A.V.V.M. Sri Pushpam College (Autonomous), Poondi – 613 503

PG & Research Department of Zoology

B.Sc. Programme in Zoology

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

SCHEME OF PROGRAMME AND SYLLABUS

(For the candidates admitted from 2023-2024 onwards)

Vision and Mission of the College

Vision

To provide quality academic programmes and value oriented higher education to the rural community, equip them to encounter current regional, national and global demands upholding moral standards and intellectual competency.

Mission

- To provide conducive environment for quality teaching-learning process and innovative research.
- To bestow substantial educational experience that is intellectually, socially, and personally transformative.
- To strive to bring out the latent potentiality and core competency of the learners
- To foster the culture of research-based learning, independent academic inquiry by encouraging the students to involve in research activities ranging from hands on training, student projects, publications etc.,
- To nurture essential skills, competent minds and compassionate hearts.
- To impart a practical, demanding and overall development of the personality generated by love, consideration and care for the society.
- To serve the society by extending needful outreach programmes to the rural populace.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- Make the learners realise the transformative power of education.
- Acquire profound disciplinary, applied, integrative knowledge and intellectual competency and domain specific and generic skills.
- Pursue lifelong learning and generate innovative solutions for the problems at individual and social level.
- Create a collaborative and inclusive environment, and serve the betterment of the society with moral integrity.
- Motivate to become a committed professional with necessary ethics as a leader as well as a team player.

PROGRAMME OUTCOMESFORB.Sc., ZOOLOGY PROGRAMMES

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PROGRAMME SPECIFIC OUTCOMES for B.Sc.,ZOOLOGY PROGRAMMES

PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations

PSO3 – Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit

CURRICULUM STRUCTURE FOR B.Sc., ZOOLOGYPROGRAMMES (OBE-CBCS) - 2023

	Nature of Course	Total No. of Courses	Total marks	Total credits	Total credits for the Programme
Part – I	Language (Tamil / Hindi)	04	400	12	123 (CGPA)
Part – II	English	04	400	12	
Part – III	Core Courses	14	1400	65	
	Core Industry Module (CIM)	01	100	04	
	Elective Courses(Generic) - Allied	06	600	18	
	Elective Courses (Discipline Centric)	04	400	12	
Part – IV	Skill Enhancement Course - Non Major Elective (NME)	01	100	02	17 (Non CGPA)
	Skill Enhancement Course – Discipline Specific(SEC)	02	200	04	
	Professional Competency Skill Enhancement Course (PCSE)	01	100	02	
	Gender Studies (GS)	01	100	02	
	Environmental Studies (ES)	01	100	02	
	Value Education (VE)	01	100	02	
	Internship / Industrial Activity	--	--	02	
Part – V	Extension Activity (EA)	--	--	01	
	Total	**40**	**4000**	**140**	**140**
Value Added Course (VAC)		01	100	--	--
Extra Credit Course – MOOC / Field visit / Hands on Training		--	--	Max: 4	--

***Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree**

COURSE STRUCTURE: B.SC., ZOOLOGY (2023)

S. No.	Semester	Part	Category	Course Code	Title of the Course	Maximum Marks			Minimum Marks			Hours/ Week	Credits
						CIA	EE	Total	CIA	EE	Total		
1.	I	I	Language	23U1ZOT1/H1	Tamil – I / Hindi – I	25	75	100	10	30	40	6	3
2.		II	Language	23U1ZOE1	English – I	25	75	100	10	30	40	4	3
3.		III	Core	23U1ZOC1	INVERTEBRATA	25	75	100	10	30	40	7	5
4.			Core	23U1ZOCP1	PRACTICAL – I (INVERTEBRATA)	25	75	100	10	30	40	3	4
5.			Allied	23U1ZOBOA1	ALLIED BOTANY – I	25	75	100	10	30	40	5	4
			Allied (NS)	23U2ZOBOAPL	ALLIED BOTANY PRACTICAL (NS)	-	-	-	-	-	-	3	-
6.		IV	ES	23U1ZOES	ENVIRONMENTAL STUDIES	-	100	100	-	-	40	SS	2
7.	II	I	Language	23U2ZOT2/H2	Tamil – II / Hindi – II	25	75	100	10	30	40	6	3
8.		II	Language	23U2ZOE2	English – II	25	75	100	10	30	40	4	3
9.		III	Core	23U2ZOC2	CHORDATA	25	75	100	10	30	40	7	4
10.			Core	23U2ZOCP2	PRACTICAL – II (CHORDATA)	25	75	100	10	30	40	3	4
11.			Allied (NS)	23U2ZOBOA2	ALLIED BOTANY – II	25	75	100	10	30	40	5	4
12.			Allied	23U2ZOBOAPL	ALLIED BOTANY PRACTICAL (NS)	25	75	100	10	30	40	3	2
13.		IV	VE	23U2ZOVE	VALUE EDUCATION	25	75	100	10	30	40	SS	2
			Extra Credit	MOOC(Massive open online course)		-	-	-	-	-	-	-	-
14.	III	I	Language	23U3ZOT3/H3	Tamil – III / Hindi – III	25	75	100	10	30	40	6	3
15.		II	Language	23U3ZOE3	English – III	25	75	100	10	30	40	4	3
16.		III	Core	23U3ZOC3	CELL BIOLOGY	25	75	100	10	30	40	7	4
17.			Core	23U3ZOCP3	PRACTICAL – III (CELL BIOLOGY)	25	75	100	10	30	40	3	4
18.			Allied	23U3ZOCHA1	ALLIED CHEMISTRY – I	25	75	100	10	30	40	5	4
			Allied (NS)	23U4ZOCHAPL	ALLIED CHEMISTRY PRACTICAL (NS)	-	-	-	-	-	-	3	-
			Extra Credit	MOOC / Field visit / Industrial Visit / Hands on Training		-	-	-	-	-	-	-	-

S. No.	Semester	Part	Category	Course Code	Title of the Course	Maximum Marks			Minimum Marks			Hours/ Week	Credits
						CIA	EE	Total	CIA	EE	Total		
19.	IV	I	Language	23U4ZOT4/H4	Tamil – IV / Hindi – IV	25	75	100	10	30	40	6	3
20.		II	Language	23U4ZOE4	English – IV	25	75	100	10	30	40	4	3
21.		III	Core	23U4ZOC4	ENVIRONMENTAL BIOLOGY	25	75	100	10	30	40	7	4
22.			Core CIM	23U4ZOCIMP4	Industry Module - PRACTICAL – 1V (Environmental Biology)	25	75	100	10	30	40	3	4
23.			Allied (NS)	23U4ZOCHA2	ALLIED CHEMISTRY	25	75	100	10	30	40	5	3
24.			Allied	23U4ZOCHAPL	ALLIED CHEMISTRY PRACTICAL (NS)	25	75	100	10	30	40	3	3
25.		IV	SEC	23U4ZOSEC1	DIGITAL LITRACY IN ZOOLOGY	25	75	100	10	30	40	2	2
26.			GS	23U4ZOGS	GENDER STUDIES	-	-	100	-	-	40	SS	2
			Extra Credit	Field visit / Industrial Visit / Hands on Training		-	-	-	-	-	-	-	-
27.	V	III	Core	23U5ZOC5	EVOLUTIONARY BIOLOGY	25	75	100	10	30	40	5	4
28.			Core	23U5ZOC6	DEVELOPMENTAL BIOLOGY	25	75	100	10	30	40	5	4
29.			Core	23U5ZOC7	IMMUNOLOGY	25	75	100	10	30	40	5	4
30.			Core-Elective	23U5ZOEL1A/ 23U5ZOEL1B	BIOTECHNOLOGY / NANOTECHNOLOGY	25	75	100	10	30	40	4	3
31.			Elective	23U5ZOEL2A/ 23U5ZOEL2B	ECONOMIC ZOOLOGY ANIMAL BEHAVIOUR	25	75	100	10	30	40	4	3
32.			Core	23U5ZOCPR	PROJECT WITH VIVA VOCE	25	75	100	10	30	40	5	4
33.		IV	NME	23U5ZONME	Non-Major Elective – AQUACULTURE	25	75	100	10	30	40	2	2s
			Internship/ Industrial training (carried out in II year summer vacation-30 hrs)									-	2
34.	VI	III	Core	23U5ZOC8	GENETICS	25	75	100	10	30	40	5	4
35.			Core	23U5ZOC9	ANIMAL PHYSIOLOGY	25	75	100	10	30	40	6	4
36.			Core	23U6ZOCP5	PRACTICAL–V– (Genetics & Animal Physiology)	25	75	100	10	30	40	5	4
37.			Core Elective	23U6ZOEL3A/ 23U6ZOEL3B	MICROBIOLOGY HUMAN REPRODUCTIVE BIOLOGY	25	75	100	10	30	40	5	3
38.			Elective	23U6ZOEL4A/ 23U6ZOEL4B	WILDLIFE CONSERVATION AND MANAGEMENT VERMICULTURE	25	75	100	10	30	40	5	3
39.		V	SEC	23U6ZOSEC2	ORNAMENTAL FISH FARMING AND MANAGEMENT	25	75	100	10	30	40	2	2
40.			PCSE	23U6ZOPCSE	Comprehensive Knowledge	-	100	100	-	40	40	2	2
					Extension Activities (outside college hours)	-	-	-	-	-	-	-	1
					Total			**4000**					**140**
					Value Added Course – Apiculture	-	100	100	-	-	50	SS	-

Internship/ Industrial Activity:

Students must complete in-plant training in any industry or organization where a programme-related procedure is being used, and this training must be done during the summer vacation at the end of II Year.A minimum of 30 hours should be spent on training. Students must submit a report on their training together with a certificate from the relevant industry or organization authority.

MOOC:

Massive Open Online Course (MOOC) is offered in the II and III Semester as an Extra Credit Course. Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves. To receive the extra credit, students must provide their MOOC course completion certificate at the end of the second year.

Field visit / Hands on Training:

In order to achieve experiential learning, these programmes with a minimum of 15 hours of contact time are offered as Extra Credit Courses in the III & IVSemester.

Evaluation of visit report will be held at the end of IVSemester.

Components of Evaluation:

Internal Marks	: 25
External Marks	: 75
Total	: 100

Skill Enhancement course (SEC) offered by the Zoology Department

1. Digital Literacy in Zoology
2. Ornamental fish farming and management

Non – Major Elective (NME) Course offered by the Zoology Department

Aquaculture

Value Added Course offered by the Zoology Department

"Apiculture" will be conducted for III UG students as a certificate Course.

A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE (AUTONOMOUS),POONDI, THANJAVUR DIST.
(NAAC Re-Accredited with A grade in 4th cycle)
Question Pattern for UG and PG Programmes
(For the students admitted from 2023 – 2024onwards)

Bloom's Taxonomy based Assessment pattern

Bloom's category	Section	Choice	Marks	Total
K1 to K6	A	Compulsory	10 x 2 = 20	75
	B	Either / Or	5 x 5 = 25	
	C	3 out of 5	3 x 10 = 30	

OBE QUESTION PATTERN

Total Marks: 75

CO	K Level	Q. No.	Questions
SECTION – A (10 x 2 = 20) **Answer All the questions** (Two Questions from each units)			
		1.	
		2.	
		3.	
		4.	
		5.	
		6.	
		7.	
		8.	
		9.	
		10.	
SECTION – B (5 x 5 = 25) **Answer All the questions** (One Question from each unit)			
		11(a).	
(OR)			
		11(b).	
		12(a).	
(OR)			
		12(b).	
		13(a).	
(OR)			
		13(b).	
		14(a).	
(OR)			
		14(b).	
		15(a).	
(OR)			
		15(b).	
SECTION – C (3 x 10 = 30) **Answer ANY THREE questions** (One Question from each unit)			
		16.	
		17.	
		18.	
		19.	
		20.	

Bloom's Taxonomy Action Verbs

K1 Remember	K2 Understand	K3 Apply	K4 Analyze	K5 Evaluate	K6 Create
• Choose • Copy • Define • Describe • Discover • Duplicate • Enumerate • Examine • Find • How • Identify • Label • List • Locate • Match • Memorize • Name • Omit • Recall • Recognize • Relate • Select • Show • Spell • State • Tabulate • Tell • What • When • Where • Which • Who • Why	• Associate • Classify • Compare • Contrast • Convert • Demonstrate • Describe • Differentiate • Discuss • Distinguish • Estimate • Explain • Express • Extend • Identify • Illustrate • Indicate • Infer • Interpret • Outline • Paraphrase • Predict • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Calculate • Change • Choose • Complete • Construct • Demonstrate • Develop • Discover • Dramatize • Experiment • Identify • Interview • Interpret • Illustrate • Make use of • Manipulate • Model • Modify • Organize • Paint • Plan • Prepare • Produce • Relate • Select • Show • Sketch • Solve • Use • Utilize	• Advertise • Appraise • Analyze • Assume • Break down • Categorize • Classify • Compare • Conclusion • Connect • Contrast • Differentiate • Discover • Dissect • Distinguish • Discriminate • Divide • Examine • Explain • Function • Inference • Inspect • List • Motive • Order • Point out • Prioritize • Relationships • Select • Separate • Simplify • Subdivide • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Convince • Criteria • Criticize • Decide • Deduct • Defend • Determine • Discriminate • Estimate • Evaluate • Explain • Find errors • Grade • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Order • Predict • Prioritize • Prove • Rank • Rate • Recommend • Reframe • Select • Summarize • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Generalize • Hypothesize • Imagine • Improve • Integrate • Invent • Make up • Maximize • Minimize • Modify • Originate • Organize • Plan • Predict • Prepare • Produce • Propose • Rearrange • Rewrite • Role-play • Solution • Solve • Substitute • Write

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
I	**23U1ZOT1**	**பொதுத் தமிழ் – 1**	**6**	**3**

Nature of the Course

1.Employablity Oriented *வேலை வாய்ப்புச் சார்ந்தது*	✓	7. Addresses Professional Ethics *தொழில் நெறிமுறைகளை நிறைவு செய்தல்*	
2. Entrepreneurship Oriented *தொழில் முனைவு சார்ந்தது*		8.Relevent To Local Need *உள்ளூர் தேவைகளோடு தொடர்புடையது*	✓
3. Skill Development Oriented *திறன்மேம்பாடு சார்ந்தது*	✓	9. Relevent To Regional Need *மண்டல அளவிலான தேவைகளோடு தொடர்புடையது*	
4. Addresses Gender Sensitization *பாலின உணர்திறன் பூர்த்தி செய்தல்*		10. Relevent To National Need *தேசிய அளவிலான தேவைகளோடு தொடர்புடையது*	
5. Addresses Environment and Sustainablity *சுற்றுச் சூழல் மற்றும் நிலைத் தன்மை நிறைவு செய்தல்*		11. Relevent To Global Development Need *உலக அளவிலான தேவைகளோடு தொடர்புடையது*	
6. Addresses Human Values *மனித மதிப்புகளை நிறைவு செய்தல்*	✓		

Course Objectives

1. முதலாமாண்டுப் பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ் மொழி இலக்கியங்களை அறிமுகம் செய்தல்
2. தற்கால இலக்கியப் போக்குகளையும் இலக்கணங்களையும் மாணவர் அறியுமாறு செய்தல்.
3. மாணவர்களுக்குத் தமிழ் படைப்பாற்றலைத் தூண்டுதல்.
4. தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.

Unit	Details	Hours
Unit-I	***மரபுக் கவிதை*** *1. பெ. சுந்தரனார் - தமிழ்த் தெய்வ வணக்கம்* *2. பாரதிதாசன் - சிறுத்தையே வெளியில் வா* *3. கவிமணி - புத்தரும் சிறுவனும்* *4. முடியரசன் - மொழி உணர்ச்சி* *5. கண்ணதாசன் - ஆட்டனத்தி ஆதிமந்தி — ஆதிமந்தி புலம்பல்* *6. சுரதா - துறைமுகம் தொகுப்பிலிருந்து ஏதேனும் ஒரு கவிதை* *7. தமிழ் ஒளி - கடல்*	18 Hrs

Unit-II	***புதுக்கவிதை*** *1. அப்துல் ரகுமான் - வீட்டுக்கொரு மரம் வளர்ப்போம்* *2. ஈரோடு தமிழன்பன் - சென்ரியூ கவிதைகள் (ஏதேனும் ஐந்து கவிதைகள்)* *3. வைரமுத்து - பிற்சேர்க்கை* *4. மு.மேத்தா- வாழைமரம்* *5. அறிவுமதி -வள்ளுவம் பத்து* *6. நா முத்துக்குமார் - ஆனந்த யாழை மீட்டுகிறாய்* *7. சுகிர்தராணி - சபிக்கப்பட்ட முத்தம்* *8. இளம்பிறை -நீ எழுத மறுக்கும் எனது அழகு*	18 Hrs
Unit-III	***சிறுகதைகள்*** *1. வாய்ச் சொற்கள் - ஜெயகாந்தன் (மாலை மயக்கம் தொகுப்பு)* *2. கடிதம் - புதுமைப்பித்தன்* *3. முள்முடி - தி ஜானகிராமன்* *4. சிதறல்கள் - விழி.பா.இதயவேந்தன்* *5. காகித உறவு - சு.சமுத்திரம்* *6. வீட்டின் மூலையில் சமையல் அறை - அம்பை* *7. (மொழிபெயர்ப்புக் கதை) ஆண்டன் செக்காவ் - நாய்க்காரச் சீமாட்டி, சந்தியா*	18 Hrs
Unit-IV	*1. பாடம் சார்ந்த இலக்கிய வரலாறு* *2. இராகபாவம் — கேட்டிவி*	18 Hrs
Unit-V	***மொழித்திறன் போட்டி தேர்வு*** *1. பொருள் பொதிந்த சொற்றொடர் அமைத்தல்* *2. ஓர் எழுத்து ஒரு மொழி* *3. வேற்றுமை உருபுகள்* *4. திணை, பால், எண், இடம்* *5. கலைச்சொல்லாக்கம், மொழிபெயர்ப்பு.* *(குறிப்பு: அலகு 4, 5 ஆகியன போட்டித் தேர்வு நோக்கில் நடத்தப்பட வேண்டும்).*	18 Hrs

CO Number	CO Statement	Cognitive Level
CO1	*பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதை இலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன் பெறுகல்.*	**K2**
CO2	*புதுக்கவிதை வரலாற்றினை அறிந்து கொள்வர்.*	**K3**
CO3	*இக்கால இலக்கிய வகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுவர்.*	**K4**
CO4	*மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்.*	**K3**
CO5	*தமிழ்மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச் சொற்களை உருவாக்கவும் அறிந்து கொள்ளுதல்.*	**K5**

Text Books

1. தமிழ் இலக்கிய வரலாறு -செம்பதிப்பு- பெ.சுபாஷ் சந்திரபோஸ்

பார்வை நூல்கள்.

1. தமிழ் இலக்கிய வரலாறு - சிற்பி.பாலசுப்பிரமணியன்

2. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு - தமிழண்ணல்
3. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு - எஃப்.பாக்கியமேரி

Web Resource

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.)

1. Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org> Tamil virtual University Library-
2. www.tamilvu.org/ library
3. http://www.virtualvu.org/library 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- tamale books downloads. 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

பொதுத்தமிழ் —1												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	2	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	3	3	2	2	2	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I	**23U1ZOE1**	**PART - II GENERAL ENGLISH**	**6**	**3**

Learning Objectives		
LO1	enable earners to acquire self awareness and positive thinking required in ious life situations.	
LO2	help the macquire the attribute of empathy	
LO3	assist them in acquiring creative and critical thinking abilities	
LO4	enable them to learn the basic grammar	
LO5	assist the min developing LSRW skills	
Unit No.	**Unit Title &Text**	**No.of Periods for the Unit**
I	**SELF-AWARENESS(WHO) & POSITIVE THINKING (UNICEF)** **Life Story** Chapter 1 from Malala Yousafzai, I am Malala An Autobiography or The Story of My Experiments with Truth (Chapters 1, 2 & 3) M.K.Gandhi **Poem** Where the Mind is Without Fear–Gitanjali 35– Rabindranath Tagore Love Cycle– Chinua Achebe	**20**
II	**EMPATHY** **Poem** Nine Gold Medals– David Roth Alice Fellor poverty–William Words worth **Short Story** The School for Sympathy– E.V. Lucas Barn Burning – William Faulkner	**20**
III	**CRITICAL & CREATIVE THINKING** **Poem** The Things That Haven't Been Done Before– Edgar Guest Stopping by the Woods on a Snowy Evening– Robert Frost **Readers Theatre** The Magic Brocade – A Tale of China Stories on Stage–Aaron Shepard (Three Sideway Stories from Wayside School" by Louis Sachar)	**20**
IV	**Reflective Thinking** The Running Rivulets of man The Lady in the Silver Coat Mr.Applebaum at Play The Feigning Brawl of an Imposter Thy Life is my Lesson	**15**

V	**Communication Skill Part of Speech** Articles Noun Pronoun Verb Adverb Adjective Preposition	**15**

Course Outcomes		
Course Outcomes	On completion of this course, students will:	
CO1	Acquire self awareness and positive thinking required in various life situations	PO1,PO7
CO2	Acquire the attribute of empathy.	PO1,PO2,PO10
CO3	Acquire creative and critical thinking abilities.	PO4,PO6,PO9
CO4	Learn basic grammar	PO4,PO5,PO6
CO5	Development and integrate the use of four language skills i.e., listening, speaking, reading and writing.	PO3,PO8

	Textbooks (Latest Editions)
1.	Malala Yousafzai. Iam Malala, Little, Brown and Company, 2013.
2.	M.K.Gandhi. An Autobiography or The Story of My Experiments with Truth (Chapter – I), Rupa Publications, 2011.
3.	Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings): A CollectionofProseTranslationsMadebytheAuthorfromtheOriginalBengali. MacMillan, 1913.
4.	N.Krishnasamy. Modern English: A Book of Grammar, Usage and Composition Macmillan, 1975.
5.	Aaron Shepard. Storieson Stage, Shepard Publications, 2017.
6.	J.C.Nesfield. English Grammar Composition and Usage, Macmillan, 2019.
7.	Sri.KTV. Melodious Harmony, New Century Book House. 2022

Web Resources	
1	MalalaYousafzai.Iam Malala(Chapter1)https://archive.org/details/i-am-malala
2	M.KGandhi.An Auto biographyor The Story of My Experiments with Truth(Chapter-1)-RupaPublication,2011https://www.indiastudychannel.com/resources/146521-Book-Review-An-Autobiography-or-The-story-of-my-experiments-with-Truth.aspx
3	Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings)https://www.poetryfoundation.org/poems/45668/gitanjali-35
4	AaronShepard.StoriesonStage,ShepardPublications,2017 https://amzn.eu/d/9rVzlNv
5	JCNesfield. Manual of English Grammar and Composition. https://archive.org/details/in.ernet.dli.2015.44179

Mapping with Programme Outcomes:-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

Mapping with Programme Specific Outcomes:-

CO /PO	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3
Weight age	15	15	15	15
Weighted percentage of Course Contribution to POS	3.0	3.0	3.0	3.0

3– Strong, 2 –Medium, 1-Low

Semester	Course Code	Course Title	Hours ofTeaching / Cycle	No.of Credits
I	**23U1ZOC1**	**INVERTEBRATA**	**7**	**5**

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:	
The main objectives of this course are:	
1.	To understand the basic concepts of lower animals and observe the structure and functions.
2.	To illustrate and examine the systemic and functional morphology of various group of invertebrates.
3.	To differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.
4.	To compare and distinguish the general and specific characteristics of reproduction lower animals.
5.	To infer and integrate the parasitic and economic importance of invertebrate animals, the evolutionary position of different groups of invertebrates

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Protozoa** Principles of Taxonomy General Characters and Classification of Phylum Protozoa up to Classes. **Detailed Study** : 1. *Paramecium* 2. *Plasmodium* **General Topics:** 1.Protozoans Parasites of Man (*Entamoeba*, *Trypanasoma* &*Leishmania*) 2. Locomotion and Nutrition of Protozoans. 3.Economic importance of Protozoa	**21 Hrs**
II	**Porifera and Coelenterata:**General Characters and Classification of Phylum Porifera and Coelenterata Upto Classes. **Detailed Study** : 1. *Leucosolenia* (Ascon Sponge) 2.*Obelia Geniculata* (Sea fur) **General Topic :** 1. Canal System In Sponges.	**21 Hrs**

	2. Skeleton System in Sponges. 3. Economic importance of Coral and Coral Reefs. 4. Polymorphism in Hydrozoa.	
III	**Platyhelminthes and Nemathelminthes:** General Characters and Classification of Phylum Platyhelminthes and Nemathelminthes Upto Classes. **Detailed Study** : 1.*Taeniasolium*, (Tapeworm) 2. *Ascaris Lumbricoides* (Roundworm) **General Topic :** 1. Parasitic Adaptations of Platyhelminthes. 2. Parasitic interactions of helminthes parasites 3.Nematode Parasites and diseases - *Wuchereria bancrofti*, *Enterobius vermicularis*, *Ancylostome duodenale*.	**21 Hrs**
IV	**Annelida and Arthropoda:** General Characters and Classification of Phylum Annelida and Arthropoda Upto Classes. **Detailed Study :** 1.*Hirudinaria Granulose* (Leech) 2. *Periplaneta Americana (*Cockroach) **General Topic :** 1. Nephridium and coelomoducts in annelids 2. Mode of life in annelids 3. Larval forms in Crustacea 4.Insects associated with human diseases: Mosquitoes, housefly, bed bug, human head louse.	**21 Hrs**
V	**Mollusca and Echinodermata:** General Characters and Classification of Phylum Mollusca and Echinodermata Upto Classes. **Detailed Study** : 1. *Pila Globosa (*Apple Snail) 2. *Asterias rubens* (Starfish) **General Topic :** 1.Economic importance of Molluscs 2. Food and torsion in Mollusca **3.**Water vascular system in Echinodermata 4. Larval forms of Echinoderms	**21 Hrs**

Text Books:

1. Ekambaranatha Iyer, 2000. A Manual of Zoology, 10th edition, Viswanathan, S., Printers & Publishers Pvt Ltd
2. Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12th edn. S. Chand& Co.
3. Kotpal, R.L, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda.
4. Arumugam.N .A Text book of invertebrates 2018. Saras Publications. Nagerkoil.
5. Vasantharaj David, B. 2001. Elements of Economic Entomology, Popular Book Depot, Chennai. 400pp.
6. Ruppert and Barnes, R.D. 2006. Invertebrate Zoology, VIII Edition. Holt Saunders International Edition, Belmont, CA : Thomson-Brooks/Cole, 928pp.

References :

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.\
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Hyman L.H, 1955. The invertebrates - Vol. I to Vol. VII – Mc Graw Hill Book Co.

5. Parker, J. and Haswell , 1978. A text book of Zoology Vol. I - Williams and Williams.
6. Barrington, E.J.W., 2012, Invertebrate structure and function. Boston – Houghton. Miffin and ELBS, London.
7. Bhamrah,H.S. and Kavitha Junea, 2002. A text book of Invertebrates. Alilnol Publications Private Limited, 4374/4B.Ansari Road, Dayaganj, New Delhi.
8. Kotpal, 1992. Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca, Echinodermata, R.L- Rastogi Publication.
9. Srivastava, M.D.L and Srivastava, 1969. A text book of Invertebrate Zoology, U.S-Central Book Depot, Allahabad.

Web resources :

1. https://www.nationalgeographic.com/animals/invertebrates/
2. https://bit.ly/3kABzKa
3. https://www.nio.org/
4. https://greatbarrierreef.org/
5. https://bit.ly/3kABzKa
6. https://www.nio.org/
7. https://bit.ly/3lJdUX0

Pedagogy: Lecture, Assignment,PPT presentation,Quiz, Demonstration

Expected Course outcomes (CO) :

On the successful completion of this course, the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Understand the basic concepts of invertebrate animals and recall its structure and functions.	**K2**
CO2	Illustrate and examine the systemic and functional morphology of various groups of invertebrata.	**K1 & K2**
CO3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.	**K2 & K4**
CO4	To compare and distinguish the various physiological processes and organ systems in lower animals.	**K2 & K4**
CO5	Infer and integrate the parasitic and economic importance of invertebrate animals.	**K2 & K6**
Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create		

Mapping of Course Outcomes with Programme Outcomes:										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	2	3	3	3	2	3	3	3
CO2	3	3	2	3	3	3	2	2	3	2
CO3	3	2	2	3	3	3	3	2	3	3
CO4	2	2	3	3	3	3	3	2	3	2
CO5	3	2	3	3	3	3	3	2	3	2

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No.of Credits
I	**23U1ZOCP1**	**Practical – I– INVERTEBRATA**	**3**	**4**

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:	
The main objectives of this course are:	
6.	To identify the different groups of invertebrate animals by observing their external characteristics.
7.	To understand the organs, organ system and their functions in lower animals.
8.	To get knowledge about the different modes of life and their adaptation based on the environment.
9.	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.

SYLLABUS		
Unit	**Content**	**No. of Hours**

Major Dissection:

Earthworm : Nervous System, Reproductive system.
Cockroach : Circulatory system, Nervous system, Reproductive system.
Leech : Nervous System, Reproductive system.
Pila *globosa* : Nervous System
Prawn : Nervous system (including Appendages).

Minor Dissection:

Cockroach : Digestive system.
Earthworm : Viscera, Lateral hearts.
Pila globosa :Digestive system (Including radula).
Freshwater Mussel : Digestive system.

Mounting:

Earthworm : Body setae; Pineal setae.
Pila globosa :Radula.
Freshwater muscle : Pedal ganglia.
Cockroach : Salivary apparatus,
Mouth parts : Cockroach, Honey Bee, House fly and Mosquito.

SPOTTERS :

Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, *Entamoeba histolytica, Plasmodium vivax.*

Porifera: Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule.

Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula.

Platyhelminthes: Planaria, *Fasciola hepatica,* Fasciola larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus, Taenia solium, Schistosoma haematobium.*

Nemathelminthes: Ascaris (Male & Female), Drancunculus, Ancylostoma, Wuchereria.

Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly.

Mollusca: Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva.

Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva.

Text Books:

1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai
2. Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp

References :

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
2. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

Web resources :

1. https://nbb.gov.in/
2. http://www.agshoney.com/training.htm
3. https://icar.org.in/
4. http://www.csrtimys.res.in/
5. http://csb.gov.in/

6. https://iinrg.icar.gov.in/
7. https://www.nationalgeographic.com/animals/invertebrates/

Pedagogy: Lecture, Assignment,PPT presentation,Quiz, Demonstration

Expected Course outcomes (CO) :

On the successful completion of this course, the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Identify and label the external features of different groups of invertebrate animals.	**K1 &K2**
CO2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.	**K1 &K2**
CO3	Differentiate and compare the structure, function and mode of life of various groups of animals.	**K2 & K4**
CO4	To compare and distinguish the dissected internal organs of lower animals.	**K4 & K2**
CO5	Prepare and develop the mounting procedure of economically important invertebrates.	**K3 & K6**
Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create		

Mapping of Course Outcomes with Programme Outcomes:										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	2	3	3	2
CO3	3	2	3	3	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3	3	2
CO5	3	2	3	3	3	3	3	3	3	2

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching/ Cycle	No. of Credits
I	23U1ZOBOA1	ALLIED BOTANY-I	5	3

Nature of the course

EmployabilityOriented		Relevant to Local need	√	Addresses GenderSensitization	
EntrepreneurshipOriented		Relevant to regional need		Addresses Environmentand Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are to:

1 study morphological and anatomical adaptations of plants of various habitats.
2 demonstrate techniques of plant tissue culture.
3 familiarize with the structure of DNA, RNA.
4 carryout experiments related with plant physiology.
5 perform biochemistry experiments.

SYLLABUS

Unit	Content	No. of Hours
I	**ALGAE, AND FUNGI:** General characters of algae - Structure, reproduction and life cycle of the followinggenera - *Anabaena* and *Sargassum* and economic importance of algae. General characters of fungi, structure, reproduction and life cycle of the followinggenera - *Penicillium* and *Agaricus* and economic importance of fungi.	12
II	**BACTERIA AND VIRUS:** Bacteria - general characters, structure and reproduction of *Escherichia coli* andeconomic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage	12
III	**BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS:** General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.General characters of Gymnosperms, Structure and life cycle of *Cycas*	12
IV	**CELL BIOLOGY:** Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structureand function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.	12
V	**GENETICS AND PLANT BIOTECHNOLOGY:** Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Planttissue culture and its application in biotechnology.	12

Textbook:

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications,Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd.,Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd.,Madras.

References:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

Web resources:

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an- introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics
8. https://www.kobo.com/us/en/ebook/plant-biotechnology-1

Pedagogy: Teaching / Learning methods

Lecture, Tutorial, Assignment, PPT presentation,Quiz, Group Discussion, e-content andSeminar.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Increase the awareness and appreciation of human friendly algae and theireconomic importance	**K1**
CO2	Develop an understanding of microbes and fungi and appreciate theiradaptive strategies	**K2**
CO3	Develop critical understanding on morphology, anatomy and reproductionof Bryophytes, Pteridophytes and Gymnosperms	**K3**
CO4	Compare the structure and function of cells and explain the developmentof cells.	**K4**
CO5	Understand the core concepts and fundamentals of plant biotechnologyand geneticengineering	**K5**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
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	2	3	3	3	3	1	3	3	3	3
CO 4	3	3	2	3	3	3	2	3	2	3
CO 5	3	2	2	2	2	2	2	1	2	1

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

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I & II	**23U2ZOBOAPL**	**ALLIED BOTANY PRACTICALS (NS)**	**5**	**3**

Nature of the course

EmployabilityOriented		Relevant to Local need	√	Addresses GenderSensitization	
EntrepreneurshipOriented		Relevant to regional need		Addresses Environmentand Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are to:

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of plant systematics.
4. Understanding of laws of inheritance, genetic basis of loci and alleles.
5. To learn about the physiological processes that underlie plant metabolism.

SYLLABUS

EXPERIMENTS

1. Make suitable micro preparation of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. To describe in technical terms, plants belonging to any of the family prescribes and to identify thefamily.
5. To dissect a flower, construct floral diagram and write floral formula.
6. Demonstration experiments:
   i. Ganong's Light screen
   ii. Ganong's respiroscope
7. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy,Embryology, Cell biology and Biotechnology.

Textbook:

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt.Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and

Company, New York, England.

5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi

References:

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual toalgae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & WileyPublications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

Web resources:

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy mnosperms&printsec=frontcover
3. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
4. https://medlineplus.gov/genetocs/understanding/basics/cell/
5. https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf
6. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
7. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To study the internal organization of algae and fungi	**K1**
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms	**K2**
CO3	To study the classical taxonomy with reference to different parameters.	**K3**
CO4	Understand the fundamental concepts of plant anatomy and embryology	**K4**
CO5	To study the effect of various physical factors on photosynthesis.	**K5**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
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	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

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

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
II	**23U2ZOT2**	**பொதுத் தமிழ் – 2**	**6**	**3**

Nature of the Course

1.Employablity Oriented வேலை வாய்ப்புச் சார்ந்தது	✓	7. Addresses Professional Ethics தொழில் நெறிமுறைகளை நிறைவு	
2. Entrepreneurship Oriented தொழில் முனைவு சார்ந்தது		8.Relevent To Local Need உள்ளூர் தேவைகளோடு தொடர்புடையது	✓
3. Skill Development Oriented திறன்மேம்பாடு சார்ந்தது	✓	9. Relevent To Regional Need மண்டல அளவிலான தேவைகளோடு தொடர்புடையது	
4. Addresses Gender Sensitization பாலின உணர்திறன் பூர்த்தி செய்தல்		10. Relevent To National Need தேசிய அளவிலான தேவைகளோடு தொடர்புடையது	
5. Addresses Environment and Sustainablity சுற்றுச் சூழல் மற்றும் நிலைத் தன்மை நிறைவு செய்தல்		11. Relevent To Global Development Need உலக அளவிலான தேவைகளோடு தொடர்புடையது	
6. Addresses Human Values மனித மதிப்புகளை நிறைவு செய்தல்	✓		

Course Objectives

1. சமய இலக்கியங்களையும் சிற்றிலக்கியங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.

2. மாணவர்களுக்கு மொழித்திறனை வளர்க்கப் பயிற்சி அளித்தல்.

Unit	Details	Hours
Unit-I	*1.திருநாவுக்கரசர் தேவாரம் - நாமார்க்கும் குடியல்லோம் எனத் தொடங்கும் பதிகம் (10 பாடல்கள்)* *2.ஆண்டாள் - திருப்பாவை (முதல் 10 பாசுரம்)*	18 Hrs
Unit-II	*1.வள்ளலார் -அருள் விளக்க மாலை (முதல் 10 பாடல்)* *2.எச்.ஏ.கிருட்டிணப்பிள்ளை - இரட்சணிய மனோகரம் - பால்ய பிரார்த்தனை* *3.குணங்குடி மஸ்தான் சாகிபு - பராபரக்கண்ணி (முதல் 10 கண்ணி)*	18 Hrs
Unit-III	*சிற்றிலக்கியங்கள்* *1.தமிழ்விடு தூது (முதல் 20 கண்ணி)* *2.திருக்குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறுதல்* *3.முக்கூடல் பள்ளு - நாட்டு வளம்*	18 Hrs
Unit-IV	*1.பாடம் தழுவிய இலக்கிய வரலாறு* *2.மனோரஞ்சிதம் -கேட்டிவி*	18 Hrs

Unit-V	மொழித்திறன்/போட்டித் தேர்வுத் திறன் *1.* தொடர் வகைகள் *2.* மரபுத்தொடர், பழமொழிகள் *3.* பிறமொழிச் சொற்களைக் களைதல் *4.* வழுச்சொற்கள் நீக்குதல் *5.* இலக்கணக் குறிப்பு அறிதல்	18 Hrs

CO Number	CO Statement	Cognitive Level
CO1	பக்தி இலக்கியங்களைக் கற்பதன் மூலம் பக்தி நெறியினையும்,சமய நல்லிணக்கத்தையும் தெரிந்து பின்பற்றுவர்.	**K1, K2**
CO2	சிற்றிலக்கியங்களின்வழி இலக்கியச் சுவையினையும் பண்பாட்டு அறிவினையும் பெறுவர்.	**K2**
CO3	பட்டப் படிப்பினைப் படிக்கும் போதே பெரும்பான்மையான தமிழ் இலக்கியங்கள் குறித்த அறிவினைப் பெறுவர்.	**K4**
CO4	தமிழ்ச் சமூகப் பண்பாட்டு வரலாற்றினை இலக்கியங்கள் வாயிலாக அறிவர்.	**K3**
CO5	போட்டித் தேர்வுகளில் வெற்றி பெறுவதற்குத் தமிழ்ப் பாடத்தினைப் பயன்கொள்ளும் வகையில் ஏற்ற பயிற்சி பெறுவர்.	**K4**

Text Books

1. தமிழ் இலக்கிய வரலாறு -செம்பதிப்பு- பெ.சுபாஷ் சந்திரபோஸ்

பார்வை நூல்கள்

1. தமிழ் இலக்கிய வரலாறு - சிற்பி.பாலசுப்பிரமணியன்

2. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு - தமிழண்ணல்

3. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு - எஃப்.பாக்கியமேரி

Web Resource:-

Related Online Contents (MOOC,SWAYAM,NPTEL,Websites etc.)

1. Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org> Tamil virtual University Library-
2. www.tamilvu.org/ library
3. http://www.virtualvu.org/library 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

பொதுத்தமிழ் —2												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	2	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	3	3	2	2	2	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23U2ZOE2**	**PART - II GENERAL ENGLISH**	**6**	**3**

Learning Objectives		
LO1	To make students realize the importance of resilience	
LO2	To enable them to become good decision makers	
LO3	To enable them to imbibe problem-solving skills	
LO4	To enable them to usetenses appropriately	
LO5	To help the muse English effectively at the work place.	
Unit No.	**Unit Title &Text**	**No.of Periods for the Unit**
I	**RESILIENCE** **Poem** Don't Quit – Edgar A. Guest Still Here–Langston Hughes **Short Story** Engine Trouble – R.K.Narayan RipVan Winkle– Washington Irving	**20**
II	**DECISION MAKING** **Short Story** The Scribe– Kristin Hunter The Lady or the Tiger- Frank Stockton **Poem** The Road not Taken–Robert Frost Snake – D. H Lawrence	**20**
III	**PROBLEM SOLVING** **Prose life Story** How I taught My Grandmother to Read– Sudha Murthy **Autobiography** How frog Went to Heaven–ATale of Angolo Wings of Fire(Chapters1, 2, 3) by A.P.J Abdul Kalam	**20**
IV	**Moral Values** The Stoic Penalty Nobility in Reasoning Malu, the Frivolous Freak Honesty is the Cream of Chastity A Boy in Boy's Town	**15**
V	**Tenses** Present Past Future Concord	**15**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Realize the importance of resilience	PO1,PO7
CO2	Become good decision-makers	PO1,PO2,PO10
CO3	Imbibe problem-solving skills	PO4,PO6,PO9
CO4	Use tenses appropriately	PO4, PO5,PO6
CO5	Use English effectively at the work place.	PO3,PO8

Text Books (Latest Editions)	
References Books	
1	Martin Hewings. Advanced English Grammar. Cambridge University Press, 2000
2	SP Bakshi, Richa Sharma. Descriptive English. Arihant Publications (India) Ltd., 2019.
3.	Sheena Cameron, Louise Dempsey. The Reading Book: A Complete Guide to Teaching Reading. S & L. Publishing, 2019.
4	Barbara Sherman. Skimming and Scanning Techniques, Liberty University Press, 2014.
5.	Phil Chambers. Brilliant Speed Reading: What every ouneed to read, however. Pearson, 2013.
6.	Communication Skills: Practical Approach Ed.Shaikh Moula Ramendra Kumar. Stories of Resilience, Blue Rose Publications, 2020.
7.	Sri.KTV.Melodious Harmony, New Century Book House. 2022

Web Sources

1	LangstonHughes.StillHere https://poetryace.com/im-still-here
2	R.K. Narayan.Engine Trouble http://www.sbioaschooltrichy.org/work/Work/images/new/8e.pdf
3	Washington Irving. Rip Van Winkle https://www.gutenberg.org/files/60976/60976-h/60976-h.htm
4	FrankStockton. TheLadyor the Tigerhttps://www.gutenberg.org/ebooks/396

Mapping with Programme Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3–Strong,2–Medium,1-Low Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3
Weight age	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0

3– Strong, 2 –Medium, 1-Low

Semester	Course Code	Course Title	Hours ofTeaching / Cycle	No.of Credits
II	**23U2ZOC2**	**CHORDATA**	**7**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need	
Entrepreneurship Oriented		Relevant to regional need	
Skill development Oriented		Relevant to national need	
Addresses Gender Sensitization		Relevant to Global development need	√
Addresses Environmentand Sustainability	√	Addresses ProfessionalEthics	
Addresses Human Values			

Course Objectives:	
The main objectives of this course are:	
1.	To understand the structures and distinct features of Phylum Chordata.
2.	To understand and able to distinguish the characteristic features of each subphylum and classes.
3.	To understand the economic importance of vertebrates
4.	To know about the adaptations of vertebrates
5.	To understand the evolutionary position of different groups of vertebrates

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Chordata** -General characters ofchordata and its outline classification - Origin of chordates. **Prochordata:**Differences between non-chordates and chordates -General characters of Prochordata and itsclassification-General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*) and Cephalochordata (*Amphioxus*).	21
II	**Vertebrata :** General characters and classification of Vertebrata up to class level. **Agnatha :** Detailed study ; **Petromyzon** **Class Pisces**: General characters and classification.	21

	Detailed study:*Scoliodon sorrakowah* **(Shark).** General Topics: 1.Affinities of Dipnoi 2. Types of scales and fins ,3.Accessory respiratory organs - Air bladder 4.Parental care in fishes 5. Migration of fishes 6.Economic importance of fishes.	
III	**Class Amphibia**: General characters and classification. Detailed study: *Rana hexatactyla* **(Frog)** General Topic:1.Origin of Amphibia 2. Adaptive features of Urodela and Apoda 3.Neoteny in Urodela 4.Parental care in Amphibia.	21
IV	**Class Reptilia**: General characters and classification. Detailed study: *Calotes versicolor***(Garden lizard).** GeneralTopics: 1.Origin of reptiles and effects of terrestrialisation. 2. Extinct reptiles. 3. Identification of poisonous and non-poisonoussnakes south India. 4.Poison apparatus and biting mechanism of poisonous snake.	21
V	**Class Aves**:General characters and classification. Detailed Study: *Columba livia***(Pigeon)**. General Topics: 1. Flight adaptations in birds 2.Migration of birds. **Class Mammalia**: General characters and classification. Detailed Study:*Oryctolagus cuniculus***(Rabbit)** General Topics: 1.Prototheria and Metatheria (salient features) 2. Dentition in Mammals. 3. Adaptations of Aquatic Mammals. 4.Adaptations of flying Mammals.	21

Text Books:

1. EkambaranathaIyyar. E.M., and Anantha Krishnan T.N. 1995. Manual of Zoology Vol.II, Part I & II. (Chordata), S. Viswanathan Pvt. Ltd., Chennai.
2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal
3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942.
4. Kotpal, R.L.2019. Modern Text Book of Zoology - Vertebrata, Rastogi and Company, Meerut, India.

References :

1. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.

2. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
3. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp.

4. Satoh, N. (2016). Chordate Origins and Evolution: The Molecular Evolutionary Road to Vertebrates. Netherlands: Elsevier Science.

5. Salazar, A. (2018). Advanced Chordate Zoology. United Kingdom: EDTECH. 4. Beer, G. R. D. (2017). Vertebrate Zoology: An Introduction to the Comparative Anatomy, Embryology, and Evolution of Chordate Animals. United States: FB&C Limited.

6. Kingsley, J. S. (2015). Text Book of Vertebrate Zoology. United States: FB&C Limited.

7. Lydekker, R. (2016). Reptiles, Amphibia, Fishes and Lower Chordata. United States: FB&C Limited.

Web resources :

1. http://tolweb.org/Chordata/2499
2. https://www.nhm.ac.uk/
3. https://www.vedantu.com/biology/mammalia
4. http://faunaofindia.nic.in/PDFVolumes/hpg/022/index.pdf
5. https://www.cdc.gov/niosh/topics/snakes/symptoms.html
6. https://www.sciencedaily.com/releases/2020/03/200312101054.htm

Pedagogy: Lecture, Assignment,PPT presentation,Quiz,Demonstration

Expected Course outcomes (CO) :

On the successful completion of this course, the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Classify, Identify and recall the name and distinct features of different subphylum belonging to phylum Chordata.	**K4**
CO2	Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates.	**K2**
CO3	Analyze, compare and distinguish the developmental stages and describe the important biological process.	**K4**
CO4	Correlate the different modes of life and parental care among different vertebrates.	**K4**
CO5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance.	**K2**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course code	Title of the course	Hours of teaching /week	No. Of Credits
II	**23U2ZOCP2**	**Practical – II CHORDATA**	**3**	**4**

Course Objectives:	
The main objectives of this course are:	
1.	To impart training on the identification of the vertebrate speciesby observing key characters.
2.	To make them understand the various systems of vertebrateanimals.
3.	To understand and compare the structure of various internal organs in different classes of vertebrates.
4.	Examine and understand the external and internal anatomy of Chordates.
5.	To understand the taxonomic position, body organization and evolutionary relationship of animals.

Virtual Dissection:

Video clippings of Digestive system , Arterial system, Venous system,

and Reproductive system of **Frog**.

Dissections:

Fish : Digestive system , Arterial system,Venous system ,

5^{th} , ,9^{th} , 10^{th} cranial nerves and Reproductive system.

Mountings: Fish : Placoid scales of Shark and ctenoid scales of fish

Brain of fish .

Frog: Hyoid apparatus and Brain (Demo).

Specimen and Slides :

1. Prochodates :Amphioxus,Amphioxus T.S. through pharynx Balanoglossus, Tornaria larvaand Ascidian ,
2. Cyclostomata : Petromyzon, Myxine, Ammocoetus larva
2. Pisces : Shark, Ray, Echeneis, Hippocampus, Exocoetus, Catla, Rohu ,Mrigal , Tilapia , channa, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid, Ctenoid
3. Amphibia :Frog, Tadpole larva, Axolotl larva, Hyla, Salamander, Ichthyophis and Bufo.
4. Reptilia :*Naja naja*, Viper, Draco, *Chemaleon ,Phrynosoma, Sphenodon,* Bungarus, Enhydrina , Crocodilus, Ptyas.
5. Aves :Pigeon,Archaeopteryx, Parrot, King fisher, owl, different types of feathers: Quill, Contour, Filoplume, Down
6. Mammalia :Echidna , Duck billed platypus, Bat, Loris, Rabbit, Tachyglossus, Pteropus

7.Osteology: **Frog:**Skull and lowerjaw -Vertebral column, -Pectoral -girdle – Pelvicgirdle Forelimb and Hindlimb.

Pigeon : skull and lower jaw, synsacrum.

Rabbit :Dentition in Rabbit.

Text Books :

1. Lal S S, 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.
2. VermaP.S,2000.AManual ofPracticalZoology:Chordates,S.ChandLimited, 627pp.

References Books

1. Robert William Hegner, 2015. Practical Zoology, BiblioLife, 522pp.
2. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press
3. Lal. S. S. (2010), Practical Zoology Vertebrate, Rastogi publications, Meerut, India.
4. Hyman, L. H. (2018). A Laboratory Manual for Comparative Vertebrate Anatomy. United States: Creative Media Partners, LLC.
5. Arumugam. N, Thangamani. A, Prasanna kumar. S, Narayanan.L.M, Jayasurya, (2019), Practical Zoology Volume 2 Chordata. Saras publications.
6. Verma, P.S. 2018. A Manual of Practical Zoology of Invertebrates, S. Chand & Company Ltd., New Delhi.

Web Resources

1. https://www.youtube.com/watch?v=b04hc_kOY10
2. https://bit.ly/3CzTEy8
3. http://tolweb.org/Chordata/2499www.prodissector.com
4. www.physioex.com

Record of Laboratory work should be maintained and submitted at the time of practical examination for valuation.

Expected Course outcomes (CO) :

On the successful completion of this course , the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Evaluate the biological significance, structure and functions of various animals.	**K5**
CO2	Identify and recognize the organisms by key characters.	**K2**
CO3	Enlighten the adaptation and unique characters of animals and their role in the development	**K2**
CO4	Apply knowledge and come to know how to handle different organisms.	**K3**
CO5	Analyze and to observe various specimens by using Microscope.	**K4**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
II	**23U2ZOBOA2**	**ALLIED BOTANY-II**	**3**	**3**

Nature of the course

EmployabilityOriented	√	Relevant to Local need	√	Addresses GenderSensitization	
EntrepreneurshipOriented		Relevant to regional need		Addresses Environmentand Sustainability	
Skill development Oriented	√	Relevant to national need	√	Addresses Human Values	√
		Relevant to Global development need	√	Addresses Professional Ethics	√

Course Objectives

The main objectives of this course are to:

1. To be familiar with the basic concepts and principles of plant systematics.
2. Learn the importance of plant anatomy in plant production systems.
3. Understand the mechanism underling the shift from vegetative to reproductive phase.
4. To learn about the physiological processes that underlie plant metabolism.
5. To know the energy production and its utilization in plants

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**MORPHOLOGY OF FLOWERING PLANTS:** Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.	**14**
II	**TAXONOMY:** Study of the range of characters and plants of economic importance in the followingfamilies: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae	**14**
III	**ANATOMY** Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocotleaves.	**14**
IV	**EMBRYOLOGY** Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonousseeds.	**14**

V	**PLANT PHYSIOLOGY** Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins andcytokinins and their applications.	**14**

TOPICS FOR SELF-STUDY

- Plant and its parts.

Textbook:

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revisedand enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. PlantMorphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

References:

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised andenlargededition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.

Web resources:

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi 0lwSXFnUC&redi r_esc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

Pedagogy: Teaching / Learning methods

Lecture, Tutorial, Assignment, PPT presentation, Quiz, Group Discussion, e-content and Seminar.

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.	**K2**
CO2	To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.	**K1**
CO3	To be familiar with the basic concepts and principles of plant systematics.	**K4**
CO4	Understanding of laws of inheritance, genetic basis of loci and alleles.	**K3**
CO5	To learn about the physiological processes that underlie plant metabolism.	**K6**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with ProgrammeOutcomes

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
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	2	3	3	3	3	1	3	3	3	3
CO 4	3	3	2	3	3	3	3	2	3	2
CO 5	3	2	2	2	2	2	2	1	2	2

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

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
I & II	**23U2ZOBOAPL**	**ALLIED BOTANY PRACTICALS (NS)**	**5**	**3**

Nature of the course

EmployabilityOriented		Relevant to Local need	√	Addresses GenderSensitization	
EntrepreneurshipOriented		Relevant to regional need		Addresses Environmentand Sustainability	
Skill development Oriented	√	Relevant to national need		Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are to:

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi.
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of plant systematics.
4. Understanding of laws of inheritance, genetic basis of loci and alleles.
5. To learn about the physiological processes that underlie plant metabolism.

SYLLABUS

EXPERIMENTS

1. Make suitable micro preparation of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. To describe in technical terms, plants belonging to any of the family prescribes and to identify thefamily.
5. To dissect a flower, construct floral diagram and write floral formula.
6. Demonstration experiments:
   i. Ganong's Light screen
   ii. Ganong's respiroscope
7. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy,Embryology, Cell biology and Biotechnology.

Textbook:

1. harma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. harma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. ubramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt.Ltd., New Delhi.

4. enjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5. oggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, NewDelhi

References:

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual toalgae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & WileyPublications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

Web resources:

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy mnosperms&printsec=frontcover
3. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ
4. https://medlineplus.gov/genetocs/understanding/basics/cell/
5. https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf
6. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
7. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To study the internal organization of algae and fungi	**K1**
CO2	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms	**K2**
CO3	To study the classical taxonomy with reference to different parameters.	**K3**
CO4	Understand the fundamental concepts of plant anatomy and embryology	**K4**
CO5	To study the effect of various physical factors on photosynthesis.	**K5**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
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	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

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

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
III	**23U3ZOT3**	**பொதுத் தமிழ் – 3**	**6**	**3**

Nature of the Course

1.Employablity Oriented வேலை வாய்ப்புச் சார்ந்தது		7. Addresses Professional Ethics தொழில் நெறிமுறைகளை நிறைவு செய்தல்	✓
2. Entrepreneurship Oriented தொழில் முனைவு சார்ந்தது		8.Relevent To Local Need உள்ளூர் தேவைகளோடு தொடர்புடையது	✓
3. Skill Development Oriented திறன்மேம்பாடு சார்ந்தது	✓	9. Relevent To Regional Need மண்டல அளவிலான தேவைகளோடு தொடர்புடையது	
4. Addresses Gender Sensitization பாலின உணர்திறன் பூர்த்தி செய்தல்		10. Relevent To National Need தேசிய அளவிலான தேவைகளோடு தொடர்புடையது	
5. Addresses Environment and Sustainablity சுற்றுச் சூழல் மற்றும் நிலைத் தன்மை நிறைவு செய்தல்		11. Relevent To Global Development Need உலக அளவிலான தேவைகளோடு தொடர்புடையது	
6. Addresses Human Values மனித மதிப்புகளை நிறைவு செய்தல்	✓		

Course Objectives

1.இலக்கியங்களின் சிறப்பினை உணர்த்துதல்.
2.காலந்தோறும் எழுந்த காப்பியங்களின் போக்கையும், புதினத்தின் இலக்கிய வடிவத்தை மாணவர்கள் உணருமாறு செய்தல்.
3.யாப்பு, அணி போன்ற இலக்கிய வகைகளையும் மொழி பெயர்ப்புத் திறனையும் மாணவர்கள் உணருமாறு செய்தல்.
4.தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்பக் கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.

Unit	Details	Hours
Unit-I	பெருங்காப்பியங்கள் *1.சிலப்பதிகாரம் - வழக்குரைகாதை-இளங்கோவடிகள்* *2.மணிமேகலை ஆதிரை பிச்சையிட்ட காதை சீத்தலைச்சாத்தனார்* *3.சீவகசிந்தாமணி - பூமகள் இலம்பகம் திருத்தக்கதேவர்* *4.வளையாபதி—நாதகுத்தனார்*	**18 Hrs**
Unit-II	சமயக் காப்பியங்கள் *1.பெரியபுராணம் - பூசலார் நாயனார்புராணம்-சேக்கிழார்* *2.கம்பராமாயணம்- மந்தரை சூழ்ச்சிப் படலம்-கம்பர்* *3.வில்லிபாரதம் - மற்போர் சருக்கம்-வில்லிப்புத்தூராழ்வார்* *4.சீறாப்புராணம் - புலி வசனித்த படலம்-உமறுப்புலவர்*	**18 Hrs**

Unit-III	புதினம் *1.*வஞ்சிமாநகரம் *(*வரலாற்றுப் புதினம்*)* -நா. பார்த்தசாரதி	**18 Hrs**
Unit-IV	*1.*பாடம் தழுவிய இலக்கிய வரலாறு *2.*குரல் கொடுக்கும் வானம்பாடி - கேட்டிவி	**18 Hrs**
Unit-V	மொழித்திறன்/போட்டித் தேர்வுத் திறன் *1.* நூல் மதிப்புரை *2.* திறனாய்வு செய்தல் *3.* கடிதம் வரைதல் *4.* விண்ணப்பம் எழுதுதல்	**18 Hrs**

CO Number	CO Statement	Cognitive Level
CO1	காப்பியங்கள் அறிமுகப்படுத்தப்படுவதால் தமிழ் மொழியின் உயர்வையும் சிறப்பையும் உணர்தல்.	**K1, K2**
CO2	தமிழ்ப் புதினங்களின்வழி சமகாலப் படைப்புகளின் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்.	**K2**
CO3	நாவல் இலக்கியம் அறிமுகப்படுத்தப்படுவதால் சிந்தனை ஆற்றல், படைப்பாற்றல், கற்பனைத்திறன் வளர்தல்.	**K4**
CO4	யாப்பு, அணி இலக்கணங்கள், மொழிபெயர்ப்புத்திறன் ஆகியவற்றைக் கற்பதன் மூலம் போட்டித் தேர்வுகளை எதிர் கொள்ளுதல்.	**K3**
CO5	காப்பியங்கள் அறிமுகப்படுத்தப்படுவதால் தமிழ் மொழியின் உயர்வையும் சிறப்பையும் உணர்தல்.	**K4**

Text Books

1. தமிழ் இலக்கிய வரலாறு -செம்பதிப்பு- பெ.சுபாஷ் சந்திரபோஸ்

பார்வை நூல்கள்

1. தமிழ் இலக்கிய வரலாறு - சிற்பி.பாலசுப்பிரமணியன்

2. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு - தமிழண்ணல்

3. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு - எஃப்.பாக்கியமேரி

Web Resources

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.)

1. Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org> Tamil virtual University Library-
2. www.tamilvu.org/ library
3. http://www.virtualvu.org/library 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- tamale books downloads. 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

பொதுத்தமிழ் —3												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	2	3	2	2
CLO3	2	2	2	3	2	3	3	2	2	2	2	3
CLO4	3	2	2	2	3	2	3	3	2	3	3	3
CLO5	2	2	2	3	2	3	2	3	3	2	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23U3ZOE3**	**PART - II GENERAL ENGLISH**	**6**	**3**

Learning Objectives		
LO1	To make students realize the importance of resilience	
LO2	To enable them to become good decision makers	
LO3	To enable them to imbibe problem-solving skills	
LO4	To enable them to usetenses appropriately	
LO5	To help the muse English effectively at the work place.	
Unit No.	**Unit Title &Text**	**No.of Periods for the Unit**
I	**ACTIVE LISTENING** **Short Story** Ina Grove–Akutagawa Ryunosuke Translated from Japanese by TakashiKojima The Gift of the Magi – O' Henry **Prose** Listening – Robin Sharma Nobel Prize Acceptance Speech –Wangari Maathai	**20**
II	**INTERPERSONAL RELATIONSHIPS** **Prose** Telephone Conversation – Wole Soyinka Of Friendship – Francis Bacon **Songon (Motivational / Narrative)** Ulysses–Alfred Lord Tennyson And Still IRise– MayaAngelou	**20**
III	**COPING WITH STRESS** **Poem** Leisure– W.H. Davies Anxiety Monster– RhonaMcFerran **Readers Theatre** The Forty Fortunes: A Tale of Iran Where there is a Will–Mahesh Dattani	**20**
IV	**Grammar** Phrasal Verb & Idioms Modals and Auxiliaries Verb Phrases–Gerund, Participle, Infinitive	**15**
V	**Composition/Writing Skills** Official Correspondence–Leave Letter, Letter of Application, Permission Letter Drafting Invitations Brochures for Programmes and Events	**15**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Listen actively	PO1,PO7
CO2	Develop interpersonal relationship skills	PO1,PO2,PO10
CO3	Acquire self-confidence to cope with stress	PO4,PO6,PO9
CO4	Master grammar skills	PO4,PO5,PO6
CO5	Carryout business communication effectively	PO3,PO8

Text Books (Latest Editions)

1	Wangari Maathai–Nobel Lecture. Nobel Prize Outreach AB 2023.Jul 2023.
2	Mahesh Dattani,Where there is W ill. Penguin, 2013.
3	Martin Hewings, Advanced English Grammar, Cambridge University Press,2000
4	EssentialEnglishGrammarbyRaymondMurphy

WebResources

1	WangariMaathai–NobelLecture.NobelPrizeOutreachAB2023.Mon.17Jul 2023. https://www.nobelprize.org/prizes/peace/2004/maathai/lecture/
2	TelephoneConversation-Wole Soyinka https://www.k-state.edu/english/westmank/spring_00/SOYINKA.html
3	AnxietyMonster- RhonaMcFerran- www.poetrysoup.com

Mapping with Programme Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3– Strong, 2– Medium, 1 -Low

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3
Weight age	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23U3ZOC3**	**CELL BIOLOGY**	**7**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

CourseObjectives

Themainobjectives ofthis courseare:

1. To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
2. To understand how these cellular components are used to generate and utilize energy in cells.
3. To understand the cellular components underlying mitotic cell division.
4. To apply the knowledge of cell biology to selected examples of changes or losses in cell function

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Tools and Techniques of Cell Biology: Cell Fractionation, Homogenization, Centrifugation, Isolation of sub cellular Components.. Histological techniques - Staining - Vital Stains. – Cytoplasmic and Nuclear Stains. Micro Technique Methods, Microscopes - Types - Light, Phase contrast, SEM, TEM - Units of measurement.	21
II	The Cell - Cell theory - Viruses -Types and Structure - Bacteria – Bacterial membrane - Ultra structure of Plant & Animal cell - Cytoplasm - Structure and Composition, Function - Extra Cytoplasmic Structure - Cilia Flagella - Cytoplasmic Inclusions.	21
III	Cell components - Plasma Membrane Ultra Structure - Different Models - Functions - Ultrastructure, Composition and Function of Endoplasmic reticulam, Ribosomes, Golgi Complex, Lysosomes, Centrioles, Microtubules Microfilaments, Mitochondria and Microsomes.	21
IV	Nucleus - Ultrastructure, Composition and Functions - Nuclear Membrane - Nucleoplasm - Chromosomes - Heterochromatin and	21

	Euchromatin –Nucleolus- DNA and RNAs - Protein Synthesis & regulation.	
V	Cell Divisions and Cell Cycle - Amitosis, Mitosis and Meiosis and their Significance - Cancer, Biology – Characteristics of cancer cells, types, theories on Carcinogenesis, Ageing of Cells – Apoptosis and Stem cell studies.	21

Textbook:

1. Ambrose, E.J. and Dorothy, M. Easty, 1970. Cell Biology, Thomas Nelson & Sons Ltd., 500 pp.
2. Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.
3. VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.
4. Verma, P.S. and V. K.Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S.Chand & co., New Delhi - 110 055, 567 pp.
5. Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.

General References:

1. Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn.,(paperback) W.W. Norton & Company p.864.
2. Burke, Jack. D., 1970. Cell Biology, Scientific Book Agency, Calcutta.
3. Challoner J. (2015) The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd., p.193.
4. Cohn, N. S., 1979, Elements of Cytology, Freeman Book Co., New Delhi – 110007, 495 pp
5. Cooper G.M. (2019) The Cell – A Molecular Approach, 8th Edn., Sinauer Associates Inc., Oxford University Press p.813.
6. DeRobertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and Molecular Biology, 8th Edition, International Edition, Info med, Hong Kong, 734pp.
7. Dowben, R., 1971. Cell Biology, Harper International Edition. Harper and Row Publisher, New York, 565 pp.
8. Giese, A.C., 1979. Cell Physiology, Saunders Co., Philadelphia, London, Toronto, 609 pp.
9. Hardin J. and Bertoni G. (2017) Becker's World of the Cell. 9th Edn (Global Edition). Pearson Education Ltd., p. 923
10. Karp G., Iwasa J. and Masall W. (2015) Karp's Cell and Molecular Biology Concepts and Experiments. 8th Edn. John Wiley and Sons. p.832.

Web resources

1. http://www.microscopemaster.com/organelles.html
2. https://bit.ly/3tXwDSB
3. https://bit.ly/3tWNpRX
4. https://bit.ly/3AuYR9M
5. https://rsscience.com/cell-organelles-and-their-functions/

Pedagogy::
Teaching / Learning methods, Assignment, PPT presentation, Seminar, Group discussio

CourseOutcomes

Students would have acquired clear knowledge on

CO Number	CO Statement	Cognitive Level
CO1	To understand and recall the basic structure, origin and development of cell organelles.	K2
CO2	To integrate and assess the biochemical, cytological and histological tools to infer cellular basis of organization.	K2 & K3
CO3	To analyze and differentiate organisms based on structure, composition and inter and intra cellular interactions.	K4& K5
CO4	To explain the role of cells and cell organelles in various biological processes.	K2
CO5	To construct and simulate the role of different cytological tools to explain the structure and complexity of cells and cell organelles.	K6

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	1	3	3	3	2	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23U3ZOCP3**	**PRACTICAL- III- CELL BIOLOGY**	**3**	**4**

Nature of the course

Employability Oriented	√	Relevant to Local need		Addresses Gender Sensitization	
Entrepreneurship Oriented		Relevant to regional need		Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need	√	Addresses Professional Ethics	

Course Objectives

The main objectives of this course are:

1. To learn how to handle microscope and observe various phases of cell division
2. To understand the differences between mitosis and meiosis cell division

Practicals:

1. Preparation and Identification of slides of Mitotic divisions with onion root tips.
2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes.
3. Identification and study of different stages of Mitosis and Meiosis.
4. Buccal epithelium (Barr body) preparation.
5. Staining and observation of polytene chromosomes in salivary glands of chironomous larva.
6. Micro technique- Fixation and Fixatives: Types of fixatives, Chemistry of fixation, Choice of Fixatives forTissue processing: Dehydration, Clearing and Embedding Microtomy:
7. Types of microtomes, Sectioning of Paraffin blocks Staining of paraffin sections: Principle and methods of staining. Histological stains: Haematoxylin and Eosin.

Spotters

Compound microscope, Electron microscope, Phases of cell division , Microtome.

Text books

1. Surya Nandan Meena, Milind Naik, 2019. Advances in Biological Science Research: A Practical Approach, Academic Press, New York, USA.
2. Michael Perlin, William Beckerson, Adarsh Gopinath, 2017. Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.
3. Saxena J., Baunthiyal M., Ravi I., 2015. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology, Scientific Publishers, India.
4. Bansal M.P., 2013. Molecular Biology and Biotechnology: basic experimental protocols,

The Energy and Resources Institute (TERI), New Delhi, India.

Reference books

1. Andreas Hofmann, Samuel Clokie, 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.
2. Bancroft, J.D. and Gamble, M (2007) Theory and Practice of Histological Techniques, 6 th Edition, Churchill Livingstone.
3. Ian Freshney R., 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, John Wiley & Sons, USA.
4. John Kiernan (2008) Histological and Histochemical Methods: Theory and Practice, 4th edition, Cold Spring Harbor Laboratory Press.
5. Kerr, J. (2013) Functional Histology, Elsevier 6. Kiernan, J.A. (2008) Histological & Histochemical methods: Theory & Practice (4th Ed). Cold Spring Harbor Laboratory Press.
6. Robert F. Schleif, Pieter C. Wensink, 2012. Practical Methods in Molecular Biology, Springer-Verlag, NY, USA.

Web Sources

1. https://www.jove.com/
2. https://vlab.amrita.edu/?sub=3&brch=77
3. http://cbii-au.vlabs.ac.in/
4. https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html
5. https://www.ibiology.org/biology-techniques/

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III	**23U3ZOCHA1**	**Allied chemistry-I (For Biologists)**	**5**	**4**

Objective of the course	Thecourseaimsatgivingan over all view of the 1. concepts of chemical bond and hybridization. 2. fuel gases, Plant nutrients and Fertilizers 3. Pesticides and polymers 4. applications of colloids and chromatographic technique. 5. study of drugs and it's application
Course Outline	**UNIT I** **Fundamental concepts** Bonding – nature of bonds – ionic, covalent, coordinate and hydrogen bonds - Cleavage of covalent bonds – homolytic and heterolytic fission – electrophiles, nucleophiles and free radicals . Types of organic reactions – substitution, addition, elimination, rearrangement – definition and examples. Hybridisation – states of hybridization of carbon in methane, ethane, ethylene, acetylene.
	UNIT II **Fuel gases, Plant nutrients and Fertilizers** Fuel gases – natural gas, water gas, semi water gas, carburetted water gas, producer gas, LPG and oil gas – composition, manufacture (elementary idea) and uses. Plant nutrients – major nutrients – role of nitrogen, phosphorus and potassium in plant life, micro nutrients. Fertilizers – definition, urea, ammonium sulphate, superphosphate of lime, triple superphosphate and potassium nitrate – preparation and uses.
	UNIT III **Industrial Organic Chemistry** Pesticides – DDT, BHC – preparation and uses. Refrigerant – freon 12 – preparation, properties and uses. Polymers – definition, classification – natural and synthetic, homo and copolymers, natural polymers – cotton, silk and wool, preparation and applications of the synthetic polymers – polythene, PVC, teflon and nylon. Synthetic dyes – classification, preparation and uses of methyl orange and indigo, food colours.
	UNIT IV **Colloidal State and Chromatography** Colloidal system – definition, types -Emulsions– definition, types – o/w and w/o emulsions – tests for identification, properties and applications. Gels – definition, classification, preparation and properties – syneresis, imbibition and thixotropy. Electrophoresis – applications. Chromatography–column and paper chromatography – experimental procedures only.

	UNIT V **Pharmaceutical chemistry** Antiseptic & disinfectants – phenolic compounds – Dettol, phenyle& Lysol – Definition – differences – medicinal uses and side effects. Anaesthetics – general anaesthetics and local anaesthetics – Definition, examples, uses and side effects. Analgesics – narcotic– morphine&pethidine, non-norcotic – salicylic acid & its derivatives –ZGH medicinal uses and side effects. Organic pharmaceutical aids – Preservatives, antioxidants, colouring, flavouring and sweetening agents – Definition, examples and uses
commendedText	1. Text Book of Ancillary Chemistry,**V.Veeraiyan** et al,revised edition, 1997. 2. Allied Chemistry, **R. Gopalan** and **S. Sundaram,** , S. Chand & Sons, 2nd edition, 1993.
ference Books	1. Text Book of Organic Chemistry**, P.L. Soni** and **H.M. Chawla**, S.Chand& Sons, , 29th edition, 2014 (Unit III). 2. Principles of Inorganic Chemsitry, **B.R. Puri,L.R. Sharma** and **K.C. Kalia** Vishal Publishing Co, Reprint 2016 (Unit I & II). 3. Principles of Physical Chemistry,**B.R.Puri, L.R. Sharma,** Vishal 4. Publishing Company, Jalandhar, 44th edition 2009. (Unit IV) 5. A text book of pharmaceutical chemistry, **JayashreeGhosh**, S.Chand and Company Ltd., New Delhi, 1st edition, 2004. (Unit V) 6. Pharmaceutical Chemistry, **S. Lakshmi**, S.Chand& Company Ltd., New Delhi, 3rd edition, 2004. (Unit V)
ebsite and earning source	**1.https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf** **2**https://lngovernmentcollege.com/chemistry-notes/ **3 https://chemistrynotes.com**

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Enable the students to understanding the concepts of bond and hybridization	**K1**
CO2	know the role of fuel gases, Plant nutrients and Fertilizers	**K2**
CO3	know the preparation of pesticides and polymers	**K3**
CO4	learn applications of colloids and chromatographic technique.	**K5**
CO5	Understanding the function of drugs and application	**K4**

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

CO-POMapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO2	**M**	**S**	**S**	**S**	**S**	**M**	**S**
CO3	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO4	**M**	**S**	**S**	**S**	**S**	**M**	**S**
CO5	**M**	**S**	**M**	**S**	**S**	**M**	**S**

S– Strong M– Medium L – Low

Level of Correlation between PSO's and CO's

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III & IV	**23U4ZOACHPL**	**Allied chemistry practical** (Non – semester)	**3+3**	**2**

Objectivesofthecourse are to	Thecourseaimsatgivinganoverallviewofthe • acquire a practical knowledge on volumetric analysis • Students learn the techniques of organic qualitative analysis.
CourseOutline	**A. Volumetric Analysis** 1. Estimation of HCl (or H_2SO_4) by NaOH using a standard oxalic acid solution 2. Estimation of NaOH by H_2SO_4 (or HCl) using a standard Na_2CO_3 solution 3. Estimation of oxalic acid by $KmnO_4$ using a standard Mohr's salt solution 4. Estimation of Ferrous sulphate by $KmnO_4$ using a standard oxalic acid solution. 5. Estimation of Mohr's salt by $KmnO_4$ using a standard oxalic acid solution. 6. Estimation of KMnO4 by thio using a standard $K_2Cr_2O_7$ solution. 7. Estimation of $K_2Cr_2O_7$ by thio using a standard $CuSO_4$ solution 8. Estimation of $CuSO_4$ by thio using a standard $K_2Cr_2O_7$ solution **B. Organic qualitative analysis** Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds. **The following substance are prescribed:** Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline ,Toludine, Urea, Benzaldehyde, Glucose
ReferenceBooks	1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Course Outcomes (for Mapping with POs and PSOs)

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

CO Number	CO Statement	Cognitive Level
CO1	acquire a practical knowledge on volumetric analysis	**K1**
CO2	gain knowledge on Dichrometry titration	**K3**
CO3	learn the techniques of organic qualitative analysis.	**K2**
CO4	Find out the functional group	**K5**
CO5	Detect the element present in a compounds	**K6**

Cognitive Level: **K1 -** Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

CO-PO Mapping(CourseArticulationMatrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	M	S	S	S	M	S	S
CO3	S	S	S	M	S	S	S
CO4	S	S	S	S	S	S	S

S– Strong M– Medium L – Low

LevelofCorrelation betweenPSO'sandCO's

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
IV	**23U4ZOT4**	**பொதுத் தமிழ் – 4**	**6**	**3**

Nature of the Course

1.Employablity Oriented *வேலை வாய்ப்புச் சார்ந்தது*		7. Addresses Professional Ethics *தொழில் நெறிமுறைகளை நிறைவு செய்தல்*	
2. Entrepreneurship Oriented *தொழில் முனைவு சார்ந்தது*		8.Relevent To Local Need *உள்ளூர் தேவைகளோடு தொடர்புடையது*	✓
3. Skill Development Oriented *திறன்மேம்பாடு சார்ந்தது*	✓	9. Relevent To Regional Need *மண்டல அளவிலான தேவைகளோடு தொடர்புடையது*	
4. Addresses Gender Sensitization *பாலின உணர்திறன் பூர்த்தி செய்தல்*		10. Relevent To National Need *தேசிய அளவிலான தேவைகளோடு தொடர்புடையது*	
5. Addresses Environment and Sustainablity *சுற்றுச் சூழல் மற்றும் நிலைத் தன்மை நிறைவு செய்தல்*	✓	11. Relevent To Global Development Need *உலக அளவிலான தேவைகளோடு தொடர்புடையது*	
6. Addresses Human Values *மனித மதிப்புகளை நிறைவு செய்தல்*	✓		

Course Objectives

1. சங்க இலக்கியத்தின் சிறப்பையும், நாடகம் என்னும் இலக்கிய வகையின் தன்மையையும் அகத்திணை, புறத்திணை இலக்கணங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
2. தமிழ் இலக்கியம் சார்ந்த போட்டித் தேர்வுகளுக்கு ஏற்பக் கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.
3.சங்க இலக்கியத்தில் காணப்பெறும் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்.
4.தமிழின் தொன்மையையும், செம்மொழித் தகுதியையும் அறிந்து கொள்ளுதல்.

Unit	Details	Hours
Unit-I	*எட்டுத்தொகை 1* *நற்றிணைஎ (10, 14, 16), குறுந்தொகை (16, 17, 19, 20, 25, 29, 38, 440* *கலித்தொகை (38, 51),அகநானூறு(15, 33, 55,) புறநானூறு (37, 86, 112,)* *பரிபாடல் —55*	**18 Hrs**
Unit-II	*எட்டுத்தொகை 2* *நெடுநல்வாடை-நக்கீரர்*	**18 Hrs**
Unit-III	*நாடகம் - சபாபதி-பம்மல் சம்பந்த முதலியார்*	**18 Hrs**
Unit-IV	*1.பாடம் தழுவிய இலக்கிய வரலாறு* *2.பயணங்கள் தொடரும் - கேட்டிவி*	**18 Hrs**

Unit-V	*1.* மொழிபெயர்ப்பு / கலைச்சொற்கள் *2.* கொடுக்கப்பட்டுள்ள ஆங்கிலப்பகுதியைத் தமிழில் மொழிபெயர்த்தல் *3.* அலுவலகத் கடிதம் - தமிழில் மொழிபெயர்த்தல்	**18 Hrs**

CO Number	CO Statement	Cognitive Level
CO1	சங்க இலக்கியத்தில் காணப்பெறும் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்.	**K1, K2**
CO2	தமிழின் தொன்மையையும், செம்மொழித் தகுதியையும் அறிந்து கொள்ளுதல்.	**K2**
CO3	நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும். கலைத்தன்மையையும், படைப்பாற்றலையும் வளர்த்தல்.	**K4**
CO4	தமிழிலிருந்து அலுவலகக் கடிதங்களை மொழிபெயர்க்கும் அறிவைப் பெறுவர்.	**K3**
CO5	மொழியறிவோடு வேலை வாய்ப்பினைப் பெறுதல்.	**K4**

Text Books

1. தமிழ் இலக்கிய வரலாறு -செம்பதிப்பு- பெ.சுபாஷ் சந்திரபோஸ்

பார்வை நூல்கள்.

2. தமிழ் இலக்கிய வரலாறு - சிற்பி.பாலசுப்பிரமணியன்.

3. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு - தமிழண்ணல்

4. வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு - எஃப்.பாக்கியமேரி

Web Resources

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.)

1. Tamil Heritage Foundation- www.tamilheritage.org <http://www.tamilheritage.org> Tamil virtual University Library-
2. www.tamilvu.org/ library
3. http://www.virtualvu.org/library 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- tamilebooks downloads. 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

பொதுத்தமிழ் —4												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	2	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	3	3	2	2	2	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	**23U4ZOE4**	**PART - II GENERAL ENGLISH**	**6**	**3**

Learning Objectives		
LO1	To make students realize the importance of resilience	
LO2	To enable them to become good decision makers	
LO3	To enable them to imbibe problem-solving skills	
LO4	To enable them to usetenses appropriately	
LO5	To help the muse English effectively at the work place.	
Unit No.	**Unit Title &Text**	**No.of Periods for the Unit**
I	**GOALSETTING(UNICEF)** **Life Story** From Chinese Cinderella–Adeline Yen Mah Why I Write- George Orwell **Short Essay** On Personal Mastery–Robin Sharma On the Love of Life – William Hazlitt	20
II	**INTEGRITY** **Short Story** The Taxi Driver – K.S. Duggal Kabuliwala -Rabindranath Tagore A Retrieved Reformation –O Henry **Extract from a play** The Quality of Mercy (Trial Scene from the Merchant of Venice - Shakespeare)	20
III	**COPING WITH EMOTIONS** **Poem** Pride – Dahlia Ravikovitch Phenomenal Woman – Maya Angelou **Reader's Theatre** The Giant's Wife A Tall Tale of Irel and–William Carleton The Princess and the God :A Tale of Ancient India	20
IV	**Language Competency Sentences** Simple Sentences Compound Sentences Complex Sentences **Direct and Indirect Speech**	15
V	**Report Writing** Narrative Report Newspaper Report **Drafting Speeches** Welcome Address Vote of Thanks	15

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Determine their goals	PO1,PO7
CO2	Identify the value of integrity.	PO1,PO2,PO10
CO3	Deal with emotions.	PO4,PO6,PO9
CO4	Frame grammatically correct sentences	PO4,PO5,PO6
CO5	Write cohesive reports.	PO3,PO8

Text Books (Latest Editions)

	ford Practice Grammar, John Eastwood, Oxford University Press
	mbridge Grammar of English, Ronald Carter and Michael McCarthy
	orge Orwell Essays, Penguin Classics

Web Resources

1	p:/www.gradesaver.com/George-orwell-essays/study/summary
2	Henry. A Retrieved Reformation. https://americanenglish.state.gov/files/ae/resource_files/a-retrieved-reformation.pdf
	aya Angelou. Phenomenal Woman. https://www.poetryfoundation.org/poems/48985/phenomenal-woman
3	eQuality ofMercy, https://poemana1ysis.com
4	ps://www'.oxfordscho1ar1yeditions.coin/disp1ay/10.1093/actrade/9780199235742.book. ctrade-9780199235742-div1-106-WilliamHazilitt

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3–Strong, 2–Medium, 1–Low

Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3
Weight age	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0

3– Strong, 2 –Medium, 1-Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	**23U4ZOC4**	**ENVIRONMENTAL BIOLOGY**	**7**	**4**

Course Objectives:	
The main objectives of this course are:	
1.	To understand the structure and functions of the ecosystem.
2.	To explain the relationship between biotic and abiotic factors in an ecosystem.
3.	To know the causes and effects of climate change and habitat loss.
4.	To bring awareness about the impact of socio-economic development on the environment and the solutions put forward by the government to reduce environmental damage.

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Ecosystem** : Concept of an ecosystem-Structure and function of an ecosystem- Producers, consumers and decomposers-Energy flow in the ecosystem-Ecological succession-Food chains, food webs and ecological pyramids-Introduction, types, characteristic features, structure and function of the following ecosystem : Forest ecosystem-Grassland ecosystem-Desert ecosystem-Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	21Hrs
II	**Population And Biological Cycles :** Structure and distribution – Growth curves - Groups, natality, Mortality -Density indices, Life study tables - factors affecting population growth -Carrying capacity. Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle.	21Hrs
III	**Environmental Stresses And Management** :Global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition. Uptake, biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and	21Hrs

	their disposal. Bio indicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.	
IV	**Environmental Pollution**: Definition- cause, effects and control measures of: -Air pollution - Water pollution -Soil pollution -Marine pollution - Noise pollution - Thermal pollution -Nuclear hazards.	21Hrs
V	**BiodiversityConservation**: Biodiversity crisis – habitat degradation, poaching of wild life. - Socio economic and political causes of loss of biodiversity. - In situ and ex situ conservation of biodiversity -Hot spots of Biodiversity. Green peace movement - Chipko Movement - Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Awareness, Programme, NGOs, Natural Disaster Management, Legislations for environmental Protection, Bio villages – sustainable utilization and development, Environmental ethics.	21Hrs

Textbook:

1. Matthew R. Fisher, 2018. Environmental Biology.Open Oregon Educational Resources. James Madison University.
2. Asthana, D.K. and Meera, A. 2009. A text book of environmental studies, S. Chand, New Delhi.
3. Sanyal, K. Kundu, M. and Rana, s. 2009. Ecology and environment, Books and allied, Kolkata.
4. Grant, W.E. and Swannack, T.M., 2008, Ecological Modelling, Blackwell.

References:

1. Odum E.P.1983. Basic Ecology, Saunders, New York
2. Wilkinson, D.M., 2007, Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.
3. Saha, T.K. 2010. Ecology and Environmental biology, Books and Allied, Kolkata.

Web resources:

1. https://bit.ly/2VYWOM5
2. https://bit.ly/2VZQFiT
3. https://bit.ly/3kqdXYA
4. https://bit.ly/39rvvgt

Pedagogy: Teaching / Learning methods

Lecture, PPT presentation, Group Discussion

(Please mention teaching / Learning methods like Lecture, Tutorial, Assignment,PPT presentation, Quiz, Group Discussion, e-content Seminar etc.)

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Understand the fundamental structure and functions of the ecosystem.	**K2**
CO2	Assess the inter-relationship between organisms and between biotic and abiotic factors in an ecosystem.	**K5**
CO3	Analyze the factors that cause pollution, climate change, loss of biodiversity and depletion of resources.	**K4**
CO4	Evaluate the impact of human population growth and socio-economic development on the structure and function of the ecosystem.	**K5**
CO5	Design plans to scientifically solve environmental problems using biological tools, technologies and government policies.	**K6**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of course outcome with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Title of the course	Hours of teaching /week	No. Of Credits
IV	**23U4ZOCIM**	**Industry Module - Environmental Biology**	**3**	**4**

Course Objectives:	
The main objectives of this course are:	
1.	To demonstrate an understanding of core ecological principles, and define scientific principles and concepts as related to environmental studies and sustainability.
2.	Tostudythephysico–chemicalparametersinecosystemandtoknowtheanimalrelationshipandpopulation.
3.	Tostudyabouttheanimalassociationandvarioustypesofpollution.
4.	Measure and interpret experimental data and demonstrate laboratory skills in ecology.

EnvironmentalBiology

1.Estimation of dissolved Oxygen in the water sample

2.Dissolved carbon-di-oxide

3.Determination of alkalinity in water samples

4.Determination of salinity of water samples

5.Determination of bicarbonate and carbonates

6. Ecological Methods:Estimation of oxygen consumption in an aquatic and a terrestrial animal.

7.Study of sandy shore fauna- Study of rocky shore fauna - Study of animal Association.

8.Collection, isolation, identification and mounting of marine and freshwater plankton.

9.pH meter for estimation of pH in water and soil samples

Text Books

1. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
2. Michael, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
3. APHA, 1992. Standard Methods for the examination of water and waste water, American Public Health association, Washington D.C.

References Books

1. Eugenia, 2008. Environmental Biotechnology and cleavers Bioprocesses, London.

2. Ramesh, R & M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.

Web Resources

1. https://www.asbmb.org/education/online-teaching/online-lab-work
2. https://open.umn.edu/opentextbooks/textbooks/687
3. https://bit.ly/3lO29yP

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

Expected Course outcomes (CO) :

On the successful completion of this course , the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Explain the theoretical principle and working mechanisms of various instruments used in environmental biology	**K1**
CO2	Make use of various instruments for their routine practical and project work	**K2**
CO3	Understand and identify the chemical composition of major and minor nutrients and	**K2**
CO4	analyse Physio - chemical parameters of different water	**K3**
CO5	Elaborate the impact of environment problems on life systems.	**K4**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	23U4ZOCHA2	Allied chemistry-II (For Biologists)	5	4

Objective of the course

The courseaimsatgivinganoverallview of the

1. about the concepts of acids, bases and catalyst
2. know about the Carbohydrates and Vitamins
3. about Amino acids, Proteins and Nucleic acids
4. study about the biochemistry
5. detail study of food and adulteration

Course Outline

UNIT I

Acids, Bases and Catalysis

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

UNIT II

Carbohydrates and Vitamins

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

UNIT III

Amino acids, Proteins and Nucleic acids

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

UNIT IV

Biochemsitry

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

	UNIT V **Food Chemistry** Food additives – sweetners, preservatives, emulsifying and stabilizing agents, flavouring agents, antioxidants and colouring agents. Food adulteration – definition and types of adulterations – adulterants in soft drinks, milk and milk products, edible oils and fats. Packaging hazards – prevention and control. Simple tests for common adulterants in coffee powder, tea leaves, cane sugar, honey, turmeric, common salt, dhals, and ice creams
commendedT ext	1. Text Book of Ancillary Chemistry,**V.Veeraiyan** et al,revised edition, 1997. 2. Allied Chemistry, **R. Gopalan** and **S. Sundaram,** , S. Chand & Sons, 2nd edition, 1993.
ference Books	1. Elements of Physical Chemistry, **B.R. Puri, L.R. Sharma, M.S. Pathania,** Vishal Publishing Co. 43rd edition, 2008-09. (Unit I) 2. TextBook of Biochemistry, **O.P. Agarwal and G.R. Agarwal,** ,Goel Publishing House, 7th edition, 1993. (Unit III & IV) 3. Chemistry for Changing Times, **John W.Hill,** St. edition, subject Publishing House, 1986 (Unit II) 4. Food Science, **B.Srilakshmi**, New Age International (P) Ltd., Publishers, 3rd edition ,2003 (Unit V). 5. Food Additives – Characteristics, Detection and Estimation, **S.N. Mahindru** Tata McGraw Hill Publishing Company Limited. (Unit V).
ebsite and earning source	**1.https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf** **2**https://lngovernmentcollege.com/chemistry-notes/ **3 https://chemistrynotes.com**

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Enable the students to understanding the concepts of acids, bases and catalyst	**K1**
CO2	know the preparation of carbohydrate and role of vitamins	**K2**
CO3	know the function of Amino acids, Proteins and Nucleic acids	**K3**
CO4	learn biological process of human body	**K5**
CO5	Evaluate the food adulteration	**K4**

Cognitive Level:K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

CO-POMapping(CourseArticulationMatrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	M	S	S	S	S	M	S
CO3	S	S	M	S	S	S	S
CO4	M	S	S	S	S	M	S
CO5	M	S	M	S	S	M	S

S– Strong M– Medium L – Low

LevelofCorrelation betweenPSO'sandCO's

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
III & IV	**23U4ZOACHPL**	**Allied chemistry practical** (Non – semester)	**3+3**	**2**

Objectives of the course are to	The courseaimsatgivinganoverallview of the • acquire a practical knowledge on volumetric analysis • Students learn the techniques of organic qualitative analysis.
Course Outline	**B. Volumetric Analysis** 1. Estimation of HCl (or H_2SO_4) by NaOH using a standard oxalic acid solution 2. Estimation of NaOH by H_2SO_4 (or HCl) using a standard Na_2CO_3 solution 3. Estimation of oxalic acid by $KmnO_4$ using a standard Mohr's salt solution 4. Estimation of Ferrous sulphate by $KmnO_4$ using a standard oxalic acid solution. 5. Estimation of Mohr's salt by $KmnO_4$ using a standard oxalic acid solution. 6. Estimation of KMnO4 by thio using a standard $K_2Cr_2O_7$ solution. 7. Estimation of $K_2Cr_2O_7$ by thio using a standard $CuSO_4$ solution 8. Estimation of $CuSO_4$ by thio using a standard $K_2Cr_2O_7$ solution **C. Organic qualitative analysis** Systematic analysis of an organic compound , Preliminary tests, detection of element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests for given organic compounds. **The following substance are prescribed:** Benzoic Acid , Cinnamic acid, Phenol , Cresol, Aniline ,Toludine, Urea, Benzaldehyde, Glucose
ReferenceBooks	1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

CourseOutcomes(forMappingwithPOs andPSOs)

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

CO Number	CO Statement	Cognitive Level
CO1	acquire a practical knowledge on volumetric analysis	**K1**
CO2	gain knowledge on Dichrometry titration	**K3**
CO3	learn the techniques of organic qualitative analysis.	**K2**
CO4	Find out the functional group	**K5**
CO5	Detect the element present in a compounds	**K6**

Cognitive Level: **K1 -** Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

CO-PO Mapping(CourseArticulationMatrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	M	S	S	S	M	S	S
CO3	S	S	S	M	S	S	S
CO4	S	S	S	S	S	S	S

S– Strong M– Medium L – Low

LevelofCorrelation betweenPSO'sandCO's

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
IV	23U4ZOSEC1	**Skill Enhancement Source -** **DIGITAL LITERACY IN ZOOLOGY**	2	2

Natureofthecourse

Relevant to Local need		Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need	√	Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

CourseObjectives

Themainobjectives ofthis courseareto

1. Introduction to basic computer knowledge and their relation to biology
2. Outline of bibliographic resources and literature databases
3. Biological databases.Molecular similarity and structural searching
4. Molecular docking related softwares and visualizing softwares
5. Zoology related softwares

SYLLABUS

Unit	Content	No. of Hours
I	**Basic Introduction to Computer** ***Information Technology:*** classification of computers: microcomputer,minicomputer, main frames, super computers, personal computers, desktop, laptop, Palmtop, tablet PC ***Hardware***:CPU, memory, input device, output device, memory Modules: RAM;ROM-different types: Flash memory, Auxiliary storage, optical device, hard disk, CD,DVD, input devices-keyboard mouse, scanner, joystick, optical readers, bar code reader, output device: display device: CRT, LCD; Printers: Dot-matrix, inkjet, plotters, sound cards & speakers. ***Software:*** Windows, linux, Microsoft office: Word, Excel, PPT and their uses; ***Internet:*** Search engine: Internet explorer, google, fire fox	8

II	**Computer Application in Zoology** ***Major Bioinformatics Resources:*** Bioinformatics and its relation with molecular biology - NCBI, EBI, ExPASy, RCSB;Biological database Tools: FASTA, BLAST, RASMOL, databases: GENBANK, Pubmed, PDB ***Open access bibliographic resources and literature databases:*** PubMed, BioMed Central, Public Library of Sciences (PLoS) ***Methods for presenting large quantities of biological data****:* sequence viewers: Artemis, SeqVISTA - 3D structure viewers: Chime, PyMol; Anatomical visualization.	8

References and Textbooks:

- Nucleic Acids Research (2014), Vol. 42, Database issue D199–D205 doi:10.1093/nar/gkt1076
- Computational Systems Bioinformatics — Methods and Biomedical Applications By Xiaobo Zhou (Harvard Medical School and Brigham & Women's Hospital, USA),
- Stephen T C Wong (Harvard Medical School and Brigham & Women's Hospital, USA).
- Bioinformatics for Systems Biology (2009) by Stephen Krawetz, Published by Humana Press
- Durbin et al (2007) Biological Sequence Analysis: Probabilistic models of protein and Nucleic acids Cambridge University Press.
- Stuart M.Brown (2013) Next-generation DNA sequencing Informatics. Cold Spring Harbor Press
- Thomas E. Creighton, Proteins: structures and molecular properties Chemoinformatics Edited by Johann Gasteiger and Thomas Engel Structural Bioinformatics, Edited Philip E. Bourne and Helge Weissig

Web Link:

- https://canvas.harvard.edu/courses/8084/assignments/syllabus (Hardvarduniversity)
- http://scse.ntu.edu.sg/Programmes/CurrentStudents/Graduate/Pages/msc-bioinformatics-desc.aspx#BI6106 (NUS)
- https://www.uu.se/en/admissions/master/selma/kursplan/?kpid=39542&type=1 (Uppsala University Sweden

Pedagogy: Teaching / Learning methods

Lecture, PPT presentation, Group Discussion

Semester	Course code	Title of the course	Hours of teaching / week	No. of Credits
V	23U5ZOC5	EVOLUTIONARY BIOLOGY	5	4

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives

- Evolutionary biology is a branch of the biological sciences concerned with the origin of life and the diversification and adaptation of life forms over time.
- This course helps to understand the important processes, principles, and concepts on evolution.
- To provide adequate information on the Lamarckism - Neo Lamarckism – Darwinism, Neutral Theory of Molecular Evolution, and Human Genome Project.
- To explain the importance of the fossil records in evolutionary studies, and the role of phylogenetic studies in the wider context of biodiversity and conservation.
- In this course, we will apply the knowledge of human evolutionary history to simulate how genetic variation within and among human populations affects risk, diagnosis, and treatment of modern diseases.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Evidences of Evolution** 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.	**15 hrs**
II	**Theories of OrganicEvolution** Lamarckism - Neo Lamarckism - Darwinism - Neo Darwinism and modern synthetic theory - DeVrie's Mutation theory – modern concepts of mutation - Mutation and their role in evolution - Animal colouration and Mimicry.	**15 hrs**

III	**Adaptation & Isolation** 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.	**15 hrs**
IV	**Animal Distribution and fossilization** 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 man and fossil records of horse.	**15 hrs**
V	**Genetics and Society** Natural selection in action in man- level of selection- Eugenics, Euphenics and Euthenics- Adaptation- Human Genome Project – Evolution and ethics.	**15 hrs**

Text Books

1. Ridley, M., 2004. Evolution. III Edition. Blackwell Publishing.
2. Rastogi, V.B., "Organic Evolution (Evolutionary Biology)", Eighth Edition, Medtech Publication, New Delhi, 2018.
3. Lull, R.S. 2010. Organic evolution, The Macmillan, New York.
4. Natarajan, P. and Arumugam, N., "Animal Behaviour", First Edition, SarasPublication, Nagercoil, Tamilnadu, 2018.
5. Hall, B.K. and Hallgrimsson, B., "Strickberger's Evolution", First Edition, Jones &Barlette India Pvt. Ltd, New Delhi, 2014.
6. Verma, P.S., and V.K. Agarwal, "Cell Biology, Genetics, Molecular Biology, Evolution and Ecology", First Edition, S. Chand &Co.Pvt. Ltd., Chennai, 2014.
7. Colbert, E.H. Morales, M. and Minkoff, E.C. 2011. Colbert's Evolution of The Vertebrates: A History of the Backboned Animals Through Time, Wiley, India.
8. Arora, R., "Elements of Organic Evolution", First Edition, Anmol Publications, Pvt. Ltd., New Delhi, 2004.
9. Khanna,D.R., "Human Evolution", First Edition, Discovery Publishing House, New Delhi, 2004.

Reference Books

1. Verma PS, & Agarwal VK *Cell Biology, Genetics, Evolution and Ecology*, S Chand Publishers, New Delhi.
2. Gupta PK, Cytology, Genetics & Evolution, Rastogi Publications, Meerut.
3. Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH, *Evolution*. Cold Spring, Harbour Laboratory Press.
4. Hall BK &Hallgrimsson B, *Evolution*, Jones and Bartlett Publishers.
5. Dobzhansky, Th. Genetic and Origin of Species. Columbia University Press.
6. Futuyama, D.J. Evolution Biology, Suinuaer Associates, INC Publishers, Dunderland.
7. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates. Inc, Massachusetts.
8. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
9. King, M. Species Evolution –The role of chromosomal change. The Cambridge University Press, Cambridge.

Web resources

- www.fruitfly.org
- https://www.uc.edu/content/dam/refresh/cont-ed-62/olli/s21/3-presentation.pdf
- http://study.com/academy/lesson/the-four-forces-of-evolution.html
- http://sysbio.oxfordjournals.org/content/6/4/187.extract

Pedagogy: Teaching / Learning methods
(Please mention teaching / Learning methods like **Lecture**, Tutorial, Assignment,**PPT presentation**, Quiz, Group Discussion, **e-content Seminar** etc.)

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To understand the Primordial earth and theories on origin of life	**K1 & K2**
CO2	To integrate and assess Lamarckism - Neo Lamarckism – Darwinism	**K1, K2 & K3**
CO3	To analyse various fossil records of man and fossil records of horse, various types of rocks - Geological time scale.	**K2, K3 &K4**
CO4	To explain the Nature of fossils- Dating of fossils, evidences of evolution, Adaptive radiation in reptiles and mammals.	**K2, K4 & K5**
CO5	To construct and compile the role of Human Genome Project, Evolution in the diagnosis, and treatment of diseases.	**K5 & K6**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	0	1	1	1	1	1
CO2	2	3	1	1	1	1	1
CO3	1	1	1	3	1	3	1
CO4	1	1	1	3	3	2	1
CO5	1	1	3	1	1	1	3

3 - Strongly Correlated; 2 - Moderately Correlated;
1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
V	**23U5ZOC6**	**DEVELOPMENTAL BIOLOGY**	**5**	**4**

Nature of the course

Employability Oriented	√		Relevant to Local need	
Entrepreneurship Oriented			Relevant to regional need	
Skill development Oriented	√		Relevant to national need	
Addresses Gender Sensitization			Relevant to Global development need	√
Addresses Environment and Sustainability			Addresses Professional Ethics	
Addresses Human Values	√			

Course Objectives:	
The main objectives of this course are:	
1.	To make aware of the students about the theories, concepts and basics of Developmental Biology.
2.	To provide students the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
3.	To make an awareness of the induction, organizers and development of extra embryonic structures.
4.	To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing
5.	To give an idea about teratogenesis, invitro fertilization, stem cells and amniocentesis to the students

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Gametogenesis & Fertilization** Scope of Embryology - Basic concepts of developmental biology - Epigenesis theory ,Germplasam theory-Gametogenesis - Spermatogenesis , Structure and types of spermatozoa - Oogenesis , vitellogenesis Types of vertebrate Eggs - Egg membranes -Fertilization- Physico-chemical changes during fertilization, Theoriesof fertilization-Parthenogenesis.	**15 hrs**
II	**Blastulation& Gastrulation** Cleavage - Planes and Patterns -Factors affecting cleavage - Blastulation : types of blastula - Blastulation in Amphioxus and Frog. Gastrulation : Morphogenetic	**15 hrs**

	movements - Gastrulation in Amphioxus , Frog and Chick - Fate maps.	
III	**Organogenesis** Development of Brain, Eye and Heart in frog. Foetal membranes in chick - Development of Pro, Meso and Metanephric kidneys - Placentation in Mammals.Metamorphosis in Amphibians.	**15 hrs**
IV	**Applied Embryology** Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis –Regeneration - Types and morphological events in regeneration - factors affecting regeneration. Embryonic stem cells and its significance. Methods of embryoculture.	**15 hrs**
V	**Human embryology** Reproductive organs, Oestrous cycle ,Menstrual cycle and menopause - Pregnancy – Erythroblastosis foetalis -Twins and its types. Infertility and its causes - Test tube baby – Methods of Birth control - Amniocentesis - Cryopreservation-Embryo transfer .	**15 hrs**

Text Books:

1. Verma, P.S. And Agarwal V.K. 2018. Chordate Embryology (Developmental Biology) S. Chand&Company Ltd., New Delhi.
2. Subramoniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.
3. Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India

References :

1. Gilbert SF (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.
3. Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.
4. Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.
5. Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA
6. Berry.A.K.2007. An Introduction to Embryology, Emkay Publications, New Delhi-51
7. Rastogi, V.B and Jayaraj, M.S. 2015. Developmental Biology Kedar Nath Ram Nath, Meerut.
8. Twymann, R.M. 2003. Developmental Biology. Viva Books Private Ltd., New Delhi.

Web resources :

https://www.ncbi.nlm.nih.gov/books/NBK10052/
https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html
https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/
https://www.sciencedaily.com/releases/2020/03/200312101054

Pedagogy: Lecture, Assignment,PPT presentation,Demonstration and group discussion.

Expected Course outcomes (CO) :

On the successful completion of this course, the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	To describe and illustrate the significance of cellular processes in embryonic development.	**K2**
CO2	To relate the factors that contribute to the developmental process, construct fate maps and illustrate the steps in morphogenesis and organogenesis.	**K3**
CO3	To correlate the involvement of specific cell types in the formation of specific organs and explain the importance of morphogens.	**K2**
CO4	To distinguish between the different types of developmental mechanisms in various organisms and appraise the species-based differences in development.	**K4**
CO5	To justify and validate the role of environment and genetics in influencing embryonic development	**K5**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	CourseCode	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	23U5ZOC7	IMMUNOLOGY	5	4

Nature of the course

Relevant to Local need		Employability Oriented	√	Addresses Professional Ethics	√
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:

To provide students with a basic understanding of:

1. To understand the fundamentals of immunology in protection against disease and also the key principles of antigen- antibody reaction in the immune system.
2. To list basic mechanisms that regulate immune responses, describe the main steps in the generation of cells and organs of the immune system.
3. To describe the basic mechanisms that provide innate immunity and antigen processing and presentation.
4. To differentiate B and T cell receptors, organs, and microenvironments of the Immune System.
5. To promote critical thinking and provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics and cell biology.

SYLLABUS

Unit	Content	No. of Hours
I	**Introduction Immune Cells and Organs**: Overview of Immune System - General concepts and Haematopoeisis. Cells of the immune system - T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophils -Mast cells and dendritic cells. Organs of the Immune system: Primary lymphoid organs - Thymus and bone marrow; Secondary Lymphoid organs - Lymph nodes and spleen; Lymphatic tissues - Peyer's patches and Kupffer cells, MALT, GALT and CALT.	15Hrs
II	**Innate and Adaptive Immunity:** Innate and Adaptive Immunity; Anatomical barriers, Inflammatory response, Cells and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral). Receptors and Signaling: Cytokines and Chemokines - General Properties of Cytokines and Chemokines. Major Histocompatibility Complex (MHC): Organization and inheritance of the MHC. Structure and cellular	15Hrs

	distributionof HLA antigens.	
III	**Antigen and Antibodies**: Antigens- Antigenicity and immunogenicity: Properties -foreignness, molecular size, heterogeneity. B & T epitopes, T-dependent and T- independent B cell responses. Antibodies: Structure, function and properties of the Immunoglobulins, Different classes of Immunoglobulins; antigenic determinants on antibodies (isotype, allotype and idiotype). Hybridoma technology - production of monoclonal antibodies and catalytic antibodies (abzymes).	**15Hrs**
IV	**Hypersensitivity and Autoimmune Diseases**: Hypersensitivity: classification and brief description of various types of hypersensitivities. Autoimmunity: cause of autoimmune diseases - classification of autoimmune diseases. Transplantation immunology: Types of grafts, immunologic basis of graft rejection, immunosuppressive therapy and clinical transplantation.	**15Hrs**
V	**Clinical Immunology:** Immunity and tumors- tumor antigens (TSTA and TAA), immune response to tumors. Tumor evasion of the immune system, Immunotherapy for tumors. Immunity against - viral, bacterial and parasitic infections. Vaccines: Types and uses - Immunization schedule for children.	**15Hrs**

Text Books

(Latest Editions)

1.Kuby, J, Punt, J, Stranford, S, Jones,Pand Owen, J, 2018. Immunology, 8th Edition, W.H.Freeman Publishing, New York, 944 pp.
2.Roitt, M, Peter J. Delves, Seamus J. Martin and Dennis R. Burton, 2017. Essential Immunology, 13th Edition, Wiley-Blackwell Publishing,USA, 576 pp.
3.Coleman,R.M., 2014. Fundamental Immunology, 2nd Edition, Published by McGraw Hill Education India, 357 pp.
4.Raj Khanna, 2011. Immunology, Oxford University press, New Delhi.428 pp.
5.Rao.C.V. 2011. Immunology, Narosa Publishing House, New Dehli, 426 pp.

References Books

(Latest editions, and the style as given below must be strictly adhered to)

1. Abul A. Andrew, Lichtman. H, Shiv. P, 2014. Cellular and Molecular Immunology, 8th Edition, Published by W.B. Saunders, 544 PP.
2. Chapel. H, Haeney. M, Misbah. S, and Snowden. N, 2006. Essentials of Clinical Immunology, 5th Edition. Blackwell Publishing, 368 PP.
3. William R. Clark, 1985. The Experimental Foundations of Modern Immunology, Published by Johns Hopkins University Press, New York. 326 PP.
4. Kenneth Murphy & Casey Weaver, 2016. Janeway's Immunology, Garland Science publishers, 924 pp.

Web Resources:

1.https://www.aaaai.org/
2.https://www.bsaci.org/
3.https://www.immunology.org/
4.https://nptel.ac.in/courses/102/103/102103038/

5.https://microbenotes.com/category/immunology/

Pedagogy: Lecture, Assignment,PPT presentation, Group Discussion

Course outcome (CO):

CO Number	CO Statement	Cognitive Level
CO1	Understand the roles of immunoglobulins and immune cells in immunological response.	**K1, K3**
CO2	Know the charateristics of antigen-antibody interactions.	**K2,K3**
CO3	Realize the T and B cell interactions	**K2**
CO4	Explain the adverse effect of immune system against autoimmune disease	**K2, K4**
CO5	Understand the roles of immunsystem in protection against tumor and stages of transplantation.	**K2,K4**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated;
1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
V	23U5ZOEL1A	Major Elective I- BIOTECHNOLOGY	4	3

Nature of the course

Relevant to Local need	√	Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need	√	Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need	√	Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

CourseObjectives

Themainobjectives ofthis coursearеto:

1. To impart the skills required to explain the protocols for genetically manipulating cells and produce transgenic animals.
2. To encourage the use of the apt molecular techniques to evaluate and analyze animal traits and diseases at the genomic level and employ methods for easy taxonomical identification and classification for biodiversity and environmental studies.
3. To study methods of transgenesis and to consider their use in improving animal husbandry and animal health.
4. To motivate students to review the ethics and speculate on the environmental implications of animal biotechnological methods.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Fundamentals of Biotechnology**: Animal cell culture: Basic requirements and techniques of cell culture, natural and synthetic culture media, primary culture and cell lines; Stem cells: types, culture and applications; r-DNA technology: Enzymes; Vectors – pBR322, Phage lambda, Cosmid, HAC, BAC, YAC; Host cells; Gene cloning: steps in cloning, selection of clones – chromogenic substrate, antibiotics.	12
II	**Techniques in Animal Biotechnology**: Isolation and purification: DNA and mRNA; Blotting techniques: Methods of different types of blotting; DNA sequencing: Sanger method, DNA chips, microarray; PCR: principle, types and application; Gene library: screening with probes; Site directed mutagenesis: principle and application; Gene transfer in animal	12

	cells: transfection, liposomal, viral mediated, electroporation, biolistic, direct DNA injection.	
III	**Transgenic Animal Technology**: Transgenesis: Concept, transgenes, transgenic animal models - knock out mice, sheep; Applications of transgenesis : Molecular farming, Transgenic fishes, transgenic live stocks, and animals as bioreactors.	12
IV	**Animal Biotech and Health Care**: Medical biotechnology: Monoclonal antibodies, recombinant vaccines –hepatitis B, hormones – insulin. DNA diagnostic systems: tuberculosis, AIDS, genetic diseases; Gene therapy: Ex vivo and in vivo, role in cancer treatment; CRISPR gene editing. Molecular markers: RFLP, RAPD, DNA fingerprinting and application.	12
V	**Applications and Ethics**: Human genome project: Mapping of human genome, applications, ethics; Industrial biotechnology: Bioreactors - Basic concepts of fermentation, bioreactor design, production of ethanol and streptomycin; Ethics: Socio ethical problem, recent trends in animal biotechnology, ethical implications.	12

Textbook:

1. Singh B. D., 2015. Biotechnology: Expanding horizon, Kalyani publishers.
2. Sasidhara, R., 2015. Animal biotechnology, MJP publishers.
3. Dubey R. C., 2014. A text Book of Biotechnology, S. Chand & Co Ltd, Ram Nagar, New Delhi.
4. Dubey R.C., 2014. Advanced Biotechnology, S. Chand Publication.
5. Sathyanarayran U., 2008. Biotechnology, Books and Allied, Kolkata.

References:

1. Veer BalaRastogi, 2016. Principles of Molecular biology, Medtech, Maine, USA.
2. Michael Crichton, 2014. Essentials of Biotechnology, Medtech, Maine, USA.
3. Godbey W.T., 2014. An Introduction to Biotechnology, Academic press, New York, USA.
4. Peters, P., 2009. Biotechnology – A guide to genetic engineering, WMC brown publisher, UK.
5. Primrose S.B., R. M. Twyman and R. W. Old, 2001. Principles of gene manipulation, Wiley- Blackwell, UK.
6. Hames B.D. and Higgins S.J. 1995. Gene Probes: A Practical Approach, Oxford University Press, UK.

Web resources:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/
2. https://www.isaaa.org/resources/publications/pocketk/40/default.asp
3. https://www.ncbi.nlm.nih.gov/books/NBK207574/
4. https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf

Pedagogy: Teaching / Learning methods

Lecture, PPT presentation, Group Discussion

(Please mention teaching / Learning methods like Lecture, Tutorial, Assignment,PPT presentation, Quiz, Group Discussion, e-content Seminar etc.)

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To impart the skills required to explain the protocols for genetically manipulating cells and produce transgenic animals.	**K2**
CO2	To encourage the use of the apt molecular techniques to evaluate and analyze animal traits and diseases at the genomic level and employ methods for easy taxonomical identification and classification for biodiversity and environmental studies.	**K3**
CO3	To study methods of transgenesis and to consider their use in improving animal husbandry and animal health.	**K4**
CO4	To motivate students to review the ethics and speculate on the environmental implications of animal biotechnological methods	**K5**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of course outcome with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	CourseCode	Title of the Paper	Hours of Teaching /Week	No. of Credits
V	23U5ZOEL1B	Major Elective – I NANOTECHNOLOGY	4	3

Objectives:

1. To know the human physiology and modern trends in Nanobiotechnology.
2. To understand the antibody based diagnostic techniques.
3. To learn the improved diagnostic products and techniques.
4. To know the new generations of prosthetic and medical implants.
5. To learn about the nanoparticles and targedted drug delivery.

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

SYLLABUS

Unit	Content	No. of Hours
I	Human anatomy – Form function and physiology – Developmental prolog – Principle of development –Neurophysiology – sensory physiology and muscle physiology – Trends in nanobiotechnology – Protein and peptide based compounds for cancer, diabetes, infectious diseases and organ transplant – therapeutic classes – focused pharmaceutical delivery systems.	12
II	Understanding of antibody based diagnostic techniques (Immunoassay) – micro and nano immunosensors – Bio-Barcode Assay – use o f magnets, gold, DNA and antibodies – therapies and diagnostics for cancer and central nervous system isorders	12
III	Improved diagnostic products and techniques – in vivo imaging capabilities by enabling the detection of tumors, plaque, genetic defects and other disease states – ability to control or manipulate on the atomic scale – Nanobot medical devices – logic and intelligence embedded into medical devices – standalone sensing and computing devices.	12
IV	New generations of prosthetic and medical implants – artificial organs and implants – artificial scaffolds o r biosynthetic coatings – biocompatibility and reduced rejection ratio-retinal, cochlear and neural implants – repair of damaged nerve cells and replacements of damaged skin, tissue, or bone.	12

V	Animation of the PCR-DNA Profiling – Cantilever Sensors – Targeted Drug Delivery – Magnetic Nanoparticles – Cancer cell targeting – Stem Cell Scaffolds – Electrochemical Impedance Spectroscopy (EIS) – tethered Lipid Membranes.	**12**

REFERENCES:

1. Brian R.Eggins, "Chemical Sensors and Biosensors", John Wiley & Sons, 2002.
2. Ed.L.Gorton "Biosensors and Modern Biospecific Analytical Techniques", &Ed.D.Barcelo, "Comphrehensive Analytical Chemistry", Wilson & Wilson's, 2005.
3. Ed.David Wild, "The Immunoassay Handbook", Elsevier, 2005.
4. Allen J Bard and Larry R Faulkner, "Electrohcemical Methods, student solutioins Manual: Fundamentals and Applications", Wiley, 2002.
5. Ed.VladimirM.Mirsky, " Ultrathin Electrochemical Chemo and Biosensors: Technology and Performance" Springer, 2004.

Web Link:

1. https://canvas.harvard.edu/courses/63206/assignments/syllabus (Harvard University)

Pedagogy: Teaching / Learning methods, **Lecture, PPT presentation, Group Discussion** (Please mention teaching / Learning methods like Lecture, Tutorial, Assignment,PPT presentation, Quiz, Group Discussion, e-content Seminar etc.)

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	- gain the knowledge on Human anatomy	**K2**
CO2	- understand the antibody based diagnostic techniques	**K3**
CO3	- skills in diagnostic techniques	**K4**
CO4	- realize the prosthetic and medical implants	**K5**
CO5	- aware on Targeted Drug Delivery	**K6**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes

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

*S - Strong; M - Medium; L – Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No.of Credits
V	23U5ZOEL2A	MAJOR ELECTIVE – II ECONOMIC ZOOLOGY	4	3

Nature of the Course

Relevant to Local need	√	Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need	√	Entrepreneurship Oriented	√	Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	√
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:	
The main objectives of this course are:	
1.	To understand the culturing techniques and production methods of different farm animals.
2.	To know the life history of animals and disease control methods used in farming.
3.	To understand the concept of breeding, cross breeding and the importance of high yield varieties.
4.	To know about the marketing strategies.
5.	To satisfy the learners with modern techniques of animal culture

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Economic Entomology** : Apiculture: Species of honey bees – Social organisation of honey bee – selection of bees and location for apiary – Newton's bee hive – products of bee keeping – enemies and diseases of honey bees. Sericulture: Species of silkworm – life history of mulberry silkworm – Rearing of silkworm – pests and diseases of silkworm.Lac Culture: Introduction – Life history – Host plants – cultivation of Lac – Enemies of lac cultivation – Economic importance of Lac	**12 Hrs**
II	**Vermiculture :** Introduction: Types of earthworms – ecological classifications of earthworms – Physical, chemical and biological changes caused by earthworms in the soil – Natural enemies of earthworms. Vermicomposting: vermicomposting methods – factors affecting vermicomposting –Vemiculture unit. Harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.	**12 Hrs**
III	**Aquaculture :** Fresh water aquaculture: Carp culture – types of ponds –	**12 Hrs**

	preparation – maintenance – harvesting and management. Integrated and composite culture. Prawn culture. Marine Aquaculture: Edible – pearl oyster culture. Ornamental fish culture: Aquarium fishes – Aquarium maintenance in home.	
IV	**Poultry Farming :** Poultry industry in India – Poultry for sustainable food production and livelihood - Commercial poultry farming – Nutritive value of egg and meat - Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) – Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat). Women in backyard poultry farming.	**12 Hrs**
V	**Dairy Farming :**Dairy farming – advantages of dairying – classification of breeds of cattle – Indigenous and exotic breeds – Selection of dairy cattle. Breeding – artificial insemination – Dairy cattle management – housing – water supply – cattle nutrition feeding standards – Common contagious diseases. Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition – Dairying as a source of additional income and employment.	**12 Hrs**

Text Books:

1. Shukla,G.S. and Upadhyay,V.B.(2016). *Economic Zoology.* Jaipur: Rastogi Publications.
2. Arumugam, N., Murugan, T., Johnson Rajeshwar, J. and N.C. Nair (2015) *Economic Zoology.* Nagercoil: Saras Publications.
3. H.C. Nigam (2014) Emerging Trends in Biology and Economic Zoology, Vishal publication Co. Jalandhar, New Delhi.
4. ICAR, 2013. Hand book of Animal Husbandry, 4th Ed., ICAR Publication, Pusa, New Delhi.

References :

1. Johnson,J.and Jeya Chandra,I. (2005). *Apiculture.* Marthandam: OlympicGrafix.
2. Tharadevi,C.S., Jayashree,K.V. and Arumugam,N. (2014). *BeeKeeeping.* Nagercoil: Saras Publications.
3. Johnson,M. and Kesary,M. (2015). *Sericulture* (5thed.). Marthandam: CSIPress.
4. Ganga,G. and Sulochana Chetty (1997). *An Introduction to Sericulture.* Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
5. Gnanamani, M.R. (2005). *Profitable Poultry Farming*. Madurai: J. Hitone Publications.
6. John Moran (2005). *Tropical Dairy Farming.* Australia: Land links Press.
7. Uma Shankar Singh (2008). *DairyFarming.* New Delhi: Anmol Publishers.
8. Arumugam,N., Murugan,T., Johnson Rajeshwar,J. and Ram Prabhu,R. (2011). *Applied Zoology.* Nagercoil : SarasPublications.
10. Jadhav, N.V. and Siddiqui, M.F. 2007. *Handbook of Poultry Production andManagement,* 2ndEdn, New Delhi.
11. Ahsan, J. and Sinha, S.P. 2009. A Handbook on Economic Zoology. S. Chand & Company Ltd., New Delhi.

12. Tomar, B.S. and Singh, N. 2011. Economic Zoology. Emkay Publications. New Delhi.

Web resources :

1. https://www.studocu.com/in/document/kerala-agricultural-university/agricultural-heritage/apiculture/34006052
2. https://www.studocu.com/in/document/sant-gadge-baba-amravati-university/zoology/sericulture-complete-lecture-notes-1-3/21243222
3. https://www.davuniversity.org/images/files/study-material/SERICULTURE%20PDF.pdf
4. https://www.mrveterinarycollege.edu.in/downloads/files/n5e327ec526cc5.pdf
5. https://www.studocu.com/in/document/mahatma-gandhi-university/general-microbiology/vermiculture-lecture-notes-for-open-course/34593394

Pedagogy: Lecture, Assignment, PPT presentation, Quiz, Demonstration

Expected Course outcomes (CO) :

On the successful completion of this course, the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic aspects of farming.	**K1 & K2**
CO2	Assess and integrate the available tools and techniques to increase the productivity in farms.	**K5**
CO3	Analyse the pros and cons of different methods of farming and marketing strategies of products.	**K4**
CO4	Evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc.	**K5**
CO5	Design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.	**K6**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

S - Strong; M - Medium; L – Low

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
V	23U5ZOEL2B	Major Elective II ANIMAL BEHAVIOUR	4	3

Nature of the course

Relevant to Local need	√	Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need	√	Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need	√	Skill development Oriented		Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

CourseObjectives

Themainobjectives ofthis courseareto:

1. To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours.
2. To understand the biological properties of animal behavior, with an evolutionary and ecological emphasis.
3. To Compare innate and learned behavior and differentiate between various mating system.
4. To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behavior and social systems; and animal personality.
5. To discuss how movement and migration behaviors are a result of natural selection.

SYLLABUS

Unit	Content	No. of Hours
I	**Genetics and Behaviour** : Genetic material, Genes and chromosomes, Genetic variation, Single and Polygenic inheritance of behaviour, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness, Evolution of adaptive strategies.	15
II	**Evolution and Social Behaviour :**Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour, Sensory processes and perception, Visual adaptations to unfavourable environments.	15
III	**Animal and the Environment:** Coordination and Orientation, Homeostasis and Behaviour, Physiology and Behaviour in changing	15

	environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning.	
IV	**Understanding Complex Behaviour :**Instinct and learning, Displacement activities, Ritualization and Communication, Decision making behaviour in Animals, Complex behaviour of hobey bees, Evolutionary optimality, Mechanism of Decision making. The mentality of Animals : Languages and mental representation, non-verbal communication in human, mental images,Intelligence, tool use and culture, Animal awareness and Emotion.	15
V	**Chronobiology** : Organization of circadian system in multicellularanimals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to Drosophila; Photoreception and photo- transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.	15

Textbook:

1. David McFarland, 1985.Animal Behaviour, Longman Scientific & Technical, UK.576pp.
2. HarjindraSingh,1990.ATextBookofAnimalBehaviour,AnomolPublication,293pp.
3. HoshangS.GundeviaandHareGovingSingh,1996.AnimalBehaviour,S.Chand&Co, 280pp.
4. Shukla, J. P 2010, Fundamentals of Animal Behaviour, Atlantic, 587pp.
5. Vinod Kumar, 2002. BiologicalRhythms. NarosaPublishingHouse, Delhi.

References:

1. Michael D. Breed and Janice Moore, 2012. Animal Behaviour, Academic Press, USA, 359pp.
2. Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to Animal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp.
3. Davis E.Davis, 1970. Integral Animal Behaviour, Mac Millan Company,London, 118pp.
4. Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.

Web resources:

1. https://www.ncbs.res.in/content/animal-behaviour
2. https://bit.ly/3i6wUxR
3. https://www.behaviour.univie.ac.at/
4. https://www.ru.nl/bsi/

Pedagogy: Teaching / Learning methods

Lecture, PPT presentation, Group Discussion

(Please mention teaching / Learning methods like Lecture, Tutorial, Assignment,PPT presentation, Quiz, Group Discussion, e-content Seminar etc.)

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Recall and record genetic basis and evolutionary history of behaviour.	**K2**
CO2	Classify movement and migration behaviors and explain environmental influence upon behaviour.	**K3**
CO3	Analyze and identify innate, learned and cognitive behavior and differentiate between various mating systems.	**K4**
CO4	Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction.	**K5**
CO5	Discuss the rhythmicity of behavioural expressions and the scientific concepts in behavior and behavioral ecology.	**K4**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of course outcome with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	23U5ZONME	Non-MajorElective AQUACULTURE	2	2

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives

1. To studythe waterqualitymanagement
2. TostudythecultureTechniquesofImportantFreshwaterfishes.
3. Tostudythe cultureTechniques ofOrnamental fish culture
4. To studythe disease management duringaquaculture.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Aquaculture:** Scope and Economic importance ofAquaculture – Different types of aquaculture systems - Ponddesign and construction - Water quality management - Culture practices of Fin Fish (*Catlacatla*) & Shell fish (Shrimp). By-products of fishes – Fish Marketing – Aquaculture AuthorityandNational Fisheries Development Board.	**Hrs 6**
II	**Ornamental fish culture:** Ornamentalfishes (Guppy, Moly, Goldfish, Angel Zebradanio), Advantages and benefits of ornamental fish keeping – Types of Aquarium – Aquarium maintenance – feedings – breeding and marketing of fresh water ornamental fishes. Disease management: Diseases (FinRot, Dropsy, Swim Bladderdisorder, Bodyflukes) & theircontrol measures.	**Hrs 6**

Textbook

1. Marx, K.K., Uma, A.,Muthu Abishag, M., 2022. Textbook on Aquaculture, Narendra Publishing House, Delhi – 85.
2. N.Arumugam, 2018. Aquaculture and Fisheries, Saras Publication, Nagercoil.
3. Jayashree, K.V., Thara Devi, C.S., Arumugam, N., 2020. Home aquarium and Ornamental fish culture, Saras Publication, Nagercoil.

Reference:

1. Dholakia A. D. Daya. (2009). Ornamental Fish Culture and Aquarium Management Publishing House. 24
2. Archana and Sinha (2021). Breeding and Culture of Freshwater Ornamental Fish New India Publishing Agency.
3. Mercy, S., Anna, T. V. and Swain S. Felix. (2013). Ornamental Aquaculture: Technology and Trade in India. Daya Publishing House.
4. Oladottir, A. D., Einarsson, A. (2020). Fisheries and Aquaculture: The Food Security of the Future. United Kingdom: Elsevier Science.
5. Srinivasan, M. (2013). A Complete Manual on Ornamental Fish Culture. Germany: Lap Lambert Academic Publishing Company.
6. T.V.R.Pillay(1994)Aquaculture–Principles,Practices,FishingNewsBook, Blackwell–London.
7. V.C.JhingronandGopalakrishanaRajmPandchosh,methodlogyforsurveyofbrackishwaterareainIndia,forcoastal–aquacultureindopacibicfishcouncil,14th session.
8. C.M.C.R.I,CoastalAquaculture–MarinePrawnCulture.
9. Jhingran,V.G(1998),FishandFisheriesofIndianHindustanPublishingcorporation,NewDelhi.
10. Stickney,R.R.PrinciplesofWarmwaterAquaculture.

E- Resources:

1. **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf**
2. **https://www.agrifs.ir/sites/default/files/AQUACULTURE.pdf**
3. **https://www.slideshare.net/pnkramesh/ornamental-fish-culture-229423500**
4. **https://www.studocu.com/in/document/mahatma-gandhi-university/aquaculture/ornamental-fish-culture-s1-2021/31441191**
5. **http://ecoursesonline.iasri.res.in/mod/page/view.php?id=47878**

Course Outcomes

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

CO Number	CO Statement	Cognitive Level
CO1	Understand the importance of Aquaculture and Ornamental fish culture.	**K1 & K2**
CO2	Understand the construction of fish pond for fish culture and setting of an aquarium	**K2**
CO3	Develop the skill of management of water quality and aquarium and apply the skill in culture practices of fish and prawn	**K6**
CO4	Understand the various types of diseases causing in fishes and able to treat those diseases.	**K2**
CO5	Understand the importance of byproducts of fish and marketing of fish and prawn.	**K2**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	CourseCode	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	23U6ZOC8	GENETICS	5	4

Nature of the course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:

To provide students with a basic understanding of:

1. basic principles of Mendelian inheritance
2. theory and mechanisms of linkage, crossing over and mutation
3. importance of genetic variation in evolution.
4. principles of sex-linked inheritance, sex determination, and non-disjunction.
5. principles of human, microbial and molecular genetics

SYLLABUS

Unit	Content	No. of Hours
I	**Mendelian Genetics and Inheritance:** Mendelian genetics: Mendelian experiments, laws of Mendel, Monohybrid, Dihybrid, back and test cross; Interaction of genes: Incomplete dominance, co dominance, complementary genes, supplementary genes, inhibiting genes, lethal genes and atavism. Inheritance: Polygenic inheritance- skin colour; multiple alleles- ABO blood groups and coat colour in rabbit; extra chromosomal inheritance- shell coiling, kappa particles; sex linked inheritance – eye colour in Drosophila, colour blindness and hemophilia in man.	**15Hrs**
II	**Linkage and Crossing Over**: Linkage: Linked genes, complete and incomplete linkage. Crossing over: molecular mechanisms of crossing over, kinds of crossing over, models of recombination. Chromosome mapping: inference and coincidence, haploid mapping, somatic cell hybridization.	**15Hrs**
III	**Cytogenetics**: Variation in chromosome number-euploidy and aneuploidy and structure: position effect, chromosomal mutation and evolution. Gene mutation: types, molecular basis of mutation, mutational hot spots, reversion; radiation and chemical agents as mutagens; Detection of mutation - ClB method	**15Hrs**
IV	**Human genetics:** Karyotype and ideogram; sex determination - Barr body technique, drumstick method; chromosomal abnormalities in humans, Pedigree	**15Hrs**

	analysis; diagnosis of genetic abnormalities; Eugenics, Euphenics, and Euthenics. Population genetics and evolution: gene pool, gene frequency and genotype frequency; Hardy-Weinberg law of equilibrium.	
V	**Microbial Genetics and Molecular Genetics:** Bacterial genetics : Conjugation, transformation, transduction and chromosome mapping .Molecular Genetics:Insertion elements, transposable elements, retroelements; Lac operon model, tryptophanoperon, role and relative positions of promoters and operators, feedback mechanism.	**15Hrs**

Text Books

(Latest Editions)

1. David E Sadava, 1993. Cell Biology - Organelle Structure and Function, Jones Bartlett Publishers.
2. Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.
3. Lewin B., 2008. Genes IX, Jones and Bartlett publishers.
4. Veer Bala Rastogi., 2019. Text Book of Genetics, Medtech
5. Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
6. Verma P. S. and V. K. Agarwal., 2018. Genetics, S. Chand & Company Pvt Ltd.
7. Meyyan RP, Fundamentals of Genetics -Saras Publication Nagercoil.8th edition2021
8. Randhawa S S**,**Textbook of Genetics-S Vikas and Company 2017

References Books

(Latest editions, and the style as given below must be strictly adhered to)

1. Cooper, Geoffrey M., 2018. The cell: A Molecular Approach, Eighth Edition, Oxford University Press.
2. De Robertis, E. D. P and E.M.F Robertis, 2017. Cell and Molecular Biology 8th Edition, LWW.
3. Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
4. Fletcher H and Hickey I., 2015. Genetics, IV Edition. GS, Taylor and Francis Group, New York and London.
5. Gardner, Anne. 2009. Human Genetics, Scion Publishing Ltd.
6. Klug, W. S., Cummings, M. R., Spencer, C. A., 2012. Concepts of Genetics. X Edition. Benjamin Cummings.
7. Lodish, Harvey, Arnold Berk *et al* .,2007. Molecular cell biology. 6th edition, W. H. Freeman.
8. Russel, Peter J. 2013. iGenetics: A Molecular Approach, Pearson.
9. Strickberger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.

Web Resources:

1. https://go.nature.com/2XE8V1q
2. https://bit.ly/3zoTt6B
3. https://bit.ly/2XAm7oa
4. https://bit.ly/2XEbhxi
5. https://bit.ly/3AB4bso
6. https://bit.ly/39pZSE4
7. https://www.genome.gov/genetics-glossary/Sex-Linked
8. https://www.vedantu.com/biology/mutagens

Pedagogy: Lecture, Assignment,PPT presentation, Group Discussion

(Please mention teaching / Learning methods like **Lecture**, Tutorial, **Assignment,PPT presentation**, Quiz, **Group Discussion**, e-content Seminar etc.)

Course outcome(CO):

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

CO Number	**CO Statement**	**Cognitive Level**
CO1	Understand the basis of inheritance and expression of genes.	**K1, K3**
CO2	Correlate changes in genetic makeup and phenotypic changes in progeny.	**K2,K3**
CO3	Analyse the causes of variations in genetic material and predict the effect in a population using different techniques.	**K2**
CO4	Explain the role of cellular processes and different genetic elements in the expression of genes.	**K2, K4**
CO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution.	**K2,K4**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	3							
CO 2		3	3		3			2
CO 3			3	3	3	3		3
CO 4		3						
CO 5		3	3	3	3	3		3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No corr

Semester	Course Code	Course Title	Hours ofTeaching / Cycle	No.of Credits
VI	**23U6ZOC9**	**ANIMAL PHYSIOLOGY**	**4**	**4**

Nature of the course

Relevant to Local need		Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented		Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:	
The main objectives of this course are:	
1.	To familiarize students with the principles and basic facts of Animal Physiology
2.	To give students aninsight about the molecular and cellularbasis of physiological functions in animals.
3.	To give anidea about the regulation of organ system functions in a whole animal using a conceptualmodel of feed back to explain homeostasis.
4.	To make the students aware about how the structure – function relationships and its synchronization with the molecular signals.
5.	To make an awareness to the students about how the structure function relationship synchronise along with the molecular signals.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**NUTRITION & RESPIRATION:** Nutrition : Digestion and absorption of carbohydrates, proteins and lipids. Minerals and Vitamins – their deficiency. Hormonal control of digestion. External and internal respiration. Respiratory pigments – Structure of haemoglobin, Transportation of gases – Bohr effect – Regulation of respiration – bronchitis, asthma – Physiological effects of smoking.	12
II	**CIRCULATION & EXCRETION:** Blood – composition and functions, Mechanism of clotting. Types of heart – Structure of heart -Heartbeat and pacemaker – Cardiac cycle – ECG – Pulse and blood pressure-Human Kidney ; structure and function- structure of Nephron- mechanism of urine formation – Excretory products, Osmo-regulation in fishes.	12

III	**MUSCLE & NERVE PHYSIOLOGY** Types of muscles – chemistry of muscles- Ultra structure of striated muscle - Muscle contraction- Neurons – Types and Structure – transmission of nerve impulse – Reflex action- Nerve disorders ; epilepsy, Alzheimer's disease and Parkinson's disease.	12
IV	**SENSE ORGANS** Structure of eye, physiology of vision, visual elements and pigments – Eye defects – myopia, hyperopia, presbyopia, astigmatism and cataract – Structure of ear and physiology of hearing – Hearing impairments – deafness – olfactory and gustatory sense organs.	12
V	**REPRODUCTIVE PHYSIOLOGY** Structure and functions of endocrine glands in man : pituitary, thyroid , pancreas, ovaries and testes -Role of Hormone in reproductive cycle- Puberty, adolescence, pregnancy, parturition , lactation and birth control.	12

Text Books :

1. Agarwal R A., Anil K Srivastava., Kaushal Kumar.,1978. Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing., 377 pp.
2. Berry A.K.1998. A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi, 320 pp.
3. Parameswaran, Ananta krishnan and Ananta Subramanian, 1975. Outlines of Animal Physiology, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.
4. Verma P.S., Tyagi B.S & Agarwal V.K., 2010. Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp.

Reference Books :

1. Guyton, A.C. and Hall, J.B., 2011. Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 pp.
2. Ganong, W.F., 2019. Review of Medical Physiology, McGraw Hill, New Delhi., 340 pp.
3. Hill, W.R., Wyse, G.A and Anderson, M. 2016. Animal Physiology (4thedn). Sinauer Associates is an imprint of Oxford University Press; USA, 828 pp.
4. Prosser C.L., 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 pp.
5. Sarada Subrahmanyam, Madhavan Kutty, K., & Singh H.D., 2018. Text Book of Human Physiology, S. Chand & Co, New Delhi.
6. Singh, H.R and Kumar, N. 2017. Animal physiology and biochemistry, Vishal publishing company, Jalandhar, 864 pp.
7. Sreekumar, S. 2010. Basic physiology, PHI learning private ltd., New Delhi.210 pp
8. Tortora G.J. & Derrickson B., 2016. Principles of Anatomy and Physiology, John Sons, Inc. 1232 pp.
9. Wood, D.W., 1968. Principles of Animal Physiology, Edward Arnold Ltd, London., 342 pp.

Web Resources :

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

Pedagogy: Lecture, Assignment,PPT presentation ,Group discussion .

Expected Course outcomes (CO) :

On the successful completion of this course , the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	Explain how the variousorg an systems are coordinated and controlled.	**K2**
CO2	List the functions of various organsinrelationtophysiologicalprocess.	**K2**
CO3	Develop the idea of multilevel controlling and feed backmechanisminrelationto various physiological functions.	**K4**
CO4	Understand the basicphysiologicalprocessrelatedtoadaptation, metabolism and majorrequirements.	**K2**
CO5	Differentiate the impact of hormones in the reproductive mechanism of the male and female organism.	**K2**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated; 0 – No correlation

Semester	Course code	Title of the course	Hours of teaching /week	No. Of Credits
VI	**23U6ZOCP4**	**Practical-IV GENETCS AND ANIMAL PHYSIOLOGY**	**4**	**2**

Nature of the course

Relevant to Local need		Employability Oriented	√	Addresses Professional Ethics	
Relevant to national need	√	Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	√
Relevant to Global need				Addresses Human Values	

Course Objectives:	
The main objectives of this course are:	
1.	To encourage students to interpret the organization of genomic material and to research theories of genetic inheritance.
2.	To understand the physiological processes that regulate body functions.
3.	To demonstrate the role of experimentation in developing our understanding of living animals.
4.	To attain knowledge of important biomolecules such as carbohydrates, Protein lipids and amino acids.
5.	Measure and interpret experimental data and demonstrate laboratory skills in genetics and animal physiology .

1. GENETICS

1. Identification of ABO Blood grouping.
2. Culturing of Drosophila.
3. Drosophila : Morphology and Sexual dimorphism (male and female)
4. Mounting of Sex Comb of Drosophila melanogaster
5. Study of at least five types of Drosophila: (Body color mutant- Ebony body and Yellow body. Wing mutant- Curly wing and Vestigial wing. Eye color mutant- Bar eye, White eye)
6. Mendelian traits -taster and non taster ,tongue rollers and non rollers and other common human traits.

2.ANIMAL PHYSIOLOGY

1. Ptyalin activity in relation to temperature and pH in human saliva.
2. Estimation of O2 consumption by freshwater fish.
3. Enumeration of blood cells counting (RBC and WBC) by haemocytometer.

4. Qualitative tests for carbohydrates, proteins and lipids.
5. Qualitative tests for Ammonia , Uric acid and Urea.
6. Separation of Amino acid from haemolymph of cockroach by chromatographic technique.
7. Estimation of Haemoglobin by Cyanmethemoglobin method.
8. Determination of urine sugar in man.
9. Demonstration of blood pressure in man.

FIELD WORK:

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

SPOTTERS:

1.Drosophila - male and female

2.Sphygmomanometer, stethoscope , haemocytometer , Kymograph,

Field work Report : A record of Laboratory work and a report on educational field trip(places of zoological interest) should be maintained and submitted at the time of practical examination for valuation.

Text books :

1. Michael Perlin, William Beckerson, Adarsh Gopinath, 2017. Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.

2. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.

3. Jayasurya, Arumugam N, Dulsy Fatima. (2013). *Practical Zoology Vol 3,* Saras Publication, Nagercoil, Tamilnadu.

References Books

1. Hoar, W.S. 1983. General and Comparative Physiology. Prentice Hall of India, New Delhi., 928 PP.
2. Prosser C.L., 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003, 966 PP.
3. Wood, D.W., 1968. Principles of Animal Physiology, Edward Arnold Ltd, London.,342 PP.
4. Guyton, A.C. and Hall, J.B., 2011. Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 PP.

Web Resources :

https://bit.ly/3hNyeFN
https://www.medicinenet.com/alp_test/article.htm
https://vlab.amrita.edu/?sub=3&brch=63
https://www.asbmb.org/education/online-teaching/online-lab-work

Course outcomes (CO) :
On the successful completion of this course , the students will be able to :

CO Number	CO Statement	Cognitive Level
CO1	To prepare samples of genetic molecules and to determine their purity, structure and characteristics.	**K3**
CO2	List and recall the basic equipment used in physiology and develop skill about quantitative determination of biomolecules and quantitative analysis of blood.	**K1**
CO3	Demonstrate the instruments, discuss the clinical importance and its applications, and explain the principle of bioinstruments.	**K3**
CO4	Understand and identify the chemical composition of major and minor nutrients and analyse Physio - chemical parameters that regulate metabolism.	**K2**
CO5	Evaluate and Examine the various parameters of haematology and biochemistry and Identify the nitrogenous waste products of animals.	**K5**

Cognitive Level : K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	3	3	3	3	2	3
CO 2	3	3	3	3	3	3	2	3
CO 3	3	2	3	3	3	3	3	3
CO 4	2	2	3	3	3	3	3	3
CO 5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated;
0 – No correlation

Semester	CourseCode	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	**23U6ZOEL3A**	**Major Elective III MICROBIOLOGY**	**4**	**3**

Nature of the course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:

To provide students with a basic understanding of:

- To become familiar with the foundation concepts of history of Microbiology
- To understand the structure and functions of a typical prokaryotic cell
- To gain the knowledge of microscopy and staining concepts
- To understand and implement disposal and safety measures
- principles of human, microbial and molecular genetics

SYLLABUS

Unit	Content	No. of Hours
I	**Introduction to microbiology** History, scope, branches of microbiology. Contribution of Leeuwanhoek, Jenner, Pasteur, Koch, Fleming, Iwanowsky, Waksman, Luria, M. J. Thirumalachar, SubbaRao, SambhuNath De. Evolution of Microbial diversity. Systematic position: 5 kingdom classification of Whittaker and 3 kingdom classification of Carl Woese. Comparison of Bacteria, Archaea, Eukarya (tabular and diagrammatic). Controlling microbes.	**15Hrs**
II	**Microscopy** Principles of microscopy ii. Compound microscope (Monocular and Binocular microscopes) – construction and function of parts, ray diagram of path of light, objectives, oculars, condensers, sources of illumination and uses iii. Dark field, Phase contrast and Fluorescence microscopes, Confocal microscopes, Atomic Force Microscope - principle, construction, ray diagram and applications iv. Electron microscopy – TEM and SEM – principle, construction, ray diagram and uses.	**15Hrs**
III	**Introductory Mycology** General characteristics and outline classification of fungi, Morphology of some	**15Hrs**

	common fungi - Mucor, Rhizopus, Aspergillus, Penicillium and Fusarium. Yeasts: General characteristics and outline classification of yeasts 3. General characteristics of Lichens and Mycorrhiza.	
IV	**Introductory Bacteriology** Classification of bacteria. Anoxygenic photosynthetic bacteria: general characteristics of purple bacteria and green bacteria. Oxygenic photosynthetic bacteria: General characteristics of Cyanobacteria – external and internal features, physiology and ecology. Magnetotactic bacteria- General characteristics, Magnetosomes, Enrichment and isolation of Magnetotactic bacteria. Types of staining.	**15Hrs**
V	**Introductory Virology** Virus Structure and Classification. Virus Entry and Viral Pathogenesis. Positive-strand RNA viruses: Picornaviruses, Flaviviruses, Togaviruses, Coronaviruses. Negative-strand and double-strand RNA viruses: Paramyxoviruses, Rhabdoviruses, Filoviruses, Bunyaviruses, Orthomyxoviruses and Reoviruses. DNA viruses: Parvoviruses, Polyomaviruses, Papillomaviruses, Adenoviruses and Baculoviruses, Herpes viruses and Poxviruses.	**15Hrs**

Text Books

(Latest Editions)

1.Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and MushrooCultivation , New Age International, New Delhi.

2.Atlas R.M., Microbiology – fundamentals and applications, MacmillanPublishing Company, New York.

3.RavindraNath, Fundamentals of Biology Courses for Biotechnology, - Vol.1, Special Bangalore University edition, Kalayani Publishers.

4.Greenwood D, Richard CD, John S and Peuther F (1992). Medical Microbiology, 16th edition. ELBS, Churchill living stone.

References Books

(Latest editions, and the style as given below must be strictly adhered to)

1.Alexopoulos C.J. and Mims C.W., Introductory Mycology, New Age International, NewDelhi.

2.Thomas M. Bell, 1965. An Introduction to General Virology, William Heinemann Medical books, London.

3.Stanier R.Y., Ingraham J.L., General Microbiology, Prentice Hall of India Private Limited, New Delhi.

4.Salle A.J., Fundamental Principles of Bacteriology, Tata McGraw – Hill Publishing Company Limited, New Delhi.

5.Pelczar .J. Chan E.C.S. and Krieg N.R., Microbiology, McGraw Hill Book Company, New York.

6.Benson Harold J, Microbiological Applications, WCB McGraw – Hill, New York.

7.Brock T.D. and Madigan M.T., Biology of Microorganisms, Prentice Hall of India Private Limited.

8.Collins CH, Patricia M, and Lyne JM (1995). Collins and Lynes Microbiological Methods 7th edition. Grange, Butter Worth, Oxford.

9.Cappucino JG and Sherman N (1996). Microbiology, A Laboratory Manual 4th edition. Benjamin Cumings Inc. California.

10.Pelczar MJ, Chan ECS and Krieg NR (1993).Microbiology 5th edition, Tata McGraw Hill.
11.Madigan MT, Martinko JM and Parker J (2012). Brock Biology of Microorganism, 11th edition Prentice Hall International Inc. London.

Web Resources:

1.https://vlab.amrita.edu/?sub=3&brch=73
2.https://learn.chm.msu.edu/vibl/
3.https://mvi-au.vlabs.ac.in/
4.https://virtuallab.tlc.ontariotechu.ca/intro.php
5.https://www.merlot.org/merlot/viewMaterial.htm?id=79694

Pedagogy: Lecture, Assignment,PPT presentation, Group Discussion

(Please mention teaching / Learning methods like **Lecture**, Tutorial, **Assignment,PPT presentation**, Quiz, **Group Discussion**, e-content Seminar etc.)

Course outcome (CO):

CO Number	CO Statement	Cognitive Level
CO1	Understand the classification of microorganisms and microbial techniques	**K1, K3**
CO2	Gain the knowledge of contribution of microbiology	**K2,K3**
CO3	Understand the isolation techniques of microorganism for culture practices.	**K2**
CO4	Acquire the knowledge of pathogenicity of viruses	**K2, K4**
CO5	Gain the techniques of microscopy types.	**K2,K4**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create\

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3							
CO 2		3	3		3			2
CO 3			3	3	3	3		3
CO 4		3						
CO 5		3	3	3	3	3		3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated;
0 – No correlation

Semester	CourseCode	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	23U6ZOEL3B	**Major Elective –III** **HUMAN REPRODUCTIVE BIOLOGY**	4	3

Nature of the course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

Course Objectives:	
The main objectives of this course are:	
1.	To enable students to understand theendocrine structures and hormones associated with the physiology of reproductive system
2.	To enable students to learn about the male reproductive system and accessory glands and regulation
3.	To enable students to learn about the female reproductive system and regulation of its function
4.	To enable students to comprehend about fertilization, pregnancy, parturition and lactation
5.	Discussa dvantages and disadvantages of available contraceptives and Analyze the different techniques and associated ethical issues related to reproductive technology To equip students with knowledge on causes of infertility, reproductive health, assisted reproductive technology and associated ethical issues

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation; Puberty	**12**
II	Outline and histoarchitecture of male reproductive system; Testis: Cellular functions; Spermatogenesis and its hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male	**12**

	tract; Andropause	
III	Outline and histoarchitecture of female reproductive system; Ovary: oogenesis and its hormonal regulation; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation, changes in the female tract; Menopause	**12**
IV	Ovum transport in the fallopian tubes; Sperm transport in the female tract, Fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation	**12**
V	Infertility in male and female: causes, diagnosis and management; Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, Stem Cell banks, *in vitro* fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; ethical issues related to ART; Surrogate motherhood; ethical issues; Consanguinity; Fetal Loss and Birth Defects; Adoption	**12**

BOOKS FOR REFERENCE

1. Cassan, A. (2005). *Human reproduction and Development (Inside the Human Body).*NewYork: ChelseaClubhouse.
2. Field,M.A.(1990).*SurrogateMotherhood.*Massachusetts:Harvard University.
3. Gardner, D. K.(2001). *Textbook of Assisted Reproductive Techniques: Laboratory andClinicalPerspectives.*London: MartinDunitz.
4. Gardner, D. K.(2006). In vitro Fertilization: A Practical Approach. CRC Press.
5. Johnson, M. H. (2018). *Essential Reproduction*. New Jersey: Wiley-Blackwell.
6. Jones,R.E.(2013).*HumanReproductiveBiology*.Amsterdam:Elsevier.
7. Neill, Jimmy D. ed (2006). Knobil and Neill's Physiology of Reproduction.Volume I. Third edn. Elsevier Academic Press.
8. Pinon, R. (2003).*Biology of Human Reproduction*. California: University Science Books.

Course outcome (CO):

CO Number	CO Statement	Cognitive Level
CO1	Recall the structure and functioning of the male and female reproductive system, associated endocrinology, causes for infertility and assisted reproductive technology	**K1, K3**
CO2	Describe the structure and physiology functions of male and female reproductive systems.	**K2,K3**
CO3	Explain the role of structures, accessory glands and hormones associated with the reproductive tracts and their control	**K2**
CO4	Explain the mechanism of sex determination.	**K2, K4**
CO5	Discuss age - associated physiological changes in the reproductive tract Describephysiologicalchangesduringpregnancyandbenefitsofbreastfeeding.Identify causes for infertility, treatments available and ethical issues related	**K2,K4**

Cognitive Level :K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated;
0 – No correlation

Semester	Course code	Title of the course	Hours of teaching / week	No. of Credits
VI	23U6ZOEL4A	Major Elective IV- WILDLIFE CONSERVATION AND MANAGEMENT	4	3

Course Objectives

- To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.
- To assess and instil strong foundations on wildlife policies and be familiar with a variety of laws and regulations.
- To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.
- To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation approachesand develop the role PVA models for protection of Endangered species.
- To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation.

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Biodiversity Extinction and Conservation Approaches**: Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.	15
II	**Theories and Analysis of Conservation of Populations**: Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis-conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species.	15

III	**National and International Efforts for Conservation**: International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest &Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031, Wildlife Protection Act 1972, National and State Biodiversity Action Plans and other Forests and Environmental Acts.	15
IV	**Wildlife in India**: Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wild life Habitat: Characteristic, Fauna and Adaptation with special reference to Tropical forest. Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves.	15
V	**Management of Wildlife**: Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild life laws and ethics.	15

Text Books

1. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478.
2. Aaron, N.M.1973 Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A.
3. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231.
4. Justice Kuldip Singh 1998. Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun.
5. Hosetti, B.B. 1997 Concepts in Wildlife Management, Daya Publishing House, Delhi.
6. Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.
7. Caughley.G and Sinclaire, A.R.E 1994 Wildlife ecology and management. Blackwell Science.
8. Woodroffe R, Thirgood, S. and Rabinowitz A. 2005.People and Wildlife, Conflict or Co exsistence? Cambridge University.
9. Sinha, P.C. 1998. Wildlife and Forest Conservation, Anmol Publishing Pvt. Ltd., New Delhi. Singh, S.K, 2005. Text Book of Wildlife Management. IBDC, Lucknow.

Reference Books

1. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547.
2. Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
3. Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
4. Goutam Kumar Saha and SubhenduMazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.
5. Katwal/Banerjee, 2002. Biodiversity conservation in managed and protected areas, Agrobios, India.
6. Gopal, Rajesh,1992. Fundamentals of Wildlife Management, Justice Home, Allahabad, India.

7. Sharma, B.D, 1999. Indian Wildlife Resources Ecology and Development, Daya Publishing House, Delhi.
8. Stephen, H.B. and V.B. Saharia,1995. Wildlife research and management. Asian and American Approaches, Oxford University Press, Delhi.
9. Negi, S.S. 1993. Biodiversity and its conservation in India, Indus Publishing Co., New Delhi.
10. Moulton, M. P. & J. Sanderson, 1997. Wildlife Issues in a Changing World. St. Lucie Press.

Web resources

- https://www.uc.edu/content/dam/refresh/cont-ed-62/olli/s21/3-presentation.pdf
- http://study.com/academy/lesson/the-four-forces-of-evolution.html
- https://bit.ly/39oPj44
- https://bit.ly/3lHdEYJ
- https://bit.ly/3CwBCfY
- https://bit.ly/3EDYr3a
- https://bit.ly/3tVtG4U

Pedagogy: Teaching / Learning methods
(Please mention teaching / Learning methods like **Lecture**, Tutorial, Assignment,**PPT presentation**, Quiz, Group Discussion, **e-content Seminar** etc.)

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife.	**K1 & K2**
CO2	To integrate and assess the National, international approaches for biodiversity conservation.	**K3 & K4**
CO3	To analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.	**K3 & K4**
CO4	To explain the role PVA models, Wildlife conservation approaches, and limitations.	**K4 & K5**
CO5	To construct and simulate National and International strategies for Conservation, Wild life laws and ethics.	**K4 & K6**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze;
K5 – Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3
CO5	3	3	3	2	2	2	2

3 - Strongly Correlated; 2 - Moderately Correlated
1 - Weakly Correlated; 0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
VI	23U6ZOEL4B	Major Elective- IV VERMI CULTURE	4	3

Course Objectives

Themainobjectives ofthis courseare:

1. To learn the biology of earthworms.
2. To learn the steps involved in vermiculture and vermicomposting.
3. To realize the importance of vermicompost in improving soil fertility.
4. To understand the significance of waste management in environmental health.

Nature of the Course

Relevant to Local need		Employability Oriented		Addresses Professional Ethics	
Relevant to national need		Entrepreneurship Oriented		Addresses Gender Sensitization	
Relevant to regional need		Skill development Oriented	√	Addresses Environment and Sustainability	
Relevant to Global need	√			Addresses Human Values	√

SYLLABUS

Unit	Content	No. of Hours
I	**EARTHWORM BIOLOGY:** Importance of Vermitechnology; Classification of earthworms; Earthworm- External features; Digestive system; Excretory system; Reproductive system; Life cycle; Importance of Earthworms.	12
II	**VERMICULTURE AND VERMICOMPOSTING:** Methods of collection of earthworms; Steps of vermiculture; Factors influencing the culture of earthworms; Vermicomposting- Steps of vermicomposting; Mechanism of vermicomposting; Changes during vermicomposting.	12
III	**METHODS OF VERMICOMPOSTING:** Small scale or Indoor vermicomposting – Pit method; Heap method; Large scale or outdoor vermicomposting – Bed method; Window method; Vermitech 200. Vermiwash preparation; Composition and applications of vermiwash.	12

IV	**VERMICOMPOST:** Physical, chemical and biological characteristics of vermicompost; Nutritive value of vermicompost; Advantages and economic importance of vermicompost; Use of vermicompost in crop production; Use of vermicompost in Land improvement and reclamation.	12
V	**ROLE OF EARTHWORM IN WASTE MANAGEMENT:** Solid waste management; Sewage waste management (Vermifilter); Faecal waste management; Industrial waste management; Role of earthworm in soil fertility; Earthworm as a Farmer's friend.	12

Textbook:

5. M. Seetha Lekshmy, R. Santhi (2015) Vemitechnology, Saras Publication.
6. Ismail, S.A, 2005, The Earthworm Book, Other India Press, Goa.
7. Shukla,G.S. and Upadhyay,V.B.(2016). *Economic Zoology.* Jaipur: Rastogi Publications.
8. Arumugam, N., Murugan, T., Johnson Rajeshwar, J. and N.C. Nair (2015) *Economic Zoology.* Nagercoil: Saras Publications.
9. H.C. Nigam (2014) Emerging Trends in Biology and Economic Zoology, Vishal publication Co. Jalandhar, New Delhi.

General References:

. Clive A.Edwards, Norman Q. Aramon, Rhonda L.Sherman (2010) Vermiculture Technology:
Earthworms, Organic waste and Environmental Management, CRC, Press.

2. Himadri Panda(2022), The complete technology book on Vermiculture and vermicompost (Available Online).
3. Ahsan, J. and Sinha, S.P. (2009) A Handbook on Economic Zoology. S. Chand & Company Ltd., New Delhi.
4. Tomar, B.S. and Singh, N. (2011) Economic Zoology. Emkay Publications. New Delhi.

. Clive A.Edwards, Norman Q. Aramon, Rhonda L.Sherman (2010) Vermiculture Technology:
Earthworms, Organic waste and Environmental Management, CRC, Press.

5. Himadri Panda(2022), The complete technology book on Vermiculture and vermicompost (Available Online).
6. Ahsan, J. and Sinha, S.P. (2009) A Handbook on Economic Zoology. S. Chand & Company Ltd., New Delhi.

Web resources:

https://en.wikipedia.org/wiki/Earthworm
https://collegedunia.com/exams/vermiculture-biology-articleid-1531
https://www.trustbasket.com/blogs/composting/vermicompost-a-complete-guide
https://www.researchgate.net/publication/259010971_Vermicomposting_in_Solid_Waste_Management_A_Review
https://en.wikipedia.org/wiki/Earthworm

Pedagogy::

Teaching / Learning methods, Assignment, PPT presentation, Seminar, Group discussion

CourseOutcomes

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

CO Number	CO Statement	Cognitive Level
CO1	develop entrepreneurial skills in the area of applied zoological sciences	**K2 K3 K4**
CO2	acquire knowledge to start up a small scale industry	**K5 K6**
CO3	develop skills, aid them make revolution in agriculture	**K4 K5**
CO4	acquire knowledge to reduce environmental pollution	**K2 K4**
CO5	create awareness to soil health and chemical free agricultural products.	**K2 K4 K6**

Cognitive Level: K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate; **K6 –** Create

Mapping of Course Outcomes with Programme Outcomes								
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3
CO4	2	2	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

3 - Strongly Correlated; 2 - Moderately Correlated; 1 - Weakly Correlated;
0 – No correlation

Semester	Course Code	Course Title	Hours of Teaching / Cycle	No. of Credits
VI	**23U6ZOSEC2**	**Skill Enhancement Course – II Ornamental Fish Farming & Management**	**2**	**2**

Nature of the course

Employability Oriented	√	Relevant to Local need	√	Addresses Gender Sensitization	
Entrepreneurship Oriented	√	Relevant to regional need	√	Addresses Environment and Sustainability	
Skill development Oriented	√	Relevant to national need	√	Addresses Human Values	
		Relevant to Global development need		Addresses Professional Ethics	

Course Objectives

Themainobjectives ofthis courseare:

1. To highlight the importance of ornamental fish culture in relation to entrepreneurship development.
2. To enable the identification, culture and maintenance of commercially important ornamental fishes.
3. To provide the knowledge on the techniques of ornamental fish breeding, rearing,disease control and economics of ornamental fish farming.

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	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. 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).	**6**
II	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. Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies.	**6**

References:

1. Swain SK., Sarangi N. and Ayyappan S. 201 0. Ornamental fish farming. ICAR, New Delhi.

2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.

3. **Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.**

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

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/

Course Outcome:

- The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.
- The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employme