience, determination, decision making skills, and problem-solving skills.
- To aid them to demonstrate improved empathy and understanding for diverse life experiences through literary analysis and discussions.
- To develop the language proficiency of the learners by practising the usage of tenses in various contexts.
- To understand the importance of tone, clarity, and formality in workplace communication.
- To enhance the creative and the critical thinking skills of the learners through class discussions and assignments.

Course Outcomes			
Course Outcomes	**Upon completion of the course, the students will be able to**	**PSOs Addressed**	**K Level**
CO1	learn to talk about everyday activities confidently	1	1
CO2	be able to write short paragraphs on people, places, and events	1, 2	2
CO3	identify the purpose of using various tenses and effectively employ them in speaking and writing	3, 4	3
CO4	gain knowledge to write subjective and objective descriptions	4, 5,	4
CO5	identify and use their skills effectively in formal contexts.	3, 4, 5	5

SEMESTER - II			
Part II English	**Poetry, Prose, Extensive Reading, and Communicative English - II**		
Course Code: 23UGEN21	**Hrs / Week: 6**	**Hrs / Semester : 90**	**Credits:3**

Unit I – Resilience

Poetry

William Ernest Henley : Invictus

Maya Angelou : Still I Rise

Prose

Julian Koepcke : How I Survived a Plane Crash

Unit II – Decision Making Skills

Poetry

Rudyard Kipling : If

Stanley Kunitz : The Layers

Short Story

Frank Stockton : The Lady or the Tiger

Unit III - Problem Solving Skills

Prose- Life Story

Sudha Murthy : How I taught My Grandmother to Read

Autobiography

A. J. Cronin : Two Gentlemen of Verona

A.P.J. Abdul Kalam : Wings of Fire (Chapters 1,2,3)

Unit IV – Language Competency

Tenses

Present Tense

Past Tense

Future Tense

Unit V - English at the Workplace

E-mail – Invitation, Enquiry, Seeking Clarification

Formal Letters

Circular

Minutes of the Meeting

Textbook:

Units I-III, V – To be compiled by the PG and Research Department of English

Unit – IV - Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai:

Vijay Nicole Imprints Private Limited, 2006.

Reference Books:

Martin Hewings. *Advanced English Grammar*. Cambridge University Press, 2000.

Web Resources:

https://www.poetryfoundation.org/

https://www.teachingenglish.org.uk/teaching-resources/teaching-adults/lesson-plans

https://www.perfect-english-grammar.com/support-files/tenses-explanations.pdf

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO- 1	PO-2	PO-3	PO- 4	PO- 5	PSO- 1	PSO- 2	PSO- 3	PSO- 4	PSO- 5
CO-1	3	2	3	3	2	3	2	3	2	2
CO-2	2	3	3	3	3	2	3	2	2	3
CO-3	3	3	3	3	3	3	3	2	2	3
CO-4	2	3	3	3	2	2	3	3	2	2
CO-5	3	3	3	2	2	3	3	3	3	2
Ave.	2.6	2.8	3	2.8	2.4	2.6	2.8	2.6	2.2	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
Core II	**Chordata**		
Course Code: 23UZOC21	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives:

- To understand the basic characters of chordates, systematic position, origin and ancestrory of chordates
- To impart information on the basic concepts of vertebrates

Course Outcome

CO. No	**Upon completion of this course, students will be able to**	CL
CO - 1	explain the structures, functions and distinct features of phylum Chordata.	**K2**
CO - 2	distinguish the characteristic features of each subphylum and class.	**K2**
CO - 3	examine the various organs of chordates using digital tools	**K4**
CO - 4	appraize the knowledge on environmental consciousness of some important fishes, amphibians, reptiles, birds and mammals.	**K4**
CO - 5	select the conservation and management strategies of the chordate fauna to gain career opportunities	**K5**

Unit I General Characters and Classification of Phylum Chordata (15 Hours)

Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata (*Amphioxus*).

Unit II Prochordates, Agnatha and Pisces (15 Hours)

Characteristics of subphylum vertebrata, Classification of Vertebrata up to class level, Agnatha *Petromyzon* – External morphology and life cycle – Pisces - General characters and classification up to sub classes – Type study - *Scoliodon sorrakowah* - digestive system, respiratory system, circulatory system, urinogenital system and reproductive

system – General topics: Accessory respiratory organs - Air bladder - Parental care – Migration of fishes.

Unit III Amphibia (15 Hours)

General characters and classification up to sub classes. Type study - *Rana hexadactyla* - External morphology, skin, digestive system, respiratory system, circulatory system, nervous system and urinogenital system. Osteology – Fore limb, hind limb, pectoral girdle and pelvic girdle - Parental care in Amphibia.

Unit IV Reptilia (15 Hours)

General characters and classification up to sub classes - Type study – *Calotes versicolor* - External morphology, digestive system and circulatory system only. Extinct reptiles (Dinosaurs). Poisonous snakes of South India. General topic – Identification of poisonous and non-poisonous snakes – Poison apparatus, fangs, biting mechanism, snake venom and first aid.

Unit V Aves and Mammalia (15 Hours)

Aves: General characters and classification up to sub classes – Type study - *Columba livia* - External morphology, digestive system, urinogenital system and reproductive system. Osteology – synsacrum. General topic - Flight adaptations of birds and migration in birds.

Mammalia: General characters and classification up to sub classes - Type study – Rabbit. Dentition, digestive system, respiratory system, circulatory system, urinogenital system and reproductive system - General topics– Adaptations of aquatic mammals.

Text Books

1. Ayyar, E.K. and T.N. Ananthakrishnan. *Manual of Zoology* Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p, 1992.
2. Jordan, E.K. and P.S. Verma. *Chordate Zoology and Elements of Animal Physiology*, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp, 1995.
3. Nigam, H.C. *Zoology of Chordates*, Vishal Publications, Jalandhar - 144008, 942, 1983.
4. Ganguly, Sinha, Bharati Goswami and Adhikari. *Biology of Animals* Vol.II - New Central Book Agency (p) Ltd, 2004.
5. Kotpal. R.L. A, *Modern Text Book of Zoology Vertebrates*- Rastogi Publications. 2009.

Books for Reference

1. Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub. Co. 2017.
2. Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts. *Integrated Principles of Zoology*, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp, 1984.
3. Newman, H.H. *The Phylum Chordata*, Satish Book Enterprise, Agra – 282 003, 477 pp, 1981.
4. Parker and Haswell. *Text Book of Zoology*, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp, 1964.
5. Pough H. *Vertebrate Life*, VIII Edition, Pearson International, 2018
6. Waterman, Allyn J. *et al.*, *Chordate Structure and Function*, Mac Millan &Co., New York, 587 pp, 1971.

Web Resources

1. http://tolweb.org/Chordata/2499
2. https://www.nhm.ac.uk/
3. https://bit.ly/3Av1Ejg
4. https://bit.ly/3kqTfYz
5. https://biologyeducare.com/aves/
6. https://www.vedantu.com/biology/mammalia

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	2	1	1	1	2	2	1	2	2	2
CO-2	3	1	2	2	3	3	1	2	3	3
CO-3	1	1	3	2	2	1	1	3	2	2
CO-4	3	3	2	2	2	3	3	2	2	2
CO-5	1	1	1	2	2	1	1	1	2	2
Ave.	2.0	1.4	1.8	1.8	2.1	2.0	1.4	2.0	2.2	2.2

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

PRACTICAL

Hours/Week: 3 **Course Code: 23UZOCR2** **Credit: 3**

I. **Dissections**:(Virtual) Frog – Brain

II. Fish: External features, Digestive system.

III. **Mounting**: Fish: Placoid and Ctenoid scales,

IV. **Osteology**: Frog: Pectoral girdle, Pelvic girdle, Fore limb, Hind limb. Pigeon: Synsacrum.

V. **Specimen and Slides**: **(i) Hemichordata:** Balanoglossus, Tornaria larva **(ii). Protochordata:** Amphioxus **(iii). Cyclostomata:** Petromyzon, Ammocoetus larva **(iv). Pisces:** Shark, Pristis, Torpedo, Anabus, Cybium, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Anguilla, Chelon, Protopterus. **(v). Amphibia:** Ichthyophis, *Amblystoma*, Hyla, Rachophous, Bufo, Rana, Axolotal larva **(vi). Reptilia:** Draco, Chemaeleon, Vipera russelli, Naja, Bungarus, Typhlops, Trionyx, Crocodilus. **(vii). Aves:** Archaeopteryx, *Passer*, *Psittacula*, *Alcedo*, *Columba*, Corvus, *Pavo*; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down **(viii). Mammalia:** Ornithorhynchus, Pteropus, Manis, Hedgehog

Text Books

1. Lal S S. *Practical Zoology Vertebrate*, Rajpal and Sons Publishing, 484 pp, 2009.
2. Verma P.S. *A Manual of Practical Zoology*: Chordates, S. Chand Limited, 627 pp, 2000.

Books for Reference

1. Robert William Hegner. *Practical Zoology*, BiblioLife, 522pp, 2015.
2. Young, J,Z. *The life of vertebrates*. OxfordUni. London, 1972.

Web Resources

1. https://www.youtube.com/watch?v=b04hc_kOY10
2. https://bit.ly/3CzTEy8
3. http://tolweb.org/Chordata/2499
4. https://www.nhm.ac.uk/
5. https://bit.ly/3Av1Ejg

SEMESTER II			
Generic Elective II	**Chemistry For Biological Sciences II**		
Code :23UCHE22	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits:3**

Objectives

This course aims at providing knowledge on

- Nomenclature of coordination compounds and carbohydrates.
- Amino acids and essential elements of biosystem
- Understand the concepts of kinetics and catalysis
- Provide fundamentals of electrochemistry and photochemistry

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	gain knowledge on coordination compounds, water technology, carbohydrate, amino acids, nucleic acids, corrosion and photochemical process.	K1
CO-2	explain the biological role of complexes, buffer solutions and preparation of carbohydrate, amino acids, nucleic acids and photosynthesis.	K2
CO-3	demonstrate the water purification techniques, interconversion of fructose, property of carbohydrate, amino acids, nucleic acids, electrochemistry principles in corrosion, electroplating and fuel cells and reactions of hydrogen chloride.	K3
CO-4	identify the application of qualitative and quantitative analysis open ring structures of carbohydrate, ionic product of water and photosensitization process	K4
CO-5	outline the purification techniques, properties of carbohydrates, various reference electrodes and various type of photochemical process.	K5

UNIT I Co-ordination Chemistry and Water Technology

Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) -Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water- determination of hardness of water using EDTA method- zeolite method-Purification techniques –BOD and COD.

Unit II Carbohydrates

Classification- preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose- starch and cellulose.

UNIT III Amino Acids and Essential elements of biosystem

Classification - Peptide linkage - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

UNIT IV Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH- pK_a- pK_b. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome

plating – Types of cells -fuel cells-corrosion and its prevention.

UNIT V Photochemistry

Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence- Quantum yield - Hydrogen - chloride reaction. Phosphorescence- fluorescence- chemiluminescence and photosensitization and photosynthesis (definition with examples).

RecommendedText

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition, 2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications, Karur, 2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition, 2012.

4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; SultanChand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
2. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition,2007.
4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventhedition, 2018.
5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	1	2	1	3	2	3	2	1
CO-2	1	3	2	2	2	2	3	2	1	1
CO-3	3	1	1	2	2	3	2	3	2	3
CO-4	3	3	2	2	2	1	3	3	2	2
CO-5	1	1	3	2	1	3	1	2	2	3
Ave.	2.2	1.8	1.8	2.0	1.6	2.4	2.1	2.3	1.8	2.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
Part III Generic Elective Practical II		**Chemistry Practical II**	
Code: 23UCHER2	**Hrs/Week:2**	**Hrs/Sem: 30**	**Credits: 1**

Objectives

This course aims to provide knowledge on

- Identification of organic functional groups
- Different types of organic compounds with respect to their properties.
- Determination of elements in organic compounds.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	gain an understanding of the physical state, odour, colour and solubility of the given organic compound.	K1
CO-2	identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	K2
CO-3	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, aldehyde, glucose and explain the reactions behind it.	K3
CO-4	analyze the aliphatic and aromatic compound.	K4
CO-5	assess the elements such as nitrogen, sulphur and halogens.	K5

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].

(b) Detection of elements (N, S, Halogens).

(c) To distinguish between aliphatic and aromatic compounds.

(d) To distinguish – Saturated and unsaturated compounds.

Reference Books

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

Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Skill Enhancement Course II Biocomposting for Entrepreneurship			
Course Code: 23UZOSE2	**Hrs / week :2**	**Hrs / Sem: 30**	**Credits:2**

Objectives

- To impart knowledge on the process of biocomposting
- Develop entrepreneurial skills to establish a biocompst unit

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	identify the appropriate method for efficient biocomposting	K1
CO-2	classify the different types of biocomposting techniques	K2
CO-3	choose the appropriate conditions to perform highly efficient biocomposting	K3
CO-4	examine the modalities to establish a biocompost unit	K4
CO-5	evaluate the applications of biocomposting	K5

Unit I **Introduction to Biocomposting** **(6 hrs)**

Definition, Types of Composting-Active composting and Passive composting, Chemical reaction of biocomposting, Ecological importance of biocomposting.

Unit II **Types of Biocomposting Technology** **(6 hrs)**

Field pits/ground heaps/ tank/large-scale/batch and continuous composting methods.

Unit III **Composting Process** **(6 hrs)**

Collection, segregation and storage of solid waste, Shredding and homogenization, Stages of composting- High rate composting stage, Thermophilic stage, Maturation stage, Biological processes involved during composting, Factors influencing composting- Oxygen content, Temperature, Moisture, pH, Carbon nitrogen ratio, Size range

Unit IV **Applications of Biocomposting** **(6 hrs)**

Maintenance of soil fertility, Plant growth promotion, Value added products, Waste reduction.

Unit V **Biocomposting entrepreneurship** **(6 hrs)**

Government subsidies for bicompost units, Economics of establishment of a small biocompost unit, Project report proposal for Self Help Group (Income and employment generation).

Practicals

- Preparation procedures for Biocompost pit.
- Selection of Biocompost material, separation of Compostable and Non-compostable materials.
- Field visit to Biocomposting unit.

Text book

1. Arumugam N. *Biocomposting for Entrepreneurship*. Saras Publication, Nagercoil. 2023.

Books for Reference

1. Bikas R. Pati and Santi M. Mandal *Recent trends in Composting Technology*.1st Edition. IK International Publishing House Pvt. Ltd.India. 2019.

2. Van der Wurff, A.W.G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J. (Editors) *Handbook for Composting and Compost Use in Organic Horticulture.* Bio Greenhouse COST Action FA 1105, www.biogreenhouse.org. 2016.

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http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000281/M02489

4/ET/1511177780Paper_11_module_26_yoga_etext.pdf

Mapping of Course Outcomes with POs and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	3	2	3	3	2	2	2	3	3
CO-2	3	3	1	2	2	3	2	2	2	1
CO-3	3	2	2	2	3	2	2	3	1	3
CO-4	2	1	3	3	3	2	2	2	3	3
CO-5	3	2	3	3	3	2	2	2	3	3
Ave.	2.6	2.2	2.2	2.6	2.8	2.2	2	2.2	2.4	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Skill Enhancement Course III	**Apiculture**		
Course Code: 23UZOSE3	**Hrs / week :2**	**Hrs / Sem: 30**	**Credits:2**

Objectives:

- To understand the history and different groups of honey bees and their social organisations.
- To develop the entrepreneurial skills and business oriented mindset, which are crucial for managing an apiary as a successful venture.

Course outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	recall the distinct features of honey bees.	K1
CO-2	distinguish the characteristic features of honey bee species.	K2
CO-3	classify the bee keeping appliances and diseases of honey bees	K3
CO-4	analyze the bee products and enemies of honey bee	K4
CO-5	evaluate the budget and the funding agency for apiary	K5

Unit I Introduction to Apiculture (6Hrs)

History, Classification, Honey bee species- *Apis dorsata, Apis mellifera, Apiscerana, Apis florea,* Social organization of bee colony

Unit II Bee-keeping (6Hrs)

Bee-keeping-appliances, Newton bee hive-Arranging an apiary- Location and preparation of an apiary

Unit III Enemies and Diseases of Honey Bees (6Hrs)

Enemies – Moth (Greater wax -moth), wasp and beetles - Characteristics and Preventive measures, Viral disease- sac brood disease, Bacterial diseases- Septicemia, Fungal disease- Chalk brood disease, symptoms and control measures

Unit IV Honey Bee Products (6Hrs)

Honey - extraction, chemical composition and nutritive values. Uses of Royal jelly, Propolis, Pollen, Bee venom and bee wax

Unit V Economics of Apiculture (6Hrs)

Budget for Apiculture, Funding agencies for Apiary, Apiculture as anEntrepreneurial venture.

Practical

1. Budget preparation
2. Filling the entrepreneur form
3. Visit to an apiary

Text book

1. Johnson, J. and I.Jeya Chandra, *Apiculture*. Marthandam: Olympic Grafix. Marthandam, 2008.

Books for Reference:

1. Mishra. R.C. *Perspectives in Indian Apiculture*, Anmol Publishers, India New Delhi, 2002.
2. Raja Instus. E. ..*Economics of Bee Keeping Industry.* Rawat Publications, Jaipur and New Delhi , 1994.
3. Delhi Pierre Jean – Prost. *Apiculture*. Oxford & IBH Publishing Co.Pvt. LTD. New Delhi, 1994.
4. Sathe, T V. *Fundamental of Beekeeping*, Daya Publishing House, New Delhi.
5. Shukla & Upadhyay, *Economic Zoology*, 5th edn. Rastogi Publication, Meerut New Delhi, 2014.
6. Vasantharaj David. B. . *Elements of Economic Entomology*. 8th Edition. Brillion Publishing, New Delhi, 2016.

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	2	3	**3**	3	**3**	**2**	**3**
CO-2	1	**1**	1	1	**3**	1	1	1	**1**	3
CO-3	2	2	**3**	3	**2**	**3**	**2**	**2**	3	**3**
CO-4	2	2	**2**	**2**	**2**	**1**	1	2	**2**	**2**
CO-5	2	3	2	3	3	**3**	3	**2**	3	**3**
Ave.	**2.0**	2.2	2.2	2.2	**2.5**	**2.3**	**2.0**	**2.0**	2.2	**2.8**

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – III			
Part-I Tamil Paper - 3 காப்பிய இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, புதினம்			
23ULTA31	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

நோக்கங்கள்

	கற்றல் நோக்கங்கள்
1	நம் தாய்மொழியில் உள்ள அரிய பொக்கிசங்களான காப்பியங்களை, அவற்றின் உட்கருத்தை மாணவியர் அறிந்துகொள்வர்.
2	சங்ககாலம் முதல் இக்காலம் வரை பல்வேறு சமயங்களின் வளர்ச்சி நிலைகள் பற்றியும் இக்காப்பியங்கள் வழி அறிந்து கொள்வர்.
3	வாழ்வுக்கு இலக்கணம் கூறும் அகப்பொருள் இலக்கணம் பற்றி அறிந்து கொள்வர்.
4	இலக்கிய வரலாற்றின் வழி மொழியின் வளர்ச்சியையும் காலந்தோறும் மாறிவரும் இலக்கியங்களின் பல்வேறு வகைகளையும் தெரிந்து கொள்வர்.
5	தன்னம்பிக்கை உருவாக்கி, வேலை வாய்ப்பிற்கான தேர்வுகளில் திறமையுடன் பங்கேற்பர்.

பாடத்திட்டத்தின் பயன்கள்

CO.NO	இப்பாடத்திட்டம் - மாணவியரிடம்	அறிவாற்றல் திறன்
CO-1	இலக்கிய அறிவையும், காப்பிய அறிமுகம் மற்றும் கருத்து நலம் குறித்த புலமையை வளர்க்கிறது	K1
CO-2	கடல் போன்ற தமிழ் இலக்கியக் கனிச் சாற்றை மேன்மேலும் பருக வேண்டும் என்னும் ஆவலை வளர்க்கிறது.	K2
CO-3	மொழியறிவோடு சிந்தனைத்திறனையும், படைப்பாற்றலையும் வளர்க்கிறது.	K3
CO-4	சங்க கால மக்களின் வாழ்க்கைச் சுவடு, மற்றும் வாழ்வியல் பண்பாட்டு நெறிகளின் தாக்கம் பெற்றுத் தங்களின் எதிர்கால வாழ்வைச் செம்மையுடன் அமைக்கும் திறனைப் பெறுகிறார்கள்.	K4
CO-5	தனிமனித, சமுதாய வாழ்க்கைச் சிக்கல்களை எதிர்கொண்டு வெற்றியோடு பயணிக்கும் திறனைப் பெறுகிறார்கள்.	K5

அலகு 1 **(18 மணி நேரம்)**

பெருங்காப்பியங்கள்

1. சிலப்பதிகாரம் - வழக்குரைகாதை - இளங்கோவடிகள்
2. மணிமேகலை – ஆதிரை பிச்சையிட்ட காதை – சீத்தலைச் சாத்தனார்
3. சீவக சிந்தாமணி – பூமகள் இலம்பகம் - திருத்தக்கத்தேவர்
4. வளையாபதி – நாதகுத்தனார்

அலகு – 2 **(18 மணி நேரம்)**

சமய காப்பியங்கள்

1. பெரியபுராணம் - பூசலார் நாயனார் புராணம் - சேக்கிழார்
2. கம்பராமாயணம் - மந்தரை சூழ்ச்சிப் படலம் - கம்பர்
3. இயேசு காவியம் - மலைப் பொழிவு – கண்ணதாசன்
4. சீறாப்புராணம் - புலி வசனித்த படலம் - உமறுப் புலவர்

அலகு – 3 **(18 மணி நேரம்)**

இலக்கணம்

1. **அகப்பொருள்:**
   1. ஏழு திணை விளக்கம்
   2. முதல், கரு, உரிப் பொருள் - விளக்கம்
2. **புறப்பொருள்:**
   1. வெட்சி முதல் பாடாண் திணை வரை - விளக்கம
3. **யாப்பின் இலக்கணம்**

அலகு – 4 **(18 மணி நேரம்)**

இலக்கிய வரலாறு

1. ஐம்பெருங் காப்பியங்கள்
2. ஐஞ்சிறு காப்பியங்கள்
3. சிற்றிலக்கியங்கள்

அலகு – 5 **(18 மணி நேரம்)**

புதினம்

1. வஞ்சிமாநகரம் (வரலாற்றுப் புதினம்) – நா.பார்த்த சாரதி

துணைநின்ற நூல்கள்

1. சிலப்பதிகாரம் - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.
2. மணிமேகலை - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.
3. .சீவகசிந்தாமணி - புலவர் பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.
4. கம்பராமயணம் - பேரா. பூவண்ணன்(உரையாசிரியர்)
   வர்த்தமானன் பதிப்பகம்
   21, இராமகிரு‘ணா தெரு
   தியாகராய நகர்
   சென்னை – 17.

5. பெரியபுராணம் - பன்னிரு திருமுறைகள்
சு.வே.சுப்பிரமணியன்
மணிவாசகர் பதிப்பகம்
31, சிங்கர் தெரு
பாரிமுனை, சென்னை – 18.

6. இயேசு காவியம் - கவிஞர் கண்ணதாசன்,
கண்ணதாசன் பதிப்பகம்
கலைக்காவிரி வெளியீடு,
திருச்சி .

7. ஐஞ்சிறுகாப்பியங்கள் (மூலமும் உரையும்) – தமிழ் நிலையம்
40, சரோஜினி தெரு
தியாகராய நகர்
சென்னை – 17

8. புறப்பொருள் வெண்பாமாலை - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. தொல்காப்பியம் - பொருளியல் உரைவளம் - க. வெள்ளைவாரணன்
பதிப்:புத் துறை,
மதுரை காமராசர் பல்கலைக் கழகம்,
மதுரை- 625 021.
முதற்பதிப்பு - 1983

7. நன்னூல் - பவணந்தி முனிவர்
திருநெல்வேலி தென்னிந்திய
சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
திருநெல்வேலி – 6.

8. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
தூய மரியன்னை கல்லூரி (தன்னாட்சி), தூத்துக்குடி.

இணைய ஆதாரங்கள்

1. Project Madurai - www.projectmadurai.org

2. Tamil Universal Digital Library – www.ulib.prg<http://www.ulib.prg>
3. Tamil Books on Line – books.tamilcube.com

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – III			
Part I French	**French Literature and Grammar I**		
Course Code: 23ULFA31/ 23ULFB31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- To get a gist of the French Literature.
- To appreciate the essence in the literary texts
- To develop an interest in the French literature that will encourage her to pursue higher studies in French.
- To identify the grammar used in the literary texts and advance into complicated grammar.

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	comprehend the history of the French literature.	K1
CO-2	interpret the values and morals through literary texts.	K2
CO-3	imbibe the basic grammatical structures of the French language	K3
CO-4	compare literary texts of different centuries to note the difference in writings.	K4
CO-5	estimate the humanistic value about author's ideas and transform her own personality	K5

SEMESTER – III			
Part I French	**French Literature and Grammar I**		
Course Code: 23ULFA31/ 23ULFB31	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Moyen Age

1.1 – Estula - Auteur Anonyme
1.2 – Balade des pendues – François Villon
1.3 – Les pronoms COD et COI

Unit II – XVI^{e} siècle

2.1 – Regrets - Joachim du Bellay
2.2 – Gargantua - François Rabelais
2.3 – Le futur proche/ Passe récent

Unit III – XVII^{e} siècle

3.1 - La cigale et la fourmi - Jean de la Fontaine
3.2 – Sur la mort de son fils - François de Malherbe
3.3 – Le passe compose avec avoir et être

Unit IV – Francophonie - Québec

4.1 – Une saison dans la vie d'Emmanuel - Marie Claire Blais
4.2 – L'imparfait
4.3 – Le passe compose et l'imparfait

Unit V – Francophonie – Afrique Noire

5.1 – L'enfant noir - Camara Laye
5.2 – L'impératif
5.3 – Le futur simple

Textbook:

- Textes complié par le département de français
- Clémence Fafa, Yves Loiseau, Violette Petitmengin, *Grammaire Essentielle Du Français A1*, Didier, 2018

Books, Journals and Learning Resources

- K. Madanagobalane, N.C.Mirakamal. *Le Francais par les Textes*. Chennai : Samhita Publications, 2019.
- Ludivine Glaud, Muriel Lannier, Yves Loiseau, *Grammaire Essentielle Du Français A1 A2*, Didier, 2015
- Blondeau Nicole, Allouache Ferroud jà, Ne Marie-Françoise. *Littérature Progressive du Français*. Paris : CLE International, 2004.
- Akyuz Anne, Bazelle-Shahmaei Bernadette, Bonenfant Joelle, Gliemann Marie-Francoise. *Les 500 exercices de grammaire*. Paris : Hachette livre, 2005
- Grégoire Maria. *Grammaire Progressive du français*. Paris : CLE International, 2002.

- Sirejols Evelyne, Tempesta Giovanna,Grammaire. *Le Nouvel Entrainez-vous avec 450 Nouveaux Exercices.* Paris : CLE International, 2002
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.conte-moi.net/node/120

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	1	3	2	2	1	2	3	3
CO-2	3	2	2	2	2	2	2	3	3	3
CO-3	3	3	1	2	2	3	3	2	2	3
CO-4	3	3	2	2	1	1	2	2	3	3
CO-5	2	1	2	3	3	1	2	3	3	3
Ave.	2.8	2.2	1.6	2.4	2	1.8	2	2.4	2.8	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER III			
Core III	**Developmental Zoology**		
Course Code: 23UZOC31	**Hrs/ Week: 5**	**Hrs/ Sem: 75**	**Credits: 5**

Objectives

- To understand the complexity of developmental processes and the underlying mechanism.
- To attain knowledge on reproductive technology and stem cells.

Course Outcome

Co.No	Upon completion of this course, students will be able to	CL
CO-1	describe the basic concept and process in developmental biology and acquire in-depth knowledge	K1
CO-2	explain the sequential changes from cellular grade of organization to organ grade of organization	K2
CO-3	apply advanced technologies in stem cell and reproductive biology to manage health related issues	K3
CO-4	analyse the causes of embryonic diseases and infertility in human and can take preventive measures for the well-being of humanity	K4
CO-5	evaluate the new developments in embryology and its relevance to man	K5

Unit I **Gametogenesis** **(15 Hrs)**

Basic concepts of developmental biology – gametogenesis – spermatogenesis, oogenesis –Role of hormones in gametogenesis - phases of development – types of eggs

Unit II **Development of Chick** **(15 Hrs)**

Fertilization : Pre and post fertilization events – sperm and egg of chick, cleavage, blastulation, gastrulation and fate map of chick.

Unit III **Development of Human** **(15 Hrs)**

Structure of sperm and egg- cleavage – fate map of human – blastulation - gastrulation in human – organogenesis -development of heart and brain in mammal.

Unit IV **Stem cells and Placenta in mammals** **(15 Hrs)**

Organizer –primary and secondary organizers, Spemann's experiment, morphogenetic fields and gradient hypothesis, embryonic stem cells – culture and applications, placenta in mammals – types and physiology.

Unit V **Assisted Reproductive Technology** **(15 Hrs)**

Manipulation of reproduction in human – Infertility in Male and Female – Poly Cystic Ovarian Disease (PCOD) – artificial insemination, i*n vitro* fertilization (IVF), Intracytoplasmic sperm injection (ICSI) test tube babies – amniocentesis – Birth control – contraceptive devices – surgical, hormonal methods, physical barriers – intrauterine contraceptive device (IUCD), termination of gestation, IVSF

Text Book

1. Berril. M.J. *Developmental Biology.* New Delhi: Tata Mc Graw- Hill Publishing Company Ltd.1982

Books for Reference

1. Arumugam. N. 2006 *Developmental Zoology*, Nagercoil: Saras Publication. 2006.
2. Verma. P.S. and U.K. Agarwal. *Chordate Embryology*. New Delhi: S. Chand & Company Ltd, 10th Edition 2014.
3. Balinsky, B. I. and Bc. Fabian. *An Introduction to Embryology*. India: Cengage Learning 5th Edition2012.

Web Resources

1. https://www.ncbi.nlm.nih.gov/books/NBK10052/
2. https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html
3. https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	1	3	2	3	2	1	3	2
CO-2	3	2	2	3	3	3	1	1	2	3
CO-3	3	1	3	3	1	3	3	2	3	3
CO-4	3	2	3	3	3	3	3	3	3	3
CO-5	2	2	3	3	3	3	3	2	3	3
Ave.	2.8	1.6	2.4	3	2.4	3	2.4	1.8	2.8	2.8

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

Practicals

Hrs / Week – 2 **Course Code: 23UZOCR3** **Credits: 2**

1. Types of eggs (alecithal, telolecithal and centrolecithal)
2. Temporary mounting of chick embryo
3. Chick – Blastula, Gastrula and Fate map
4. Observation of permanent slides of chick embryo 24, 48 ,72, and 96 hours.
5. Pregnancy test kit - Demonstration
6. Mounting of egg of fish
7. Museum specimens/ slides/ models and charts:

a. Sperm and egg of mammal

b. Contraceptive devices – condom, copper T, pills (Mala D).

c. Placenta in mammals – diffuse, discoidal, zonary and cotyledenary placenta.

Books for Reference

1. Verma P. S, *A Manual of Practical Zoology*

   Chordates. New Delhi: S. Chandand Company

   Ltd.1992.

2. Balinsky B. *An Introduction to Embryology*. U.S.A

   and Japan:, B.W. SaundersCompany Ltd. Fourth

   edition.1976.

3. Jeyasuriya, Arumugam , N , Dulcy Fatima , Narayanan.

   Nagercoil: *L.M. PracticalZoology* Saras Publications, Vol.

   3. 2013.

SEMESTER III			
GENERIC ELECTIVE III - FUNDAMENTALS OF BOTANY I			
Course Code: 23UBOE31	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

COURSE OBJECTIVE

To familiarize with the microbes, diverse groups of plants, cell organelles and genetics.

COURSE OUTCOMES

CO	On completion of this course, the students will be able to	PO
CO1	recall the general characteristics of algae, microbes, bryophytes, pteridophytes, gymnosperms and concept of cell	**K1**
CO2	distinguish between diverse groups of plants	**K2**
CO3	demonstrate practical skills in thallophytes, microbes, bryophytes, pteridophytes, gymnosperms and cell biology	**K3**
CO4	compile the structure, reproduction and life cycle of different plant groups and analyze the genetics problems	**K4**
CO5	evaluate the economic and ecological significance of different groups of plants	**K5**

SEMESTER III			
GENERIC ELECTIVE III - FUNDAMENTALS OF BOTANY I			
Course Code: 23UBOE31	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

UNIT I **Algae and Fungi:** General characters of algae, structure, reproduction and life cycle of *Anabaena* and *Sargassum*, Economic importance of algae. General characters of fungi, structure, reproduction and life cycle of *Penicillium* and *Agaricus*, Economic importance of fungi.

UNIT II **Bacteria and Virus:** General characters of bacteria, structure and reproduction of *Escherichia coli*, Economic importance of bacteria. General characters of virus, structure of TMV and bacteriophage.

UNIT III **Bryophytes, Pteridophytes and Gymnosperms:** General characters of Bryophytes, Pteridophytes and Gymnosperms. Structure, reproduction and life cycle of *Funaria*, *Lycopodium* and *Cycas*.

UNIT IV **Cell Biology:** Difference between prokaryotic and eukaryotic cell. Ultra structure and functions of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.

UNIT V **Genetics:** Mendelism: Law of dominance, segregation, incomplete dominance and independent assortment. Monohybrid and dihybrid cross, Test cross and Back cross.

Text Books:

1. Dubey, R. C., and Maheswari, D. K. (2010). *A Textbook of Microbiology*. Chand and Company Ltd.
2. Gupta, P. K. (2018). *Genetics*. Rastogi Publications.
3. Pandey, B. P. (1986). *Text Book of Botany* (College Botany) Vol. I and II. S. Chand and Co.

Reference

1. Alexopoulos, C. J. (2013). *Introduction to Mycology.* Willey Eastern Pvt. Ltd.
2. Coulter, M. J. (2014). *Morphology of Gymnosperms*. Surjeet Publications.
3. Lee, R. E. (2008). *Phycology* (4th ed.). Cambridge University Press.

4. Rao, K., Krishnamurthy, K. V., and Rao, G. S. (1979). *Ancillary Botany*. S. Viswanathan Pvt. Ltd.
5. Singh, V., Pande, P. C., and Jain, D. K. (2021). *A Textbook of Botany*. Rastogi Publications.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	2	3	3	3	3	2	3	3
CO5	3	2	3	3	3	3	3	3	2	3
Avg	3	2.8	2.8	2.8	2.8	3	3	2.8	2.8	2.8

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

SEMESTER III			
GENERIC ELECTIVE PRACTICAL III - FUNDAMENTALS OF BOTANY PRACTICAL I			
Course Code: 23UBOER3	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credit: 1**

COURSE OBJECTIVE

To identify algae, fungi, bacteria, bryophytes, pteridophytes, and gymnosperms based on morphological and anatomical characters.

COURSE OUTCOMES

CO	On completion of this course, the students will be able to	PO
CO1	identify the morphological and internal organization of algae, fungi, bacteria, virus, bryophytes, pteridophytes and gymnosperms.	**K1**
CO2	understand the fundamental concepts of plant groups, their evolutionary and reproductive mechanisms, and the laws of inheritance.	**K2**
CO3	solve the genetic problems to understand the concepts of Mendelian theories.	**K3**
CO4	distinguish the structures and functions of various cell organelles.	**K4**
CO5	evaluate the significance of different plant groups.	**K5**

SEMESTER III			
GENERIC ELECTIVE PRACTICAL III - FUNDAMENTALS OF BOTANY PRACTICAL I			
Course Code: 23UBOER3	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credit: 1**

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

   Algae: T.S of axis and leaf of *Sargassum*

   Fungi: T.S of pileus of *Agaricus*

   Bryophytes: T.S of stem and leaf of *Funaria*

   Pteridophytes: T.S of stem of *Lycopodium*

   Gymnosperms: T.S of leaf of *Cycas*
2. Electron micrograph of chloroplast, mitochondria and nucleus
3. Identification of different stages of mitosis using squash technique from onion root tip.
4. To work out simple genetic problems in monohybrid and dihybrid

References

1. Bendre Kumar. (2014). *A Textbook of Practical Botany*, Volumes I and II (7th ed.). Rastogi Publications.
2. Serediak, N., and Huynh, M. (2011). *Algae Identification Lab Guide: Accompanying Manual to Algae Identification Field Guide*. Ottawa Agriculture and Agri-Food Canada Publisher.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	2
CO4	3	2	3	3	3	3	3	2	3	3
CO5	3	3	3	2	3	3	3	3	3	3
Avg	3	2.8	3	2.8	2.8	3	3	2.8	2.8	2.8

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

SEMESTER –III			
NME I	**Basic Biotechnology**		
Course Code: 23UZON31	**Hrs/week : 2**	**Hrs/Sem: 30**	**Credit: 2**

Objectives

- To impart basic knowledge on biotechnology and develop skills in biology using various biotechniques
- To motivate the students to take up career in biotechnology related fields in their future

CO. No	Upon completion of this course, students will be able to	CL
CO-1	recall the scope and importance of biotechnology by understanding the basic structure and functions of cells	K1
CO-2	associate biotechnology concepts to solve problems across various fields	K2
CO-3	apply their skills in biotechnology to pursue research in their fields of specialization	K3
CO-4	analyze the role of biotechnology in human welfare with a deep sense of environmental responsibility	K4
CO-5	recommend a suitable field of biotechnology for and entrepreneurial venture	K5

Unit I **Introduction to Basic Biotechnology** **6 hrs**

Definition, History of biotechnology-Scope of biotechnology Structure of cell-Eukaryotic and prokaryotic cells-DNA structure and composition-Gene concept-Central dogma of life

Unit II **Basics of Gene Manipulation** **6 hrs**

Concept of Genetic Engineering-Tools for genetic Engineering-Restriction enzymes and DNA ligases - Methodology of genetic engineering- Introduction of recombinant DNAs into host cells- Transformation, Electroporation, Microinjection, -Cloning of Dolly

Unit III **Cell culture** **6 hrs**

Introduction and historical background-Cell culture technique-Cell types- Cell lines- -Stem cells -Embryonic stem cell, Adult stem cells-Applications of stem cells-Organ culture-Raft culture-Applications of organ cultures

Unit IV **Transgenic plants** **6 hrs**

Agrobacterium mediated gene transfer to plants-types of transgenic plants-Insect resistant plants (Bt. Cotton)- Transgenic plants with improved shelf life (Tomato), Transgenic plants with improved nutritional quality (Golden Rice)-Transgenic plants producing pharmaceutical products (Plantibodies)

Unit V **Transgenic animals** **6 hrs**

Microinjection method of gene transfer to animals-Transgenic animals – Transgenic mouse (Super mouse)- Transgenic sheep for wool production-Transgenic pig (Enviro pig)- Transgenic fish (Glo fish)

Text Book

Kumaresan, V. *Biotechnology*. 6th edition, Saras Publication, Kottar P.O, Nagercoil. 2012.

Books for Reference

1. Dubey, R.C. *A Textbook of Biotechnology*. S.Chand and Company Ltd. 2009.

2. Rastogi, S.C. *Biotechnology Principles and Applications*. Narosa Publishing House. Chennai. 2012.

3. Singh, B.D. *Biotechnology*. Kalyani Publishers. New Delhi. 2015.

4. Sathyanarayana,V. *Biotechnology*. 8th Edition. Books and Allied (P) Ltd. Kolkatta. 2013

5. Harisha S. *Biotechnology Procedures and Experiments Hand Book*. Infinity Science Press, LIC, Hinghum, Massachusett, New Delhi, India.. 2007

6. AsishVerma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. 2007. S.Chand and Company, Ltd., New Delhi. 2008.

Web Resources

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021493/ET/1501755501ApplicationsofBiotechnologyE-text.pdf

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	2	2	2	3	3	3	2	1
CO-2	2	2	3	3	2	2	3	2	2	2
CO-3	2	2	3	3	3	2	2	3	2	3
CO-4	3	3	2	3	3	3	3	2	2	3
CO-5	2	3	3	3	2	2	3	3	3	2
Ave.	2.4	2.6	2.6	2.8	2.4	2.4	2.8	2.6	2.2	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER III			
Skill Enhancement Course IV	**Poultry Farming**		
Course Code: 23UZOSE4	**Hrs/Week : 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

- To impart knowledge on the fundamentals of poultry farming and management
- To create an avenue for self employment and entrepreneurship.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	identify the commercial strains for poultry farming	K1
CO-2	explain the management strategies for a profitable farming	K2
CO-3	apply innovative technologies to manage the problems encountered in poultry keeping	K3
CO-4	analyse the management techniques to handle adverse conditions	K4
CO-5	evaluate the strategies for self employment to become entrepreneurs	K5

Unit I **Poultry Industry** **(6 Hrs)**

General introduction to poultry farming – choosing commercial layers and broilers – poultry housing –cage rearing – feeder and waterer - deep litter system

Unit II **Practical Aspects of Rearing Fowl** **(6 Hrs)**

Management of chick, broiler, grower and layer. Composition and nutritive value of eggs and poultry meat.

Unit III **Management of Poultry** **(6 Hrs)**

Summer management –winter management, debeaking of chick – growers – layers and broilers.

Unit IV **Poultry Nutrition** **(6 Hrs)**

Feed stuffs of poultry, feed formulation – non nutritive feed additives.

Unit V **Disease Management and Economics of Poultry Farming** **(6 Hrs)**

Poultry diseases -viral-ranikhet, bacterial –foul cholera, fungal – aspergillosis, vaccination programme – Economics of poultry farming

Books for Reference

1. Gnanamani, M.R. *Profitable Poultry Farming*. Giri Publication, Madurai. 2003.
2. Prakash Malhotra. *Economic Zoology*. Adhyayan Publishers, New Delhi.2008.

Web Resources

1. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
2. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	3	2	3	3	2	3	2	2
CO-2	3	3	3	3	3	3	3	2	2	3
CO-3	2	3	3	3	3	2	3	3	2	2
CO-4	3	3	3	2	2	3	3	2	3	3
CO-5	3	3	3	1	3	3	2	2	2	3
Ave.	2.8	2.6	3	2.2	2.8	2.8	2.6	2.4	2.2	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER –III			
Ability Enhancement Course Yoga and Meditation			
Course Code: 23UAYM41	**Hrs/Week: 1**	**Hrs/Semester: 15**	**Credits: 1**

Objectives

This course aims at providing knowledge on

- self -awareness and concentration.
- yoga and benefits of yoga asanas.
- the power of positive attitude.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Acquire knowledge in Meditation, awareness, different types of yoga mindfulness and attitude to life.	K1
CO-2	Gain knowledge on Major types of meditation, self-awareness, basic asanas and three components of mindfulness, positive and negative attitude.	K2
CO-3	Explain health benefits of meditation, concentration, asanas for healthy life, mindfulness and Brainwave patterns, heartfullness	K3
CO-4	Understand better meditation, levels of concentration, surya namaskar, Myths about mindfulness, feat and its types.	K4
CO-5	Evaluate the psychological benefits of meditation, ways to develop Presence, benefits of doing in regular life, Scientific Facts about Mindfulness and anger styles.	K5

Unit I Meditation

Meditation — Major types of meditations: Zazen, Mindfulness, Vipasana, Yoga, Self-inquiry, Listening, – Health benefits of meditation: physical, psychological, spiritual–Tips for better meditation. **Exercises:** Practicing Zazen meditation – Self-enquiry meditation exercises

Unit II Self-Awareness

Awareness – Self-awareness – Importance of self-awareness –Difference between Awareness and Concentration – Power of concentration – Levels of concentration – How to increase concentration? – Ways to develop your presence

Exercises: Body Scan exercise

Unit III Yoga

Different types of yoga- Pranayama – Surya namaskara– Basic asanas for healthy life- Pranam asana, Hasta Uttan Asana- Pada Hasta Asana- Adhomukha Svanasana - Danda Asana -Vajra Asana, Padmasana, Parvat Asana, Utthita Padasana, Navasana, Bujang Asana- Dhanur Asana- Savasana **Exercises**: Practicing basic Asanas – Doing Sun Salutation

Unit IV Mindfulness

Definition of mindfulness – Three components of mindfulness– Mindfulness and Brainwave patterns – Myths about mindfulness – Scientific Facts about mindfulness – Formal and Informal methods method to practice mindfulness

Exercises: Practice Mindful Walking –Practice Mindful Talking

Unit V Heartfulness

Attitude to life – Power of positive attitude– Techniques to develop positive attitude– Positive vs negative people – Forms of negative attitude – Heartfulness – Managing fear: Basic 5 fears, way's to overcome fear– Handling anger: Anger styles, Tips to tame anger

Exercises: Practice Loving-Kindness meditation– Doing compassionate actions.

SEMESTER III	
Self-Study Wildlife Conservation and Management	
Course Code :23UZOSS1	**Credits: +2**

Objectives:

- To build up scientific knowledge on wild life resources and their management
- To promote sustainable practices and educate about wild life conservation

Course Outcome

CO. No	Upon completion of this course, students will be able to	C L
CO-1	recall the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies	**K1**
CO-2	discuss the various threats to biodiversity, including habitat loss, climate change, invasive species, and over-exploitation**.**	**K2**
CO-3	apply the conservation and management strategies such as protected areas, habitat restoration and sustainable resource utilization**.**	**K3**
CO-4	examine the ecological tenets of national parks and sanctuaries, ecotourism, and community involvement in order to ensure sustainable management and preservation.	**K4**
CO-5	recommend the national and international rules and regulations pertaining to the preservation and management of wildlife in order to raise awareness	**K5**

Unit I Wildlife Census Techniques

Wildlife census techniques - direct method - line transect method,

block count method indirect method - pellet analysis method, pugmark techniques.

Unit II Need for Conservation

Wildlife values and benefits - causes of wildlife depletion, need for conservation endangered species of reptiles, birds and mammals in India.

Unit III Wildlife and their Management

Principles of wildlife management - wildlife wealth of India – threatened wildlife,

threats to survival and management of Musk deer, Great Indian Bustard,

Olive ridley turtle, Nilgiri tahr, Nilgiri langur.

Unit IV Sanctuaries and National Parks

Definition - importance - Vedanthangal, Koonthankulam Bird Sanctuary - Mudumalai Sanctuary- Anamalai Sanctuary - National Parks - Guindy Deer Park - Gulf of Mannar Biosphere Reserve.

Unit V Wildlife Conservation Policies

The World Conservation Union (IUCN), Red Data Book. World Wildlife Fund (WWF), Indian Board of Wildlife (IBWL), Man and Biosphere Programme (MAB), Project Tiger. Wildlife Protection Act 1972, Significance of NGO's in wildlife conservation.

Books for Refernces:

1. Jugale. K.P.*Wildlife in India.* Bio-Green Books, 2011.
2. Hosetti. B.B. *Concepts in Wildlife Management*. Daya Publishing House, 2017.
3. Anathakrishnan. T. N. *Bioresources Ecology.* Oxford and IBH Publishing Co, New Delhi. 1981.
4. David Western and Mercy.C. *Pearl Conservation for the Twenty-first Centuary.* Oxford University Press, New York. 1992.
5. Arumugam.
6. N and V. Kumersan, *Environmental Studies*. Saras Publications, Nagercoil. 2014.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	3	2	3	3	2	2	2
CO-2	3	2	2	3	2	3	2	2	3	2
CO-3	2	2	2	3	2	2	2	2	3	3
CO-4	3	3	3	3	2	3	2	2	3	3
CO-5	3	3	2	3	2	3	2	2	3	2
Ave.	2.8	2.6	2.2	3	2.0	2.8	2.2	2.0	2.8	2.5

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – IV			
Part-I Tamil Paper - 4 சங்க இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, நாடகம்			
Course Code 23ULTA41	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

நோக்கங்கள்

	Learning Objectives
1	சங்க இலக்கியத்தின் சிறப்பையும் நாடகம் என்னும் இலக்கிய வகையின் தன்மைமையையும், அகத்திணை புறத்திணை இலக்கணங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்
2	இலக்கியங்களின் சிறப்பினை உணர்த்துதல். சங்கம் வைத்துத் தமிழாய்ந்த மன்னர், புலவர், மக்கள் இவர்களின் வாழ்வியல் அறங்களைக் கண்டறிவர்.
3	மொழியைப் பிழையின்றி பேசவும் எழுதவும் பயன்படுகிறது. படைப்பாற்றல் திறனை வளர்க்க உதவுகிறது.
4	பழந்தமிழர் வாழ்வியல் முறைகளை கற்று பயனடைய உதவுகிறது பண்பாட்டுச் சிறப்பினை மொழியின் வழி அறிந்து தம் வாழ்வில் கடைப்பிடிக்க வழிகாட்டுகிறது.
5	தமிழ் இலக்கியம் சார்ந்த போட்டித்தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்

பாடத்திட்டத்தின் பயன்கள்

CO.No.	**இப்பாடத்தைக் கற்பதால் மாணவிகள் பின்வரும் பயனை அடைவர்**	**Cognitive Level**
CO-1	சங்க இலக்கியத்தில் காணப்பெறும் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்	K1
CO-2	தமிழின் தொன்மையையும் செம்மொழித் தகுதியையும் அறிந்து கொள்ளுதல்	K2
CO-3	நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும், கலைத்தன்மையையும், படைப்பாற்றலையும் வளர்த்தல்	K4
CO-4	பழந்தமிழர் வாழ்வியல் முறைகளை கற்று பயனடைய உதவுகிறது.	K4
CO-5	போட்டித் தேர்வுகளுக்குப் பயன்படும் வகையில் படைப்பாக்கத் திறனை வளர்த்து வேலைவாய்ப்பினையும் பெறுவர்.	K5

அலகு – 1 **(18 மணி நேரம்)**

I. எட்டுத்தொகை

1. நற்றிணை – பாடல்கள் 10, 14, 16
2. குறுந்தொகை – பாடல்கள் 16, 17, 19, 20, 25, 29, 38, 440
3. கலித்தொகை – பாடல்கள் 38, 51
4. அகநானூறு - பாடல்கள் 15, 33
5. புறநானூறு - பாடல்கள் 37, 86, 112
6. பரிபாடல் - பாடல் - 55

அலகு – 2 **(18 மணி நேரம்)**

பத்துப்பாட்டு – நெடுநல்வாடை – நக்கீரர்

அலகு - 3 **(18 மணி நேரம்)**

இலக்கணம்

பா வகைகள்

1. ஆசிரியப்பா, வெண்பா பொது இலக்கணம்

அணி இலக்கணம்

1. உவமை அணி
2. உருவக அணி
3. வேற்றுமை அணி
4. வஞ்சப் புகழ்ச்சி அணி
5. சிலேடை அணி
6. தற்குறிப்பேற்றணி

அலகு - 4

இலக்கிய வரலாறு **(18 மணி நேரம்)**

1. எட்டுத்தொகை
2. பத்துப் பாட்டு
3. சங்க இலக்கியச் சிறப்பியல்புகள்

அலகு - 5 **(18 மணி நேரம்)**

நாடகம் : சபாபதி - பம்மல் சம்பந்த முதலியார்

துணை நின்ற நூல்கள்

1. பத்துப்பாட்டு - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

2. எட்டுத்தொகை - பொ.வே. சோமசுந்தரனார் (உரையாசிரியர்)
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.

பார்வை நூல்கள்

1. நன்னூல் - பவணந்தி முனிவர்
   திருநெல்வேலி தென்னிந்திய
   சைவசித்தாந்த நூற்பதிப்புக் கழகம், லிமிடெட்,
   திருநெல்வேலி – 6.
2. தமிழ் இலக்கிய வரலாறு - தமிழ்த்துறை தொகுப்பு
   தூய மரியன்னை கல்லூரி (தன்னாட்சி),

தூத்துக்குடி.

3. பத்துப்பாட்டு - முனைவர் நாகராசன் (உரையாசிரியர்)
நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்
41, அம்பத்தூர்
சென்னை – 98.
4. பத்துப்பாட்டு - முனைவர் கு.வெ. பால சுப்பிரமணியன்(உரையாசிரியர்)
நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்
41, அம்பத்தூர்
சென்னை – 98.

இணைய ஆதாரங்கள்

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

Course Outcomes (PO)	Programme Specific Outcomes (PSO)				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	3
CO-2	2	3	2	1	1
CO-3	3	2	2	2	3
CO-4	1	3	3	2	2
CO-5	3	1	2	2	3
Ave	2.4	2.1	2.3	1.8	2.4

Maping	**<40%**	**≥ 40%and<70%**	**≥70%**
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER – IV			
Part I French	**French Literature and Grammar II**		
Course Code: 23ULFA41/ 23ULFB41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Learning Objectives:

- To explore the French Literature.
- To appreciate the values imbibed in the literary texts
- To develop an interest in the French literature that will encourage her to pursue higher studies in French.
- To analyse and interpret verbal expressions of cause, effect, purpose, and opposition in French

Course Outcomes		
Course Outcomes	**On completion of this course, students will be able to**	**Cognitive Level**
CO-1	comprehend the French literary background and inculcate the values imparted through the literary texts	K1
CO-2	interpret a literary text, with the perspective of analyzing the content and manner of writing	K2
CO-3	imbibe the basic grammatical structures of the language to demonstrate knowledge of various expressions used to convey opinion, emotions, cause, effect, purpose, and hypothesis in French	K3
CO-4	analyze simple literary texts to acquire literary knowledge and enhance aesthetic perception	K4
CO-5	evaluate and reflect on the humanistic value by reflecting upon the author's ideas and transform her own personality	K5

SEMESTER – IV			
Part I French	**French Literature and Grammar II**		
Course Code: 23ULFA41/ 23ULFB41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – XVIII^{e} siècle

1.1 – Candide : il faut cultiver notre jardin - Voltaire
1.2 – Le Barbier de Séville - Beaumarchais
1.3 – Les pronoms relatifs

Unit II – XIX^{e} siècle

2.1 – Le lac - Alphonse de Lamartine
2.2 – La mare au diable (extrait) - Georges Sand
2.3 – Le présent du conditionnel

Unit III – XX^{e} siècle

3.1 – Pour faire le portrait d'un oiseau - Jacques Prévert
3.2 – Mémoires d'une jeune fille rangée (extrait)- Simone de Beauvoir
3.3 – Le subjonctif présent

Unit IV Francophonie - Belge

4.1 – Monsieur friquet – Camille Lemonnier
4.2 – Le discours indirect
4.3 – La comparaison

Unit V – Francophonie – Afrique noire

5.1 – Le Mandat (La carte d'identité) - Ousmane Sembène
5.2 – L'expression de la cause et conséquence
5.3 - L'expression de but et opposition

Textbook:

- Textes complié par le département de français
- Clémence Fafa, Yves Loiseau, Violette Petitmengin, *Grammaire Essentielle Du Français A1*, Didier, 2018

Books, Journals and Learning Resources

- K. Madanagobalane, N.C.Mirakamal. *Le Francais par les Textes*. Chennai : Samhita Publications, 2019.
- Ludivine Glaud, Muriel Lannier, Yves Loiseau, *Grammaire Essentielle Du Français A1 A2*, Didier, 2015
- Blondeau Nicole, Allouache Ferroud jà, Ne Marie-Françoise. *Littérature Progressive du Français*. Paris : CLE International, 2004.
- Akyuz Anne, Bazelle-Shahmaei Bernadette, Bonenfant Joelle, Gliemann Marie-Francoise. *Les 500 exercices de grammaire*. Paris : Hachette livre, 2005

- Grégoire Maria. *Grammaire Progressive du français*. Paris : CLE International, 2002.
- Sirejols Evelyne, Tempesta Giovanna,Grammaire. *Le Nouvel Entrainez-vous avec 450 Nouveaux Exercices.* Paris : CLE International, 2002
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.conte-moi.net/node/120

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	1	3	2	2	1	2	3	3
CO-2	3	2	2	2	2	2	2	3	3	3
CO-3	3	3	1	2	2	3	3	2	2	3
CO-4	3	3	2	2	1	1	2	2	3	3
CO-5	2	1	2	3	3	2	2	3	3	3
Ave.	2.8	2.2	1.6	2.4	2	2	2	2.4	2.8	3

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – IV			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English - IV**		
Course Code: 23UGEN41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 3**

Objectives:

- To enable the learners to experience the aesthetics of literary works.
- To make them use English effectively for academic purpose.
- To develop interest in the appreciation of Literature.
- To develop and integrate the use of LSRW skills.

Course Outcomes:

CO. No.	Upon completion of the course, the students will be able to	PSO Addressed	K Level
CO -1	identify and comprehend the general themes of the given works.	1,2	1
CO – 2	explain the text within their historical and cultural contexts.	1,2,3	2
CO – 3	present scholarly conversation and show their capabilities in literary competitions.	3	3
CO – 4	examine their educational and career goals.	2,4	4
CO – 5	test their understanding level in the literary development.	5	5

SEMESTER – IV			
Part II English	**Poetry, Prose, Extensive Reading and Communicative English - IV**		
Course Code: 23UGEN41	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits:3**

Unit I – Poems

Lord Byron (1788 – 1824) : The Darkness
Robert Frost (1874 – 1963) : Home Burial
John Masefield (1878 -1967) : Laugh and Be Merry
Edgar A. Guest (1881-1959) : Don't Quit

Unit II –Prose

R.K. Narayan (1906 – 2001) : An Astrologer's Day
Stephen Leacock (1869- 1944) : How to be a Doctor

Unit III – Scenes from Literature

Christopher Marlowe (1564-1503) : The Parade of Seven Deadly Sins
(Act 2 Scene 3 in *Doctor Faustus)*
William Shakespeare (1564- 1616): *Julius Caesar* – Assassination Scene (Act III – Scene I)

Unit IV – Grammar

Synthesis of Sentences
Direct and Indirect Speech

Unit V – Communication Skills

Narrative Report
Newspaper Report

Reference Books

1. Malathi, *Functional English*. New Century Book House (P) Ltd., 2007.
2. Joseph, K.V. *A Text book of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited.

Web Resources

http:/www.gradesaver.com/George-orwell-essays/study/summary
https://americanenglish.state.gov/files/ae/resource_files/a-retrieved-reformation.pdf The Quality of Mercy, https://poemana1ysis.com
https://learnodo-newtonic.com/famous-indian-poem

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO- 5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	3	3	2	3	2	3	2	2
CO-2	3	2	2	3	2	3	2	2	3	2
CO-3	2	3	2	3	3	2	3	2	2	3
CO-4	3	2	2	3	3	3	2	2	2	3
CO-5	2	2	3	3	3	2	2	3	2	3
Ave.	2.6	2.2	2.4	3	2.6	2.6	2.2	2.4	2.2	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER IV			
Core IV	**Biochemistry**		
Course Code: 23UZOC41	**Hrs/Week : 5**	**Hrs/Sem: 75**	**Credits: 5**

Objectives

- To gain in-depth knowledge about the chemical nature of biological macromolecules and its structure and functions.
- To understand the biochemical processes and develop biochemical laboratory skills to enhance the quality of life.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	describe the structure of biomolecules and acquire knowledge about their significance	K1
CO-2	explain the mechanism of biochemical processes concerned with life and develop the ability to solve analytical skills	K2
CO-3	compile the principle, working mechanism and application of biological techniques and macromolecules to inculcate scientific attitude	K3
CO-4	analyze the properties, sources and beneficial effects of biomolecules and macronutrients for the wellbeing of human	K4
CO-5	evaluate the techniques and applications of biological instruments with a scientific approach contributing to the welfare of society	K5

Unit I **Carbohydrates** **(15 hrs)**

Carbohydrates – outline classification, properties, and biological significance - monosaccharides (glucose and fructose), glycoside linkage, disaccharides (sucrose, lactose) and polysaccharides (cellulose and glycogen).

Unit II **Proteins** **(15 hrs)**

Structure of amino acid - Classification of amino acids based on the structure of side chain; Protein - classification based on shape and structure, peptide bond, primary, secondary, tertiary and quaternary structure, properties, biological significance.

Unit III **Lipids** **(15 hrs)**

Fatty acids - types - saturated, unsaturated fatty acids, essential, non-essential fatty acids; Lipids - classification, simple lipids (triglycerides and waxes), compound lipids (phospholipids, cerebrosides), derived lipids (steroids - cholesterol), properties, biological significance.

Unit IV **Enzymes and Vitamins** **(15 hrs)**

Enzymes - classification and nomenclature, properties, mechanism of enzyme action, factors affecting enzyme activity, co-enzymes – functions of coenzyme. Vitamins: fat soluble and water soluble, properties, sources, dietary requirements and deficiency symptoms.

Unit V **Techniques in Biochemistry** **(15 hrs)**

Principle, technique and applications of pH meter, colorimeter, spectrophotometer, centrifuge (ordinary centrifuge, ultracentrifuge) and chromatography (Paper, Thin Layer Chromatography and Gel exclusion chromatography).

Text Book

1. Dulsy Fatima, L., Narayanan, R.P., Meyyan Pillai, K., Nallasivam, S., Prasanna Kumar and A. Arumugam. *Biochemistry*. Nagercoil: Saras Publication. 2013.

Books for Reference

1. Satyanarayana,V. and U. Chakrapani. *Biochemistry* – Elsivier – Division of Reed Elsevier India PVT. Ltd. and Books and Allied Pvt.Ltd.2013.
2. Ambika Shanmugam. *Fundamentals of Biochemistry for Medical Students.* Chennai: Navabharat Offset Works. 2000.
3. David L. Nelson and Michael M. Cox, *Lehninger Principles of Biochemistry* USA :W.H. Freeman & Co Ltd; 8th edition. 2021
4. Denise R. Ferrier. *Biochemistry*. Philadelphia – Baltimore – Newyork–London: Wolters Kluwer/ Lippincott Williams and Wilkins. 2011
5. Srivastava, H.S. *Elements of Biochemistry*. Meerut: Rastogi Publications. 2006.
6. Jeremy M. Berg, John L.Tymoczko, Gregory J.Gatto, Jr. Lubert Stryer. *Biochemistry* 9th Edition. W.H.Freeman and Company. New York. 2019.

Web Resources:

1. https://www.jove.com/
2. https://www.ibiology.org/biology-techniques/
3. https://www.nature.com/subjects/biological-techniques
4. https://www.ibiology.org

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	1	3	2	2	1	2
CO-2	2	3	3	1	2	2	3	3	2	1
CO-3	1	3	3	2	2	2	3	3	3	2
CO-4	2	1	2	3	3	1	2	2	3	3
CO-5	2	2	1	3	3	2	1	2	3	3
Ave.	2	2.2	2.4	2.2	2.2	2	2.2	2.4	2.4	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

PRACTICALS

Hrs/Week: 2 **Course Code: 23UZOCR4** **Credits: 2**

1. Qualitative test for carbohydrate
2. Qualitative test for proteins
3. Qualitative test for lipid
4. Determination of iodine number of coconut oil
5. Determination of saponification number of coconut oil
6. Verification of Beer-Lambert's law using colorimeter
7. Separation of amino acids by paper chromatography
8. Measurement of pH in different water samples
9. Model/ chart – Structure of glucose, sucrose, glycogen, amino acid and cholesterol, pH meter, centrifuge.

Books for Reference

1. David T. Plummer. *An Introduction to Practical Biochemistry*. New Delhi: Fifth Reprint. Tata Mc Graw – Hill Publishing Company Limited, Third Edition. 1992.
2. Jayaraman J. *Laboratory Manual in Biochemistry*. New Delhi: New Age International (P) Ltd. Publishers, 2000.
3. Sashidhar Rao, Beedu and Vijay Deshpande. *Experimental Biochemistry – A Student Companion*. I.K. International Pvt. Ltd., New Delhi. 2019.

SEMESTER IV			
GENERIC ELECTIVE II - FUNDAMENTALS OF BOTANY II			
Course Code: 23UBOE41	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

COURSE OBJECTIVE

To be familiar with the morphology of flowering plants including it's vegetative, floral structure, internal tissue organization and the physiological processes that underlie plant metabolism.

COURSE OUTCOMES

CO.No.	On completion of this course, the students will be able to:	PO
CO1	recall on classification, morphology of flowering plants, tissues, anther, ovules and absorption of water	**K1**
CO2	illustrate vegetative, floral characters, economic importance of selected families, endosperm, pollination and imbibition	**K2**
CO3	compile the primary structure of root and stem of dicot and monocot. classify the flowering plants and growth hormones	**K3**
CO4	analyze the different types of ovules and the structural organization of flower in relation to the process of pollination fertilization	**K4**
CO5	examine and identify the locally available plants prescribed in the syllabus and evaluate water relation of plants with respect to various physiological processes.	**K5**

SEMESTER IV			
GENERIC ELECTIVE II - FUNDAMENTALS OF BOTANY II			
Course Code: 23UBOE41	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

UNIT I **MORPHOLOGY OF FLOWERING PLANTS:** Definition and scope of Taxonomy. Modification of root, stem and leaf. Venation, apices, margins and arrangements of leaf. Types and modification of stipules. Types of inflorescences (Racemose, cymose and special). Terms used in description of calyx, corolla, androecium and gynoecium.

UNIT II **CLASSIFICATION AND DESCRIPTION OF PLANTS:** Systems of classification: natural (Bentham and Hooker (1862 - 1883). Vegetative, floral characters and economic importance of following families: Annonaceae, Caesalpiniaceae, Rubiaceae, Asclepiadaceae, Euphorbicaeae and Poaceae

UNIT III **ANATOMY:** Tissues: Definition, Simple tissues (parenchyma, collenchyma and sclerenchyma), Complex tissues (xylem and phloem). Primary structure of dicot and monocot of root, stem and leaf.

UNIT IV **EMBRYOLOGY:** Structure of mature anther and ovule, Types of ovules, structure of pollen grain, structure and types of embryo sac, Endosperm types and functions, Double fertilization, Structure of dicot and monocot embryo

UNIT V **PLANT PHYSIOLOGY:** Active and passive absorption of water. Photosynthesis: light reaction, Calvin cycle. Photoperiodism and vernalization. Growth hormones: auxins and cytokinins and their applications.

Text Books

1. Jain, V. K. (2006). *Fundamentals of Plant Physiology.* S. Chand and Company Ltd.
2. Bhojwani, S. S., Bhatnagar, S., and Dantu, P. K. (2015). *The Embryology of Angiosperms* (6th revised and enlarged edition). Vikas Publishing House.
3. Sharma, O. P. (2017). *Plant Taxonomy (2nd ed.)*. The McGraw Hill Companies.

Books for Reference

1. Vashista, P. C. (1985). *Taxonomy of Angiosperms.* Vikas Publications.
2. Verma, S. K. (2006). *A Textbook of Plant Physiology*. S. Chand and Co.
3. Pandey, B. P. (2013). *Taxonomy of Angiosperms.* S. Chand Publishing.
4. Sharma, P. C. (2017). *Textbook of Plant Anatomy*. Arjun Publishing House.
5. Gurucharan Singh, G. (2007). *Plant Systematics*: Theory and Practices. Oxford and IBH Publishing Co.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	2
CO2	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	2	3	3
CO5	3	3	2	3	3	3	2	3	2	3
Avg	3	2.8	2.8	2.8	2.8	3	2.8	2.8	2.8	2.8

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

SEMESTER IV			
GENERIC ELECTIVE PRACTICAL IV - FUNDAMENTALS OF BOTANY PRACTICAL II			
Course Code: 23UBOER4	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credit: 1**

COURSE OBJECTIVES

1. To enhance information on the identification of each taxonomical group of flowering, anatomy, embryos in plant production systems
2. To learn about the physiological processes that underline plant metabolism.

COURSE OUTCOMES

CO. No.	On completion of this course, the students will be able to:	PO
CO1	describe the morphological features and architecture of floral components.	**K1**
CO2	understand the natural and phylogenetic classification with reference to vegetative and floral characters	**K2**
CO3	demonstrate the primary structure of stem and root of dicot and monocot, dissection of embryos from *Tridax*	**K3**
CO4	analyze the different types of flowers, ovules, embryo and endosperm	**K4**
CO5	estimate the effect of various physical factors on photosynthesis.	**K5**

SEMESTER IV			
GENERIC ELECTIVE PRACTICAL IV - FUNDAMENTALS OF BOTANY PRACTICAL II			
Course Code: 23UBOER4	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credit: 1**

1. Dissect and display different parts of a flower

Anonaceae	-	*Anona squamosa*
Caesalpiniaceae	-	*Caesalpinia pulcherima*
Rubiaceae	-	*Ixora coccinea*
Asclepiadaceae	-	*Calotropis gigantea*
Euphorbiaceae	-	*Euphorbia cyathophora*
Poaceae	-	*Chloris barbata*

2. **Experiments on Physiology**

Imbibition by direct weight method.

Determination of effect of light intensity on photosynthesis

3. **To make suitable micro preparations of anatomy materials prescribed in the syllabus.**

Sectioning of stem	-	Dicot (*Polyalthia*), Monocot (*Zea mays*).
Sectioning of root	-	Dicot (*Azadirachta*), Monocot (*Crinum*).
Sectioning of leaf	-	Dicot (*Mangifera*), Monocot (Grass)

4. **Structure of young and mature anther (permanent slide)**

5. **Types of ovule:**

Anatropus (permament slide), orthotropus, circinotropus, amphitropus, campylotropus (models)

6. **Dissection of embryo from *Tridax*.**

References

1. Ashok Bendre and Ashok Kumar. (1976). *Text Book of Practical Botany II.* Meerut: Rastogi Publications.
2. Gamble, J. S. (1997). *Flora of Presidency of Madras (Volumes I-III).* Adlard and Son.
3. Mathew, K. M. (1981-1984). *The Flora of Tamil Nadu, Carnatic (Volumes I-III).* Rapinet Herbarium, St. Joseph's College, Tiruchirapalli.
4. Sundara Rajan, S. (2003). *Practical Manual of Plant Anatomy and Embryology (1st ed.).* Anmol Publications.

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	3	3	2	2	3	3	2
Avg	3	3	2.8	2.8	2.8	2.8	2.8	3	2.8	2.8

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

SEMESTER IV			
NME II	**Applied Biotechnology**		
Course Code: 23UZON41	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 2**

Objectives

- To impart comprehensive knowledge on biotechnological implication in various fields
- To understand the applications of biotechnological innovations for environmental protection and human welfare.

Course Outcomes

CO. No.	Upon completion of this course, students will beable to	CL
CO-1	identify the biotechnological applications involved in various fields	K1
CO-2	interpret the concepts of biotechnology and acquire creative skills to solve problems for the wellbeing of man and the environment	K2
CO-3	implement the knowledge they have acquired to their research career in relevant fields	K3
CO-4	examine biotechnology concepts to upheave human welfare with environmental consciousness	K4
CO-5	select a field of biotechnology to empower themselves as independent individuals with social responsibloity	K5

Unit I	**Food and Fuel Biotechnology**	**6 hrs**
	Fermented food – Cheese, bread –Food Spoilage and preservation- Single Cell Proteins – Mushroom culture- - Biogas composition and production	
Unit II	**Industrial Biotechnology**	**6 hrs**
	Microbial production of organic solvents -Ethanol- Microbial production of organic acid-Gluconic acid-Microbial production of penicillin	
Unit III	**Environmental Biotechnology**	**6 hrs**
	Sewage treatment – primary, secondary and tertiary treatments. Bioremediation – In-situ and Ex-situ bioremediation-Biosensors and their applications	
Unit IV	**Health Care Biotechnology**	**6 hrs**
	Gene therapy methods – germ line and somatic cell line – gene therapy for cancer.	
Unit V	**Regulations in Biotechnology**	**6 hrs**
	Biosafety – guidelines, Intellectual Property Right – Copy right and Trade mark – Patent.	

Text Book

1. Kumaresan, V. *Biotechnology.* Kottar, Nagercoil: Saras Publication: - 6th edition. 2012.

Books for Reference

1. Dubey, R.C. *A Textbook of Biotechnology*. New Delhi: S. Chand and Company Ltd.2009
2. Rastogi, S.C. *Biotechnology, Principles and Applications*. Chennai: Narosa Publishing House. 2012.
3. Singh, B.D. *Biotechnology*. New Delhi: Revised edition. Kalyani Publishers. 2015
4. Sathyanarayana, V. *Biotechnology*. Kolkatta: Books and Allied(P) Ltd.15th edition 2020
5. Harisha S. *Biotechnology Procedures and Experiments Hand Book*. New Delhi, India: Infinity Science Press, LIC, Hinghum, Massachusett. 2007.
6. Asish Verma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. New Delhi: S. Chand and Company. 2008.

Web Resources

https://unacademy.com/content/wp-content/uploads/sites/2/2022/10/Biotechnology-and-Its-Applications-3.pdf

https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P001357/M021493/ET/1501755501ApplicationsofBiotechnologyE-text.pdf

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	3	2	3	3	3	2	2
CO-2	2	2	3	3	2	2	3	2	2	2
CO-3	2	3	2	3	3	2	3	2	2	3
CO-4	3	2	2	3	3	3	3	2	3	2
CO-5	2	3	2	3	2	2	3	3	3	2
Ave.	2.4	2.6	2.2	3	2.4	2.4	3	2.4	2.4	2.2

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER IV			
Skill Enhancement Course V Medical Laboratory Techniques			
Course Code: 23UZOSE5	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credits: 2**

Objectives

- To learn the utility and the applications of the instruments become skilled persons for employment.
- To study the etiology of various diseases affecting human beings.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	recall the knowledge of laboratory safety protocols and develop proficiency in various laboratory techniques	**K1**
CO-2	discuss accurate and precise analyses of samples using appropriate laboratory equipment and methods	**K2**
CO-3	interpret laboratory results, including recognizing normal and abnormal findings, understanding their significance in the diagnosis and treatment of diseases	**K3**
CO-4	analyze proper techniques for collection, labelling, transporting medical specimens, maintaining sample integrity and avoiding contamination with a sense of environmental consciousness	**K4**
CO-5	evaluate the principles and techniques of clinical chemistry to the welfare of society	**K5**

Unit I **Best Laboratory Practices and Instrumentation** **(6 Hrs)**

Best laboratory practices - norms to be followed in a clinical lab, X- Ray - CT scan and MRI scan – ECG – EEG – Stethoscope - sphygmomanometer

Unit II **Haematology** **(6 Hrs)**

Collection and storage of blood - bloodgroupings (ABO and Rh factor). Estimation of haemoglobin (Sahli's method), RBC and WBC count- Erythrocyte sedimentation rate - Westergren's Tube

Unit III **Clinical Pathology** **(6 Hrs)**

Dialysis - hepatitis test – hemolytic jaundice - analysis of sputum - AIDS (ELISA Western blot test) Diagnosis of dengue and COVID-19.

Unit IV **Clinical Biochemistry** **(6 Hrs)**

Estimation of cholesterol (enzymatic assay), urea (Benedict Gephart method), uric acid (Phosphotungstate reduction method) and creatinine of blood (Folin and Wu's Alkaline Picrate method) Glucose (Benedict's Qualitative Glucose Test) - assay of enzymealkaline phosphatase (Colorimetric method).

Unit V **Basic Urine Analyses** **(6 Hrs)**

Analysis of urine - routine physical examination, detection of sugar and albumin, pregnancy test (detection of hCG)

Text Books

1. Ramnik Sood. *Medical Laboratory Technology*, Methods and Interpretations New Delhi: JaypeeBrothers Medical Publishers (P) Ltd.2005.
2. Jyoti Saxena, Mamta Banuthiyal and Indu Ravi Laboratory. *Manual of Microbiology, Biochemistry, and Molecular Biology*. New Delhi: Scientific Publishers (India). 2015.

Books for Reference

1. Biswajit Mohanty and Sharbari Basu. *Fundamentals of Practical Clinical Biochemistry*. New Delhi: B.I Publications Pvt. Ltd. 2006.
2. Estridge, B.H., Reynolds, A.P. and N.J. Walters. *Basic Medical Laboratory Techniques*. Banglore:Thomson Delmar Learing Fastern Press (Bangalore) Pvt. Ltd. 4th edition 2000.
3. Kannai, L. Mukherjee. *Medical Laboratory Technology*. Chennai: Tata Mc Graw Hill Publishing Company Limited, Vol-I, Vol-II and Vol-III. 1997.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	2	2	3	3	2	2	2
CO-2	3	2	2	2	1	3	3	3	2	2
CO-3	3	2	2	2	2	3	3	2	2	2
CO-4	2	2	1	3	2	3	3	3	3	3
CO-5	3	2	2	2	2	3	3	2	3	3
Ave.	2.8	2.2	1.8	2.2	1.8	3	3	2.6	2.6	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER IV			
Ability Enhancement Course II Value Added Fishery Products			
Course Code:23UAZO41	**Hrs/Week: 1**	**Hrs/Sem: 15**	**Credits: 1**

Objectives:

- To obtain knowledge on the safety and quality requirements of fishery products
- To develop entrepreneurial skills in the preparation of sea-food based convenience products in ready-to-eat or ready-to-cook forms

Course Outcome:

CO.NO	Upon completion of this course, students will able to	CL
CO -1	discuss various processing and preservation methods of fishery products for industrial and domestic purpose	K1
CO - 2	describe the efficient preparation, preservation, and storing of fish minced products,battered and surumi products	K2
CO – 3	implement the accurate usage of seaweeds as food and medicine for human consumption	K3
CO – 4	analyze the advanced techniques of preparation, preservation, sanitation and quality control of fishery products for hygienic utility of society	K4
CO – 5	evaluate the level of expertise in processing and preservation methods and suggest becoming an independent, powerful entrepreneur.	K5

Unit I **Techniques of Preservation and Processing** **(3Hrs)**

Curing, Drying, salting, pickling, icing and freezing

Unit II **High Value Fishery Goods** **(3Hrs)**

Fish pickles, fish cutlets, fish balls, fish finger and dry prawn sambal

Unit III **Fishery by Products** **(3Hrs)**

Fishery by products - fish oil, shark fins and ornamental sea shells

Unit IV **Sea Weed Products** **(3Hrs)**

Use of sea weeds as food for human consumption- agar agar milk pudding. use of sea weed for medicinal value Haizo (Sargassum) sea weed soup, sea weed powder

Unit V Quality Control and Sanitation (3Hrs)

Sanitation in processing – environmental hygiene and personal hygiene in processing. visit to fish processing unit

Text Book

1. Surekha Gupta. *Textbook of Fishery*. Ane Books Pvt. Ltd. New Delhi. 2010

Books for Reference

1. Gopakumar, K. *A Textbook of Fish Processing Technology*. New Delhi. ICAR. 2002.
2. Gupta, S.K. and P.C Gupta. *General and Applied Ichthyology* [*Fish and fisheries*].Chand and Company Ltd Ramnagar, New Delhi. 2006
3. K.R. Ravindranathan. *A Text book of Economic Zoology*. WisdomPress, New Delhi. 2013.
4. Ayyapar, S. *Handbook of Fisheries and Aquaculture*. New Delhi. 2010
5. Srivastava, C.B.L. *A Text book of Fishery Science – Indian Fisheries.* Kitab Mahal. New Delhi. 2006.
6. Santhosh Kumar and Manju Tembhre. *Fish and Fisheries.* New Central Book Agency (P) Ltd, Kolkata. 2010

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	**3**	**1**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**
CO-2	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
CO-3	**1**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**3**
CO-4	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO-5	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**
Ave.	**3.0**	**2.5**	**2.6**	**2.8**	**2.8**	**2.6**	**2.0**	**2.4**	**3**	**3**

Mapping	**< 40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	Low level	Medium level	High level
Scale	1	2	3

SEMESTER - V			
Core V	**Cell Biology**		
Course Code: 23UZOC51	**Hrs/week : 4**	**Hrs/sem: 60**	**Credits: 4**

Objectives

- To elucidate the structure, function of cell organelles and the harmony of the cell
- To understand the cellular and molecular basis of life processes.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO - 1	recall the basic components of a cell, including its organelles, membranes, and cytoplasmic structures	**K1**
CO - 2	discuss the cellular processes such as cell division, DNA replication, transcription, translation and their significance in growth, development, and reproduction	**K2**
CO - 3	apply their knowledge of cell biology to real-world scenarios, such as environmental issues related to cellular processes	**K3**
CO - 4	analyze the factors controlling cell proliferation with a sense of environmental consciousness	**K4**
CO - 5	estimate the knowledge from cell biology with other areas of biology, such as genetics, biochemistry and physiology to the human welfare	**K5**

Unit I **Cell and Plasma Membrane** **(12Hrs)**

History of Cell Biology- protoplasm theory- cell theory- prokaryotic and eukaryotic cells. Ultra structure of Plant cell and Animal cell, Plasma membrane- structure, chemical composition, specialized structures, functions.

Unit II **Cell Organelles** **(12Hrs)**

Cytoplasm- cytoskeleton- microtubules, microfilaments. Ultrastructure and functions of mitochondria, Golgi apparatus, endoplasmic reticulum, lysosome, ribosome.

Unit III **Nucleus** **(12Hrs)**

Ultrastructure, composition and functions - nucleus, nuclear membrane, nucleolus, chromosome – types- giant chromosomes- polytene chromosome, lampbrush chromosome.

Unit IV **Nucleic acids and Protein Synthesis** **(12Hrs)**

Nucleic acids and DNA- chemistry - structure – Watson and Crick double strand - replication. RNA - types - tRNA, rRNA, mRNA, Components of protein synthetic machinery, mechanism – initiation, elongation and termination.

Unit V **Cell Cycle and Cell Division** **(12Hrs)**

Cell cycle - Amitosis – mitosis - meiosis – significance – factors controlling cell proliferation.Cancer - types - characteristics of cancer cells - causes of cancer – diagnosis – treatment – role of oncogenes.

Text Book

1. Arumugam, N. 2003. *Cell Biology*. Saras Publications, Nagercoil.

Books for Reference

1. Power, C.B. *Cell Biology*. Himalaya Publishing House, Mumbai. 2004
2. Verma, P.S. and V.K Agarwal. *Cytology* (8^{th} edition). S.Chand and Co Ltd, New Delhi. 2008.
3. De Robertis, E.D.P. and Robertis, E.M.F. *Cell and Molecular Biology* 9^{th} International Edition, K.M. Varghese Company, Mumbai. 1988.
4. Agarwal, V.K. *Molecular Biology*. S. Chand & Co Ltd New Delhi. 2008.
5. Gupta and Jangir. *Cell Biology, Fundamentals and Applications*. Student Edition. 2012.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	3	2	3	3	2	3	3
CO-2	3	2	2	2	1	3	2	2	1	1
CO-3	2	2	2	1	1	3	2	2	3	3
CO-4	3	2	2	3	2	3	2	2	3	3
CO-5	2	2	1	1	2	3	3	2	2	3
Ave.	2.6	2.2	1.8	2	1.6	3	2.4	2	2.4	2.6

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Practical

Course Code: 23UZOCR5

Hrs / Week : 2 **Credit: 1**

1. Microscopy- Light microscope
2. Preparation of squamous epithelium.
3. Onion root tip squash: Observation of different stages of mitosis.
4. Observation of various stages of meiosis in grasshopper testis (demo)
5. Chironomous larva: Mounting of polytene chromosomes.
6. Measurement of cell size by micrometry
7. Study of prepared slides of histology
   Columnar epithelium, ciliated epithelium, glandular epithelium, muscle tissue, nervous tissue, cartilage- T.S, bone- T.S.
8. Models /charts - Golgi complex, endoplasmic reticulum, lysosomes - polymorphism, mitochondria, ribosome.
   DNA – (Watson & Crick model), tRNA.

Books for Reference

1. Jayasurya, Dulsy Fatima, Meyyan, R.P., Arumugam, N. and V. Kumaresan Practical Zoology. (Cell Biology-Embryolgy- Animal Physiology- Immunology Ecology Genetics- Evolution - Microbiology - Biochemistry - Biophysics) Saras Publication, Kottar P.O., Nagercoil. 2013.
2. Powar, C.B. *Cell Biology.* Mumbai: Himalaya Publishing House. 8th Edition. 2015.

SEMESTER – V			
Core VI	**Genetics**		
Course Code: 23UZOC52	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives

- To enhance the knowledge of genetic basis of inheritance and welfare of human society.
- To create awareness about the hazards of radiation

Course Outcome:

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CO. No	Upon completion of this course, students will be able to	C L
CO-1	recall the fundamental genetic principles, including Mendelian inheritance, genetic variation, and gene expression regulation.	**K1**
CO-2	discuss about the genetic basis of human diseases and disorders and the role of genetic counseling in clinical practice.	**K2**
CO-3	apply genetic data obtained from experiments, pedigrees about inheritance patterns, genetic disorders	**K3**
CO-4	analyze and interpret genetic data using appropriate tools and techniques	**K4**
CO- 5	evaluate genetic principles to solve problems in various fields, such as medicine, agriculture, and conservation biology	**K5**

Unit I **Mendelian Genetics** **(12 Hrs)**

Introduction - Mendelian laws – monohybrid and dihybrid cross – back cross – test cross – incomplete dominance – Supplementary genes - inheritance of combs in fowls – multiple alleles – ABO blood group – Rh factor in man – Erythroblastosis foetalis – multiple genes – skin colour in man – simple Mendelian traits in man.

Unit-II **Sex Determination and Sexlinked Inheritance** **(12 Hrs)**

Sex determination in Drosophila – genic balance theory – sex determination in man - Barr bodies and dosage compensation – sex linked inheritance in man – haemophilia – colour blindness- hypertrichosis – sex limited traits – sex influenced traits.

Unit-III **Operon Model and Maternal Inheritance** **(12 Hrs)**

Regulation of gene expression in prokaryotes - inducible and repressible systems – operon concept of Jacob and Monad – components and control mechanisms of lactose and tryptophan operon – extrachromosomal inheritance – kappa particles in Paramecium – shell coiling pattern in snail Limnaea.

Unit IV **Genetic Disorders and Radiation Genetics** **(12 Hrs)**

Inborn errors in phenylalanine metabolism – phenylketonuria, alkaptonuria-albinism - mutant haemoglobins- sickle cell anaemia – thalassemia – syndromes – autosomal – Down's and Edward's syndrome – sex chromosomal – Turner's and Klinefelter's syndrome.

Unit-V **Genetics and Human Society** **(12 Hrs)**

Twins – types – importance in nature and nurture studies – pedigree analysis – symbols – construction – genetic counselling – prenatal diagnosis of genetic disorders by amniocentesis- betterment of human society –eugenics – euthenics – euphenics.

Text Book

1. Meyyan .R.P. 2007. *Genetics*. Saras Publication, Nagercoil.

Books for Reference

1. Winchester, A.M. *Genetics*. 3rd edition, Oxford and IBH Publishing Co, New Delhi. 1969
2. Gardner, Simmons and Snustad. *Principles of Genetics*, 8th edition. John Wiley and Sons. Inc. New York. 1991

3. Verma, P.S.and V.K. Agarwal. *Genetics*, 9th edition, S.Chand and Co Ltd., New Delhi. 2008.
4. Alice Marcus. *Genetics*, MJP Publishers New Delhi. 2011
5. Klug, W.S.and M.R.Cummings. *Concepts of Genetics*, 6th edition. Prentice Hall,Inc. New York. 2000.
6. Russel, Peter J. *Genetics: A Molecular Approach*, Pearson. 2013.
7. Strickberger M. W., *Genetics*, Prentice Hall India Learning Private Limited. 1995.
8. Cooper, Geoffrey M., *The cell: A Molecular Approach*, Eighth Edition, Oxford University Press. 2018.
9. Dobzhansky T., *Genetics and The Origin of Species*, Columbia University. 1982.
10. Fletcher H and Hickey I., *Genetics*, IV Edition. GS, Taylor and Francis Group, New York and London. 2015.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	2	1	3	2	3	2	2
CO-2	3	2	2	3	2	3	3	3	2	3
CO-3	3	3	2	2	1	3	3	3	2	2
CO-4	3	2	1	2	1	3	3	3	2	2
CO-5	3	3	2	3	3	3	3	3	3	3
Ave.	3	2.6	1.8	2.4	1.6	3	3	3	2.2	2.4

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

PRACTICALS

Course Code: 23UZOCR5 **Credits: 1** **Hrs/Week: 2**

1. Verification of Mendel's monohybrid cross using beads
2. Verification of Mendel's dihybrid cross using beads.
3. Observation of simple Mendelian traits in the class population.
4. Analysis of ABO blood group and Rh factor.
5. Demonstration of Barr bodies and Lyon's hypothesis
6. Sex linked inheritance of colour blindness and haemophilia (chart)
7. Genetic basis and clinical manifestations of Down's, Klinefelter's and Turner's syndrome (chart).
8. Organization of lac operon (chart)
9. Types of twins (photo).
10. Genetic significance of Drosophila and distinguishing features of males and females (slides).

SEMESTER V			
Core VII	**Animal Physiology**		
Course Code: 23UZOC53	**Hrs/ Week: 4**	**Hrs /Sem: 60**	**Credits: 4**

Objectives

- To gain deep understanding of structure and functions of organs and organ systems of living organisms.
- To provide an insight into the coordination of physiological systems and processes to maintain homeostasis.

Course Outcome

CO. No	**Upon completion of this course, students will be able to**	**CL**
CO–1	recall the structure and functions of organs and organ systems of living organisms	**K1**
CO-2	interpret the complexities of life processes and behaviour	**K2**
CO–3	predict the causes, prevention and treatment of illnesses to develop healthy personal lifestyle	**K3**
CO–4	examine and solve the physiological issues to promote the welfare of society	**K4**
CO–5	evaluate physiological challenges and processes under fluctuating environmental conditions	**K5**

Unit I Digestion and Nutrition (12 Hours)

Digestive system of man - role of enzymes in digestion of carbohydrates, proteins and lipids – absorption of digested food materials –malnutrition – Marasmus and Kwashiorkor.

Unit II Respiration and Circulation (12 Hours)

Types of respiratory pigments – transport of respiratory gases – oxygen and carbon dioxide - Respiratory quotient. Composition of blood – blood coagulation – structure of human heart– origin and conduction of heart beat – cardiac cycle.

Unit III Excretion and Homeostasis (12 Hours)

Nitrogenous waste products – ammonotelism, ureotelism, uricotelism. Structure and function of nephron – mechanism of urine formation in man — homeostasis: osmoregulation in crustaceans and fishes – thermoregulation – mechanisms – ectotherms – endotherms – heterotherms.

Unit IV Muscular, Nervous and Sensory System (12 Hours)

Structure of skeletal muscle – mechanism and chemistry of muscle contraction. Structure of neuron – generation and conduction of nerve impulse - synaptic transmission – neuromuscular junction. Receptors – structure of eye and photochemistry of vision.

Unit V Reproduction and Endocrinology (12 Hours)

Anatomy of reproductive organs in human – ovary – testis – hormonal control of menstrual cycle, pregnancy, parturition and lactation. Endocrine glands: structure and functions of pituitary, thyroid, adrenal and pancreas.

Text Book

1. Verma P, Tyagi S. and Agarwal V.K. *Animal Physiology*. New Delhi: S. Chand & Company Ltd, 2002.

Books for Reference

1. Goyal and Sastry, *Animal Physiology*, Meerut: Rastogi Publications, 7th Edition, 2017.
2. Rastogi S.C., *Essentials of Animal Physiology*, Chennai: New Age International Private Limited 4th Edition, 2019.

3. Sembulingam K., and Prema Sembulingam, *Essentials of Medical Physiology*, NewDelhi:8th Edition, Jaypee Brothers Medical Publishers, 2019.
4. Maria Kuttikan,A, and Arumugam , *Animal Physiology*, Nagercoil Kottar: Saras Publication 2014.
5. Nagabhushanam R, Kodarka,, M.S. and Sarojini R, *Text Book of Animal Physiology*. New Delhi: Second Edition, Oxford and IBH Publishing Co, Pvt. Ltd, 2002.

Web Resources:

1. https://www.stem.org.uk/resources/collection/3931/animal-physiology
2. https://animalphys4e.sinauer.com
3. https://nptel.ac.in/courses/102/104/102104042/
4. https://biochem.oregonstate.edu

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO1	3	1	2	3	2	2	3	2	2	2
CO-2	3	1	2	3	2	3	3	2	1	2
CO-3	3	1	3	3	2	3	2	3	2	3
CO-4	3	3	2	3	2	3	3	3	1	3
CO-5	3	3	2	3	3	3	3	3	1	3
Ave.	3	1.8	2.2	3	2.2	2.8	2.8	2.6	1.4	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

PRACTICALS

Course Code: 23UZOCR6

Hrs/Week: 2 **Credit-1**

1. Human salivary amylase activity in relation to temperature.
2. Effect of temperature on the opercular movement in fish and calculation of Q10.
3. Examination of excretory products (ammonia, urea and uric acid crystals)
4. Rate of oxygen consumption in fish
5. Study of osmosis in red blood cells
6. Haemocytometer –Demonstration of RBC and WBC counting
7. Human blood smear (Preparation and observation of different blood cells)
8. Kymograph/simple muscle twitch – model
9. Hormonal control of menstrual cycle (chart)
10. Slides – sections of skeletal, cardiac, smooth muscle and endocrine glands (pituitary, thyroid, adrenal and pancreas).

Books for Reference

1. Nigam S.C., and Omkar, *Experimental Animal Physiology and Biochemistry,* New Age International (P)Limited New Delhi, 2006.

SEMESTER V			
Core VIII	**Animal Biotechnology**		
Course Code: 23UZOC54	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credit: 4**

Objectives:

- To introduce students to cutting-edge methods in biotechnology and its application in a real world setting to improve human and animal health, research, and production
- To expose students to updated curricula in biotechnology and to recent advances in the subject and enable the students to take up successful career in the field of biotechnology

CO. No	Upon completion of this course, students will be able to	CL
CO-1	recall the basic principles of gene cloning and integrate the knowledge to develop recombinant organisms	K1
CO-2	associate the knowledge gained to solve problems effectively in emerging fields of biotechnology	K2
CO-3	implement the skills to improve their proficiency in biotechnology and to acquire scientific attitude	K3
CO-4	analyze and address the ethical issues of genetically modified organisms	K4
CO-5	Evaluate the applications of biotechnology and to choose the appropriate field for and entrepreneurial venture	K5

Unit I Introduction to Biotechnology **12 hrs**

History and Scope biotechnology – Gene cloning -Steps in gene cloning- Restriction endonucleases-Ligase-Gene cloning vectors-Plasmid vector (pBR322) - Bacteriophage vectors (Lambda vector)-Animal viral vector (SV-40)-Methods of introduction of cloned genes into host cells-Transformation, Electroporation, Transfection, Transduction, Liposome mediated method, Microinjection.

Unit II Basic Techniques in Biotechnology **12 hrs**

Agarose gel electrophoresis-SDS PAGE-Polymerase Chain Reaction-Gene cloning – methods of introduction of cloned genes into host cells – transformation –liposome mediated transfer – electroporation – particle bombardment gun – viral vector method PCR -Types of PCR -RT PCR, Inverse PCR, Nested PCR –Southern, Northern and Western blotting techniques-DNA sequencing (Maxam and Gilbert method and Sanger's method)

Unit III Animal Cell Culture **12 hrs**

Introduction and history-Basic requirements of animal cell culture-Culture media – Natural and Synthetic Medium- Primary cultures- Secondary culture-Cell culture types – Cell lines-Maintenance and storage of cell lines-Stem cell cultures-Organ culture-Methods of organ culture-Advantages and applications of Animal cell culture

Unit IV Genetic Engineering **12 hrs**

Transgenesis-Definition-Methods of generating transgenic animals-Retroviral method, microinjection, gene transfer to embryo/stem cells-Genetically modified/transgenic animals and their applications (Cattle, Fish, Poultry, Mice)-Biosafety of transgenic animals-Patent

Unit V Medical Biotechnology **12 hrs**

Hybridoma technology-Monoclonal antibody production-DNA probes and diagnosis of genetic disorders – DNA fingerprinting technique – gene therapy and treatment of genetic diseases.

Text Books

1. Dubey R.C. S. *A Text Book of Biotechnology*. New Delhi, Chand and Comp. Ltd, 2004.

2. Kumaresan, V. *Biotechnology* Nagercoil, Saras Publication, 2010.

Books for Reference

1. Clark and J. Pazdernik. *Biotechnology*, Elsevier Academic Press, California, USA. 2009.

2. Dubey, R.C. *Text Book of Biotechnology*, New Delhi. 4th edition, S. Chand and Co Ltd, 2006.

3. Ramadass, P. *Animal Biotechnology – Recent Concepts and Development*. Chennai. MJP Publishers. 2009.

4. Rema, L.P. *Applied Biotechnology*, MJP Publishers, Chennai. 2009.

5. Singh S, *Applied Biotechnology*, 1st edition, New Delhi. Campus Books International, 2007.

6. Singh, B.D. *Biotechnology*, Chennai. *Revised edition*, Kalyani Publishers. 2005.

Web Resources

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=t5vt4STquHRj94mcOBMr5g==

https://www.khanacademy.org/science/biology/biotech-dna-technology

Core Practical VI

Course Code: 23UZOCR6 **Hrs/ Week: 2** **Credit: 1**

1. Plasmid DNA isolation-(Plasmid isolation kit)
2. Genomic DNA isolation
3. DNA estimation by UV-Spectrophotometric method
4. Restriction digestion
5. Agarose gel electrophoresis
6. SDS-PAGE
7. Bacterial transformation (Calcium chloride mediated transformation)
8. Polymerase chain reaction
9. Preparation of animal cell culture medium
10. Charts and models:

pBR322, SV-40, Blotting techniques (Southern, Northern, Western), Gene delivery methods (Lipsome mediated method, Microinjection), Monocolonal antibody

Books for Reference:

Swagat Kumar Das Hrudayanath Thatoi, Supriya Dash. *Practical Biotechnology: Principles and Protocols*. Dreamtech Press . New Delhi. 2020

Michael R. Green, Joseph Sambrook. *Molecular Cloning: A Laboratory Manual*. 4th Edition. Cold Spring Harbor Laboratory Press. 2012

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	2	3	3	3	2	2	3	3
CO-2	2	3	2	2	3	2	2	2	3	3
CO-3	2	2	2	2	2	2	2	2	2	2
CO-4	2	3	3	3	2	2	3	2	3	2
CO-5	3	3	3	2	3	3	3	3	3	3
Ave.	2.4	2.6	2.4	2.4	2.6	2.4	2.4	2.2	2.8	2.6

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – V			
Discipline Specific Elective I	**Commercial Aquaculture**		
Course Code:23UZOE51	**Hrs/ Week: 4**	**Hrs/ Sem:60**	**Credits: 4**

Objectives

- To develop proficiency in various culture methods and farm management techniques
- To acquire expertise in preservative methods and export techniques, while understanding the employment implications within the aquaculture sector.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	CL
CO-1	recall the culture methods, disease management strategies, and economic variables pertinent to cultivable aquatic species, while integrating insights from various disciplines to assess their contributions to aquaculture.	K1
CO-2	explain farm management techniques, disease management strategies, and economic considerations within aquaculture to enhance production efficiency and foster sustainability	K2
CO-3	demonstrate culture techniques and feed preparations, leveraging digital tools for data analysis, and employing entrepreneurial skills to propel innovation in aquaculture research.	K3
CO-4	analyze the health status of cultivable species by applying expertise in feed composition, with a focus on mitigating diseases, while adhering to ethical standards in conservation efforts.	K4
CO-5	assess the quality of cultivable organisms, preservation techniques and export potential towards sustainable fishery practices, aiming for the holistic welfare of society.	K5

Unit I **Cultivable Species** **(12 Hours)**

Importance of aquaculture – Current status of aquaculture in India – Cultivable organisms and their qualities. Fin fishes – carps and live fishes. Shell fishes- shrimp, lobster, edible oyster and pearl oyster. sea weeds- Sargassum and Caulerpa

Unit II **Culture Methods and Farm Management** **(12 Hours)**

Polyculture, integrated fish farming – paddy - cum fish culture, animal husbandry-cum fish culture, Management of culture ponds - control of water quality parameters - fertilization - control of predators and weeds.

Unit III **Culture Techniques** **(12 Hours)**

Fin Fish culture – Culture of Indian Major Carp (Catla) _ Carp seed production- Bundh breeding, Induced breeding. Culture of marine prawn: Seed collection – Stocking ponds – Traditional culture, paddy field culture, pen culture, cage culture – Harvesting

Unit IV **Fish feed and Disease management** **(12 Hours)**

Fish feed – artificial feed - feed formulation and composition of formulated feed, live feed - Spirulina Bacterial Diseases - Fish tuberculosis and Dropsy. Fungal diseases - Dermatomycosis and Saprolegniasis Protozoan diseases - Costiasis and Whirling Disease Parasites - Argulus and Lernea- prevention and management.

Unit V **Fishery Economics** **(12 Hours)**

Preservative methods - Drying, freezing, freeze drying , smoke curing and canning, irradiation, Role of MPEDA in exports of fish and fishery products. Employment potential of fishery and aquaculture.

Text Book

1. Santhana Kumar and A.M. Selvaraj, *Concepts of Aquaculture*. Mac ram Publications, Nagercoil. 2006.

Books for Reference

1. Santhanam, R., Sukumaran, M. and P. Natarajan, *A Manual of Freshwater Aquaculture*. Oxford & IBH publishing Co Pvt. Ltd, Janpath, New Delhi, 1990.
2. Dinabandhu Sahoo, S.Z. Qasim, *Sustainable Aquaculture*. A.P.H Publishing Co, NewDelhi, 2009.
3. Agarwal, S.C. *A Hand book of Fish Farming*. Naranda Publishing House, Delhi 1994.
4. Chaudhuri, A.B. *Aquaculture Resurgence Birth of Blue Revolution*. Daya Publishing House, Delhi, 2009.
5. Sailendra Ghosh, *Fisheries and Aquaculture Management*. Adhyayan Publisher & Distributors, New Delhi, 2009.
6. Santhanam,R., N. Ramanathan and G. Jegathesan, *Coastal Aquaculture in India.* First Edition, CBS Publishers, New Delhi, 1990.
7. Agnihotri, S.B. *Aquaculture Management and Technology*, Swastik Publications, New Delhi, 2013.
8. Chandral, S., Lily Premila, C. and R.L.Sinazer, *Aquaculture*, Diocesan Press, Nagercoil, 2009.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	1	1	2	3	2	2	2
CO-2	2	2	3	2	2	3	3	2	2	3
CO-3	2	3	3	3	3	3	3	3	3	3
CO-4	2	2	2	2	3	2	2	2	3	2
CO-5	2	2	3	2	3	2	2	2	2	3
Ave.	2.2	2.2	2.6	2.0	2.4	2.4	2.6	2.2	2.4	2.6

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Discipline Specific Elective I	**Animal Behaviour**		
Course Code: 23UZOE52	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credit: 4**

Objectives

- To acquire comprehensive knowledge on the fundamental concepts of animal behaviour.
- To understand the biological rhythms that control animal behaviour.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**CL**
CO-1	describe the the behaviour, ecological patterns, evolutionary processes and conservation strategies of animals.	K1
CO-2	to discuss animal intelligence, problem-solving abilities and the learning processes that contribute to behavioral flexibility.	K2
CO-3	applying insights to improve animal training, captive care, and addressing behavioral issues of animals	K3
CO-4	analyze communication, mating, and social structures, contributing to wildlife management and animal welfare	K4
CO-5	recommend an appropriate entrepreneurial venture in animal husbandry, pet care, poultry, dairy, apiculture, sericulture and allied fields	K5

Unit I Introduction to Animal Behaviour (12 Hours)

Behaviour: Introduction - origin and history of ethology - mechanism of behaviour - motivation – fixed action pattern - innate behaviour, learning, reasoning, - migration and homing with special reference to birds.

Unit II Ecological Aspects of Behaviour (12 Hours)

Habitat selection- food selection and optimal foraging theory anti - predator defense mechanism - aggression, territoriality and dispersal.

Unit III Social Behaviour (12 Hours)

Schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, inclusive fitness, and social organization in insects and primates.

Unit IV Reproductive Behaviour (12 Hours)

Evolution of sex, reproductive strategies, mating systems, courtship, sperm competition, sexual selection and parental care, Hormones and behaviour, pheromones and behaviour.

Unit V Biological Rhythms (12 Hours)

Circadian, circannual, tidal/ lunar, ultradian, infradian rhythms - synchronization of biological rhythms, phase shift - photoperiodism with reference to birds and mammals.

Text book

1. Reena Mathur. *Concepts of Animal Behaviour* (*Z-80*). India: Rastogi Publications; 1st Edition. 2018.

Books for Reference

2. Dustin R. Rubenstein, Johb Alcock. *Animal Behaviour*. New York: Oxford University Press. 2019.
3. Mandal Fatik Barar. *Textbook of Animal Behaviour*. India: PHI Learning Pvt Ltd; 3rd Edition. 2015.
4. Agarwal V.K. *Animal Behaviour* (*Ethology*). New Delhi: S Chand & Company, First Edition. 2010.
5. Shukla J.P. *Fundamentals of Animal Behaviour*. India: Atlantic, First Edition. 2021.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	2	2	2	3	2	2	2	2
CO-2	3	2	2	2	2	3	2	2	2	2
CO-3	2	2	2	2	2	2	2	2	2	2
CO-4	2	2	2	3	3	2	2	2	3	3
CO-5	2	2	3	3	3	2	2	3	3	3
Ave.	2.4	2.0	2.2	2.0	2.4	2.4	2.0	2.2	2.0	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER V			
Ability Enhancement Course III Environmental Studies			
Course Code: 23UAEV51	**Hrs/ week: 2**	**Hrs/Sem:30**	**Credits: 1**

Course Outcomes:

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

1 Recognize the biotic and abiotic components of ecosystem and how they function.

2 Use natural resources more efficiently and know more sustainable ways of living.

3. Acquire an attitude of concern for the environment.

4. Participate in improvement and protection of environment.

5. Manage unpredictable disasters.

6. Create awareness about environmental issues to the public.

Unit I :

Environment and Ecosystem: Aim and need for Environmental Awareness - Components of Environment Ecosystem - Components of Ecosystem: Abiotic and biotic factors (Producer, Consumer and Decomposer) – Food Chain, Tropic Levels - Food Web, Energy flow and Ecological pyramids

Unit II :

Natural Resources: Renewable and non-renewable resources – Water Resources: Uses and Conservation of Water – Rain Water Harvesting – Forest Resources: Importance of Forests - Major and Minor forest produces - Conservation of Forest Energy Resources: Solar Fossil Fuel – Wind – Role of individuals in the conservation of natural resources

Unit III :

Environmental Pollution: Pollutants – Types of pollution: Air, Water, Noise and Plastic Pollution – Causes, effects and Control measures – Global warming and Climate Change

Unit IV:

Human Population and Environment: Effect of human population on environment – Population Explosion problems related to population explosion – Involvement of population in conservation of environment – Measures adopted by the Government to control population growth – Environment and human health

Unit V:

Disaster Management: Floods–Drought–Earthquakes– Cyclones – Landslide–Tsunami–Control measures

SEMESTER V	
Self-Study	**Dairy Farming**
Course Code: 23UZOSS2	**Credits: +2**

Objectives

- To understand the selection of dairy breeds and efficient management of dairy farming.
- To gain deep insight into various techniques and biotechnological aspects related to dairy management.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	identify the various breeds and techniques involved in dairy farming and enhance the skills to solve complex biological problems	K1
CO-2	discuss the construction of dairy house, feeding management and needs for dairy farming to employ the creative skills	K2
CO-3	compute the basic concepts, biotechnological practices and management approaches of dairy farming and inculcate the skills for entrepreneurship	K3
CO-4	appraise the skill and knowledge obtained from dairy farming for environmental and research ethics	K4
CO-5	evaluate the difficulties and various perspectives in dairy farming towards the development of human welfare and society	K5

Unit I Introduction to Dairy Farming

Introduction to dairy farming - advantages of dairying - classification of breeds of cattle - indigenous and exotic breeds - selection of dairy cattle. Breeding - artificial insemination - dairy cattle management.

Unit II **Dairy House and Management**

Study of general management practices of dairy animals – grooming, drying off, castration, dehorning, identification marks - construction of model dairy house – major components of a housing system.

Unit III **Feeding and Health Care**

Feed stuffs – hay – silage - mineral Supplements - vitamin Supplements - feed additives - feeding management - calves Feeding - feeding of adults.

Unit IV **Diseases in Dairy Animals**

Common bacterial diseases – anthrax - helminth – worm infestation and Viral diseases – blue tongue - Parasitic and Protozoan diseases – Theilariasis, Trypanosomiasis.

Unit V **Economics of Dairy Farming**

Artificial insemination – oestrous cycle – pregnancy diagnosis in cattle – multiovulation and embryo transfer technique – cloning. Dairy products – Paneer, Ghee, Cheese and Kesin.

Books for Reference

1. Roger W. Blowey. *The Veterinary Books for Dairy Farmers*. Old Pond Publishing Ltd., 2016.
2. Board Eiri. *Hand Book of Dairy Farming*. Engineers India Research Institute, 2008.
3. Aruna T. Kumar. *Handbook of Animal Husbandry*. TATA, S.N ed., ICAR, 1990.
4. Hafez E. S. E. and B. Hafez. *Reproduction in Farm Animals*. Wiley-Blackwell, 2000.
5. Shyam Kishore Singh. *Dairy Farming*. Alfa Publications, New Delhi, 2012.
6. Schmidt G.H. and L. D. Van Vleck. *Principles of Dairy Science*. Surjeet Publications, Delhi. 1982.
7. Banerjee G.C. *Textbook of Animal Husbandry.* 8th Edition. Oxford Publishers. 2019.

Web Resources:

1. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20Dairy%20unit.html
2. https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Tata,+S.N.,+ed%22

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	3	3	2	1	3	2	2	2	1
CO-2	2	3	3	1	2	2	3	2	1	2
CO-3	1	2	3	2	3	2	2	3	3	2
CO-4	2	2	1	3	3	1	2	2	3	3
CO-5	3	2	3	1	3	2	1	3	2	3
Ave.	2.2	2.4	2.6	1.8	2.4	2	2	2.4	2.2	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER VI			
Core IX	**Marine Biology**		
Course Code: 23UZOC61	**Hrs/Week : 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives

- To provide quality education and training in the field of marine biology and raise awareness about marine environment for the welfare of the community.
- To develop necessary skills to manage and preserve the resources of sea.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	identify the different ecological zones of marine environment and gain in-depth knowledge in diversity of marine organisms to specialize in various fields	K1
CO-2	explain the different characteristics, adaptations and resources of the ocean and employ skills to resolve the complex environmental issues	K2
CO-3	present the formation, properties and types of dynamics of ocean to find novel solutions in research and scientific problems	K3
CO-4	appraise the resources of marine habitat and develop skills to conserve the environment for the wellbeing of the society	K4
CO-5	evaluate the scientific issues in marine biology within the larger social context and develop fishery products to become an empowered women	K5

Unit I **Marine Habitat** **(12 hrs)**

Classification of marine habitat. Characteristics of pelagic and benthic divisions – Intertidal rocky, sandy and muddy shores – the features of flora and fauna and their adaptations.

Unit II **Physical and Chemical Characteristics of Sea Water** **(12 hrs)**

Physical parameters – light, temperature, density. Chemical parameters – Nutrients - major, minor and trace elements, dissolved gases and salinity.

Unit III **Biological Characteristics of the Sea** **(12 hrs)**

Plankton – classification, adaptations and methods of collection. Primary and secondary production. Coral reef, mangroves, estuaries – characteristics, types and their adaptations.

Unit IV **Dynamics of Ocean** **(12 hrs)**

Tides - generating forces, types, effects of tides in coastal areas; Waves - formation, properties, types – tsunami, currents – equatorial and western boundary currents.

Unit V **Resources of the Sea** **(12 hrs)**

Chemical resources - manganese nodules, phosphorite, petroleum. Energy resources – tidal energy. Biotic resources – seaweeds – Sargassum and calurpa.

Text Book

1. Nybakken J.W. *Marine Biology – An Ecological Approach*. California: Addison Weslay Longman, Inc. 1997.

Books for Reference

1. Gross G. *Oceanography: A view of the Earth.* New Jersey: Sixth edition. Prentice Hall Inc 2008.
2. Mc Cormick J.M. and Thiruvathaakal J.V. *Elements of Oceanography*. Philadelphia: W.B. Saunders Company1981.
3. Olivia J. Fernando. *Sea water - Properties and dynamics*. Ponnagam, Thanjavur: Dhanesh Publications 1999.
4. Girish Chopra. *Coastal and Marine Geography*. Delhi: Common Wealth Publisher 2012.
5. Veena. *Understanding Marine Biology - Discovery.* New Delhi: Publishing House PVT. LTD 2012.
6. Russel. *Marine Ecology*. London: Academic Press.1970.
7. Frances Dipper. *Elements of Marine Ecology 5th Edition*. Elsevier. 2022.
8. Seshappa G. *Indian Marine Biology*. Thaya Publishing House, New Delhi. 2018.

9. John F.Morrissey and James L.Sumich. *Introduction to the Biology of Marine Life 10th Edition*. Jones and Bartlett Learning. 2012.

Web Resources:

1. https://www.livescience.com
2. https://www.icriforum.org
3. https://www.cbd.int

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	1	2	1	3	2	2	2	1
CO-2	3	3	3	2	2	3	3	2	1	2
CO-3	1	3	3	2	2	3	3	3	2	1
CO-4	2	2	2	3	3	2	2	1	3	3
CO-5	2	2	3	3	3	1	2	2	3	3
Ave.	2.2	2.4	2.4	2.4	2.2	2.4	2.4	2	2.2	2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

PRACTICALS

Hrs/Week: 2 **Course Code: 23UZOCR7** **Credit: 1**

1. Collection and identification of marine plankton (any two zooplankton)
2. Estimation of primary productivity
3. Determination of salinity in sea water
4. Estimation of total dissolved solids in sea water
5. Determination of acidity in sea water
6. Estimation of nitrite in sea water
7. Determination of phosphorus in sea water
8. Museum Specimen/ Charts

   Barnacles, Sea anemone, Uca, Cerithidea, Oyster, Ascidian, Rhizophora, Chiton, Arenicola, Nereis, Sargassum
9. Visit to Marine Environment/ Mangroves/ Estuary.

Books for Reference

1. Michael P. *Ecological methods for field and laboratory investigations.* New Delhi: Second Reprint. Tata Mc Grew - Hill Publishing Company Limited 1990.

SEMESTER VI			
Core X	**Immunology and Microbiology**		
Course Code: 23UZOC62	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To understand the protection of immune system from microbial pathogens
- To impart knowledge of microbes in agriculture, food and in medical field.

Course outcome

Co.No	Upon completion of this course, students will be able to	CL
CO-1	describe the basic mechanisms, importance of immunity and immune response to solve biological issues	K1
CO-2	explain the structure, functions of different types of lymphoid organs, lymphocytes and acquire comprehensive knowledge	K2
CO-3	compile the mechanism of innate and adaptive immune response against infection to pathogens and find innovative idea in research	K3
CO-4	analyse the fundamental concepts, techniques in microbiology and immunology to become skilled professionals	K4
CO-5	evaluate the causes, prevention of food poisoning, food spoilage and microbial disease towards the contribution of human welfare.	K5

Unit I **Immunity Types and Lymphoid Organs** **(12Hrs)**

Immunity – types – innate immunity – factors controlling innate immunity – acquired immunity –types – active and passive immunity, Lymphoid organs – thymus, bone marrow, spleen and lymph nodes.

Unit II **Immune Response** **(12Hrs)**

Cells of the immune system – development and fate of stem cells - Lymphocytes, B Lymphocytes, T Lymphocytes - types of T cells and macrophages –Immune response – humoral - primary and secondary – B cell activation - cell mediated immune response – T cell activation – biological functions of cell mediated immunity.

Unit III **Antigens and Antibodies** **(12Hrs)**

Antigens – definition – epitopes and paratopes– cross reactive antigen - heterophile antigen – Frossman antigen – haptens. Antibodies (Immunoglobulins) - definition – properties of immunoglobulin - structure and functions of immunoglobulin – IgG, IgA, and IgE.

Unit IV **Structure, Shape and Culture of Microbes** **(12Hrs)**

Scope of Microbiology – classification of bacteria - general structure of bacteria, fungus and virus. Culture media, continuous and batch culture techniques – bacterial growth curve – factors affecting bacterial growth

Unit V **Food, Agricultural and Medical Microbiology** **(12Hrs)**

Food Microbiology: Food poisoning - botulism, salmonellosis; food spoilage and preservation methods. Agricultural Microbiology: Rhizosphere - microorganisms - symbiotic and asymbiotic nitrogen fixation. Medical Microbiology: Causative agent, symptoms, prevention and control of tuberculosis, candidiasis and COVID-19.

Textbooks

1. Kannan, I. *Immunology*. Chennai: MJP Publishers 2007
2. Chakraborty, P.A. *Text Book of Microbiology*. Kolkata: New Central Book Agency (P) Limited. 1995.

Books for Reference

1. Arumugam, N., Mani, A., Narayanan, L.M., Dulsy Fatima and A.M.Selvaraj. *Immunology and Microbiology*. Nagercoil : Saras Publication. 2015.
2. Rao, C.V. *An Introduction to Immunology*. New Delhi: Narosa Publishing House. 2005.
3. Joshi K.R and Osamo N.O. *Immunology*. India: Agro Botanical Publishers, 4th Edition,1994.
4. Surendra Naha. *Fundamentals of Immunology*. New Delhi: Dominant Publishers &Distributors Pvt. Ltd. 2012.
5. Pelczar, M.J, Chan, E.C.S. and N.R. Krieg. *Microbiology* New Delhi: Mc Graw– Hill Book Company. 1986.
6. Arti Kapil. *Text Book of Microbiology*. India: Universities Press (India) Pvt. Ltd. 9thEdition, 2013.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	2	1	3	2	3	1	1	3	1
CO-2	3	3	1	2	1	3	2	1	1	1
CO-3	3	1	3	3	3	2	3	3	3	3
CO-4	3	3	3	3	1	3	3	3	2	3
CO-5	3	2	3	3	1	3	1	2	3	3
Ave.	3	2.2	2.2	2.8	1.6	2.8	2	2	2.4	2.2

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

Practicals

Hours/Week:2 **Course Code:23UZOCR8** **Credit:1**

1. Lymphoid organs– chart/ slides of histology
2. Single Radial Immuno diffusion (Demonstration)
3. Double Immuno diffusion (Demonstration)
4. Microscopic observation of different types of lymphocytes
5. Sterilization techniques – Hot air oven
6. Preparation of culture media
7. Serial dilution and plating technique - Pour plating
8. Simple staining of bacteria
9. Gram staining of bacteria
10. Hanging drop technique.
11. Study of distribution of microorganisms in nature – soil, water and air.
12. Culture and counting of bacterial colonies using colony counter.
13. Spotters – autoclave, laminar flow hood, inoculation needle, agar plate.

Books for Reference

1. Jayasurya, Dulsy Fatima, Meyyan, R.P., Arumugam, N. and V. Kumaresan. *Practical Zoology*.(*Cell Biology- Embryology - Animal Physiology - Immunology- Ecology-Genetics-Evolution - Microbiology - Biochemistry - Biophysics*). Nagercoil: Saras Publication, Kottar P.O.2013.
2. James Cappuccino and Natalie Sherman. *Microbiology A Laboratory Manual*. Tokyo: Addison - Wesly- Hyman Inc.1990.

SEMESTER VI			
Core XI	**Biostatistics and Bioinformatics**		
Course Code: 23UZOC63	**Hrs/ Week : 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To explore the integration and application of statistics and bioinformatics in biology
- To acquire the skills and perspectives on statistics and bioinformatic tools in analysis and interpretation of data

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO-1	show the statistical methods for analysis of biological data and acquire knowledge on the bioinformatics concepts for analyzing molecular data	K1
CO-2	explain the problems in data analysis and match the appropriate statistical method and corresponding software	K2
CO-3	analyse and use the bioinformatics tools for advanced sequence alignment, data base searches, genome analysis and protein structure studies	K3
CO-4	apply bioinformatics and statistical operations in developing novel algorithms, improving data analysis techniques by collaborating with researchers, clinicians and professionals in related fields	K4
CO-5	evaluate and explore opportunities for translating research findings into practical applications like developing software tools or contributing to personalized medicine initiatives.	K5

Unit I Biostatistics–Collection and Display of Data (12 hours)

Introduction–populations and samples–types of variables–classification of data – frequency distribution – presentation of data –tables - parts and types – diagrams – bar diagram, pie diagram – graphs –histogram, frequency polygon, frequency curve and ogives.

Unit II Measures of Location and Dispersion (12 hours)

Concept – computation for grouped and ungrouped data – relative merits and limitations of measures of central tendency mean, median and mode – emprical relationship between mean, median and mode – measures of dispersion – range, variance, standard deviation, standard error and coefficient of variation.

Unit III Statistical Inference and Correlation Analysis (12 hours)

Probability theory – terminology – types - theorems of probability - chi-square test and goodness of fit – correlation – definition – types - scatter diagram – Karl Pearson's correlation coefficient–calculation of r value and interpretation – testing the significance of relationship using student's t-test – uses of correlation analysis.

Unit IV Bioinformatics– An Overview (12 hours)

Definition – scope – applications of bioinformatics – properties of biological databases – Kinds of biological databases - hard link relationships between databases - database retrieval tools – Entrez, Sequence Retrieval System, PubMed – Medline .

Unit V Protein and Nucleotide Sequence Databases (12 hours)

Protein sequence databases – NCBI – Protein Information Resource (PIR) – Protein Data Bank (PDB) – nucleotide sequence databases – EMBL – GENBANK – homology search tools – BLAST – FASTA – applications of bioinformatics tools in research.

Text Books

1. Gurumani N. *An Introduction to Biostatistics.* 2nd edition, Chennai: MJP Publishers, 2005.
2. Prakash Lohar. *Bioinformatics*. 1st edition Chennai: MJP Publishers, 2019.

Books for Reference

1. Palanisamy S. and Manoharan M. *Statistical Methods for Biologists.* Palani: Palani Paramount Publications, 1990.
2. Arumugam N. *Biostatistics, Computer Applications, Bioinformatics and Instrumentation.* Nagercoil: Saras Publication, 2010.
3. Agarwal S.K. *Biostatistics.*New Delhi: APH Publishing Corporation, 2008.
4. Arunima Mukherjee. *Bioinformatics.* Jaipur, India: Oxford Book Company, 2008.
5. Thiagarajan B. and Rajalakshmi Pa. *Computational Biology.* Chennai: MJP Publishers, 2009.
6. Claverie J M. and Notredame C. *Biinformatics for Dummies.* 2nd edition, Hoboken: Wiley Publishing Inc, NJ07030-5774, 2007.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	3	2	3	3	2	3	2
CO-2	3	3	3	2	2	3	3	3	2	2
CO-3	3	3	3	2	3	3	3	3	2	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	2	2	3	3	3	2	2	3	3	3
Ave.	2.8	2.8	2.8	2.6	2.6	2.8	2.8	2.8	2.6	2.6

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

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PRACTICALS

Hours/ Week: 2 **Course Code: 23UZOCR8** **Credit: 1**

1. Preparation of a questionnaire and collection of data by survey method.
2. Demonstration of simple random sampling by simulation using students (lottery and table of random number method)
3. Construction of continuous frequency table for the weight/height of students.
4. Diagrammatic presentation of data - simple bar diagram and pie diagram
5. Graphical presentation of data – histogram, frequency polygon, frequency curve and ogives
6. Calculation of mean, median, mode, variance, standard deviation, standard error and coefficient of variation using neem leaves
7. Study of probability and chi – square test with two coins tossing experiment
8. Calculation of correlation coefficient and testing its significance
9. FASTA format conversion and sequence alignment using BLAST
10. Retrieving data from EMBL database - Print out

Books for Reference

1. Rajadurai M. *Bioinformatics – A Practical Manual*. Chennai: PSB Book Enterprises, 2010.
2. Gurumani N. *An Introduction to Biostatistics.* 2nd edition. Chennai: MJP Publishers, 2005.

SEMESTER VI			
Discipline Specific Elective II **Introduction to Research**			
Course Code: 23UZOE61	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 3**

Objectives:

- To inculcate research aptitude in students.
- To equip students with the skills to utilize scientific writing effectively

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	C L
CO-1	recall research concepts and methodologies and communicate scientific findings to address biological challenges.	K1
CO-2	discuss research objectives and scientific findings across disciplines utilizing diverse data collection techniques presenting research findings creatively through reports	K2
CO-3	apply research designs with randomization and replication techniques, and communicate scientific findings through employing tools for literature collection and citation management	K3
CO-4	analyse ethical principles across research types, integrating environmental consciousness, and prioritizing the minimization of bias while upholding ethical standards in scientific writing.	K4
CO-5	evaluate research designs with a focus on societal impact and develop proficiency in communicating scientific findings to diverse audiences.	K5

Unit I **Essentials of Research** **(12 hrs)**

Introduction – concept of research – reflection and science - objectives – motivation- Essential steps in research – Role of research in scientific advancements - Qualifications of a researcher

Unit II **Types of Research** **(12 hrs)**

Descriptive vs analytical research — Basic and applied research, other types of research – longitudinal research, simulation research, clinical research, exploratory research. Types of research studies - Qualitative and Quantitative approaches

Unit III **Methods of Research** **(12 hrs)**

Research methods in biological sciences – Types of data – Data collection - survey – types of surveys – Survey methodology and design – Sampling – types of sampling – random and non-random sampling – Case Study – Questionnaire design.

Unit IV **Designing of Research** **(12hrs)**

Categories of research design – Design of experiments – bias, randomization, blinding, replication, sample selection, minimization - Experimental Research design - pre-experimental, true experimental, quasi experimental, statistical design.

Unit V **Scientific Writing** **(12 hrs)**

Selection of title – Literature collection – Computer aided searches – Search Engines –Different systems of citing references - Components of a report - authors and addresses, abstract, keywords, introduction, materials and methods, results, discussion, summary, conclusion, bibliography, acknowledgement – Plagiarism – types of plagiarism.

Text book

1. Ramadoss. P and A. Wilson Aruni. *Research and Writing: Across the Disciplines*. Chennai: MJP Publishers, Triplicane.2009.

Books for Reference

1. Palanichamy S. and M. Shanmugavelu. *Research Methods in Biological Sciences*. Palani:Paramount Publication.1997.

2. Arumugam.N. *Research Methodology for Life Sciences*. Nagercoil: Saras Publication, Kottar Post.2015.
3. Gurumani. *Research Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.
4. Debbie Holmes Peter Moody and Diana Dine. *Research Methods for the Biosciences*. United Kingdom : OUP Oxford Publisher. 2006.
5. C.R. Kothari and Gaurav Garg. *Research Methodology: Methods and Techniques*. India: New Age International Publishers, Fourth edition. 2019.
6. Bipin Asthana, Vijaya Srivastava, Nidhi Asthana. K. *Research Methodology*. India: RastogiPublications, Shivaji Road Meerut - 250002. 2019.
7. Kulkarni. A.P. *Basics of Research Methodology*. Karnataka: Paras Medical Books Pvt. Ltd. 2015.
8. Elizabeth De Poy, Laura Gitlin. United States of America*: Introduction to Research: Understandingand Applying Multiple Strategies*. Elsevier. 2019.

PSO Relation Matrix

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO-2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO-3	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**
CO-4	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**
CO-5	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**3**
Ave.	**2.4**	**2.8**	**2.4**	**2.2**	**2.4**	**2.4**	**2.8**	**3.0**	**2.4**	**2.4**

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER - VI			
Discipline Specific Elective II	**Evolutionary Biology**		
Course Code: 23UZOE62	**Hrs/week: 4**	**Hrs/sem: 60**	**Credits: 3**

Objectives

- To learn the origin of species and their diversification
- To impart knowledge on impact of environmental factors on natural selection and adaptive radiation

Course Outcome

CO. No.	Upon completion of this course, students will be able to	CL
CO - 1	recall the biological sciences concerned with the origin of life and the diversification and adaptation of life forms over time.	**K1**
CO - 2	summarize the important processes, principles, and concepts on evolution to improve their numerical skill	**K2**
CO - 3	apply their scientific aptitude to unveil the theories of evolution	**K3**
CO - 4	analyze the importance of the evolutionary records and phylogenetic studies in biodiversity conservation.	**K4**
CO - 5	evaluate the contribution of genetic variation to the human welfare and society	**K5**

Unit I **History of Evolution** **(12 Hrs)**

Inorganic and organic evolution-History of evolutionary thought, Primordial earth and primeval atmosphere, Chemical origin of life: Synthesis of organic molecules, Urey-Miller experiment - Origin of prokaryotes and eukaryotes.

Unit II **Evolutionary Theories** **(12 Hrs)**

Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and modern synthetic theory - DeVries Mutation theory – modern concepts of mutation - Mutation and their role in evolution - Animal colouration and Mimicry.

Unit III **Species Concept** **(12 Hrs)**

Isolating mechanisms - Modes of speciation-Hybridization is an evolutionary catalyst- Law of Adaptive Radiation - Adaptive radiation in reptiles and mammals - Convergence and parallelism - Evolutionary constancy

Unit IV **Evidences of Evolution** **(12 Hrs)**

Morphological, physiological and biochemical, embryological, Taxonomical and geographical evidences - Palaeontological evidences – evolutionary genomics. Types of rocks - Geological time scale – Nature of fossils - Dating of fossils - fossil records of horse

Unit V **Human Evolution** **(12 Hrs)**

Organic evolution - Stages of evolution- Important fossils of human evolution – Ramapithecus, Australopithecus, Homoerectus, Homo neanderthalensis, Cro-Magnon man, Cultural evolution of man - Milestones of Cultural Evolution - Future evolution of man

Text Books:

1. Rastogi VB. *Organic Evolution*. Kedar Nath Ram Nath Publications. Meerut, Uttar Pradesh, India. 1991.
2. Stricberger, M.W., *Evolution*. Jones & Bartlett, USA. 1996.

Books for Reference:

1. Ridley, M., *Evolution*. III Edition. Blackwell Publishing. 2004.
2. Lull, R.S. *Organic Evolution*, The Macmillan, New York. 2010.

3. Minkoff, E. C. *Evolutionary Biology*. Reading, MA: Addison-Wesley Publishing Company. 1983.
4. Sober, E. *Conceptual Issues in Evolutionary Biology*. Cambridge, MA: MIT Press. 1994.
5. Dr. Kishore R. Pawar, Dr. Ashok E. Desai, *A text book of Organic Evolution*, Nirali Prakashan. 2019.
6. Colbert, E.H. Morales, M. and Minkoff, E.C. *Colbert's Evolution of The Vertebrates: A History of the Backboned Animals Through Time*, Wiley, India. 2011.

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	3	3	3	3	3	3	3
CO-2	3	3	2	2	2	3	3	3	2	2
CO-3	3	3	2	2	2	3	3	2	2	3
CO-4	3	2	3	3	2	3	3	2	3	3
CO-5	3	2	3	3	1	3	2	2	3	3
Ave.	3	2.6	2.4	2.6	2	3	2.8	2.4	2.6	2.8

Mapping	**<40%**	**≥ 40% and < 70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER – VI			
Skill Enhancement Course VI	**Sericulture**		
Course Code: 23UZOSE6	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives

- To impart about the significance of sericulture in India, the life cycle of the silkworm, and various rearing methods.
- To develop skills to identify and manage common diseases and understand the role of sericulture in economics

Course Outcome

CO.No.	Upon completion of this course, students will be able to	CL
CO-1	recall the intricate life cycle of the silkworm, diverse rearing methods, and acquire the skills to tackle and solve complex biological challenges encountered in silk production.	K1
CO-2	discuss scientific findings on sericulture and become skilled in identifying and managing diseases and pests affecting cocoon production,	K2
CO-3	demonstrate their proficiency in silkworm management to establish themselves as entrepreneurs in the sericulture sector.	K3
CO-4	examine environmental awareness and social responsibility in sericulture practices such as silkworm rearing, cocoon harvesting and transportation.	K4
CO-5	prove as economically independent individuals with a broad understanding of sericulture, actively contributing to human welfare and society.	K5

Unit I **Introduction** **(6hrs)**

Introduction to sericulture – sericulture in India – importance of sericultureSilk producing organisms- mulberry silk worm (*Bombyx mori*)- non- mulberry silkworm - tasar, muga and eri silkworm.

Unit II **Silkworm Rearing** **(6hrs)**

Life cycle of *Bombyx mori* - egg, larva, pupa and adult. Silk worm rearing - chawki rearing- shelf rearing – floor rearing – shoot rearing

Unit III **Cocoon Mounting** **(6hrs)**

Mountage - Chandrike - mounting methods – harvesting of cocoon - transport of coccons

Unit IV **Silkworm Diseases** **(6 hrs)**

Bacterial disease – flacherie. Fungal disease - muscardine, Pest - Uzifly - symptoms and control measures.

Unit V **Economics of Sericulture** **(6 hrs)**

Role of Governmental organizations in the development of Sericulture industry - Central Silk Board (CSB) Central - Sericultural Research and Training Institute (CSRTI) – Employment, generation in sericulture - Role of women in sericulture.

Text Book

1. Ganga, G. and J. Sulochana Chetty, *An Introduction to Sericulture*. Oxford &Publishing Co Pvt. Ltd. New Delhi, 1991.

Books for Reference

1. Krishnaswamy S, *New Technology of Silkworm Rearing.* Published by Central SilkBoard, Bangalore, 1990.
2. Hisao Aruga, *Principles of Sericulture*. Published by Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi, 1990.
3. Tammanna N. Sonwalker, *Hand Book of Silk Technology*. Published by Wiley EasternLtd, Madras, 1993.
4. Manjeet S. Jolly, *Appropriate Sericulture Techniques*. Published by Director, International Centre for Training and Research in Tropical Sericulture, Mysore, 1987.
5. Kamal Jaiswal, Sunil, P., Trivedi, B., Pandey, V. and P.N. Pandey, *Indian Sericulture*.ALFA Publication, New Delhi, 2009.

6. Johnson, M and Kesari, M, *Sericulture*, Fifth edition 2015.

Web Resources

1. https://agritech.tnau.ac.in/sericulture/
2. https://csb.gov.in/

PSO Relation Matrix

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	2
CO-2	2	3	3	2	2	2	3	2	2	2
CO-3	3	3	3	2	3	2	3	3	2	3
CO-4	2	2	2	3	2	2	2	2	3	2
CO-5	3	2	2	3	3	2	2	3	2	3
Ave.	2.6	2.6	2.6	2.4	2.4	2.2	2.6	2.6	2.2	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3