CHOICE BASED CREDIT SYSTEM (CBCS) Learning Outcome-based Curriculum Framework (LOCF) SYLLABUS

B.Sc.

2023 - 2024



MADRAS CHRISTIAN COLLEGE (AUTONOMOUS) College with Potential for Excellence Affiliated to University of Madras Tambaram Chennai – 600 059

VISION

Madras Christian College aspires to be an Institution of excellence transforming livesthrough education with a commitment to service.

MISSION

The Madras Christian College (MCC), with the inspiration of the love of God, offers to people of all communities education of the whole person, which is congruous with God's revelation in Christ of the true nature of humanity and is appropriate to the needs of Indiaand of the world.

Graduate Attributes

The Madras Christian College defines the philosophy underpinning its academic programmes and student life experience on campus through the Graduate Attributes (GA), that describe the knowledge, competencies, values and skills students imbibe for holistic development and contribution to society. These attributes encompass characteristics that are transferable beyond the domain of study into the national and international realm fostered through curricular, co-curricular and extra-curricular engagements.

GA 1: Intellectual Competencies

- Graduates of MCC have a comprehensive and incisive understanding of their domain of study as well as the capability for cross-disciplinary learning.
- They have the ability to apply the knowledge acquired through the curriculum as well as self-directed learning to a broad spectrum ranging from analytical thinking to synthesise new knowledge through research.
- Forming independent individual opinions regarding academic cores and socially relevant issues

GA 2: Professional Ethics

- Graduates of MCC develop ethical and professional behaviour, which will be demonstrated in their chosen careers and constructive citizenship roles.
- They imbibe intellectual integrity and ethics in scholarly engagement and develop a spirit of inclusiveness through interactions with people of special needs and diversity.

GA3: Leadership Qualities

- Graduates of MCC inculcate leadership qualities & attitudes, and team behaviour along democratic lines through curricular, co-curricular and extra-curricular activities
- They develop managerial and entrepreneurial skills to ideate and create new opportunities along with career readiness and capacity to take up various competitive exams.

GA 4: Holistic Skill Development

- Graduates of MCC develop critical thinking, problem-solving, effective communication, emotional and social skills
- They develop digital competency to live, learn and serve in society.

GA 5: Cross-Cultural Competencies

- Graduates of MCC imbibe cross-cultural competencies through engaging with diverse linguistic, ethnic and religious communities providing scope to understand, accept and appreciate individuals at local, national and international levels.
- They develop a global perspective through contemporary curriculum, culture, language and international exchange programmes

GA 6: Service-Oriented Focus

- Graduates of MCC have sensitivity to social concerns and a conviction toward social justice through a commitment to active social engagement.
- They are endowed with a strong sense of environmental awareness through the curriculum and campus eco-system.

GA 7: Value-Based Spiritual Development

- Graduates of MCC are rooted in the principles of ethical responsibility and integrity permeated with Christian values leading to the building of character.
- They develop virtues such as love, courage, unity, brotherhood, industry and uprightness.

Programme Outcomes

Programme Outcomes (POs) of Madras Christian College define the minimum level that students are expected to do, achieve and/or accomplish in order to graduate from a particular programme. These Outcomes are a framework to assess the nature of learning activity experienced within the programme.

POs for Under Graduate Programmes

UG Programmes are designed to have the following outcomes:

On successful completion of the Undergraduate programme, the students will be able to

PO	РО	Descripton of PO	Mapped with GA
PO 1	Language Skills	 Demonstrate oral and written skills to effectively communicate in English and Languages of their choice Apply reading and listening skills to facilitate access to knowledge resources and understanding 	GA1, GA4, GA5
PO 2	Domain Knowledge	 Acquire knowledge of basic concepts, theories and processes through study of core courses in respective programmes Apply and Analyze domain specific knowledge to emerging areas of academia and industry Assess, adapt and develop domain specific transferrable skills to new/unfamiliar context 	GA1, GA3, GA4, GA5
PO 3	Interdisciplinary knowledge	 Identify and determine relationships across disciplines Acquire and apply interdisciplinary knowledge for holistic academic 	GA1, GA4

		development	
PO 4	Digital Skills	 Acquire computer skills and their application relevant to classroom andself-directed web- based learning Familiarize with and use domain-related software resources, computational skills and digital tools for data analysis, visualization and interpretation Ethically apply digital skills to creatively communicate a wide range of ideas and issues related to academic experiences 	GA1, GA2, GA3, GA4, GA6
PO 5	Analytical skills	 Develop the ability to think critically and relate learning to academic, professional and reallife problem solving Apply empirical knowledge and skills to identify and collect quantitative and qualitative data to analyze and formulate evidence-based suggestions and solutions 	GA1, GA2, GA4, GA6
PO 6	Academic writing & Presentation skills	 Formulate and document results obtained in laboratory, case studies, project work, field work and internships Effectively communicate through engaging presentations using 	GA1, GA4, GA5

		methodologies appropriate to the discipline	
PO 7	Innovation and Creativity	 Demonstrate transferable capabilities and intrapreneurial skills that are relevant to the industry and other employment opportunities Develop entrepreneurial skills and generate intellectual property 	GA1, GA2, GA3
PO 8	Social Engagement and Responsibility	 Demonstrate the ability to link classroom learning with social concerns through service learning and outreach programmes. Enhance positive personality traits to adapt to changing circumstances and demonstrate leadership qualities as an individual and a member of cross-cultural and multi-disciplinary teams. Appreciate environmental consciousness and sustainability Draw valuable insights from one's own spiritual tradition and that of others for peaceful coexistence and general wellbeing 	GA1, GA2, GA5, GA6, GA7

PROGRAM SPECIFIC OUTCOMES (PSO's)*

At the time of graduation they would be able to:

PSO #	Statement	Mapped with PO#
PSO 1	Identify, classify and differentiate diverse chordates and non chordates based on their morphological, anatomical and systemic organization.	PO2, PO3, PO5
PSO 2	Acquire complete knowledge of the types of behavior of different animals and biological clock. biological clock.	PO2, PO3
PSO 3	Identify the relationship or synchronization between structure and function at all levels: molecular, cellular, and organismal level.	PO2, PO3
PSO 4	Understand the working principles and handle the sophisticated instruments/equipments.	PO4, PO5, PO7
PSO 5	Understand the applications of biological sciences in Apiculture, Aquaculture, Agricultural Entomology and Poultry Science etc.	PO6, PO8

B.Sc. ZOOLOGY – Curriculum

(Effective from 2023- 2024)

		Course code (willbe given			Hou per c	ırs ycle	Maximum Marks			
Semester	Part	by COE after the approval in AC)	Title of the Course	Credits	Theory	Practical	ICA	ESE	Total	Duration of Exam
Ι	Ι		Language	3	4		50	50	100	3
	Π		English	3	4		50	50	100	3
	III	231ZO1M01	Animal Life I: Invertebrata	4	5		50	50	100	3
		231ZO1M03	Agricultural Entomology	2	3		50	50	100	3
		231ZO1M02	Animal Life I Practical: Invertebrata	2		2	50	50	100	3
	III	231ZO1A01	Allied Botany I/ Allied Zoology I	3	4		50	50	100	3
		231ZO2A01	Allied Botany I/ Allied Zoology I Practical	2		2	50	50	100	3
	IV	231ZO1G01	General Course- Entrepreneurship Development in Ornamental Fishes	2	4		50	50	100	3
			Value Education	1	2		50	50	100	3
п	T									3
	1			3	4		50	50	100	3
	11		English	3	4		50	50	100	3
	III	231ZO2M01	Animal Life II : Chordata	4	5		50	50	100	3
		231ZO2M03	Biostatistics and Instrumentation	2	3		50	50	100	3
		231ZO2M02	Animal Life II Practical : Chordata	2		2	50	50	100	3
		231ZO2A01	Allied Botany II/ Allied Zoology II	3	4		50	50	100	3
		231ZO2A01	Allied BotanyII/ Allied Zoology II Practical	2		2	50	50	100	3
	IV	231ZO2G01	General Course- Nutrition and Wellness	2	4		50	50	100	3
			Value Education	1	2		50	50	100	3
			Total		3	0				
III	Ι		Language	3	4		50	50	100	3
	Π		English	3	4		50	50	100	3
	III	231ZO3M01	Cell Biology	3	4	-	50	50	100	3
		231ZO3M02	Developmental Biology	3	4	-	50	50	100	3
		231ZO3M03	Cell and Developmental Biology Practical	2	-	2	50	50	100	3

			Allied Chemistry I	3	4		50	50	100	3
			Allied Chemistry I Practical	2		2	50	50	100	3
	ΙV		Personality Development	_	2		50	50	100	3
		231ZO3I01	Wild Life Management	3	4		50	50	100	3
			Total		3	0				
IV	Ι		Language	3	4		50	50	100	3
	Π		English	3	4		50	50	100	3
	III	231ZO4M01	Genetics & Molecular Biology	3	4		50	50	100	3
		231ZO4M03	Evolution and Ethology	3	4		50	50	100	3
		231ZO4M02	Molecular Biology and Genetics Practical	2	_	2	50	50	100	3
			Allied Chemistry II	3	4		50	50	100	3
			Allied Chemistry II Practical	2		2	50	50	100	3
	ΙV		Personality Development	2	2		50	50	100	3
			Environmental Studies	3	4		50	50	100	3
			Total		3	0				
V	III	231ZO5M01	Biotechnology and Bioinformatics	5	6		50	50	100	3
		231ZO5M02	Aquaculture	3	5		50	50	100	3
		231Z05M03	Immunology & Microbiology	3	5		50	50	100	3
		231ZO5M04	Biotechnology and Bioinformatics Practical	2		2	50	50	100	3
		231 ZO5M 05	Aquaculture Practical	2		2	50	50	100	3
		231ZO5M06/ 231ZO5M07	a) Forensic Entomology / Epidemiology	3	4		50	50	100	3
	IV	231ZO5M08	Computer Basics	3	2		50	50	100	3
	GE	081ZO5L01	Vermitechnology	2	4		50	50	100	3
			Total	18	3	0				
VI	III	231ZO6M01	Animal Physiology & Endocrinology	5	6		50	50	100	3
		231ZO6M02	Environmental Biology & Biodiversity	4	6		50	50	100	3
		231ZO6M03	Animal Physiology & Endocrinology Practical	2		2	50	50	100	3
		231ZO6M04	Environmental Biology & Biodiversity Practical	2		2	50	50	100	3
		231ZO6M05/ 231ZO6M06	a) Aquarium Science & Management /	4	5		50	50	100	3

	231ZO6M07/ 231ZO6M08	b) Apiculture / Poultry Science	4	5		50	50	100	3
	231ZO6M09/ 231ZO6M10 231ZO6M11/ 231ZO6M12	 c) On-site Training of (a) Aquarium Science & Management / Vermiculture & (b) Apiculture / Poultry Science 	2+2		2+2	50	50	100	3
				3	0				

(For the students admitted during the academic year 2021 – 22 onwards)

Part V – Extension Activities:- Service Learning-2Hrs./Physical Education-2Hrs./Dept. Assn. activity-1Hr/NCC-1Hr./NSS-Hr./Sports-Hr/Scrub Society-1Hr.

Curriculum Overview Table									
Part	Credits	Hours / Cycle							
I - Tamil/Language	12								
II - English	12								
III – Core theory (mandatory)	44								
III – Core Elective	15								
III – Core Practical*	16								
III – Internship / Field work	-								
III – Project	-								
III – Allied theory	12								
III – Allied Practical*	8								
IV – GC	4								
IV – GE	3								
IV – ID	3								
IV – EVS	2								
IV- Value Education	2								
IV – Computer Training	3								
IV – Personlaity Development / Soft Skill	3								
V – Extension Activity	1								
Total	140								

Weightage for Correlation									
$0 \leq C \leq 5\%$	No correlation	-							
5% <c 40%<="" td="" ≦=""><td>Low / Slight</td><td>1</td></c>	Low / Slight	1							
40% <c 60%<="" <="" td=""><td>Moderate</td><td>2</td></c>	Moderate	2							
60% ≦C < 100%	Substantial / High	3L							

ANIMAL LIFE I: Invertebrata

C	Course title ANIMAL LIFE I: Invertebrata									
Co	urse Code	231ZO1M01								
	Credits	4	4							
Ho	urs / Cycle	5								
(Category	Part III	Core	Theory						
S	Semester	I								
	Year of	From the aca	ademic year 2023 onwards							
Impl	ementation									
		1. The s	yllabus would introduce the s	student to the b	basics of animal					
		kingd	om.							
		2. To wi	tness animal kingdom with sp	ecial focus on	the invertebrate					
		classi	fication.							
Cours	e Objectives	3. To understand the unique features and anatomy with a few type								
		study of the different phyla								
		4. To be able to identify any invertebrate based on their characteristic								
		morph	nological and anatomical chara	acters						
		5. Be ready to take up chordates effectively								
			• •		Bloom's					
~~~ <i>"</i>		~ ~		PSO	Taxonomy					
CO#		Course O	utcome(s)	Addressed	Levels					
					(K1 to K5)					
On con	npleting the cou	ırse successful	lly, the student will be able to	)						
CO1	Acquire kno	wledge on	the principle involved in	PSO1	K1					
	classification	6	I I							
CO2	Classify prin	nitive inverte	brates with emphasis on	PSO1	K2					
	protozoan pai	rasites, water o	canal system in sponges and							
	coral reefs									
CO3	Identify and u	inderstand the	parasitic adaptations and	PSO1	K3					
	diseases of he	lminthes								
CO4	Enlists the ed	conomic impo	rtance of the metameric	PSO5	K4					
	Invertebrates	1.01 2.1		DO01						
CO5	Assess the Sig	gnificance of th	e higher invertebrates	PSOI	К5					

	Animal Life I			
UNIT	CONTENT	HOURS	COs	BLOOM'S
				TAXONOMY I EVEL
T	INTRODUCTION TO ANIMAL KINGDOM	8	CO1	
-	Outline classification: Definition: taxonomy.	0	CO1	<b>M1, M2, M3</b> ,
	systematics, classification, identification,		CO3	K4. K5
	nomenclature; major hierarchies; International Code		CO4	7
	of Zoological Nomenclature & International		CO5	
	Commission on Zoological Nomenclature.			
II	PROTOZOA, PARAZOA & METAZOA	14	CO1	K1, K2, K3,
	(PROTOZOA, PORIFERA & CNIDARIA)		CO2	K4, K5
	General characters – classification upto classes with		CO3	
	examples; Type study – <i>Plasmodium</i> , <i>Sycon</i> sp.,		CO4 CO5	
	<i>Aurelia</i> sp., protozoan parasites and diseases.		COS	
	Reproduction in sponges – gemmules - canal system			
	in sponges: corals and coral reefs			
Ш	HELMINTHES	10	CO1	K1. K2. K3.
	(PLATYHELMINTHES &	10	CO2	K4, K5
	NEMATHELMINTHES)		CO3	,
	General characters – classification upto classes with		CO4	
			CO5	
	examples; Type study – Taenia solium, Wuchereria			
	bancroftii; common cestode, trematode and			
	nematode parasites in man			
IV	METAMERIC METAZOANS	14	CO1	K1, K2, K3,
	(ANNELIDA & ARTHROPODA)		CO2	K4, K5
	General characters – classification upto classes with		CO3	
	examples; Type study – <i>Megascolex</i> sp., <i>Periplaneta</i>		CO4	
	sp.; vermiculture; Economic importance of insects		CO5	
V	HIGHER INVERTERRATES	1/	CO1	K1 K2 K3
v	(MOLLUSCA & ECHINODERMATA)	17	CO1 CO2	K1, K2, K3, K4, K5
	General characters – classification upto classes with		CO3	,
	examples; Type study – Pila sp., Asterias sp.;		CO4	
	Economic importance of mollusca; Water vascular		CO5	
	system – larval forms of Mollusca and			
	Echinodermata; Origin of Chordates.			
Prescrib	ed Books/Textbooks			
1. A	Ayyar, E.K., Manual of Zoology Part I			
2. J	ordan E.L. 2004 Invertebrate Zoology Chand & Co			
J. F Deferer				
1 V	era Fretter 1976 A functional anatomy of invertebrates	1 st Ed by Ac	ademic r	recc
1. V	ora i rener, 1970 A functional anatomy of mycheolates	I EuroyAC		1000

- 2. Gonzalo Giribet, Gregory D. Edgecombe 2020, The Invertebrate Tree of Life. Princeton University Press
- 3. <u>Claudio Carere</u>, <u>Jennifer Mather</u>, 2019 The Welfare of Invertebrate Animals, Springer Verlag

#### Suggested Reading

- 1. Hickman, Jr.C.P. 1981, Integrated Principles of Zoology 7th Ed.
- 2. Terera Andesirk and Gerald A. 1990, Biology & Life of earth
- 3. Jordan and Verma. 2006 Invertebrate Zoology, Chand & Co.

#### Web Resources

- 1. <u>https://www.coursera.org/lecture/introduction-to-biology-biodiversity/molluscs-dPblH</u>
- 2. <u>https://mooc.es/course/applied-and-economic-zoology/</u>
- 3. https://www.acs.edu.au/courses/invertebrate-animals-730.aspx

#### Correlation of POs/PSOs to each CO and make a corresponding mapping table.

Course articulation matrix														
Programme Outcomes         Programme Specific Outcom											omes	Cognitive		
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	2	2	1	2	1	2	2	2	3	3	2	1	1	K1
CO2	2	2	2	2	3	3	3	2	2	2	2	2	1	K2
CO3	2	2	2	2	1	2	2	2	2	2	2	-	1	К3
CO4	2	1	2	1	2	1	1	2	-	1	2	2	2	K4
CO5	2	2	1	2	2	2	2	2	1	1	-	2	1	K5
AVG	2	2	1.2	1.2	1.2	2	2	2	1.6	1.8	1.6	1.4	1.2	
							1.7						1.5	
									0	verall Map	pping of th	e Course	1.6	

*3-Strong; 2-Medium; 1-Low

## AGRICULTURAL ENTOMOLOGY

Cou	rse title	AGRICULT	AGRICULTURAL ENTOMOLOGY									
Cour	rse Code	231ZO1M03										
C	redits	2										
Hour	s / Cycle	3										
Ca	tegory	Part – III	Core	Theor	у							
Sei	mester	Ι										
Ye Impler	ear of nentation	From the academic year 2023-2024 onwards										
C Obj	ourse ectives	<ul> <li>Be introdu</li> <li>Understand pest manage</li> <li>Study the open of the formation of the formatio</li></ul>	<ul> <li>Be introduced to a range of pests on important crops</li> <li>Understand the common principles, methods and applications in pest management</li> <li>Study the common compounds, application methods and appliances in pest control.</li> <li>Know the basic theory and practice of integrated pest management.</li> </ul>									
CO #		Course Outo	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)							
On con	npleting th	e course succ	cessfully, the stude	ent will be ab	le to							
CO 1	Recall a	and List the fa	actors influencing	PSO1	K1							
	insects t	o reach pest s	tatus.	PSO5								
CO 2	Summari manager	ize on various ment.	pests and their	PSO2	К2							
CO 3	Build research avenues in the field of Agricultural Entomology.PSO8K3											
CO 4	Examine using va	Examine the damage and control pests using various chemical methods.PSO2K4										
CO 5	Evaluate pest m status.	e the various anagement t	s technologies in o determine the	PSO4	К5							

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
Ι	<b>INTRODUCTION TO PESTS</b> Introduction to Entomology; General classification of Insects: Hemiptera, Lepidoptera, Coleoptera & Hymenoptera; Types of damage to plants by insects; Types of insect pests; Causes of insects assuming pest status.	6	C01 C02	K1 K2 K3 K4 K5
Π	INSECT PESTS OF CROPS <u>Pests of Rice</u> : Rice stem borer, Rice gall midge, Green rice leaf hoppers, Brown plant hopper, Rice earhead bug. <u>Pests of Sugarcane</u> : Sugarcane Shoot borer, Stem or internode borer, Top borer. <u>Pests of Coconut</u> : Rhinoceros beetle, Red palm weevil, Black-headed caterpillar. <u>Pests of Vegetables</u> : Brinjal - Shoot and fruit borer, Grey weevil, Spotted beetle;Tomato - Fruit borer, Serpentine leaf miner. <u>Pests of Beverages</u> : Coffee - Coffee white borer, Green scale, Red borer; Tea - Tea mosquito bug. <u>Pests of Stored products</u> : Rice weevil, Pulse beetle, Red flour beetle, Indian meal moth, Rice moth.	7	CO1 CO2	K1 K2 K3 K4 K5
III	<b>PEST CONTROL</b> Methods of pest control: Natural control, Applied or artificial control: Prophylactic methods; Curative or Direct methods: Cultural methods, Mechanical methods, Physical methods; Biological methods; Recent trends in Pest control: Chemosterilants, Insect attractants,Repellents; Genetically modified crops: Bt cotton; Bt brinjal and Bt maize.	12	CO1 CO2 CO3	K1 K2 K3 K4 K5

IV	PESTICIDES	6	CO4	K1 K2 K3 K4					
	Classification of Insecticides based on the mode of entry and mode of action; Inorganic compounds; Organic compounds: Synthetic organic insecticides and Synthetic Pyrethroids; Hazards of pesticides.			K5					
V	PESTMANAGEMENTANDAPPLIANCESIntegratedPest Management; Plant protection	5	CO1 CO2	K1 K2 K3 K4 K5					
	appliances: Dusters and Sprayers; Global warming and pest outbreak.		CO3						
			CO4						
			CO5						
Presc. 1. Ento Intl., L 2. Gen edition 3. E V.V.Ra Refer 1. Esse 2. Agr Awastl 3. Fun Deshw	Prescribed Books/Textbooks         1. Entomology and Pest Management - Pedigo, L. P. 2007, 5th Ed. Prentice & Hall, Intl., London.         2. General and Applied Entomology - B.V. David, T. Ananthakrishnan, 2004, 2 nd edition.         3. Elements of Economic Entomology - B. Vasantharaj David, V.V.Ramamurthy,2016,8 th edition.         References         1. Essentials of Agricultural Entomology - Ram Singh, Chhillar & Dhaliwal, 2014.         2. Agricultural Insect Pests and their Control. Scientific Publishers (India) Jodhpur - Awasthi, V.B. 2007.         3. Fundamentals of Agricultural Entomology - Shravan. L. Haldhar, Hanuman. L.								
Sugge 1.Fun 2.Agrid Cambr 3. Hand	<b>Suggested Reading</b> 1.Fundamental of Applied Entomology - Pfadt. R. E. 1985, 4 th Ed. The McMillan Co. 2.Agricultural Insect Pests of the Tropics and their Control - Hill, D. S. 1993, Cambridge University Press, Cambridge. 3. Handbook of Agricultural Entomology - Van Emden H.F.,2013.								
Web 1. App <u>entom</u> 2. Inte 3 <u>https</u>	Web Resources         1. AppliedEntomology:       https://www.classcentral.com/course/swayam-applied- entomology-17515         2. Integrated Pest Management:       https://nptel.ac.in/courses/126/104/126104003/ 3https://www.coursera.org/learn/bugs-101								

	Course Articulation Matrix													
Course	Programme Outcomes									ogramm	e Specifi	c Outcoi	nes	~
s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	Cognitive Level
CO 1	3	3	2	1	1	-	-	2	2	2	-	1	3	K1
CO 2	3	3	2	1	2	1	1	-	3	3	-	2	3	K2
CO 3	3	3	3	2	3	2	1	1	1	1	-	1	3	К3
CO 4	3	2	1	1	1	3	1	1	2	2	-	2	3	K4
CO 5	3	2	3	1	3	3	3	2	2	2	1	3	3	К5
Wt. Avg.	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$									1	1. 8	3		
2.03 1.96														
	Overall Mapping of the Course											1.	99	

### ANIMAL LIFE I PRACTICAL

Cour	se Title	ANIMAL LIF	E I PRACTICAL					
Cour	se Code	231ZO1M02						
Cr	edits	2						
Hours	s / Cycle	2						
Cat	tegory	Part III	Core		Practical			
Sen	nester	I						
Ye	ar of	From the ac	ademic year 2023 onwards					
Implen	nentation	To be L'eter	1 · · · · · · · · · · · · · · · · · · ·					
Course Objectives		<ol> <li>To impart basic knowledge on Systematics</li> <li>Discuss the animal architecture and function during the course of evolution</li> <li>Describe evolutionary history of complex multicellular life forms</li> <li>To appreciate the diversity in higher invertebrates including arthropods, molluscs and echinoderms</li> <li>Discuss the biology of Agricultural pest</li> </ol>						
CO #		Cou	ırse Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)			
On com	pleting the	course succes	sfully, the student will be able to	·				
CO 1	Identify an	nd Classify ani	mals in Taxonomic importance	PSO1	K1			
CO 2	Understand	d the economic	c importance of animals and classify	PSO2	K2			
CO 3	Analyse th	e importance	PSO3	К3				
<b>CO 4</b>	Dissect and display various organ systemPSO4K4							
CO 5	Mount and	l display body	parts	PSO4	K5			

	SYLLABUS			
UNIT	CONTENT	HRS	COs	BLOOM'S TAXONOMY LEVEL
т		10	<u>CO1</u>	
1	Identification and classification of animals of taxonomic	12	CO1	K1
				W2
	importance: Paramoecium, Euglena, Foraminifera,		CO3	K2
	Vorticella, Noctiluca, Euplectella, Sycon, Physalia,		CO4	17.2
	Aurelia, Morphysa, Heteronereis, P. monodon, S.		005	КЗ
	serrata, P. sanguinolentus, Limulus, Chiton, Sepia.			K4
	2. Identification and classification of animals of animals of economic importance: <i>Bombyr mori Leptocorisa</i>			K5
	auta Lousing das arbanalis anotted bestle of brinisland			
	Red cotton bug.			
	3. Identification and classification of animals of health			
	importance: <i>Entamoeba</i> , <i>Taenia solium</i> , <i>Fasciola</i> , <i>Anopheles</i> and <i>Musca domestica</i> .			
	4. Study of larval forms: Miracidium, Redia, Cercaria, Nauplius, Zoea, Mysis, Phyllosoma, Alima, Glochidium,			
	Veliger, Pluteus, Ophiopluteus, Echinopluteus and Auricularia			
	5. Dissection: Digestive, reproductive and nervous systems of Cockroach / prawn			
	6. Mounting of mouthparts of Cockroach, Mosquito, Housefly, Honey Bee			
	7. Mounting of sting apparatus, pollen basket and antenna cleaner of Honeybee			
	8. Mounting of prawn appendages			
	9. Collection & Identification of insects on campus (field			
	Study			
Reference	res Books	I		
1	Text book of Practical Zoology – Invertebrata by SSI al			
1.	TERT UUUR OF FRACTICAL ZUULUSY – IIIVEHEUTALA UY S.S.LAI			

	Course articulation matrix													
Programme Outcomes         Programme Specific Outcomes												Cognitive		
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO5	SKIII		
CO1	3	3	3	1	3	-	-	-	3	2	2	2	3	K1
CO2	3	3	3	1	3	-	-	-	3	2	2	2	3	K2
CO3	3	3	3	1	3	-	-	-	3	3	3	3	3	K3
CO4	3	3	3	1	3	-	-	-	2	2	2	3	3	K4
CO5	3	3	3	1	3	-	-	-	3	3	3	3	3	K5
AVG 3 3 3 1 3 2.8 2.4 2.4 2.6										3				
2.6 2.64														
	Overall Mapping of the Course 2.62													

### Correlation of POs/PSOs to each CO and make a corresponding mapping table.

# ALLIED ZOOLOGY I - Theory

Course	Title	ALLIED ZOOLOGY I - Thee	ory							
Course	Code	231ZO1A01								
Credits	5	3								
Hours/	Cycle	4								
Categor	у	Allied		Part III c	Theory					
Semest	er	I								
Year of	f Implementation	From the academic year 2021 -2022 onwards (this is required as some of the courses may not be revised during particular revision)								
Course	Objectives:			Semes	ter I					
	<ol> <li>The synabus</li> <li>To witness an</li> <li>To understand</li> <li>To be able to anatomical char</li> <li>Be ready to ta</li> </ol>	s on the in with a few on their c	w type study of haracteristic m	sification. f the different phyla orphological and						
Expected	l Course Outcomes			PSO addressed	Bloom's Taxonomy Levels (K1 to K5)					
CO1	It enables the stude in classification	ents to understand the principle	PSO 1	K1 & K2						
CO2	Knowledge on pri protozoan parasites reefs	mitive invertebrates with emp , water canal system in sponges	hasis on and coral	PSO 1	K2					
CO3	Understand the par helminthes	asitic adaptations and diseases of	of	PSO 1	K2					
CO4	Enlists the econom	ic importance of the invertebrate	es	PSO 2	K4					
CO5	Significance of the	higher invertebrates		PSO 2	K3 & K5					
	K1 - Remember; K	2 - Understand; K3 - Apply; K4	<b>4</b> - Analys	e; <b>K5</b> – Evalua	ate					
UNIT		CONTENT	Hours	COs	Bloom's Taxonomy Levels					
1	Classifica Outline Classifica Protozoa: General classes, protozoan d	ation and Protozoa tion of Animal Kingdom. characters, Classification upto iseases – amoebiasis, malaria.	10	CO 1 & 2	K1 K2 K3 K4 K5					

2		Porifera and Coelenterata	8	CO1 & 4	K1 K2 K3 K4 K5				
		Porifera: General characters; Classification upto							
		classes. Water Canal System, Economic							
		importance. Coelenterata: General characters;							
		Classification upto classes. Coral Reef							
3		Platyhelminthes and Aschelminthes	10						
		Platyhelminthes: General characters,		CO1 & 3	K1 K2 K3 K4 K5				
		Classification upto classes. Parasitic adaptations		CO1 & 3					
		Aschelminthes: General characters, classification							
		upto classes. Common Helminth parasites of man.							
4		Annelida and Arthropoda	10	CO1 & 4	K1 K2 K3 K4 K5				
		Annelida: General characters, Classification upto							
		classes, Vermiculture. Arthropoda: General							
		characters, Classification upto classes, economic							
		importance of insects and crustaceans.							
5		Mollusca and Echinodermata	10						
		Mollusca: General characters, Classification upto		CO1, 2, 4 &	K1 K2 K3 K4 K5				
		classes, polymorphism in molluscs, Economic		5					
		importance of Molluscs. Echinodermata:							
		General characters; Classification upto classes,							
		Water vascular system.							
Т	ext Bo	pok(s)	I		L				
1	Ayya	r, E.K., Manual of Zoology, 2016, Vol 1. Part I							
2	Jorda	n E.L. 2004, Invertebrate Zoology Chand & Co							
3	Jorda	n and Verma 2006, Invertebrate Zoology, Chand & C	Co						
4	Mode	ern Text Book of Invertebrates, Kotpal series, 5 th Edn	. Rastogi I	Publication					
R	eferei	nce Books							
1	Janet	Moore, 2006. Introduction to Invertebrates, Cambrid	dge						
2	Jan Pechenik, Mc Graw Hill, 2019. Biology of Invertebrates,								
Su	uggested Reading								
1	A	Amita Sarkar, 2010. Understanding Invertebrates, Dis	covery Pu	blishing Pvt. L	td.				
2	E	Barrington, Nelson, 1967. Invertebrate Structure and H	Function.						
W	eb Res	sources							
1	https://www.coursera.org/lecture/introduction-to-biology-biodiversity/molluscs-dPblH								
2		https://www.acs.edu.au/courses/invertebrate-anim	nals-730.as	<u>spx</u>					

	Course articulation matrix													
Programme Outcomes         Programme Specific Outcomes													Cognitive	
COS	PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PSO1 PSO2 PSO3 PSO4								PSO5	skill			
CO1	3	3	3	1	3	-	-	-	3	2	2	2	3	K1
CO2	3	3	3	1	3	-	-	-	3	2	2	2	3	K2
CO3	3	3	3	1	3	-	-	-	3	3	3	3	3	К3
CO4	3	3	3	1	3	-	-	-	2	2	2	3	3	K4
CO5	3	3	3	2	3	-	-	-	3	3	3	3	3	K5
AVG	3	3	3	1.1	3	-	-	-	2.8	2.4	2.4	2.6	3	
							2.7						2.64	
	•	•	•	•	•	•	•	•	(	Overall Ma	pping of th	ne Course	2.63	

## ALLIED ZOOLOGY I PRACTICAL

Cou	rse title	ALLIED ZO	ALLIED ZOOLOGY I PRACTICAL								
Cour	rse Code	231ZO2A02									
Cı	redits	2									
Hour	s / Cycle	24									
Ca	tegory	Part – III	Allied		Practical						
Sei	mester	Ι									
Ye Impler	ear of nentation	From the academic year 2023 onwards									
<ul> <li>Knowledge about the Animal kingdom</li> <li>Describe the distinguishing characteristics of the major taxa</li> <li>Classify variety of invertebrates.</li> <li>Distinguish between classification, morphology and invertebrates</li> <li>To observe the anatomy and structural modifications in and to develop dissection skill.</li> </ul>											
CO #		Course Outo	come(s)	A	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On con	npleting th	e course succ	essfully, the stude	nt will	be able to						
CO 1	Able to dis	cuss the inverte	brates	PS	O4 & PSO5	K1, K2, K4					
CO 2	Understand	I the differences	s among phyla	PSO	4 & PSO5	K2, K3					
CO 3	Identify characteristics in the second secon	aracteristic anat ive organisms in	omical features of n each phylum	PSO4 & PSO5		K4 & K5					
CO 4	Recite the taxonomy and hierarchy of invertebrate binomial nomenclature,PSO4 & PSO5K2& K3										
CO 5	Dissect the	cockroach and	Honeybee	PSO	4 & PSO5	K4 &K5					

## ALLIED ZOOLOGY PRACTICAL – I

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
	ALLIED ZOOLOGY	Y		1
1.	Euglena sp., Paramecium sp., E. histolytica, Noctiluca sp., Euplectella, Spongilla sp., Sycon sp., Physalia sp., Sea anemone.	24	CO1, CO2, CO3, CO4, CO5	K1- K5
2.	Fasciola sp., Miracidium, Redia, Cercaria, Taenia sp., Mytilus sp., Chiton sp., Head louse, Octopus sp., Asteropecten sp., Holothuria sp.,			
3.	Two major pests of Brinjal			
4.	Two specimens of parasitic worms			
5.	Dissection: Cockroach-Digestive system			
6.	Dissection: Cockroach- Nervous System			
7.	Dissections: Cockroach- Reproductive system – Male & Female			
8.	Mountings: Mouth parts of Cockroach and House fly			
9.	Honey bee – Antenna cleaner and Pollen basket			
10.	Mounting : Earthworm - Body Setae			
Presci	ibed Books/Textbooks	1		1

1. A Manual of Zoology – Ekambaranathalyer (2000) 10th edition, Vishwanath Publication.

2. Invertebrate Zoology - VeerbalaRastogi. (or) Dhami&Dhami

3. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut.

4. Kotpal RL; Modern Textbook of Zoology – Invertebrates; Rastogi Publications - Meerut; 2016 edition

5. Richard Busca, W. Moore, Stephen M. Shuster. Invertebrates; OUP USA; 3 edition (19 January 2016)

#### 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). TheInvertebrates: A New Synthesis, III Edition, Blackwell Science

- 3. S.Viswanathan, Chennai. 3. Barnes, 1995 Invertebrate Zoology, W.B.Saunders, Philadelphia.
- 4. Verma P. S. A Manual of Practical Zoology: Invertebrates. S Chand Publication
- 5.Parker JJ and WA Haswel Textbook of Zoology. Vol I and II

#### Suggested Reading

1. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson.

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. Verma P S. (2010) A Manual of Practical Zoology: Non-chordates. S Chand Publication

#### Web Resources

1. <u>https://www.uou.ac.in/sites/default/files/slm/BSCZO-104.pdf</u> 2.https://www.mlsu.ac.in/econtents/758_PRACTICAL%20ZOOLOGY%20%20VERTEBRATE%20(%20PDFDri ve% 20).pdf

						Cou	rse Articu	lation M	atrix					
Course Outcomes		Programme Outcomes									Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	2	2	1	2	2	2	2	3	-	-	2	-	2	K1, K2 & K4
CO 2	2	2	2	3	3	2	3	3	-		2		2	K2 & K3
CO 3	2	2	2	2	3	3	3	3	-		3		3	K4 & K5
CO 4	2	3	3	2	3	3	3	2	-		3		3	K4 & K5
CO 5	2	4	3	2	3	2	3	3	-		2		3	K4 & K5
Wt. Avg.	2	2.	2.	2.	2.	2.4	2.8	2.8	-	2.6	2.4		2.6	
		6	2	2	8									
2.47 2.5														

Overall Mapping of the Course 2.4

## ENTREPRENEURSHIP DEVELOPMENT IN ORNAMENTAL FISHES

Course Title	e Entrepreneurship Developm	Entrepreneurship Development in Ornamental Fishes										
Course Co	de 231ZO1G01											
Credits	2											
Hours / Cy	cle											
Category	Part General Cours	e Theory										
Semester	II	· ·										
Year of	From the academic year 202	3-24 onwards										
Implement	ati											
on												
Course Objective	<ul> <li>The main objectives of this continues</li> <li>1. To acquire knowledge on importance.</li> <li>2. To know the techniques aquarium.</li> <li>3. To understand the breedin</li> <li>4. To learn the management</li> <li>5. To develop business orient</li> </ul>	<ol> <li>The main objectives of this course are to:</li> <li>To acquire knowledge on the biodiversity of ornamental fishes and their importance.</li> <li>To know the techniques involved in construction and maintenance of aquarium.</li> <li>To understand the breeding techniques of livebearers and egg layers.</li> <li>To learn the management aspects in breeding</li> <li>To develop business oriented skill among the student</li> </ol>										
CO #	Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)									
On complet	ing the course successfully, the stu	he course successfully, the student will be able to										
CO1	The students will learn to identify commercially important freshwater and marine ornamental fishes and their sexual dimorphism.	PSO1	K1									
CO2	Will be equipped to model and construct an aquarium tank and learn about the accessories needed for the proper maintenance of aquarium.	PSO3	К2									
CO3	Acquire knowledge on the breeding techniques.	PSO8	К3									
CO4	This course offers a wide range of employment opportunities in the field of ornamental fish farming, trading and setting up of aquariums.	PSO8	K3 & K4									

CO5	Motivate the students to take up entrepreneurship in setting up of aquariums and farming.	PSO3	803 K5	
	SILL	ADUS		
U NI T	CONTENT	HOURS	COs	BLOOM'S TAXONO MY LEVEL
Ι	<b>Introduction to ornamental fishes</b> Scope and importance of ornamental fishes - indigenous and exotic freshwater, marine and brackishwater ornamental fishes of India – Benefits of ornamental fishes - Global and National status of ornamental fish farming and trading.	14	CO1	K1, K2, K3, K4, K5
Π	FabricationandsettingupofaquariumsConstructionandmaintenanceofaquarium:Different types of fish tanks -MaterialsrequiredforconstructionMaterialsrequiredforconstructiontanks-Glasscover,Hood,Aquariumstand,pebbles,sandcrystals,rocksotherdecors.SettingofAquarium.Aquariumaccessories:Airpumps,filters,functionsofgravelbed,foamfilters,powerfilters,Carbonfiltration,lighting,aquariumheaters.bittalbittalbittal	12	CO2	K1, K2, K3, K4, K5
III	<b>Breeding techniques</b> Sexual dimorphism in livebearers and egg layer - selecting the parent; conditioning the fish to breed - various types of breeding - Egg -scatterers, Egg-depositors, Egg-buriers, Mouth- brooders, Nest-builders - Conditioning of fish for packaging- Transport of ornamental fishes - role of anaesthetics in transportation. Common aquarium plants and their propagation – Importance of aquarium	14	CO3	K1, K2, K3, K4, K5

	plants – advantages and disadvantages							
	of live and artificial plants in the							
	aquarium							
IV	Management practices	8	CO4	K1. K2.				
1,	<b>Pregnancy:</b> Food and feeding of	Ū	601	K3 K4 K5				
	ornamental fishes - Nutritional			113, 114, 113				
	requirements types of fish feed live							
	and artificial food Water quality							
	and artificial feed. Water quality							
	management - Common diseases and							
	their control – Bacterial, Viral,							
	Protozoan, Fungal and Crustacean.							
V	Entrepreneurship Development	12	CO5	K4 & K5				
	Scope for entrepreneurs in the							
	ornamental fish sector- Fabrication of							
	glass tanks, Aquascaping, Aquarium							
	plants propagation and trade, Culture							
	and breeding, Making and marketing							
	of accessories, Setting up an aquarium							
	shop and Consultancy							
	servicesGovernment role and schemes							
	towards ornamental fisheries							
	development in India – MPEDA –							
	CMFRI – NFDB – CIFA – NCDC-							
	PMMSY- challenges in the Indian							
	ornamental fish sector							
Dro	soribod Books/Toxt Books							
110	SCHOCU DOORS/ I CAT DOORS							
	1. Biswas S.P. IN Das U.K. Sarkar and La	akra W S 2007 Or	namental fishes o	f North East				
	India An Atlas : NBFGR		indificition fishes o					
Rof	aronco Books							
Ku	crence books							
1. Ya	adav, B.N 2006. Fish and fisheries 4 th edition	on. Daya publishing	g House.					
2 St	ickney R R 1979 Principles of Aquaculture	John wiley& Sons	NY					
2. 50	iexitey, R.R.1979 Timespies of Aquaculture.	John wheye bons	, , , , ,					
3. A:	kelrod, H.R., 1967.Breeding aquarium fishes	.TFH publications	Inc.England.					
4. Sr	ivastava.C.B.L., 1985. Textbookoffishervscie	nceandIndianFishe	ries. KutubMahal	Publications.				
	Allahahad							
<b>5 T</b> 1								
<b>5</b> . Th	habrow De, W.V. 1981.Popular aquarium pla	ints. Thornbill Pres	S.UK.					
MO	DC Courses							
1 h4	nev//youtu ho/VI mbDwHoil							
1. 110	ps.//youu.be/1J_mokwfion							

Course Outco mes	Programme Outcomes									Programme Specific Outcomes				
	PO 1	PO 2	P O 3	P O4	PO 5	Р Об	Р 07	PO8	PS O1	PSO2	PS O3	PSO 4	P S O 5	e Lev el
CO 1	3	-	3	1	3	3	2	2	3	3	3	1	3	K1
CO 2	3	3	3	-	3	-	2	2	3	-	3	1	3	K2
CO 3	3	3	-	1	3	3	3	3	3	3	3	1	3	K3
<b>CO 4</b>	3	3	3	1	3	2	2	2	-	3	3	1	3	K4
CO 5	3	3	3	1	-	3	3	3	3	3	3	1	3	K5
Wt. Avg.	3	3	3	1	3	2.8	2.5	2.5	3	3	3	1	3	
		<u>.</u>	•		2.6	·	•		2.6			·	•	
	1		Ov	erall I	Mappir	ng of t	he Co	ourse					2.6	

### ANIMAL LIFE-II

Co	ourse Title	ANIMAL LII	E-II: Chordata							
C	ourse Code	231ZO2M01								
	Credits	3								
H	ours / Cycle	5								
	Category	Part III   Core   Theory								
	Semester	II								
Year of	f Implementation	From the academic year 2021 -2022 onwards (this is required as some of the courses may not be revised during particular revision)								
Cour	rse Objectives	<ol> <li>The synabus would introduce the basics of Chordates.</li> <li>The broad classification of the animal kingdom with special focus on the vertebrates</li> <li>To understand the unique features and anatomy across phyla with a few type study of the different phyla.</li> <li>Students will be able to differentiate between invertebrates and chordates.</li> <li>The comparative anatomy would enable to distinguish between phyla.</li> </ol>								
CO #		Course Outco	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On con	npleting the course s	successfully, th	e student will be able to							
CO1	Recall and relate the chordates.	e groups that le	d to the origin of	PSO1	K1					
CO2	Understand the mo	orphological, an rtant fishes	natomical characters and	PSO1	K2					
CO3	Identify and explain water to the land.	the origin of 1	novement of animalsfrom	PSO7	K3					
CO4	Appreciate the ad radiation and paren	aptations to flintal care in bird	ght, migration, adaptive s and mammals.	PSO2	K4					
CO5	Compare and inter groups of vertebrat	pret the anaton tes	nical differences among he	PSO1	K5					

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S
				TAXONOMY I EVEL
т	Introduction to Prochardates and Primitive	10	CO1	K1
1	Chordsteer	12		KI K2
				KZ V2
	General characteristics and classification of sub-		CO3	KJ KA
	phylum- Protochordates. Type Study: Amphioxus.		CO4 CO5	K4 K5
	General characteristics, four chordate hallmarks		005	NJ
	(dorsal tubular nerve cord, notochord, gill slits			
	and post anal tail) adaptations that have guided			
	chordate evolution.			
	Agnatha: Ostracoderms and Cyclostomata –			
	classification and general characteristics.			
	Gnathostomata : Placoderms – classification and			
	general characteristics			
II	Poikilotherms - Pisces:	12	CO1	K1
	Fishes: Cartilagenous fishes (Elasmobranchii,		CO2	K2
	Holocephali), Bony fishes (Teleostomi); Dipnoi,		CO3	K3
	Crossopterygii, Branchiopterygii and		CO4	K4
	Actinopterygii: Chirolepis – chondrostei, Holostei		005	К5
	and Teleostel. Fins and locomotion, swim			
	fishes specialized organs, Electric organs, sound			
	producing organs, light producing organs			
	Migration and parental care. Food fishes of India			
	(20 FW, BW and Marine)			
Ш	Poikilotherms – Amphibia and Reptilia	1/1	CO1	K1
	Amphibians: Origin and relationships of	14	CO2	K2
	amphibians, appearance of lungs, development of		CO3	K3
	limbs for travel on land earliest amphibians		CO4	K4
	amphibian contribution to vertebrate evolution		CO5	K5
	General characteristics and classification unto			
	orders perental are			
	Partilas: Origin and adaptive radiation of extinct			
	reptiles. Origin and adaptive radiation of extinct			
	reputes – general characteristics and classification			
	up to orders with local examples – poisonous and			
	non-poisonous reputies with special reference to			
	snakes of India. – Reptiles of Mesozoic Era –			
	Phylogeny of Reptiles			

IV	Homeotherms:	14	CO1	K1							
	Birds: Origin and relationship, general		CO2	K2							
	characteristics with local examples. Common		CO3	К3							
	Birds of India (any Ten) - migration and		CO4	K4							
	navigation, Ratitae – characters, examples;		CO5	K5							
	Carinatae, perching mechanism, flight										
	adaptations Types of beak and feet, nesting and										
	parental care										
	Mammals: General characteristics and										
	Classification up to orders with examples –										
	Dentition in mammals – types of Placenta –										
	Flying mammals – Aquatic mammals – Adaptive										
	radiation - Human Skeletal System										
Prescribed Books/Textbooks											
4.	4. Manual of Zoology, Vol.2. Parts I & II (Chordata). M. Ekambaranatha Iyar and										
_	T.N.Ananthakrishnan. 1992. Viswanathan (Printers & Publishers).										
5.	Chordate Zoology. E.L. Jordan and P.S. Verma										
6.	Chordata and Comparative Anatomy Prof. R. L. Kot	pal									
Refere	ences										
4.	Animal Diversity. Hickman, C.; Roberts, L.S.; Ke	en, S.L.; La	arson, A	A. and Eisenhour, D.							
	(2018) McGraw-Hill.										
5.	The Animal Kingdom: A Very Short Introduction, H	Iolland, P. (2	2011) O	xford University							
	Press										
6.	Vertebrates: Comparative Anatomy, Function, Evolu	ution (4th ed	ition), k	Kardong, K.V. (2006)							
	McGraw- Hill.			-							
Sugges	sted Reading										
4.	The Life of Vertebrates. III Edition. Young, J. Z. (200	04). Oxford	universi	ty press.							
5.	Vertebrate life, VIII Edition, Pough H. Pearson Intern	national.		~ 1							
6.	Comparative Chordate Anatomy - Shekhar Chander,	Vats Rajeev									
Web F	Resources	-									
1.	General Human Anatomy (WMA): https://www.mooc-	-list.com/cou	rse/gene	eral-human-							
an	atomy-wma										
2.	Evolutionary Biology: https://onlinecourses.swayam	2.ac.in/cec20	<u>_bt06/p</u>	review							
3.	https://www.my-mooc.com/en/mooc/megafauna/		3. https://www.mv-mooc.com/en/mooc/megafauna/								

	Course articulation matrix													
Programme Outcomes         Programme Specific Outcomes													omes	Cognitive
COS PO PO PO PO PO PO PO PO PSO							PSO	PSO	PSO	PSO	PSO	- skill		
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	3	3	3	1	3	-	-	-	3	2	2	2	3	K1
CO2	3	3	3	1	3	-	-	-	3	2	2	2	3	K2
CO3	3	3	3	1	3	-	-	-	3	3	3	3	3	K3
CO4	3	3	3	1	3	-	-	-	2	2	2	3	3	K4
CO5	3	3	3	1	3	-	-	-	3	3	3	3	3	K5
AV G	3	3	3	1	3	-	-	-	2.8	2.4	2.4	2.6	3	
							2.6						2.64	
	Overall Mapping of the Course 2.62													

### BIOSTATISTICS AND INSTRUMENTATION

Cou	rse title	Biostatistics and Instrumentation									
Cou	rse Code	231ZO2M03	231ZO2M03								
C	redits	2									
Hour	s / Cycle	3									
Ca	tegory	Part – III Core Theory									
Sei	mester	II	Π								
Y Impler	ear of nentation	From the academic year 2023-2024 onwards									
Course	Objectives	<ul> <li>Impart the basic knowledge on Biostatistics</li> <li>Students will learn concepts of Data collection</li> <li>Learn analytical techniques required for data analysis.</li> <li>Expose the students to basic instruments that are used in a Biological laboratory</li> <li>Learn the utility and their mode of operation of different equipment's.</li> </ul>									
CO #		Course O	utcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the	course success	fully, the student will be	able to							
CO 1	Define a tools	and identify the	different bio statistical	PSO1	K1						
CO 2	Classify o experimer	r distinguish the ntation.	tools for data analysis and	PSO4	K2						
CO 3	Interpret t presentation	the biological da	ta using SPSS for scientific	PSO5	K3						
<b>CO</b> 4	Analyze a conclusion	nd evaluate a da	ta and make meaningful	PSO5 K4							
CO 5	Utilize t techniqu	he information les and develop	based on the latest startups on their own.	PSO6	K5, K6						
	SYLLABUS										
------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------	--------------------------	------------------------------							
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL							
Ι	<b>Population and Sampling</b> Population: Defining a population in biological terms, Estimation, Interval estimation, Testing of Hypothesis; Sampling: Necessity, Types, Simple & Random, Bias/Non-bias; Variables: Qualitative, Quantitative (Continuous and discontinuous), Ranked, Derived	6	C01 C02	K1 K2 K3 K4 K5							
п	Collection and Classification of Data Classification of Data: Need, Characters, Types; Primary: Direct observations, Surveys and Records; Secondary Data – Government data, Trade information, Data from research; Collection of Data – Hypothesis, Nature of the sample, Sample size, measurement, Notation and Significant digits	6	CO1 CO2	K1 K2 K3 K4 K5							
III	InterpretationofDataanalysisIntroduction toSPSS for data analysis;Tabulationofdata–OrganizationofTables,Generalrulesfortables,Generalrulesfortableconstruction,Types;DiagrammaticandGraphicalRepresentationofdata– Need,Usesandgraphs,Pie;MeasuresofcentralGraphs,Pie;Measuresofcentraldispersion– Mean,Median,Mode,SD,ANOVAAAAA	8	CO1 CO2 CO3	K1 K2 K3 K4 K5							
IV	Instrumentation I – Working principle and Significance Basic Laboratory Equipment: Autoclave, Incubator, Water bath, Hot Air Oven and Burette handling, Vortex; Microscope, Inverted microscope, Microphotography, Hemocytometer, Micrometer, Chemical Balance, Digital Balance, Colorimeter, Spectrophotometer, Hotplate with stirrer, Microtome, Cryotome.	8	C01 C02 C03 C04	K1 K2 K3 K4 K5							

V	Instrumentation II – Working principle and Significance Liquid handling: Micropipette usage; Freezers: (- 20°C, -80°C), Cryopreservation, HPLC, ELISA, Thermocycler, RT PCR, Refrigerated Centrifuge, Laminar Air Flow, UV Transilluminator, CO2 Incubator	8	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5							
<ul> <li>Prescribed Books/Textbooks</li> <li>1. An Introduction to Biostatistics- N. Gurumani.</li> <li>2. Introduction to Light Microscopy Tips and Tricks for Beginners - Dee Lawlor</li> <li>3. Biology Laboratory Manual Lab Manual - Darrell S Vodopich, Randy Moore</li> </ul>											
Refere 1. Stati 2. Bio Upadh 3. Expe	<ul> <li>References</li> <li>1. Statistical methods in biology - Bailey Norman T J</li> <li>2. Biophysical Chemistry: Principles and Techniques – Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath.</li> <li>3. Experimental Methods in Biology - Ramesh Maheshwari</li> </ul>										
<ul> <li>Suggested Reading</li> <li>1. Methods in plant biochemistry and molecular biology - Dashek, William V</li> <li>2. Bioinstrumentation- Enderie</li> <li>3. Statistical Methods of Bioinstrumentation – Ewens W. J.</li> </ul>											
Web 1. Fu 2 Bi 3.Bio previe	<b>Resources</b> indamentals of Biotechnology: <u>https://nptel.ac.in/c</u> omedical Signal Processing: <u>https://onlinecourse</u> statistics and Mathematical Biology: <u>https://sw</u>	courses/102 s.nptel.ac.i ayam.gov.	2/103/10 n/noc20_ in/nd2	<u>2103045/</u> _ee41/preview ugc19_ma03/							

Course Articulation Matrix														
Course			Prog	gramn	ne Ou	tcome	es		Prog	ramme	Specif	ic Out	comes	Comitivo
Outco mes	PO 1	<b>PO</b> 2	PO 3	PO 4	РО 5	PO 6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Level
CO 1	1	2	2	3	1	2	-	1	-	-	-	3	1	K1
CO 2	1	2	2	3	1	3	2	2	-	-	-	3	3	K2
CO 3	1	3	2	3	3	2	-	2	-	-	-	3	2	К3
CO 4	1	3	2	3	3	3	2	1	-	-	1	3	3	K4
CO 5	1	3	3	3	3	1	3	-	-	-	-	1	1	K5
Wt.       1       2       2       3       2       2.       2.       1.       -       -       1         Avg. $1$ $2$ $2$ $3$ $2$ $2$ . $2$ . $3$ $1$ .       -       - $1$											2. 6	2		
2.12 1.8													•	
Overall Mapping of the Course 1.96														

### ANIMAL LIFE II PRACTICAL: Chordata

Course	e title	ANIMAL LIFE I	IPRACTICAL: Chord	ata						
Course	Code	231ZO2M02								
Cree	lits	2								
Hours /	Cycle	2								
Categ	gory	Part – III	Core	Practical						
Seme	ster	п								
Year Impleme	r of ntation	From the academic year 2023-2024 onwards								
Course Ol	ojectives	<ul> <li>Be introduced to the dissection of various systems of fish</li> <li>Familiarize with the identification of prochordates, fishes, reptiles, amphibians and mammals</li> <li>Know the accessory respiratory organs of fishes and mounting of placoid scales</li> <li>Familiarize with the identification of campus birds</li> </ul>								
CO #		Course Ou	utcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On comple	eting the c	ourse successfully,	the student will be able	to						
CO 1	Identify importa	and Classify nce	animals in Taxonon	nic PSO1	K1					
CO 2	Identify	and Classify animal	s in economic importance	e PSO1	K2					
CO 3	Identify	and Classify animal	s in health importance	PSO3	К3					
CO 4	Dissect and display various organ system PSO3 H									
CO 5	Mount a	nd display body par	rts	PSO3	K5					

	SYLLABUS			
UNIT	CONTENT	BLOOM'S TAXONOMY LEVEL		
Ι	<ol> <li>Dissections of various systems: Alimentary, circulatory and urinogenital systems of fish.</li> <li>Mounting: Placoid scales of Shark</li> <li>Slides and specimens of Prochordates: <i>Herdmania, Amphioxus</i> (section through pharynx) Agnatha: <i>Petromyzon</i> and <i>Ammocoetus</i> larva, Tornaria larva, <i>Salpa</i></li> <li>Specimens of fishes: <i>Trygon, Acipenser,</i> <i>Protopterus, Echeneis and Hippocampus,</i> <i>catla, Labeo rohita</i> and <i>Cirrhinus mrigala</i></li> <li>Accessory respiratory organs: <i>Anabas.</i> FW catfish</li> <li>Specimens of reptiles: <i>Chelonia, Calotes,</i> <i>Chameleon,</i> poisonous and non-poisonous snakes (Krait, <i>Enhydrina,</i> Cobra, <i>Eryx,</i> <i>Typhlops</i>).</li> <li>Field visit to identify Campus birds (10 birds) relate their beak and feet and two ratitae</li> <li>Field visit to identify Campus mammals and study about Echidna, Platypus, Loris and Koala</li> </ol>	24	CO1 - 5	K1 K2 K3 K4 K5
Textbooks Text	book of Practical Zoology – Chordata by S.S.Lal	I	I	1

Textbook	extruors Text book of Flactical Zoology – Chordata by S.S.Lai														
	Course Articulation Matrix														
			Prog	ramm	e Outc	omes			Programme Specific Outcomes					Cognitive	
COs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PSO1	PSO2	PSO3	PSO4	PSO5	Level	
CO 1	2	3	2	2	2	-	-	1	3	1	2	-	1	K2	
CO 2	2	3	2	2	2	-	-	2	3	1	1	-	3	K2	
CO 3	2	3	2	2	2	-	-	1	3	1	1	-	3	K2	
CO 4	2	3	2	2	2	-	-	1	3	2	3	-	-	K1	
CO 5	2	3	2	2	2	-	-	1	3	3	3	-	-	K1	
Wt. Avg.	5	3	5	5	5	-	-	1.2	3	1.6	2	-	2.3		
	4.03 2.2														
			(	Overall	Mapp	oing of	the Co	urse				3.	11		

### **ALLIED ZOOLOGY II - Theory**

Course	Title	ALLIED ZOOLOGY II - Theory									
Course	Code	231ZO2A01									
Credits	5	3									
Hours/	Cycle	4									
Categor	y	Allied		Part III c	Theory						
Semest	er	П									
Year of	² Implementation	From the academic year 202 of the courses may not be rev	1 -2022 on vised durin	wards (this is ng particular i	required as some revision)						
Course (	<b>Objectives:</b>	Semester II									
	1. The syllabus v	vould introduce the student to the basics of vertebrates									
	2. To witness and	mal kingdom with special focus on the vertebrate classification.									
	3.To understand	the unique features of the differ	the unique features of the different classes								
	4. To understand	the various life patterns of verte	ebrates								
	5. To learn the st	ignificance of the chordates									
Expected	l Course Outcomes		PSO addressed	Bloom's Taxonomy Levels (K1 to K5)							
CO1	It enables the stude classes	nts to understand the origin of v	ertebrate	PSO 1	K1 & K2						
CO2	Knowledge on verte	ebrates with emphasis on their li	fe cycle	PSO 1	K2						
CO3	Understand the pec	uliarities in higher mammals		PSO 1	K2						
CO4	To develop entrepre	eneurs through aquarium fish ke	eping	PSO 3	K4						
CO5	Understand the eco	nomic value of vertebrates		PSO 3	K3 & K5						
	K1 - Remember; K	2 - Understand; K3 - Apply; K4	- Analyse	; <b>K5</b> – Evaluat	e						
UNIT		CONTENT	Hours	COs	Bloom's Taxonomy Levels						
1	PROCHO Introduction to Proto characters. <b>Pisc</b> Classification upto of and migration	<b>RDATES &amp; PISCES</b> ochordates - Basic chordate es: General characters; orders – parental care in fishes	9	CO1	K1 K2 K3 K4 K5						
2	AMPHII	BIA & REPTILES	12	CO1 & 2	K1 K2 K3 K4 K5						
	Amphibia: General orders, Parental ca General characters. Identification of ve snakes of India – Po	characters, Classification upto re in Amphibians. <b>Reptilia:</b> , Classification upto orders, nomous and non - venomous ison apparatus and its function									

3			12	CO1 8 2						
		BIRDS & MAMMALS		01 & 3	K1 K2 K3 K4 K3					
		fossil birds – migration in birds. <b>Mammalia:</b> General								
		characters, Classification upto orders – Marsupials,								
		Aquatic and flying mammals.								
4		ORNAMENTAL FISH CULTURE	10	CO4	K1 K2 K3 K4 K5					
		Aquarium fish keeping – Scope and importance of								
		ornamental fishes – freshwater, brackish and								
		egg layers, types of breeding, scope for								
		entrepreneurs in ornamental fish industry								
5			5							
-		ECONOMIC ZOOLOGY	-	CO5	K1 K2 K3 K4 K5					
		Poultry farming – importance of poultry, nutritive								
		value of egg; Cattle farming – dairy product;								
1	ext Bo	pok(s) r. E.K. Manual of Zoology, 2016 Vol 2 Part II								
$\frac{1}{2}$	Eleme	ents of Economic Zoology – B V David 2016 $8^{\text{th}}$ Economic 2016 $8^{\text{th}}$ Economic 2016 $8^{\text{th}}$ Economi	- 1n							
2	a ·									
3	Srivas	stava, C.B.L.: Fishery Science and Indian Fisheries, 2	002							
4	Mode	rn Text Book of Vertebrates, Kotpal series, 5 th Edn. R	Rastogi Pu	blication						
R	leferer	ice Books								
1	Hick	man, Jr.C.P. 1981 Integrated Principles of Zoology 7	7 th Edn.							
2	Terer	a Andesirk and Gerald A, 1990, Biology Life of Eart	h							
Su	ggeste	d Reading								
1	Т	he Life of Vertebrates. III Edition. Young, J. Z. (2004)	4). Oxford	university pres	8.					
2	2 Vertebrate life, VIII Edition, Pough H. Pearson International.									
W	Web Resources									
1	E	volutionary Biology: <u>https://onlinecourses.swayam2.</u>	ac.in/cec20	)_bt06/preview						
2	h	ttps://www.my-mooc.com/en/mooc/megafauna/								

	Course articulation matrix													
			Progra	mme O	utcomes				Pro	gramme S	Specific O	utcomes		Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	3	3	3	1	3	-	-	-	3	2	2	2	3	K1
CO2	3	3	3	1	3	-	-	-	3	2	2	2	3	K2
CO3	3	3	3	1	3	-	-	-	3	3	3	3	3	К3
CO4	3	3	3	1	3	-	-	-	2	2	2	3	3	K4
CO5	3	3	3	1	3	-	-	-	3	3	3	3	3	K5
AVG	3	3	3	1	3	-	-	-	2.8	2.4	2.4	2.6	3	
2.6 2.64														
	Overall Mapping of the Course 2.62													

# ALLIED ZOOLOGY II PRACTICAL

Cou	rse title	ALLIED ZOOLOGY II PRACTICAL										
Cour	rse Code	231ZO2A02										
C	redits	2										
Hour	rs / Cycle	24										
Ca	tegory	Part – III	Allied		Practical							
Sei	mester	II										
Ye Impler	ear of nentation	From the academic year 2023 onwards										
<ul> <li>Course Objectives</li> <li>Course Objectives</li> <li>Classify variety of Chordates</li> <li>Distinguish between classification, morphology and function Chordates</li> <li>To observe the anatomy and structural modifications in Chordates and to develop dissection skill.</li> </ul>												
CO #		Course Outo	come(s)	A	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On con	npleting th	e course succ	essfully, the stude	nt will	be able to							
CO 1	Enable to a mounting.	cquire the pract	tical knowledge of	PS	O3 & PSO5	K1, K2, K4						
CO 2	To identify identifying	chordates base characters	d on special	PSO	2 & PSO5	K2, K3						
CO 3	Describe g animal cla	general taxonor ssification of	mic rules on chordates	PSO2, PSO4 & K4 & K5 PSO5								
<b>CO 4</b>	Understand adaptaions	l Mammals with	n specific structural	PSO	4 & PSO5	K2& K3						
CO 5	To maintai identified r	n a neat, labelec nuseum specim	l record of ens	PSO	4 & PSO5	K4 &K5						

	SYLLABUS													
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL										
	ALLIED ZOOLOGY													
1.	Amphioxus and Balanoglossus	24	CO1, CO2, CO3, CO4,	K1 K2 K3 K4 K5										
2.	Mounting: Placoid scales		005											
3.	5 Elasmobranchs of South India													
4.	5 Teleosts of South India													
5.	Parental care in Amphibia (Ichthyophis sp. & Alytes sp.)													
6.	Venomous Snakes – Cobra (Naja sp.), Krait (Bungarus sp.), Viper (Echis sp.)													
7.	Chameleon, 2 birds, Echidna, Platypus, Bat, Loris													
8.	Dissection: Digestive system of Fish													
9.	Dissection: Reproductive system of Fish													
10.	Identification of five beaks and feet of Birds													

### **Prescribed Books/Textbooks**

1. Arumugam, N. Chordate Zoology, Vol. 2. SarasPlublication. 278 pages. 200 figs.

2. A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., □ UK). 852pages. (Revised edition of Parker & Haswell, 1961).

M. EkambaranathaAyyar, 1973. A manual of zoology. Part II. (S. ViswanathanPvt. ☐ Ltd., Madras).
 P.S. Dhami & J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.

5. Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp.

#### References

1. Jordan E.L. and P.S. Verma 1995.Chordate Zoology and Elements of Animal Physiology.S.Chand and Co.New Delhi

2. Kotpal, R.L 2012. Vertebrata, Rastogi publication Merruth.

3. Nigam, H.C. 1983. Zoology of chordates, Vishal publication, Jalandhar

- 4. R.L.Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut). 632 pages.
- 5. E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.

#### **Suggested Reading**

1. A.K. Sinha, S. Adhikari& B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages

2. G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.

3. Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p.

4. S.S.Lal, Practical Zoology - Vertebrata

5. P.S.Verma, A manual of Practical Zoology - Chordata

#### Web Resources

1.https://www.mlsu.ac.in/econtents/758_PRACTICAL%20ZOOLOGY%20%20VERTEBRATE%20 (%20PDFDrive%20).pdf

2. https://uou.ac.in/sites/default/files/slm/BSCZO-201.pdf

3.https://www.schandpublishing.com/books/higher-education/biology/a-manual-practical-zoologychordates/9788121908306/

	Course Articulation Matrix													
Course Outcomes			P	rogramı	ne Outc	omes			Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	2	2	1	2	2	2	2	3	3	2	2	2	2	K1, K2 & K4
CO 2	2	2	2	3	3	2	3	3	2	2	2	3	2	K2 & K3
CO 3	2	2	2	2	3	3	3	3	3	3	3	3	3	K4 & K5
CO 4	2	3	3	2	3	3	3	2	3	3	3	3	3	K4 & K5
CO 5	2	4	3	2	3	2	3	3	2	3	2	3	3	K4 & K5
Wt. Avg.	2	2.	2.	2.	2.	2.4	2.8	2.8	2.6	2.6	2.4	2.8	2.6	
		6	2	2	8									
	2.47 2.6													

Overall Mapping of the Course2.53

#### **Course Title NUTRITION & WELL BEING Course Code** 231ZO2G01 Credits 4 4 Hours / Cycle Category Part IV **General Course** Theory Semester V Year of 2023 Implementation The main objectives of this course are to: 1. Understand and assess the relationship between nutrition, physical fitness, and disease status of an individual. 2. Examine the effects of nutritional influence on health. **Course Objectives** 3. Students will cultivate knowledge on nutritional requirements from infancy to adulthood. 4. Students will understand nutritional requirements during pregnancy and lactation. 5. Analyze the significance of physical exercises **Bloom's Taxonomy** PSO Levels **CO**# **Course Outcome(s)** Addressed (K1 to K5) On completing the course successfully, the student will be able to **CO1** Explain the principles of nutrition. PSO1 K1 PSO2 K2 **CO 2** Assess the energy requirements in humans. Understand the nutritional requirements from infancy to **CO3** PSO3 K3 adulthood. **CO**4 Understand the nutritional requirements during pregnancy K4 PSO4 and lactation. K5 **CO 5** PSO5 Analyse the role of nutrition on human health. **BLOOM'S** TAXONO UNIT CONTENT Hrs. COs MY LEVEL Concept & Definition: Nutrition, Malnutrition & Health. K1, K2, K3, Scope of Nutrition. CO1, CO2, 8 Ι CO3, CO4, Minimum Nutrition Requirement, Recommended dietary K4, K5 **CO5** allowance (RDA), Dietary Guidelines in Man & Woman. Adult Consumption Unit. Energy Unit, Energy balance, Assessment of Energy Π 10 CO1, CO2, K1, K2, K3, CO3, CO4, requirements, Basal Metabolic Rate, Determination of K4, K5

### **NUTRITION & WELL BEING**

	Energy in food. Macro Nutrients - Protein, Carbohydrate,		CO5	
	Fat-Classification, functions, Digestion & absorption,			
	RDA, sources and deficiencies. Micronutrients -			
	Calcium, Phosphorus and magnesium: Functions,			
	absorption, RDA, sources and deficiencies.			
TTT	From infancy to adult: Somatic, Physical, Brain & Mental	10	CO1, CO2,	
111	development, Puberty, Menarche, Menopause. Factors	10	CO3, CO4,	KI, K2, K3,
	affecting growth & development.		CO5	<b>K4, K</b> 5
	Pregnancy: Importance of adequate weight gain during			
IN/	pregnancy, Nutritional Requirements during pregnancy.	10	CO1, CO2,	K1 K2 K3
1 V	Management of preterm & low weight babies. Common	10	CO3, CO4,	$\mathbf{K}$
	problems of pregnancy: Nausea, vomiting, food aversions.		CO5	м4, мэ
	Lactation: Nutritional requirements during Lactation			
N/	Diabetes mellitus, Cancer, Thyroid, PCOS, Obesity,	10	CO1, CO2,	<b>V1 V2 V2</b>
v	Arthritis, Hypertension, Gestational Diabetes, Cholesterol	10	CO3, CO4,	$\mathbf{K}\mathbf{I}, \mathbf{K}2, \mathbf{K}3, \mathbf{V}4, \mathbf{V}5$
	management, Glucoma, Anemia. Exercise for good health.		CO5	N4, NJ

### **Prescribed Books/Textbooks**

- 1. Anita F.P., Philip Abraham, Clinical Dietetics and Nutrition, Oxford University Press; 4th edition.
- 2. Kathleen Mahan L., Sylnia Escott-Stump, Krause's food, nutrition and diet therapy (11th edition). Saunders Company, London.
- 3. Passmore R. and Davidson S. (1986) Human nutrition and Dietetics. Liming stone\ublishers. Robinson C.H. Careme, Chenometh W.L., Garmick A.E. (1986) 16th edition.
- 4. Williams, M. H., Anderson D. E., & Rawson, E. S. (2017). Nutrition for health, fitness, and sport (11th Ed.). Boston: McGraw-Hill. ISBN: 9781259953996.
- 5. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed;; New Age International Publishers
- 6. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.

#### **References**

- 1. <u>Encyclopedia of Human Nutrition. Lindsay H Allen, Andrew Prentice, Benjamin Caballero 2013.</u> <u>Academic Press.</u>
- 2. Advanced Nutrition and Human Metabolism. 2018 Sareen S. Gropper, Jack L. Smith, Timothy P. Carr. Cengage Learning.
- 3. Handbook of Nutrition and Pregnancy. 2018. Carol J. Lammi-Keefe, Sarah C. Couch, John P. Kirwan. Springer International Publishing;Humana Press.
- 4. Nutrition During Pregnancy and Lactation: Implications for Maternal and Infant Health. 2019. Leanne M. Redman.

#### Web Resources

**1.** MOOC: Coursera-Stanford Introduction to Food and Health, Stanford Universityhttps://www.coursera.org/learn/food-and-health. 3. Population, Food, and Soil

	Mapping with Programme Outcomes													
COs	COsPSO1PSO2PSO3PSO4PSO5PSO6PSO7PSO8PSO9PSO10													
CO1	S	S	S	L	S	S	М	М	М	S				
CO2	S	S	S	L	S	S	М	М	М	S				
CO3	S	S	S	L	S	S	S	S	S	S				
<b>CO4</b>	S	S	S	L	S	М	М	М	S	S				
CO5	S	S	S	L	S	S	S	S	S	S				

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

*S-Strong; M-Medium; L-Low

			CELL DIOLOGI									
Course	e Title	CELL BIOI	JOGY									
Cour	se Code	231ZO3M01										
Cr	edits	3										
Hour	s / Cycle	5										
Cat	tegory	Part I	Part ICoreTheory									
Ser	nester	III										
Ye	ear of	From the ac	cademic year 2024 onwards									
Implen	nentation	The last for the										
Course	Objectives	1. Understand 2. To learn t 3. Study the 4. Examine t 5. To get acc	d in bunct points / Describe in 100 d the existence of life and cellular o he functions and the structure of the cell cycle and cell communication the structure of DNA and its propert quainted with the various methods o	rganization cell meml ies f cellular a	n branes a nalysis	nd organelles						
CO #		Cour	rse Outcome(s)	PSO Address	ed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the	course succes	ssfully, the student will be able to									
CO 1	Study and and basics	remember the	e basics of cell visualization types organisation	PSO1		K1						
CO 2	Understan	d Cell membr	ranes and function	PSO2		K2						
CO 3	Identify signaling	and interpre	t cellular communication and	PSO3		K3						
<b>CO 4</b>	Analyse th	ne structure of	DNA and its properties	PSO4		K4						
CO 5	Appraise	the learner on	the methods of cellular analysis	PSO5		K5						
UNIT			CONTENT	Hrs.	COs	BLOOM'S TAXONOMY LEVEL						
I	I       CELL BASICS       12       CO1       K1 K2 I         Course Introduction, Evolution of life on Earth – Prebiotic       Chemistry leading to RNA world Historical landmarks in       14       CO1       K1 K2 I         Chemistry leading to RNA world Historical landmarks in       the discovery of the cell, Microscopy and Cell theory.       Divergent Evolution – LUCA, Gene diversion,       Corthologues, Paralogues and Homologues. Cell       III       IIII       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII											
II	CELL Role a	MEMBRAN	<b>E AND ORGANELLES</b> f cellular organelles – Ribosome	, 10	CO2	K1 K2 K3 K4 K5						

# **CELL BIOLOGY**

	Nucleus, Golgi complex, Mitochondria, Rough and										
	Smooth Endoplasmic Reticulum, Chloroplast, Lysosome,										
	Nucleolus Membrane structure – Plasma membrane,										
	Lipid and Lipid Bilayer Model, Unit Membrane Model										
	(Protein-Lipid Bilayer-Protein), Fluid mosaic model and										
	Danielle Model.										
III	CELL COMMUNICATION AND CELL CYCLE	10	CO3	K1 K2 K3 K4							
	Cellular communication and signal transduction,			K5							
	Transport across cell membranes Interaction of cells with										
	other cells – Cadherins, Adherens, Junctions and										
	Desmosomes Introduction to Cell cycle and Cell cycle										
	regulators Mitosis, Meiosis and Programmed cell death										
IV	DNA STRUCTURE, GENETIC CODE AND RNA	8	CO4	K1 K2 K3 K4							
	Structure of DNA, Packaging of DNA molecules into		00.	K5							
	chromosomes, Prokaryotic and Eukaryotic Chromosomes,										
	The Genetic Code RNA – Types, Structure and function,										
	Transcript, Transcriptome Plasmids and Viruses										
	Epigenetics										
V	CELLULAR ANALYSIS	8	CO5	K1 K2 K3 K4							
	Cell culture, Fractionation of cell contents, FACS-			K5							
	Fluorescence Activated Cell Sorter Chromosomal staining										
	technique – FPG staining, C -banding, G-banding FISH -										
	Fluorescence in-situ hybridization. Use of radioisotopes										
	in cellular analysis and Autoradiography										
Prescribed I	Books/Textbooks										
1. Cell and N	Iolecular Biology. GERALD KARP. 2019. (9th Edition) Wil	ey Publ	ications								
2. Molecular	Biology of The Cell. ALBERTS et al., 2015 (6th Edition). C	Garland	Science								
3. Cell Biolo	gy. Wiley Publications. STEPHEN R. BOLSOVER et al., 20	11. (3rd	l Editior	ı).							
4. Molecular	Cell Biology. LODISH et al: (Freeman, 2000). W.H.Freema	n & Co	Ltd.								
5. Essential C	Cell Biology. ALBERTS et al: 1998. Garland Science.										
References											
1. Molecular	Cell Biology. HARVEY LODISH et al., 2016. WH Freeman										
2. DNA the S	Secret of Life. JAMES D. WATSON, 2003. RHUK.										
3. Genetics:	Principles and Analysis. HARTL & JONES, 1997. Jones and	Bartlett	Publish	ers, Inc.							
Suggested R	eading										
1. Cell and M	Iolecular Biology: Concepts and Experiments, KARP, G. 201	0 (6th e	edition)	John Wiley &							
Sons.Inc.				-							
2. Cell and M	Iolecular Biology (8th edition), DE ROBERTIS, E.D.P. and I	DE ROI	BERTIS	, E.M.F. 2006							
Lippincott Williams and Wilkins, Philadelphia.											
3. The Cell: A Molecular Approach. COOPER, G.M. and HAUSMAN, R.E. 2009. (5th edition) ASM											
Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.											
4. The World of the Cell. BECKER, W.M.; KLEINSMITH, L.J.; HARDIN. J. AND BERTONI, 2009.											
(7th edition) Pearson Benjamin Cummings Publishing, San Francisco.											
Web Resour	·ces										
1. Coursera: I	Decoding the Universal Language of Life										
2.EdX: The C	Cytoskeleton and Cell Cycle; The Cell; Introduction to Biolog	gy - The	-Secret	of Life							
3.NPTEL: C	ell Biology; Molecular Cell Biology										

Course articulation matrix														
	Programme Outcomes Programme Specific Outcom													Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	3	1	1	3	1	2	2	2	3	3	3	3	-	K1
CO2     3     1     2     2     2     1     3     2     3     3     3													-	K2
CO3	3	1	1	1	1	2	2	2	2	2	3	-	1	K3
CO4	3	2	2	1	1	1	1	2	-	1	3	2	2	K4
CO5	3	2	1	1	2	2	2	2	1	1	-	3	-	K5
AVG	3	1.4	1.4	1.8	1.4	1.6	2	2	2.2	2	2.4	2.2	1.3	
				Ov	erall M	lapping	g of the	Cours	e				1.8	

### DEVELOPMENTAL BIOLOGY

Cours	e Title DEVELOPMENTAL BIOLOGY											
Cour	se Code	231ZO3N	<b>M</b> 02									
Cr	edits	3										
Hour	s / Cycle	5		1	1							
Cat	tegory	Part	Ι	Core			T	neory				
Sen	nester	III										
Ye	ar of	From t	he a	cademic year 2024 of	nwards							
Implen	ientation	Tabal	inte	d in hullot noints /De	aniha in 100	worda						
Course	Objectives	<ol> <li>To be 1</li> <li>To e skills an</li> <li>Unde</li> <li>Know</li> <li>The s</li> <li>Mechaninvolve</li> <li>Stud</li> <li>higher a</li> </ol>	quip nd an ersta v the stude isms d. ents anim	o students to face comp nalytical skills in the la nd the concepts on dev e recent advancement is ents will attain a basic s of development and will be able to learn nals.	service in 100 petitive examinate ab. velopment and in development conceptual kn identify the gen about the com	the technical science owledge of netic and parative of	d by usin iques. e. of the pr molecul developr	ng creative thinking inciple cellular ar elements that are ment from lower to				
CO#			Cou	rse Outcome(s)		PSO Address	sed	Bloom's Taxonomy Levels (K1 to K5)				
On com	pleting the	course si	icce	essfully, the student w	vill be able to							
CO 1	To study t	he basic	phei	nomenon of sex deterr	mination and	PSO3	3	K1				
	Gametoge	nesis	-									
CO 2	Understan developm	d and ent	di	scover the early	embryonic	PSO3	3	K2				
CO 3	Analyze mechanisi	the dev n	velo	pmental patterns w	vith genetic	PSO3	3	К3				
CO 4	To class developm	ify and ent	c	ategorize the late	embryonic	PSO3 &	25	K4				
CO 5	To interpr	et and foo	cus o	on human reproductive	e biology	PSO3 &	\$5	K5				
UNIT				CONTENT		Hrs.	COs	Bloom's Taxonomy Level				
Ι	INTRODU	CTION,	SEX	DETERMINATION A	AND	8	CO1	K1 K2 K3				
	GAMETO Ontogeny a of Xenop Chromoson	GENESIS nd Phylog us laevi nal, Horme	s eny, s onal,	Preformation/Epigenesi development. Sex d Environmental Develop	is. Basic stages letermination oment of Gonad			K4 K5				

	- Spermatogenesis and Oogenesis The Sperm and the Egg			
II	<b>EARLY EMBRYONIC DEVELOPMENT</b> Fertilization – External and Internal, Activation of Egg metabolism. Cleavage – types and patterns Gastrulation. Fate map – Origin and specification of germ layers. Morphogenesis.	10	CO2	K1 K2 K3 K4 K5
III	<b>DEVELOPMENTAL PATTERNS</b> Axis specification – Genetic mechanism, Anterior-posterior and Dorso-Ventral Axis specification – Genetic mechanism, Anterior- posterior and Dorso-Ventral. Segmentation and the Anterior- Posterior Body Plan. Segmentation Genes - The gap genes, The pair-rule genes, The segment polarity genes	8	CO3	K1 K2 K3 K4 K5
IV	<b>LATE EMBRYONIC DEVELOPMENT</b> Somitogenesis, Sclerotome, Dermomyotome, Osteogenesis, Heart development, Vasculogenesis, Hematopoiesis. Hox genes and limb development Pharynx, Digestive and Respiratory tube Metamorphosis, Parthenogenesis, Regeneration and Ageing	12	CO4	K1 K2 K3 K4 K5
V	HUMAN REPRODUCTIVE BIOLOGY AND EVOLUTION Puberty, Estrous/Menstrual cycle, Pregnancy and Menopause. Pregnancy and Health – IVF, Gestational Diabetes, Hypertension, PCOS, Contraception Teratogenesis – Alcohol, Retinoic Acid, Diethylstilbestrol (DES) and Bisphenol A (BPA) Evolutionary change – Heterotopy, Heterochrony, Heterometry, and Heterotypy	10	CO5	K1 K2 K3 K4 K5

### **Prescribed Books/Textbooks**

1. KOTPAL, R.L. 2019. Comparative Anatomy and Developmental Biology. Rastogi Publications

2. MICHAEL J.F. BARRESI & SCOTT F. GILBERT. 2019. (12th Edition). Developmental Biology. Sinauer Associates Inc

3. SASTRY, K.V. & VINEETA SHUKLA. 2018. Developmental Biology. Rastogi Publications

#### References

SLACK J. M. W. 2012. (3rd Edition). Essential Developmental Biology. Wiley-Blackwell.

BALINSKY, B.I. 2012. An Introduction to Embryology. Cengage Learning India

LEWIS WOLPERT, CHERYLL TICKLE & ALFONSO MARTINEZ ARIAS. 2019. Principles of Development. Oxford University Press.

BERRILL, N.J. 1971. Developmental Biology. McGraw-Hill Inc., US

SCHATTEN, H. & G. SCHATTEN. 1989. Molecular biology of fertilization. Elsevier.

### **Suggested Reading**

1. SUBRAMONIAM, T. (2008) Molecular Developmental Biology. Narosa Publication, New Delhi and Alpha Science International Ltd. United Kingdom.pp.279.

2. MCEWVEN. 1949. Comparative Vertebrate Embryology. IBH Publishing Co., New Delhi.

NELSON, O.E. 1953. Comparative Vertebrate Embryology of the Vertebrates. Mcgraw - Hill Book Com New York. 3. BARRINGTON, E.J.W. 1967. Structure and Function of Invertebrates. Houghton Mifflin.

4. RAJINI ARORA & ANITA GROVER. 2019. Developmental Biology Principles and Concepts. R Chand & CO New Delhi.

#### Web Resources

1. Coursera: Decoding the Universal Language of Life

2. EdX: The Cytoskeleton and Cell Cycle; The Cell; Introduction to Biology - The -Secret of Life

3.NPTEL: Cell Biology; Molecular Cell Biology

Course articulation matrix														
Programme Outcomes         Programme Specific Outcomes														Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	1	2	1	2	2	2	2	2	-	-	3	-	2	K1
CO2	2	2	1	1	3	3	3	3	-	-	3	-	2	K2
CO3	2	2	2	2	2	2	2	2	-	-	3	-	2	K3
CO4	2	2	2	2	2	2	2	2	-	-	3	-	3	K4
CO5	2	2	2	2	2	2	2	2	-	-	3	-	3	K5
AVG	1.8	2	1.6	1.8	2.2	2.2	2.2	2.2	-	-	3	-	2.4	
				Ov	erall M	lapping	g of the	Cours	e				1.5	

# PRACTICAL - CELL AND DEVELOPMENTAL BIOLOGY

Cour	se Title	CELL AND	DEVELOPMENTAL BIOLOG	GY							
Cour	ourse Code 231ZO3M03 Credits 2										
Cı	redits	2									
Hours	s / Cycle	2		1							
Ca	tegory	Part I	Core		Practical						
Ser	nester	III	Ш								
Ye	ear of	From the academic year 2024 onwards									
Impler	nentation	To be Lister	in hullot points (Describe in	100 words							
Ca Obj	ourse ectives	<ol> <li>To impart</li> <li>Study and</li> <li>Describe et</li> <li>Interpret, a manner.</li> </ol>	basic knowledge on Cell and De understand the staining technique mbryonic development in human nalyse and present experimental	evelopmental bio es, cell division and chick. results and con	ology a and chromosome types aclusions in a scientific						
CO #	#     Course Outcome(s)     PSO Addressed     Bloom's Taxonomy Levels (K1 to K5)										
On con	pleting the	e course succe	ssfully, the student will be ab	le to							
CO 1	Identify the division.	e chromosomes	and stages of the cell	PSO3 & 4	K1						
CO 2	Stain and i leukocytes	dentify differer	t blood cell types and separate	PSO3	K2						
CO 3	Understand chick.	d the embryoni	c development in human and	PSO3	К3						
<b>CO 4</b>	Analyze th	e sperm and ov	um.	PSO3	K4						
CO 5	Identify an	d understand th	e importance of placenta.	PSO3	K5						

	SYLLABUS			
UNIT	CONTENT	Hrs.	COs	Bloom's
				Taxonomy
				Level
Ι	1.Introduction to Microscopy, Liquid handling-	24	CO1,	K1, K2, K3,
	Micropipette and Sterilization		CO2,	
	2. Mitosis – Onion root tip		CO3,	K4, K5
	3. Meiosis – Grasshopper testis		CO4,	
	4. Differential staining of Peripheral Blood smear		COS	
	5. Separation of Leukocytes by Histopaque – Ficoll – 1077			
	6. Slides - Metaphase chromosome of Mouse and human			

	7. Study of developmental stages in chick embryo: 24, 36,										
	48 and 72 hrs.										
	8. Study of egg types, cleavage, blastula and gastrula stages										
	of Amphioxus & Frog										
	9. Morphometries of Sperm										
	10.Morphometries of ovum										
	11. Placentation – Pigs and Goats and Study of Human										
	Foetal stages										
References	Books										
1. GERA	1. GERALD KARP. 2019. (9th Edition). Cell and Molecular Biology. Wiley Publications.										
2. STEPH	EN R. BOLSOVER et al., 2011. (3rd Edition). Cell Biology. Wiley Publications.										

3. KOTPAL, R.L. 2019. Comparative Anatomy and Developmental Biology. Rastogi Publications

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

	Course articulation matrix													
COS			Pro	gramm	e Outco	omes			P	rogramn	ne Specif	ic Outco	mes	Cognitive
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	1	3	2	3	1	2	2	-	-	3	3	-	K1
CO2	1	1	3	2	3	1	2	2	-	-	3	3	-	K2
CO3	1	1	3	2	3	1	2	2	-	-	3	3	-	K3
CO4	1	1	3	2	3	1	2	2	-	-	3	3	-	K4
CO5	1	1	3	2	3	1	2	2	-	-	3	3	-	K5
AVG	1	1	3	2	3	1	2	2			3	3		
	Overall Mapping of the Course 2.1													

### WILD LIFE MANAGEMENT

Cours	se Title	WILD LIFE	MANAGEMENT								
Cours	se Code	231ZO3I01									
Cre	edits	2									
Hours	s / Cycle	4									
Cat	egory	Part III	<b>General Elective</b>		Theory						
Sem	nester	V									
Yea Implen	ar of nentatio n		From the academic year 2023 onwards								
1. This paper deals with wild life from an Indian point of view allowing the students to understand the ecological concepts, evaluate a given habitat and identify the critical issues related to management of wildlifeCourse Objectives2. Identify native wildlife species and agencies responsible for providing the protection, conservation, management, and enhancement of wildlife populations and habitat.3. The objective of this paper is to expose the student to the potential of Indian forestry and wildlife and to equip him/her to undertake minor projects in this area.4. He/she will also be in a position to attempt questions in this to											
CO#		Course	Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
	On completing the course successfully, the student will be able to										

CO 1	understanding the man animal relationship and their conservation	PSO1	K1
CO 2	To understand the structure of different ecosystems	PSO2	K2
CO 3	To be familiar with various types of conservation methods	PSO3	K3
<b>CO 4</b>	To enrich knowledge on protected areas	PSO4	K4
CO 5	To understand the laws to protect wildlife	PSO5	K5

	SYLLABUS			
UNIT	CONTENT	Hrs.	COs	BLOOM'S TAXONO MY LEVEL
Ι	<b>Introduction:</b> Definitions, Scope of wild life biology. Governmental and NGO involvement in protection and conservation of wildlife. Relationship between animals and man.	14	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
п	Wildlife ecology: Aquatic, terrestrial, forest and mountain ecosystems. Food chain and food web. Intraspecific and interspecific relationships. Dispersal and factors influencing dispersal.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
ш	Wild Life in India Threats to Biodiversity, In-situ and Ex-situ conservation. Endangered, Endemic, Extinct and Invasive species of India. Animals in human lives. Economically important fishes, amphibians, reptiles, birds and mammals	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Protected Areas Protected areas – national parks, wildlife sanctuaries, marine parks & Sanctuaries, Sites of conservation importance – Tiger reserves, elephant reserves, Biosphere Reserves, RAMSAR wetland sites, BHS (Biodiversity Heritage Sites), IBAs (Important Bird Areas) in India. Hot spots.	8	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	Wildlife conservation and Legislation The Biological Diversity Act (2002). Wildlife protection Act (1972, Indian Forest Act (1927,) Forest 52 Conservation Act (1980). Red Data Book. - Role of state, central, statutory and international bodies in conservation and protection of wild life - NBA, State Biodiversity Board, People's Biodiversity Register, WII, BNHS, ZSI.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

#### **Prescribed Books/Textbooks**

1. The Development of International Principles and Practices of Wildlife Research Management by Stephen H. Berwick and U. B. Sahania

#### **References**

- 1. Ecology of a changing planet by Mark B. Bush
- 2. Human import on ecosystem by Trivi and O'Hore
- 3. National Parks of Madhyapradesh by S. K. Tiwari
- 4.

#### Suggested Reading

1. Endangered Animals of India and their Conservation by S. M. Nair

#### Web Resources

1. el@umt.edu.my

Course articulation matrix														
Programme Outcomes Programme Specific Outcomes													Cognitive	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	2	3	3	1	3	2	2	2	3	2	1	1	3	K1
CO2	2	3	2	1	2	2	2	2	3	3	3	1	2	K2
CO3	2	3	3	1	3	3	3	3	2	2	1	1	3	K3
CO4	2	3	3	1	3	3	3	3	2	2	1	1	3	K4
CO5	2	3	3	1	3	3	3	3	2	2	1	1	3	K5
AVG	2	3	2.8	1	2.8	2.6	2.6	2.6	2.4	2.2	1.4	1	2.8	
								2.4					1.96	
				Ov	erall M	lapping	g of the	Cours	e				2.18	

## GENETICS AND MOLECULAR BIOLOGY

Cour	se Title	GENET	ICS A	AND N	MOLI	ECULAR I	BIOLOGY				
Cour	se Code	231ZO4	M01								
Cı	edits	3									
Hour	s / Cycle	5									
Ca	tegory	Part	Ι			Core				The	eory
Ser	nester	IV									
Ye	ear of	From t	he ac	ademi	ic yea	r 2024 onw	vards				
Implen	nentation										
Course	Objectives	To be I 1. To skills an 2. Unde 3. Know 4. Stude mechan 5. Stud express	<ol> <li>To equip students to face competitive examinations by using creative think skills and analytical skills in the laboratory.</li> <li>Understand the concepts on molecular genetics and their techniques.</li> <li>Know the recent advancement in Molecular biology.</li> <li>Students will attain a basic conceptual knowledge of the principle cellular mechanism and identify the genetic and molecular elements that are involved.</li> <li>Students will be able to learn about the various process of translation and avprassion techniques.</li> </ol>								
CO#			Cour	se Out	tcome	e(s)		PSO Addres	sed		Bloom's Taxonomy Levels (K1 to K5)
On com	pleting the	course si	icces	sfully,	, the s	tudent will	l be able to				
CO 1	Understan	d the basis	s of in	heritar	nce			PSO:	3		K1
CO 2	Understan	d the impo	ortanc	e of ge	enetic	maps		PSO:	3		K2
CO 3	Describe I	DNA repli	catior	ı in euk	caryote	es and proka	aryotes	PSO	3	К3	
<b>CO 4</b>	Examine g coding gen	gene expr nome	essior	n and o	contro	l with a no	te on non-	PSO3 a	<b>&amp;</b> 4		K4
CO 5	Appraise the of cellular	raise the learner on the methods on molecular analysis PSO3 & 4 K5 ellular activity									K5
UNIT				CONT	TENT			Hrs.	C	Os	Bloom's Taxonomy Level
I	GENETICS AND INHERITANCE12CO1Introduction to Genetics - (Classical, Modern, sub disciplines, Databases and organisms for Genetic research), Allele, Locus and Genes/Genotype; Principles of hereditary – Monohybrid, Dihybrid and Multiple allele; Single gene – inheritance pattern (Mendel's law of Segregation) and Chromosomal basis; Sex linked gene inheritance and Epistasis12CO1							K1 K2 K3 K4 K5			

II	GENETIC MAPS AND BACTERIAL GENETICS	10	CO2	K1
	Gene Structure – Watson & Crick Proposal, Genome structure			K2
	and stability; Genetic Maps, Linkage and Pedigree;			K3
	Chromosome mapping and recombination; Plasmids –			K4
	Conjugation, Transformation and Transduction; Chromosome			K5
	variation – Rearrangements, aneuploidy and polyploidy			
III	DNA REPLICATION	8	CO3	K1
	Semiconservative DNA replication – The Meselson-Stahl			K2
	Experiment; DNA Polymerases and replisome; Model of DNA			K3
	replication – Initiation, semidiscontinous and rolling circle;			K4
	Eukaryotic replication and errors in DNA Replication;			K5
	Mutation types – Gene mutation and Chromosomal Mutation			
IV	GENE TRANSCRIPTION AND PROCESSING	10	CO4	K1
	Overview of transcription in prokaryotes and eukaryotes;			K2
	mRNA, tRNA, rRNA and transcription factors; Synthesis and			K3
	processing of mRNA – splicing and capping and tailing;			K4
	Regulatory Non-coding RNA – miRNA, siRNA, piRNA,			K5
	CircRNA			
V	TRANSLATION, EXPRESSION AND TECHNIQUES	8	CO5	K1
	Decoding the mRNA – Prokaryotes and Eukaryotes; Bacterial			K2
	Operon - Lac and Tryptophan; DNA extraction,			K3
	Spectrophotometric analysis of DNA, Gel electrophoresis,			K4
	Western blotting			K5

### **Prescribed Books/Textbooks**

1. WATSON et al., 2004. Molecular biology of the Gene. Pearson Education

2. LODISH et al., 2008. Molecular Cell Biology. Freeman Company

3. GERALD KARP, 2010. Cell and Molecular Biology. Wiley Publications

#### Reference

1. JAMES D. WATSON, 2003. DNA the Secret of Life. RHUK.

2. ALBERTS et al.2015 (6th Edition). Molecular Biology of The Cell. Garland Science

3. COOPER, G.M. AND HAUSMAN, R.E. 2009. The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland Weshington, D.C., Singura Associates, MA

Sunderland, Washington, D.C.; Sinauer Associates, MA.

4. BENJAMIN LEWIN, 2007. Genes IX. Jones and Bartlett Publishers, Inc.

5. EBERHARD PASSARGE. 2007. Colour Atlas of Genetics. Thiemeces

#### **Suggested Reading**

1. TAMARIN, 2001. Principles of Genetics. McGraw-Hill

2. GRIFFITHS et al., 2015. Introduction to Genetic Analysis. W H Freeman & Co

3. HARTL & JONES, 1998. Genetics: Principles and Analysis. Jones and Bartlett Publishers, Inc

4. BENJAMIN A. PIERCE, 1919. Genetics: A conceptual approach. W H Freeman & Co ALBERTS B, BRAY D,

5. LEWIS J, RAFF M, ROBERTS K, AND WATSON J.D. 2008. Molecular Biology of the Cell. Garland Science.

#### Web Resources

Coursera: The Little Stuff: Energy, Cells, and Genetics; Methods of molecular biology edX: DNA Replication and Repair; Genetics; Genes and Genetic Inheritance; Transcription NPTEL: Molecular Genetics

	Course articulation matrix													
Programme Outcomes Programme Specific Outcomes														Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	3	1	1	3	1	2	2	2	-	-	3	-	3	K1
CO2	3	1	2	2	2	1	3	2	-		3	-	3	K2
CO3	3	1	1	1	1	2	2	2	-	-	3	-	3	K3
CO4	3	2	2	1	1	1	1	2	-	-	3	3	3	K4
CO5	3	2	1	1	2	2	2	2	-	-	3	3	3	K5
AVG	3	1.4	1.4	1.8	1.4	1.6	2	2	-	-	3	1.2	3	
1.5 1.4											1.4			
				Ov	erall M	lapping	g of the	Cours	e				1.5	

# **EVOLUTION AND ETHOLOGY**

Co	urse Title	<b>EVOLUTION</b>	AND ETHOLOGY								
Cou	urse Code	231ZO4M03									
(	Credits	3									
Hou	ırs / Cycle	4									
C	Category         Part I         Major / Core         Theory										
Semester IV											
Year of ImplementationFrom the academic year 2023 - 2024 onwards (this is required as some of the courses may not be revised during particular revision)											
Cours	Course ObjectivesTo be Listed in bullet points /Describe in 100 words1. To understand the evolution of life and organisms2. To bring out the different types of Behaviours3. To evaluate behaviour of all animals, including humans.										
CO#		Course Outcome(s)PSO AddressedBloom's Taxonomy Levels (K1 to K5)									
On cor	mpleting the c	course successfu	lly, the student will be a	able to							
CO 1	Focusses on	the concepts of o	origin of life	PSO7	K1						
CO 2	Evaluate and demonstrate	compare the evol the origin of the f	utionary pressures and uture man	PSO7	K2						
CO 3	Understand a inhabit in the their activitie seasons.	nderstand and conceptualize how species profitably habit in the temporal environment and space out for eir activities at different times of the day and asons.PSO2K3									
<b>CO 4</b>	Understand a role of behav animals in the	nd be able to obje iour in the protec e wild.	ectively evaluate the tion and conservation of	PSO2	K4						
CO 5	Consider and evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environmentPSO2K5										

	SYLLABUS			
UNIT	CONTENT	Hrs.	COs	Bloom's
				Taxonomy
				Level
Ι	ORIGIN AND EVOLUTION OF LIFE	10	CO1	K1 K2 K3
				K4 K5
	Historical review of evolutionary concept: Theory of special creation,			
	Theory of spontaneous generation (Abiogenesis), Theory of			
	Biogenesis, Theory of eternity of life, Modern concept of origin of			
	life (Oparin-Haldane Theory/ biochemical). Evidences of Evolution:			
	Evidences from Palaeontology (fossilization, types of fossils,			
	computation of the age of a fossil, fossil parks, mass-extinction,			
	Anotomy (homology, analogy, vesticial organs, connecting links			
	Anatomy (nonology, analogy, vestigial organs, connecting miks,			
	Theories of Evolution: Lamarchism (postulates, avidences, criticism)			
	and Neo Lamarkism: Darwinism (postulates, evidences, endersin)			
	Darwinism Sources of variations: Heritable variations and their role			
	in evolution			
II	NATURAL SELECTION, ADAPTATION, HUMAN	15	CO2	K1 K2 K3
	EVOLUTION			K4 K5
	Network and a fitter a selection and fitter			
	of one unit of selection for a dominant allele genetic load			
	mechanism of working types of selection density-dependent			
	selection, heterozygous superiority, kin selection, adaptive			
	resemblances, sexual selection). Genetic Drift (mechanism, founder's			
	effect, bottleneck phenomenon; Role of Migration and Mutation in			
	changing allele frequencies). Product of evolution: Micro			
	evolutionary changes (inter-population variations, clines, races,			
	Species concept, Isolating mechanisms, modes of speciation—			
	allopatric, sympatric). Adaptive radiation/ macroevolution			
	(exemplified by Galapagos finches Extinctions); Background and			
	extinction Origin and evolution of man: Unique hominin			
	characteristics contrasted with primate characteristics. Primate			
	Phylogeny from Dryopithecus leading to Homo sapiens.			
III	INTRODUCTION TO ETHOLOGY	10	CO3	K1 K2 K3
				K4 K5
	Fundamentals of Ethology: Description and measurement of			
	benaviour by its function and form (continuous process, series of			
	uiscrete events), Causation of behaviour (proximate/ultimate), Mathods and approaches (avalutionary) Concerts and retterney Virda			
	(foregoing territorial mate selection and courtship percent)			
	defensive displacement activities ritualization habitat calestica			
	Allomimetic and maladaptive (abnormal) behaviour Storectured			
	hebayiour (orientation reflexes) Mativation and models of			
	behaviour (orientation, reflexes), initiation and models of			

	motivation (Lorenz's (Psychohydraulic), Tinbergen's (Hierarchial).Innate/Instinct vs Learning: Communication (primates, bees and ants), types (visual, acoustics, chemical signals; tactile), Motor output (escape behaviour, cricket vocalizations) and Sensorimotor integration (electric fish, birdsong).Mimicry and colouration; Learning and memory: Habituation, imprinting (filial/sexual), conditioned reflex, trial and error learning, latent			
	learning, insight learning. Regulation of behaviour: Neural control (kineses, taxes, simple reflexes). Sensory processing: toad prey capture, sound localization (owls), echolocation (bats)			
IV	SOCIAL ORGANIZATION	6	CO4	K1 K2 K3
	Social organization in animals (honey bee, termites, lion, deer, antelopes, monkeys and other mammals). Communication in living in groups. Elements of socio-biology (selfishness, cooperation, altruism, kinship and inclusive fitness). Evolution of sociality, eusocial organisation; Evolution of reproductive behaviour, mating systems and parental care.			K4 K5
V	BIOLOGICAL RHYTHMS AND CHRONOBIOLOGY	7	CO5	K1 K2 K3
Procoribod	Biological rhythms: Types (ultradian, circadian, infradian), Properties of circadian rhythms. Migration and navigation in birds and fishes. Terminologies used (zeitgeber, phase, phase shift, entrainment, free running rhythm, actogram, masking, arrhythmia). Biological oscillation and the role of melatonin; Chronobiology (history, clocks and human physiology, clock genes, sleep disorders, chronotherapy) Human Behaviour: Actions (Inborn, discovered, absorbed, trained and mixed actions), Gestures (Primary and secondary gestures), Baton signals, Greeting signals.			K4 K5
1 RIDI FY	BOOKS/1extbooks(1-5 books) M 1993 Evolution Blackwell Scientific Publications			
<ol> <li>A. MOLET</li> <li>MANNI</li> <li>REENA</li> <li>MORRIS</li> <li>SCOTT,</li> </ol>	NG, A, 1993. Evolution: Blackweit Scientific Fublications NG, A, 1967. Introduction to Animal Behaviour. Addison Wesley MATHUR, 2005. Animal Behaviour. Rastogi Publications S DESMOND, 1977. Manwatching. Jonathan Cape Ltd. GRAHAM, 2005. Essential Animal Behavior. Wiley-Blackwell			
References	(3-5)			
<ol> <li>HALL, B</li> <li>CAMPBI</li> <li>DOUGLA</li> <li>MCFARI</li> <li>HUNTIN</li> </ol>	K. AND HALLGRIMSON, B, 2007. Evolution. Jones and Bartlett Publishe ELL, N. A. and REECE J. B. 2011. Biology. IX Edition, Pearson, Benjamin, AS, J. FUTUYMA.1997. Evolutionary Biology. Sinauer Associates LAND, D, 1987. Companion to Animal Behaviour. Oxford University Press (GFORD, FELICITY, 1984. The study of Animal Behaviour. Springer	rs, Inc Cumming	8	

	Course Articulation Matrix													
Course Programme Outcomes								]	Programm	ne Specifi	c Outcon	ies	Cognitive Level	
s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	1	1	1	1	1	1	1	1	-	-	-	-	3	K1
CO 2	2	2	2	2	3	3	3	2	-	-	-	-	3	K2
CO 3	2	2	2	2	3	3	2	3	-	3	-	-	-	К3
CO 4	2	2	2	2	2	2	2	3	-	3	-	-	-	K4
CO 5	2	2	2	2	2	3	2	2	-	3	-	-	-	K5
Avg.	1.8	1.8	1.8	1.8	2.2	2.4	2	2.2	-	1.8	-	-	1.2	
	2 0.6													
Overall Mapping of the Course 1.3														

# **PRACTICAL - MOLECULAR BIOLOGY AND GENETICS**

00025	se 1 itie	MOLLCULA	R BIOLOGY AND G	ENETIC	CS PRAC	TICAL					
Cours	se Code	231ZO4M02									
Cre	edits	2									
Hours	/ Cycle	2									
Cate	egory	Part I   Core   Practical									
Sem	lester	IV Even the coordonic year 2024 converde									
Y ea Implem	ar of entation	From the academic year 2024 onwards									
Course (	Objectives	<b>To be Listed</b> 1. To impart 2. Understan 3. Describe t 4. Interpret, a	<ul> <li>To be Listed in bullet points /Describe in 100 words.</li> <li>1. To impart basic knowledge on genetics and molecular biology</li> <li>2. Understand the significance of blood groups, dermatoglyphics and karyotypes</li> <li>3. Describe the genomic DNA isolation</li> <li>4. Interpret, analyse and present experimental results out of electrophoresis and PCR</li> </ul>								
CO #		Course Ou	tcome(s)	PS Addı	SO ressed	Bloom's Taxonomy Levels (K1 to K5)					
On comp	oleting the	course succes	sfully, the student will	be able	to						
CO 1	Identify	the mutants	of Drosophila &	PS	03	K1					
	Mendelia	in traits									
CO 2	Analyses	of blood grou	ps	PS	603	K2					
CO 3	Study the	patterns in De	ermatoglyphics	PS	03	К3					
CO 4	Analyse Syndrom	the karyo es	types of various	PS	604	K4					
CO 5	Analyses and PCR	s of DNA & u	se of Electrophoresis	PS	SO4	K5					

SYLLABUS									
UNIT	CONTENT	HOURS	COs	BLOOM'S					
				TAXONOMY					
				LEVEL					
Ι	1. Drosophila genetics – identification of mutants	24	CO1,	K1, K2, K3,					
	2. Human Mendelian Traits – Widows, Ear lobe,		CO2,						
	Rolling of tongue, crossing of Finger, Length of		CO3,	K4, K5					
	Index		CO4,						
	3. Blood Group Analysis: ABO, Rh and Multiple		CO5						
	Allele Inheritance pattern								
	4. Dermatoglyphics								
	5. Karyotype – Normal, Kleinfelder's, Downs,								
	Turners, Pataus and Edward syndromes								

	6. Giant Chromosomes - Chironomous Larvae							
	7. Genomic DNA isolation							
	8. Qualitative assessment of gDNA by Gel							
	Electrophoresis							
	9. Quantitative Estimation of DNA by							
	Diphenylamine and UV - Spectrophotometric							
	method							
	10. PCR & Gel Electrophoresis of PCR amplified							
	product							
Referen	ces Books							
1. WATSON et al., 2004. Molecular biology of the Gene. Pearson Education								
2. I	2. LODISH et al., 2008. Molecular Cell Biology. Freeman Company							
2 0	2 CEDALD KADD 2010 Coll and Malagular Dialogy, Wiley Dubligations							

3. GERALD KARP, 2010. Cell and Molecular Biology. Wiley Publications.

Course articulation matrix														
	Programme Outcomes							Programme Specific Outcomes				Cognitive		
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	SKIII
CO1	1	1	3	2	3	1	2	2	-	-	3	3	-	K1
CO2	1	1	3	2	3	1	2	2	-	-	3	3	-	K2
CO3	1	1	3	2	3	1	2	2	-	-	3	3	-	K3
CO4	1	1	3	2	3	1	2	2	-	-	3	3	-	K4
CO5	1	1	3	2	3	1	2	2	-	-	3	3	-	K5
AVG									-	-	3	3	-	
								3					1.2	
Overall Mapping of the Course 2.1														

# **BIOTECHNOLOGY AND BIOINFORMATICS**

Cou	rse title	title BIOTECHNOLOGY AND BIOINFORMATICS							
Course Code		231ZO5M01							
Credits		5							
Hour	rs / Cycle	72							
Category		Part – I	Core	Theory					
Semester		V							
Year of Implementation		From the academic year 2024 onwards							
Course Objectives		<ul> <li>Onderstand aims of molecular background in biotechnology techniques to develop new products.</li> <li>This course is designed for learners to get exposed to recombinant biotechnology and the use in industry.</li> <li>This is courses that build up student's deep knowledge towards the modern approaches for genetically modified organisms.</li> <li>The objective of this course is to learning and understanding basic concepts of Bioinformatics</li> <li>The student will be introduced to the world of Bioinformatics /insilico analysis of the genome.</li> <li>Students will learn how to search, visualize protein using different visualization tool.</li> </ul>							
CO #	Course Outcome(s)				PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)			
On completing the course successfully, the student will be able to									
CO 1	Describe the role of Biotechnology and Bioinformatics to analyze a cell				PSO3 & PSO4 K1, K2				
CO 2	Employme the genome	ent of suitable te	echnology to analyze	PSO3 & PSO4 K1, K2					
CO 3	Outline the different areas of expertise in the field of Biotechnology				PSO3 & PSO4 K4 & K5				
CO 4	Trace the genetic and molecular basis using Bioinformatic tools				PSO3 & PSO4 K2 & K3				
CO 5	Trace the genetic and molecular basis using Bioinformatic tools				3 & PSO4	K3 & K5			

SYLLABUS								
UNIT	CONTENT	HO URS	CO s	BLOOM'S TAXONOMY LEVEL				
Ι	<b>Introduction to Biotechnology:</b> Biotechnology a science of many disciplines – Types (Microbial, Agricultural, Forensic, Bioremediation, Fisheries, and Medical. Biotechnology – "The Big Picture", Biotechnology and business, Jobs in Biotechnology, Future trends.	12	CO 1	K1 K2 K3 K4 K5				
II	<b>Recombinant DNA technology: Microbial</b> Biotechnology - Restriction Enzymes, Plasmids, Vectors, Cloning, Microbial insecticides, Biomass utilization, Fermentation and Brewing. Proteomics - In drug development, in food processing, in Textile industry and Protein Engineering. Ethics – Regulating the use of Biotechnology, Societal issues, Patenting and IPR	12	CO 2	K1 K2 K3 K4 K5				
III	Industrial Biotechnology: Agricultural Biotechnology – Bio-agricultural commercialization, Food safety, GE plants and food, Transgenic plants, Herbal Medicine. Animal Biotechnology – Cloning of animals, Transgenic animals. Fisheries Biotechnology - Methods of gene transfer in fishes - fish vaccines – immunostimulants – probiotics Cryopreservation of gametes – drug development from marine organisms – disease diagnosis. Environmental Biotechnology – Biofuels, Bioremediation, Biochemodynamics, Environmental Biotechnological Pollutants, Management of Biotechnologies.	20	CO 3	K1 K2 K3 K4 K5				
IV	<b>Bioinformatics</b> : Introduction, Omics, Concepts, Databases, Information retrieval and storage of data. Application of Bioinformatics, Benefits of the Human Genome Project. Biomarker discovery, Pharmacogenomics, Pharmacokinetics, Chemoinformatics.	20	CO 4	K1 K2 K3 K4 K5				
V	<b>Tools and Technologies</b> : PubMed, NCBI, Pubchem, PopSet, UniProtKB/Swiss-Prot, PDB, Gene Bank, MedGen, RefSeqGene. Nucleotide database – OMIM, KEGG, Human Protein Atlas, Ensembl, miRBase. Molecular Taxonomy – Phylogeny, Plylogenic Tree, Cladogram, Phylogenomics. Interactome – Network analysis, Gene ontology, Structural Bioinformatics, 3D Visualization, Metabolomics Emerging web tools and their application in Bioinformatics.	14	CO 5	K1 K2 K3 K4 K5				
- 1. William J. Thieman, 2013. Introduction to Biotechnology. Pearson Benjamin Cummings 3rd edition.
- 2. Bernard R. Glick, 2009. Molecular Biotechnology Principles and Applications of Recombinant DNA. United States; Publisher: Washington, DC : ASM Press.
- 3. David P. Clark , 2016. Biotechnology. Applying the Genetic Revolution. San Francisco Pearson.
- 4. Trevor Palmer, 2007. Enzymes Biochemistry, Biotechnology, Clinical Chemistry. Woodhead Publishing.
- 5. Pavel Pevzner & Ron Shamir, 2011. Bioinformatics for Biologists. Cambridge University Press.
- 6. Arthur Lesk, 2014. Introduction to bioinformatics. OUP Oxford

### References

1. Stefano Allesina & Madlen Wilmes, 2019. Computing Skills for Biologists A Toolbox. Princeton University Press.

2. E. O. Wiley & Bruce S. Lieberman, 2011. Phylogenetics Theory and Practice of Phylogenetic Systematics Wiley-Blackwell.

- 3. T. A. Brown, 2016. Gene Cloning and DNA Analysis: An Introduction. Wiley-Blackwell.
- 4. T.R. Srinivas, 2008. Environmental Biotechnology, New Age International Pvt. Ltd. Publishers.

5. Akoh, Casimir C, 2017. Food Lipids: Chemistry, Nutrition, and Biotechnology. CRC Pres

### **Suggested Reading**

1 Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten; 2009. Molecular Biotechnology. 4th Edition. ASM Press.

2. Christina A. Crawford, 2018. Principles and Applications of Recombinant DNA, Principles of Biotechnology. Salem Press,

3. Trevor Palmer, Philip L. Bonner, 2007. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, Wood head Publishing,

4. Goutam Brahmachari, 2016. Biotechnology of Microbial Enzymes. Production, Biocatalysis and Industrial Applications. Academic Press.

5. William J. Thieman, Michael A. Palladino. 2012. Introduction to Bio - technology, Pearson.

						Cour	se Articu	lation Ma	atrix					
Course Outcomes			P	rogramı	ne Outc	omes			Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	2	1	-	2	2	-	3	3	-	-	-	2	K1 & K2
CO 2	-	2	2	-	3	2	-	3	2	-	-	-	2	K2 & K3
CO 3	-	2	2	-	3	3	-	3	3	-	-	-	3	K4 & K5
CO 4	-	3	3	-	3	3	-	2	3	-	-	-	3	K4 & K5
CO 5	-	4	3	-	3	2	-	3	2	-	-	-	3	K3 & K5
Wt. Avg.	-	2.6	2.2	-	2.8	2.4	-	2.8	2.6	-	-	-	2.6	
	2.56 2.6													

**Overall Mapping of the Course** 2.58

## AQUACULTURE

Cour	se title	AQUACULT	URE							
Cours	se Code	231ZO5M02								
Cre	edits	3								
Hours	/ Cycle	60								
Cate	egory	Part – I	Core		Theory					
Sem	nester	V								
Ye: Implem	ar of entation	From the academic year 2023 onwards								
Co Obje	urse octives	<ul> <li>Understand the scope, importance and prospects in Aquaculture and</li> <li>Acquire knowledge on cultivable fin fishes and shellfishes.</li> <li>To meet the academic to provide knowledge for sustainable aquaculture.</li> <li>To train learners for better performance in various competitive examination and in research careers.</li> <li>To facilitate Higher education &amp; research in Aquaculture</li> </ul>								
CO #	(	Course Outcon	ne(s)	P Add	'SO ressed	Bloom's Taxonomy Levels (K1 to K5)				
On com	pleting the o	course successf	fully, the student will	be ab	le to					
CO 1	Will be equ	ipped with the l	know-how of	PSC	01 &	K1, K2				
	aquaculture			PS	O5					
CO 2	Will get em options in t	ployment opport he field of aqua	tunities andresearch culture.	PSC PS	01 & O5	K1, K2				
CO 3	Will get the shrimp/fish	confidence to t farming on thei	ake up r own.	PSC PS	01 & O5	K4 & K5				
<b>CO 4</b>	Will be able ways of sus	e to develop nev tainable farming	w and innovative g.	PSC PS	01 & O5	K2 & K3				
CO 5	Will explor and their m	e the recent tren anagement	nds in aquaculture	PSC PS	01 & O5	K3 & K5				

	SYLLABUS			
UNIT	CONTENT	HOU RS	COs	BLOOM'S TAXONOMY LEVEL
Ι	Introduction to aquaculture: Definition - scope and importance; National and global aquaculture production and trends; Indian research and development organizations; Scope for entrepreneurs in aqua farming	5	CO1	K1 K2 K3 K4 K5
Π	Pond Preparation and Farm Management: Pre- requisites of cultivable organisms; Common aquaculture species (freshwater, marine and estuarine finfishes and shellfishes); Exotic species; Selection of suitable sites: Farm construction – pond preparation - fertilization - stocking - monitoring - harvesting; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shellfish diseases and their control measures	15	CO2	K1 K2 K3 K4 K5
III	Types and Recent Trends in Aquaculture: Farming of finfish and shellfish: traditional - extensive - semi intensive - intensive - Pokkali culture and sewage- fed fish culture; Monoculture- Polyculture and Integrated farming; Pond – cage – pen - raft - rope culture - race way culture - recirculatory aquaculture system - warm water and cold water aquaculture; Aquaponics and Biofloc technology; Seaweed culture	14	CO3	K1 K2 K3 K4 K5
IV	Breeding techniques and application of Biotechnology in aquaculture: Techniques in aquaculture: hybridization - selective breeding - in- breeding - out breeding and hybrid vigor; Sex control and sex reversal in fishes; Induced breeding; Gynogenesis - androgenesis – polyploidy; Genetic manipulation: transgenics; Vaccination in fishes; Cryopreservation of gametes; Biotechnology in fish health management and nutrition.	13	CO4	K1 K2 K3 K4 K5
V	Seed production and hatchery Management: Broodstock Management: Factors affecting the maturation and spawning of finfishes and shell fishes; Criteria for the selection of broodstock; Nutritional and environmental requirement for	13	CO5	K1 K2 K3 K4 K5

- 1. T.V.R. Pillai, 2011. Aquaculture Principles and Practices. Black well publishers,
- 2. Uk. Ramaswamy Santhanam, N. Sukumaran And P. Natarajan, 1990. A Manuel of Freshwater Aquaculture.
- 3. Robert R. Stickney, 2009. Aquaculture: An Introductory Text. CABI publisher.
- 4. Ramasamy Santhanam, N Ramanathan And G Jegatheesan, 1990.Coastal Aquaculture in India. CBS Publishers & amp; Distributors. Delhi, India

### References

- 1. Andrew Mcdeere, 2019. Aquaponics for Beginners. Amazon Digital Services LLC KDP Print, US.
- 2. Yoram Avnimelech , 2013. Biofloc Technology A Practical Guidebook. The World Aquaculture society, USA.
- 3. Robert R. Stickney, 2013. Principles of Aquaculture. Wiley India Pvt. Ltd, Noida.
- 4. Mathew Landau, 2014. Introduction to Aquaculture. Wiley publisher, USA
- 5. S.D. Tripathi, W.S. Lakra And N.K. Chadha, 2018. Aquaculture in India. Narendra Publishing House, Delhi.

### **Suggested Reading**

- 1 Rath, R.K. 2000. Freshwater Aquaculture. Scientific Publishers (India), Jodhpur.
- 2 Jhingran, A.V.G, 1991. Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.
- 3 Baradach, J.E. J.H., Ryther & Wo, M.C. Larney, 1972. Aquaculture: The farming and Husbandary of Freshwater and Marine Organisms. Wiley Inter Science, New York.
- 4 S. Athithan 2020. Coastal Aquaculture and Mariculture. Narendra Publishing House, Delhi.
- 5 R. Santhanam, N. Sukumaran And P. Natarajan, 1987. A Manual of Freshwater Aquaculture. Oxford and IBH Publishing, New Delhi.

### Web Resources

- Becoming Aquaculture expert Part I, II and III: https://www.udemy.com/
   Aquaponics the circular food production system (edX): <u>https://www.mooc-list.com/</u>
- Introduction to Aquaculture https://www.udemy.com/ 3.

Course Articulation Matrix														
Course Outcomes		Programme Outcomes Programme Specific Outcomes												Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	2	1	-	2	2	-	3	3	-	-	-	2	K1 & K2
CO 2	-	2	2	-	3	2	-	3	2	-	-	-	2	K2 & K3
CO 3	-	2	2	-	3	3	-	3	3	-	-	-	3	K4 & K5
CO 4	-	3	3	-	3	3	-	2	3	-	-	-	3	K4 & K5
CO 5	-	4	3	-	3	2	-	3	2	-	-	-	3	K3 & K5
Wt. Avg.	-	2.6	2.2	-	2.6	-	-	-	2.6	2.6	-	-	-	
2.56 2.6														
	Overall Mapping of the Course												2.58	

## IMMUNOLOGY AND MICROBIOLOGY

Cou	rse title	IMMUNOLO	MMUNOLOGY AND MICROBIOLOGY											
Cour	rse Code	231ZO5M03												
C	redits	3												
Hour	s / Cycle	2												
Ca	tegory	III a	Core	Theo	ry									
Sei	mester	V												
Y Impler	ear of nentation	From the ac	ademic year 2023-:	2024 onward	ls									
C Obj	ourse ectives	<ul> <li>The primary objective of this course is to help the students to develop the knowledge necessary to understand and analyze the health and disease related topics.</li> <li>Know the vital role of immune system in human.</li> <li>Familiarize students with the foundation and concepts of history of Microbiology and also to understand the structure and classification of microorganism.</li> <li>Provide the conceptual basis for understanding pathogenic microorganism and the mechanisms by which they cause disease in the human body.</li> </ul>												
CO #		Course Outo	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)									
On cor	npleting th	e course succ	cessfully, the stude	ent will be a	ole to									
CO 1	Upon cor will have essential e preparing evolving	npletion of th a sound und elements of th them to enga field.	e course students lerstanding of the e immune system, age further in this	PSO1 PSO5	K1									
CO 2	The stude cellular a responsive innate an coordinate	ents will be al nd molecular eness and un d adaptive in e to fight invac	ble to identify the basis of immune derstand how the mmune responses ling pathogens.	PSO2	K2									

CO 3	Understand the immunomodulatory strategies essential for generating or suppressing immune responses as required in hypersensitivity reactions, transplantation, autoimmune diseases and cancer.	PSO8		K	3 & K5	
CO 4	To understand history, relevance of microbiology and classification of microorganisms and Bacterial physiology		K	4 & K5		
CO 5	The student will be able to describe the infectious agents including how infectious diseases are transmitted.	K5				
	SYL	LABUS				
UNIT	CONTENT		HOURS	COs	BLOOM'S TAXONOMY LEVEL	
Ι	Introduction and Basics of Immunity Historical perspective of Immunology, C the Immune system. Anatomical barrie Cell and molecules involved in innate in immunity (Cell mediated and humoral), and natural Immunity, Active: Arti Immunity	Cells and orga ers, Inflamma mmunity, Ada Passive: Art ficial and na	ans of ation, aptive ificial atural	8	CO1	K1 K2 K3 K4 K5
П	Antigens and Immunoglobulins Antigenicity and immunogenicity, Immu and haptens, Factors influencing immun Cell epitopes. Structure and functions of immunoglobulins, Antigen-antibod Immunoassays (ELISA and RIA), Hybridoma technology: Monoclona therapeutics and diagnosis	avants and T- sses of ctions, sera, s in	13	CO2	K1 K2 K3 K4 K5	
Ш	MHC, Complement system and Immu Structure and functions of MHC molecu processing and presentation. Properties a cytokines. Complement System. Hypers dysfunctions (brief account of autoimmu to Rheumatoid Arthritis and tolerance,	of mune erence arious	14	CO3 & CO4	K1 K2 K3 K4 K5	

	types of vaccines.			
IV	History & Bacterial Physiology History of Microbiology - Major contribution of scientists - Leeuwenhoeck, Edward Jenner, Alexander Flemming, Joshep Lister, Robert Koch, Louis Pasteur. General Classification of microorganisms - Salient features of bacteria, viruses and fungi. Structure of the Bacterial cell - cell wall - Gram +ve and – ve. Bacterial photosynthesis, Respiration - aerobic and anaerobic, Fermentation/ nutrition and growth.	12	CO4 & CO5	K1 K2 K3 K4 K5
V	Reproduction & Medical Microbiology Reproduction: Fission & spore formation. Genetic transfer system in microbes: Conjugation, Transformation and Transduction. Pathogenic Microorganisms – bacterial diseases – Cholera, Typhoid, Tuberculosis, Diptheria & Pneumonia. Viral diseases – Influenza, Mumps, Chicken pox, HIV & Covid19. Fungal diseases – Candidiasis, Pneumocystis, Tinea pedis, Histoplasmosis & Kerion. Beneficial microbes in the human body – Lactobacilli, Bifidobacterium, Prevotella & Corynebacterium. Microbiome – Bacteria, Virus and Fungi.	13	CO4 & CO5	K1 K2 K3 K4 K5
Pre	scribed Books/Textbooks			
1. 2. 3. 4. 5. 6. 7.	Text Book: Microbiology – Pelczar, Reid and Chan Microbiology – Anna K. Joshua Microbiology – Norten C.F Text Book of Microbiology – Ananthanarayanan and Jayaram A Text Book of Immunology – Dr. Madhavee Latha Basic Immunology – Abul K Abbas, Andrew H. Lichtman, Shiv I Cellular and Molecular Immunology. V Edition. Abbas, K. Ab (2003.) Saunders Publication.	Pillai ul and Lec	chtman	H. Andrew
Refe	rences			
1.	General Microbiology – Boyd			
2.	Microbiology – Atlas – Biology of Microorganisms – Brock and	Madigan		
3.	General Microbiology – Stainer, John, Mark			
4.	Microbiology – Zinsser			
5. 6.	Immunology, VI Edition. Kindt, T. J., Goldsby, R.A., Osborne, H Freeman and Company. Immunology, VII Edition, David, M., Jonathan, B., David, R. H Elsevier Publication.	3. A. and K 3. and Ivar	Cuby, J ( n R. (20	2006). W.H. 06). Mosby,

### **Suggested Reading**

- 1. Immunology, VI Edition. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). W.H. Freeman and Company.
- 2. Immunology, VII Edition, David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Mosby, Elsevier Publication.
- 3. Microbiology Atlas Biology of Microorganisms Brock and Madigan
- 4. General Microbiology Stainer, John, Mark

### Web Resources

1. General Microbiology –

https://www.classcentral.com/course/swayam-general-microbiology-14088

2. Intro to Medical Microbiology: Bacteriology

https://www.classcentral.com/course/canvas-network-intro-to-medical-microbiology-1-

bacteriology-12514

- 3. Fundamentals of Immunology https://www.classcentral.com/course/immunology-23214
- 4. Vaccinology:
- https://www.classcentral.com/course/france-universite-numerique-vaccinology-4585

	Course Articulation Matrix													
Course			Prog	gramme (	Outcome	es			Programme Specific Outcomes					Cognitive Level
Outcomes	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	3	3	3	2	2	1	2	2	2	3	3	2	3	K1
CO 2	3	3	2	3	2	2	2	2	3	3	2	2	3	K2
CO 3	3	3	3	2	3	2	3	3	3	3	2	3	3	K3 & K5
CO 4	3	2	3	3	2	3	3	3	2	2	2	2	3	K4 & K5
CO 5	3	3	3	2	3	2	3	2	3	3	1	3	3	К5
Wt. Avg.	3	2.8	2.8	2. 4	2 4	2	2.6	2.4	2.6	2.8	2	2.4	3	
2.55 2.56														
								Ove	erall Map	ping of th	e Course	2.	55	

## **BIOTECHNOLOGY AND BIOINFORMATICS PRACTICAL**

Cou	rse title	BIOTECHN	OLOGY AND BIOINF	ORMATICS PRACTIO	CAL										
Cour	rse Code	231ZO5M04	231ZO5M04												
C	redits	2	2												
Hour	rs / Cycle	24	24 Part - I Core/Allied / Flective Practical												
Ca	tegory	Part - I	Core/ <del>Allied / Elective</del>	Practical											
Sei	mester	· <b>v</b>													
Ye Impler	ear of nentation	From the academic year 2024 onwards													
<ul> <li>To introduce and strengthen the basic biotechnological processes for the utilization of living organisms for commercial use</li> <li>To expose the concepts of utilization of animals' cells and understanding their metabolisms for commercial use</li> <li>To educate students about the application of and animal metabolism biotechnology</li> <li>To appraise the students to the vital concepts of technologies pertinen Genes and Proteins</li> <li>To train students with computational analysis to identify drug-targets us theoretical modeling and structure, based drug design</li> </ul>															
CO#		Course	Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)										
On con	npleting th	e course succ	essfully, the student will	be able to											
CO 1	To acquire interpret an biology tec	the required lab ad analyze core/ hniques.	poratory skills to perform, /widely used molecular	PSO4 & PSO5	K1, K2, K4										
CO 2	Demonstra software/ e problems in	te skills to use r quipments and n various course	nodern analytical tools/ analyze and solve es of biotechnology.	PSO4 & PSO5	K2, K3										
CO 3	To be able experiment	be able to integrate the theory concepts and the PSO4 & PSO5 K4 & K5 eriments/techniques													
<b>CO</b> 4	Carry out the and nucleic	arry out the sequence alignment of various aminoacid PSO4 & PSO5 K2 & K3 nd nucleic acid sequences.													
CO 5	Analyze the organisms.	e Phylogenetic	relation between different	PSO4 & PSO5	K4 & K5										

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
	<b>BIOTECHNOLOGY AND BIOI</b>	NFORMATIC	CS	
1.	Enzyme Immobilization	24	CO1 CO2 CO3	K1 K2
2.	Microbial Drug - Sensitivity Testing		CO4 CO5	K3 K4 K5
3.	Restriction Digestion of DNA			
4.	Separation of Proteins by SDS Page			
5.	Setting up of Primary cell culture			
6.	Sequence (FASTA and BLAST) searches, Primer designing using Primer BLAST			
7.	Pair wise comparison of sequences –Analysis of parameters affecting alignment			
8.	Multiple sequence alignment by CLUSTAL x/w			
9.	Evolutionary analysis - Phylogenetic tree construction and Cladogram			
10.	PDB structure retrieval and visualization: Analysis of homologous structures			
Presci	ibed Books/Textbooks			
1. Gene	s and Genomes – By Maxine Singer and Paul Berg			
2. Mole	cular Biology - By D. Freifelder, Publ: Narosa			
3. Mole	cular biology. By;F.Weaver. WCB/McGraw Hill.	analysis of C	not and not	toing (Edited)
4. A.D. B.F.Pul	Daxevaris, 1998, Bioinformatics: A practical guide to the blication.	e analysis of Ge	enes and pro	tems,(Eaitea)
5. Bioir New Y	formatics: Sequence and Genome Analysis by Mount ork. 2004	D., Cold Sprir	ng Harbor La	aboratory Press,

#### References

1. Glick and Pasternock 2002. Molecular Biotechnology, Paneema-2004.

2. D. Balasubramanian 2005. Concepts of Biotechnology new edition..

3. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.

4. T.A.AttwoodandD.J.parry-smith, 2001, Introduction of Bioinformatics.

5. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2ndEdition By Mount CBS publishers

### **Suggested Reading**

1. Recombinant DNA Technology, AEH Emery

2. Essentials of Biotechnology - By Irfan Ali Khan and AtiyaKhanum (Ukaaz Publications)

3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999 Old editions

4. Bioinformatics for Dummies by Jean-michel Claverie Cedric Notredame. Publisher: Dummies (Jan 2007)

5. Introduction to Proteomics – Tools for the new biology (1st Ed.) by Liebler, D.C., Humana Press Inc., New Jersey, USA. 2002

### Web Resources

1. https://www.mooc-list.com/course/industrial-biotechnology-edx

2. https://www.coursera.org/search?query=systems%20biology%20and%20biotechnology

3. <u>https://www.my-mooc.com/en/mooc/bioinformatics-introduction-and-methods-sheng-wu-xin-xi-xue-dao-</u>lun-yu-fang-fa/

4. https://www.my-mooc.com/en/mooc/statistics-for-genomic-data-science/

	Course Articulation Matrix													
Course Outcomes			P	rogramr	ne Outc	omes			Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	2	1	-	2	2	-	3	3	-	-	-	2	K1 & K2
CO 2	-	2	2	-	3	2	-	3	2	-	-	-	2	K2 & K3
CO 3	-	2	2	-	3	3	-	3	3	-	-	-	3	K4 & K5
CO 4	-	3	3	-	3	3	-	2	3	-	-	-	3	K4 & K5
CO 5	-	4	3	-	3	2	-	3	2	-	-	-	3	K3 & K5
Wt. Avg.	-	2.6	2.2	-	2.8	2.4	-	2.8	2.6	-	-	-	2.6	
				2	2.56				2.6					

**Overall Mapping of the Course** 2.58

# **PRACTICAL – AQUACULTURE**

Course '	Title	AQUACULTURE PRACTICAL								
Course	Code	231ZO5M	105							
Cred	its	2								
Hours /	Cycle	24								
Catego	ory	Part I	Core	Practical						
Semes	ster	V								
Year	of	From the academic year 2023 - 2024 onwards								
Implemen	tation									
Course Ob	jectives	<ul> <li>T</li> <li>S</li> <li>A</li> <li>T</li> <li>cc</li> <li>g</li> <li>A</li> <li>A</li> <li>U</li> </ul>	<ul> <li>To provide the students with the knowledge on identification of cultivable fin finds Shell fishes, aquatic insects and plankton.</li> <li>Acquire knowledge on water quality analysis.</li> <li>To understand the basics requirements of fish nutrition, role of various nutrit components and vitamins in fish diet; nutritional requirement of different stag growth of the fish</li> <li>Apply the knowledge on microbial infection, disease diagnosis and control meas</li> <li>Understand the Aquaculture systems and methods</li> </ul>							
CO#		Course Outcome(s)PSO AddressedBloom's Taxonomy Levels (K1 to K5)								
On comple	ting the c	ourse suc	cessfully, the student w	vill be able to						
CO1	The stu cultivab insects a	udents wi le fin fishe and live fee	ill learn to identify es, shellfishes, aquatic ed organisms.	PSO1 & PSO5	K1, K2					
CO2	The stud and ider ponds.	lents will ntify plank	be equipped to collect ton from the culture	PSO1 & PSO5	K1, K2					
CO3	Acquire diseases organist	knowledg and paras ns.	ge on the diagnosis of ites from cultivable	PSO1 & PSO5	K4 & K5					
CO4	Knowle will helj the culti	dge on wa o them to c vable orga	ater quality analysis correlate the health of nisms in ponds	PSO1 & PSO5	K2 & K3					
CO5	Field vi and Ins take up	sit to shrir titutions w own farmi	mp/fish farm, hatchery vill motivate them to ng.	PSO1 & PSO5	K3 & K5					
			SY	LLABUS						
UNIT		CO	NTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL				

1. Identification of cultivable fin	24	CO1, CO2,	K1, K2, K3, K4,
2. Identification of shellfishes (Crustaceans and Molluscs)		CO5	
3. Identification of aquatic insects (any 5)			
4. Identification of different live feed organisms and artificial feeds			
5. Collection and identification of plankton in an aquculture pond			
6. Identification of parasites and diseases of finfishes			
7. Water quality analysis – PH (pen), salinity (refractrometer), alkalinity (kit) and hardness (kit)			
8. Field visity to fish/shrimp farms/hatchery			
9. Field visit to Pulicat: Finfish culture – Physicochemical parameters – Management aspects in feeding- water quality – diseases.			
10. Institutional visit – CIBA, CMFRI			

1. Chakroff, M. 1993. Freshwater Fish Pond Culture and Management. Daya Publishing House, New Delhi.

2. Pillay, T. V. R. and W. A. Dill. 1979. Advances in Aquaculture. Fishing News Books Ltd.

3. Chakrabarti, N. M. 1998. Biology, Culture and Production of Indian Major Carps. Narendra Publishing House, New Delhi.

4. Coche, A. G. and J. F. Muir. 1996. Pond Construction and Fresh Water Fish Culture – Pond Farm Structures and Layouts – Simple Methods for Aquaculture. FAO. Daya Publishing House, New Delhi

5. . Rath, R. K. 2000. Freshwater Aquaculture. Scientific Publishers (India) Jodhpur

### References

1. Piska, R. S. 1999. Fisheries and Aquaculture. Lahari Publications. Hyderabad.

2. Pandian, T. J. 2001. Sustainable Indian Fisheries. National Academy of Agricultural Sciences

3. Das, M. K. And R. K. Das. 1997. Fish and Prawn Diseases, Inland Fisheries Society of India, Barrackpore.

4. Chakrabarthi, N. M. 1995. Diseases of Cultivable Fresh Water Fishes and Their Control. Daya Publishing House, New Delhi.

5. Ellis, Anthony E. (Edr.) 1995. Fish and Shell Fish Pathology. Daya Publishing House, New Delhi

### **Suggested Reading**

1. Mathew Landau. 1995. Introduction to Aquaculture. Daya Publishing House, New Delhi.

2. Pillay, T. V. R. 1993. Aquaculture : Principles and Practices. Fishing News Books. Black Well Scientific Publications

- 3. Cyrino EP & Bureau D & Kapoor BG. 2008. Feeding and DigestiveFunctions in Fishes. Science Publ.
- 4. ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.
- 5. Jhingran VG & Pullin RSV. 1985. Hatchery Manual for the Common, Chinese and Indian Major Carps. ICLARM, Philippines

### Web Resources

- 1. Introduction to Aquaculture <u>https://www.udemy.com/</u>
- 2. https://aquavitaeproject.eu/mooc-on-sustainable-aquaculture-for-low-trophic-species/
- 3. https://www.mooc-list.com/tags/fishing-industry

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

						Cour	se Ar	ticulati	ion Matrix					
Course Outcomes			Prog	ramm	e Out	comes			Progra	ies	Cognitive Level			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	-	-	3	2	3	2	3	-	-	-	3	3	K1 & K2
CO 2	-	-	-	2	3	3	2	3	-	-	-	2	2	K2 & K3
CO 3	-	-	-	2	2	3	3	2	-	-	-	3	2	K4 & K5
<b>CO 4</b>	-	-	-	2	3	3	3	2	-	-	-	3	3	K4 & K5
CO 5	-	-	-	3	3	2	2	3	-	-	-	3	2	K3 & K5
Wt. Avg.	-	-	-	2.4	2.6	2.8	2.4	2.6	-	-	-	2.8	2.4	
						2.56						2.6		
	•	•	Over	all Ma	pping	of the	Course	e					2.59	·

## FORENSIC ENTOMOLOGY

Cour	se Title	FORENSIC ENTOMOLOGY						
Cour	se Code	231ZO5M06						
Cr	edits	3						
Hours	s / Cycle	4						
Cat	tegory	Part III b GE		]	Theory			
Sen	nester	V						
Ye	ear of	From the academic year 2024 onwards						
Implen	nentation							
Course	<ul> <li>Course Objectives</li> <li>To be Listed in bullet points / Describe in 100 words.</li> <li>1. To provide basic understanding of the interaction between entomology and system, entomological concepts necessary to understand forensic entomology.</li> <li>2. To know the taxonomy and biology of insects of forensic importance</li> <li>3. To acquire knowledge on the methodology of investigation</li> <li>4. To gain more information on Urban Forensic Entomology.</li> </ul>							
CO #		Course Outcome(s)PSO AddressedBloom's T Lev (K1 to						
On com	pleting the	course successfully, the student will be able to						
CO 1	Gain an un utilized in	nderstanding of how forensic entomology is law and in the courtroom.	PSO	1	K1			
CO 2	Procedural and carrior	knowledge on the process of insect succession n degradation	PSO	2	K2			
CO 3	Have fami describe in	iliarity with techniques used to identify and usects of forensic importance	PSO	3	К3			
<b>CO 4</b>	Learn the J	proper way to prepare and write a case report.	PSO	4	K4			
CO 5	Knowledg investigati	e on the benefits of insects in other fields of on	PSO	5	K5			
UNIT		CONTENT	Hrs.	COs	BLOOM'S TAXONOMY LEVEL			
Ι	Definitio Entomol Future; l	on; History; Principles and Scope of Forensic logy; Forensic Entomology: Past, Present and Forensic Entomology and the Law	C01	K1, K2, K3, K4 & K5				
II	Brief me Insect as and Po successi successi	ntion of Common insects of Forensic importance; sociation with decomposition; Faunal succession at Mortem Index (PMI); Factors influencing on: geographical differences in on, effects of season, humidity, effects of sunlight						

	exposure, urban versus rural scenarios.			
III	Native Species and their Identification. Taxonomy and Biology of Insects (Egg, Larval, Pupal & Adult identification) of forensic importance: Coleoptera: Silphidae (Carrion beetles), Staphylinidae (Rove beetles), Histeridae (Clown beetles), Dermestidae (Hide & Skin beetles), Cleridae (Checkered beetles), Carabidae(Ground beetles). Diptera: Calliphoridae, Sarcophagidae, Phoridae, Muscidae, Fanniidae.	12	CO3	K1, K2, K3, K4 & K5
IV	Collection of specimens before body removal: ground- crawling arthropods on and around the body, entomological samples from the body, entomological samples during autopsy, specimens from buried remains, from enclosed structures & amp; aquatic habitats, bodies found inside buildings, effects of burial, bodies in water, bodies in vehicles, bodies in enclosed spaces, hanged bodies, burnt remains, wrapped remains. DNA analysis for species identification; Entomotoxicology; Case studies(2).	14	CO4	K1, K2, K3, K4 & K5
V	Introduction: Urban forensic entomology, pest infestation on buildings, gardens, litigation; Civil cases; cutaneous Myiasis; property disputes; Stored product forensic entomology: Detection of contamination of stored food products, major stored product pests, detection of infestation, FDA regulations, Limitations of forensic entomology; Case studies (2).	9	CO5	K1, K2, K3, K4 & K5
Prescribed 1. JASON H 2. SMITH, J 3. ANILKU 4. DOROTH 5. NICHOL	<b>Books/Textbooks</b> I BYRD & JAMES L CASTNER, 2009. Forensic Entomology, ITHACA 1986. A Manual of Forensic Entomology. NY Camsto MAR D. AND PARDESHI, 2017. Applied Forensic Entomolog IY GENNARD 2012. An Introduction to Forensic Entomology, AS MÁRQUEZ, JULIE ROBERTS, 2012. Forensic Ecology Ha	2nd editi ck Univ gy. India Wiley- andbook	on CRC . Press, in books Blackwe	Press. US). and Periodicals. ell; 2nd Edition. Crime Scene to
Court. Wile	y-Blackwell.			
References1. AMENDForensic En2. DAVID HBlackwell.3. SMITH, H4. ANILKU5. DAVID HBlackwell.	G T, J., GOFF, M.L., CAMPOBASSO, C.P., GRASSBERGER, M tomology. Springer. B. RIVERS, GREGORY A. DAHLEM, 2014. The Science of Fo ITHACA 1986. A Manual of Forensic Entomology. NY Camsto MAR D. AND PARDESHI, 2017. Applied Forensic Entomolog B. RIVERS, GREGORY A. DAHLEM, 2014. The Science of Fo	I, 2010. orensic F ck Univ y. India orensic F	Current Entomole . Press, n Books Entomole	Concepts in ogy. Wiley US). and Periodicals. ogy, Wiley
Suggested	Reading			

1. ANILKUMAR B. PARDESHI, 2017. Applied Forensic Entomology, Oxford cook company.

2. GENNARD DOROTHY, 2007. Forensic Entomology: An Introduction, Wiley Blackwell.

3. DAVID B. RIVERS, GREGORY A. DAHLEM, 2014. The Science of Forensic Entomology, Wiley Blackwell.

4. JASON H. BYRD, JEFFERY K. 2019. Tomberlin, Forensic Entomology: The Utility of Arthropods in Legal Investigations, CRC Press.

5. ERICA MCALISTER, 2017. The Secret Life of Flies, Firefly Books Ltd.

#### Web Resources

1. https://www.sifs.in/course-details/online-course-forensic-entomology

2. http://www.openlearningworld.com/innerpages/Basics%20to%20Forensic%20Entomology.html

3. http://www.openlearningworld.com/books/Basics%20to%20Forensic%20Entomology/Basic

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

Course articulation matrix														
Programme Outcomes										Programme Specific Outcomes				Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	2	3	3	1	3	3	3	3	2	3	1	2	3	K1
CO2	2	3	3	1	3	3	3	3	2	3	1	2	3	K2
CO3	2	3	3	1	3	3	3	3	2	3	1	2	3	K3
CO4	2	3	3	1	3	3	3	3	2	3	1	2	3	K4
CO5	2	3	3	1	3	3	3	3	2	3	1	2	3	K5
AVG	2	3	3	1	3	3	3	3	2	3	1	2	3	
								2.6					2.2	
Overall Mapping of the Course         2.4														

## EPIDEMIOLOGY

Cou	ırse title	EPIDEMIOLOGY										
Cour	rse Code	231ZO5M07	31ZO5M07									
C	redits	3										
Hour	rs / Cycle	2										
Ca	tegory	III a	Elective	Theo	ry							
Se	mester	V										
Y Impler	ear of mentation	From the ad	cademic year 2023	-2024 onwar	ds							
C Obj	ourse jectives	<ul> <li>To fa</li> <li>To di</li> <li>biosta</li> <li>To un</li> <li>maki</li> <li>To in</li> <li>To un</li> </ul>	<ul> <li>To familiarize students on science and methods of epidemiology</li> <li>To distinguish the roles and relationships between epidemiology and biostatistics in the prevention of disease and the improvement of health. To understand the applications of epidemiology in public health decision making</li> <li>To introduce students to the use of bio-statistics in health sciences</li> <li>To understand the biology of pathogens</li> </ul>									
CO #		Course Out	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)							
On cor	mpleting th	ne course succ	cessfully, the stude	ent will be al	ble to							
CO 1	Understar disease at	nding the statu global and na	s of health and tional levels	PSO1 PSO5	K1							
CO 2	understan supportive	d the role of e discipline of	biostatistics as a epidemiology	PSO2	K2							
CO 3	Gain know of infectio	wledge about ous and chroni	the Epidemiology c diseases	PSO8	K3 & K5							
CO 4	Calculate identifyin	measures of a g risk factors	association by of diseases	PSO5	K2 & K5							
CO 5	Clinical L epidemiol	Life tables can logical studies	be created in	PSO3	К3							

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
Ι	<b>INTRODUCTION TO EPIDEMIOLOGY</b> Introduction: Historical aspects and evolution of epidemiology, definitions and Concepts in Epidemiology. Epidemiology outbreak – WHO, UNESCO, ICMR and NIE. Approaches in epidemiology- disease burden, natural history of diseases and measures of risk and death.	6	CO1	K K1 K2 K3 K4 K5
П	BASICPRINCIPLESOFSTATISTICSINEPIDEMIOLOGYBasic statistics - Linear regression, logistic regression, Poisson regression, and statistical methods for survival data. Techniques of social sciences research relevant to health fields- mathematical models Research related to health economics - graphical presentation of predicted responses	8	CO2	K1 K2 K3 K4 K5
ш	EPIDEMIOLOGY IMPORTANCEPUBLICHEALTHEpidemiological aspectsaspects of diseasesof national importance- ARI - Diarrhea - Vaccine preventable disease - Tuberculosis - Visual impairment/blindness - Malaria - Dengue - Swine Flu - Chikungunya - COVID - Filariasis - HIV - STD. Non - communicable diseases- coronary heart disease, hypertension, diabetes mellitus, cancers, etc. Occupational disorders like, pneumoconiosis, etc.	16	CO3 & CO4	K1 K2 K3 K4 K5
IV	<ul> <li>PATHOGENS ON MAN <ul> <li>(1) VBacteriology – Classification – Diseases caused by Staphylococcus, Streptococcus, Pneumococcus, Mycobacterium, Bacillus</li> <li>(2) Virology – Classification, Human viruses, Bacteriophage∖</li> <li>(3) Mycology – Classification - Dimorphic fungicausing Systemic Mycoses, Diamataeceous Fungi, agents of Zygomycosis</li> </ul> </li> </ul>	12	CO4 & CO5	K1 K2 K3 K4 K5
V	HEALTHMANAGEMENTANDDISEASECONTROLNational health programmes- Monitoring and evaluation,ICMR, NIE, Role of Genetic and Environmental Factors inDisease Causation - Health Economics, Infectious diseaseEpidemiology - Chronic disease Epidemiology. ClinicalEpidemiology - Screening and diagnosis	6	CO4 & CO5	K1 K2 K3 K4 K5

- Validity, reliability, and yield - Evaluating the screening test – Vaccination		

- 8. Text Book: Microbiology Pelczar, Reid and Chan
- 9. Microbiology Anna K. Joshua
- 10. Epidemiology. Leon Gordis. Latest edition / Pub. Date: November 2004. Publisher: Elsevier Health Sciences.
- 11. Diseases and Human Evolution. Ethne Barnes. Latest edition / Latest edition / Pub. Date: March 2005. Publisher: University of New Mexico Press.
- 12. Richard, D.G., C.B., Slack, J. F. Peuthere, 1996. Medical Microbiology. Churchill Livingstone, USA

### References

- 7. General Microbiology Boyd
- 8. Microbiology Atlas Biology of Microorganisms Brock and Madigan
- 9. Dona Schneider and David E. Lilienfeld. Lilienfeld's Foundations of Epidemiology, Fourth Edition, Oxford University Press, USA, 2015
- 10. Epidemiology: An Introduction. Kenneth J. J. Rothman. Latest edition / Pub. Date: May 2002. Publisher: Oxford University Press.
- 11. Barrett-Connor, E. (2002). Teaching epidemiology, a guide for teachers in epidemiology, public health and clinical medicine.

### Suggested Reading

- 5. Microbiology Atlas Biology of Microorganisms Brock and Madigan
- 6. General Microbiology Stainer, John, Mark
- 7. Barker, D. J. P., & Rose, G. (1976). Epidemiology in medical practice. Churchill Livingstone, Medical Division of Longman Group Ltd, 23 Ravelston Terrace, Edinburgh EH4 3TL..
- 8. Rothman, K. J. (2012). Epidemiology: an introduction. Oxford university press.
- 9. Timmreck, T. C. (2002). An introduction to epidemiology. Jones & Bartlett Learning.

### Web Resources

- 5. General Microbiology -
- https://www.classcentral.com/course/swayam-general-microbiology-14088
- 6. Intro to Medical Microbiology: Bacteriology

https://www.classcentral.com/course/canvas-network-intro-to-medical-microbiology-1-

### bacteriology-12514

- 7. Vaccinology:
  - https://www.classcentral.com/course/france-universite-numerique-vaccinology-4585
- 8. https://www.cdc.gov/training/publichealth101/epidemiology.html
- 9. https://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated/1-what-epidemiology
- 10. https://www.omicsonline.org/scholarly/epidemiology-and-disease-control-journals-articles-ppts-list

	Course Articulation Matrix														
Programme Outcomes						Programme Specific Outcomes Cognitive				tive Level					
Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PSO1	PSO2	PSO3	PSO4	Р	SO5	
CO 1	3	3	3	2	2	3	2	2	2	1	3	2	3		K1
CO 2	3	3	2	3	2	2	2	2	3	2	2	2	3		K2
CO 3	3	3	3	2	3	3	3	3	3	2	2	3	3		K3 & K5
CO 4	2	3	3	3	2	3	3	3	2	3	2	2	3		K4 & K5
CO 5	3	3	3	2	3	3	3	2	3	2	1	3	3		K3
Wt. Avg.	2.8 $3$ $2.8$ $2.4$ $2.6$ $2.4$ $2.6$ $2$ $2$ $4$ $4$ $2.8$ $2.6$ $2.4$ $2.6$ $2$ $2$									2.4	3				
	2.55 2.56														
Overall Mapping of the Course 2.55															

## **COMPUTER BASICS**

Cou	rse title	COMPUTE	COMPUTER BASICS								
Cour	rse Code	231ZO5M08									
C	redits	3	3								
Hour	s / Cycle	2									
Ca	tegory	Part – I Skill-based Theory									
Sei	mester	V	V								
Year of Implementation     From the academic year 2024 onwards											
C	ourse	<ul> <li>This cours computers</li> <li>Know above</li> <li>Understan</li> </ul>	ew of introdu omputer systen fundamental o	ctory concepts about n. concepts of computer							
	<ul><li>networks</li><li>Introduces the students to the fundamentals of database manager system</li></ul>										
CO #		Course Ou	itcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On cor	npleting th	e course suco	cessfully, the student v	vill be able to							
CO 1	Handle a	computer sy	vstem for day to day	PSO1	K1						
	use.			PSO5							
CO 2	Enumerate devices ar	e different typ nd types of me	bes of input/ output emory.	PSO2	K2						
CO 3	Differentiate between system and applicationPSO8K3 & K5software.										
CO 4	Enumerate various network topologies and identify situations when different network topologies would be usefulPSO8K4 & K5										

CO 5	Describe	the	features	of	database	PSO4	K5
	manageme	nt syst	ems				

	SYLLABUS	5		
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
I	Introduction: Components of computer – hardware and software, power supply, peripherals. Installation of operating system	6	CO1	K1 K2 K3 K4 K5
II	MS word, MS excel, MS power point- short cut keys, saving documents, printing, scanning.	6	CO2	K1 K2 K3 K4 K5
III	Internet : LAN, MAN, WAN, types of topology, requirements for internet connections, Integrated Service Digital Networking and its utility, Internet Service Provider (ISP) – IP address, File Tranfer Protocol (FTP).	12	CO3 & CO4	K1 K2 K3 K4 K5
IV	Internet access: web pages, web browsers, search engines: google, yahoo, Uniform Resource Locator (URL), electronic mail, installation of antivirus.	6	CO4 & CO5	K1 K2 K3 K4 K5

1. A. Forouzan. Data Communication and Networking, 5th Edition, TMH, 2013.

2. T.A. Powell, HTML & CSS: The Complete Reference, 5th Edition, Tata McGraw-Hill, 2010

3. Rajaraman and N. Adabala, Fundamentals of Computers, Prentice Hall of India Pvt. Ltd. New

Delhi, 6th Edition, 2015.

### References

1. Anita Goel, Computer Fundamentals, Pearson Education, 2010

2. Computer Networks by Andrew S. Tanenbaum, 5th Edition, Pearson Education India, 2013.

3. J. Duckett, HTML and CSS: Design and Build Websites, 1st Edition, Wiley, 2011.

### **Suggested Reading**

1. C.J. Date, A. Kanman and S. Swamynathan, An Introduction to Database Systems, 8th edition, Pearson, 2006.

2. Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th edition,

Tata McGraw-Hill Education, 2011.

3. R. Elmsasri, S. Navathe, Fundamentals of Database Systems, 7th Edition, PearsonEducation, 2017.

#### Web Resources

- 1. <u>https://cs.du.ac.in/uploads/syllabus/Other%20Courses/2019/(cbcs)_b.a.(prog)-file.pdf</u>
- 2. <u>https://www.researchgate.net/publication/326310102_A_Study_on_the_Role_of_MOOCs_in_Computer_Basic_Teaching_in_Universities</u>
- 3. https://www.researchgate.net/publication/281555011_Developing_a_Computer_P rogramming_MOOC

	Course Articulation Matrix													
Course		Programme Outcomes									e Specifi	e Outcom	nes	Cognitive Level
Outcome s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	3	3	3	2	2	1	2	2	2	3	3	2	3	K1
CO 2	3	3	2	3	2	2	2	2	3	3	2	2	3	K2
CO 3	3	3	3	2	3	2	3	3	3	3	2	3	3	K3 & K5
CO 4	3	2	3	3	2	3	3	3	2	2	2	2	3	K4 & K5
CO 5	3	3	3	2	3	2	3	2	3	3	1	3	3	К5
Wt. Avg.	3	2. 8	2. 8	2. 4	2 4	2	2.6	2.4	2. 6	2. 8	2	2. 4	3	
				2.55	5				2.56					
								Overa	ll Mappi	ng of the	Course	2.	55	

## VERMITECHNOLOGY

Cours	se Title	VERMITE	CHNOLOGY									
Cours	se Code	081ZO5L01										
Cr	edits	2										
Hours	s / Cycle	4										
Cat	egory	Part IV	<b>General Elective</b>		Theory							
Sen	nester			V								
Ye	ar of											
Implementatio From the academic year 2023 onwards												
	n											
Co Obje	urse ectives	To be List1. To2. Gai3. Toin V4. To5. Tosoil	ed in bullet points /Descr understand the status of or in knowledge about the bio inculcate concepts of biofe Vermicomposting. develop knowledge in esta intenance of the unit. increase employability of quality by promoting the	abe in 100 words ganic waste pollu- plogy of earthwor ertilizers and under blishing a Vermi the students and a biofertilizers.	s. ntion and its impact ms erstand the techniques culture unit and also to improve the							
CO#		Course	Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)							
	On completing the course successfully, the student will be able to											

CO 1	Students gain a detailed knowledge on the soil organisms and highlight the benefits of eco- friendly agriculture by way of organic farming and Vermicomposting	PSO1	K1
CO 2	They understand the classification of theearthworm and changes caused by the earthworm to the environment	PSO2	K2
CO 3	Students learn vermicomposting technique and also to handle the problems in the unit	PSO3	K3
CO 4	It helps to understand the benefits of earthwormin the fields other than Vermicomposting	PSO4	K4
CO 5	Students will be able to establish a vermiculture unit and also understand the cost benefit analysis of the culture	PSO5	K5

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	SYLLABUS			
UNIT	CONTENT	Hrs.	COs	BLOO M'S TAXO NOMY LEVEL
I	<b>CONCEPT OF VERMITECHNOLOGY</b> Concepts of vermitechnology, objectives, scope and application of vermitechnology. Endemic and exotic species of earthworms. Distribution and seasonal dynamics of earthworms. Drilospheresand vermicasts.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
п	EARTHWORM BIOLOGY Special features of Lumbricidae, Megascolidae and Eudrilidae with suitable examples. Biology and anatomy of earthworms : metamerism, musculature, locomotion, digestive system, nutrition, reproductive system, clitellum and cocoon formation. Classification of earthworms.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	VERMICOMPOSTING Ideal conditions for vermicomposting and maintaining a vermiculture unit. Types of vermicomposting - large scale and small scale vermicomposting. Vermicomposting - raised bed method and pot method. Earthworms as bioreactors. Materials required for vermibed preparation. Bioremediation using earthworms - minimizing pollution hazards and application of vermitechnology by recycling of organic wastes.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	ENEMIES OF EARTHWORMS & USES IN OTHER FIELDS Diseases caused in earthworms, attack of predators and parasites and suitable remedies. Solutions for problems affecting worm bins. Properties of vermicompost. Collection of vermiwash and methods to obtain vermiwash.	8	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

	ESTABLISHMENT OF VERMICULTURE UNIT		CO1,	
V	Economics of vermiculture - cost benefit analysis : establishment of vermiculture unit, infrastructure, raw materials, labour, accessories. Harvesting of vermicompost, packaging and marketing.	10	CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

1. Vermicomposting - P.K.Gupta. Published by Agrobios, Jodhpur, 2005

2. Vermiculture and Organic Farming - Jan 2022 by T.V.Sathe. <u>Daya Publishing</u> <u>House</u>

3. The Complete Technology Book on Vermiculture and Vermicompost (Earthworm) with Manufacturing Process, Machinery Equipment Details & Plant Layout January 2022 by <u>Dr. Himadri Panda</u>. Asia Pacific BusinessPress Inc.

### **References**

**1.** Vermiculture And Vermicomposting - Veerabhadra Swamy M L Ranjith Y Lambert Academic Publishing (2023-01-28)

**2.** Handbook of Vermicomposting Technology - October 2018. Sreenivasan EttammalPublisher: <u>www.free-ebooks.net</u>

**3.** Worms Eat My Garbage: How to Set Up and Maintain a Worm Composting System - Mary Appelhof, Joanne Olszewski, Amy Stewart - December 26, 2017by Storey Publishing, LLC

### Suggested Reading

1. Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management - Clive A. Edwards, Norman Q. Arancon, Rhonda L. Sherman CRC Press, 20 Dec 2010 - Nature

2. The Worm Farmer's Handbook Mid- to Large-Scale Vermicomposting for Farms, Businesses, Municipalities, Schools, and Institutions by Rhonda Sherman. Chelsea Green Publishing 2018

3. Earthworm-Vermi Culture and Vermi Composting [Jan 01, 2017] Bhatnagar R.K., Palta R.K. Kalyani Publishers

### Web Resources

**1.** Municipal Solid Waste Management in Developing Countries. <u>https://www.coursera.org/learn/solid-waste-management</u>.

**2.** Discover Best Practice Farming for a Sustainable 2050.

https://www.coursera.org/learn/best-practice-farming-sustainable-2050.

**3.** Population, Food, and Soil

https://www.coursera.org/learn/population-food-and-soil.

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

Course articulation matrix														
Programme Outcomes										Programme Specific Outcomes				
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	skill
CO1	2	3	3	1	3	2	2	2	3	2	1	1	3	K1
CO2	2	3	2	1	2	2	2	2	3	3	3	1	2	K2
CO3	2	3	3	1	3	3	3	3	2	2	1	1	3	K3
CO4	2	3	3	1	3	3	3	3	2	2	1	1	3	K4
CO5	2	3	3	1	3	3	3	3	2	2	1	1	3	K5
AVG	2	3	2.8	1	2.8	2.6	2.6	2.6	2.4	2.2	1.4	1	2.8	
												1.96		
				Ov	erall M	lapping	g of the	Cours	e				2.18	

## ANIMAL PHYSIOLOGY & ENDOCRINOLOGY

Cou	Course title ANIMAL PHYSIOLOGY & ENDOCRINOLOGY									
Cour	rse Code	231ZO6M01								
C	redits	5								
Hour	rs / Cycle	72								
Ca	tegory	Part – I								
Sei	mester	V								
Ye Impler	ear of nentation	From the academic year 2023 onwards								
C Obj	ourse jectives	<ul> <li>To en system</li> <li>to und adapta</li> <li>to pro questi</li> <li>to lear pathoj</li> <li>to gai</li> </ul>	hance the knowledge on ns in relation to their stru derstand how these princ ations of different animal vide experience in researce ons about animal physiole on the basic and advanced physiology in exposure to endocrinole	basics of various ctures. Fiples are incorpor groups ching, discussing, Fogy endocrine physio	physiological rated into the and answering logy and n					
CO #		Course Out	tcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On completing the course successfully, the student will be able to										
On com	pleting the	course succes	sfully, the student will b	e able to						
On com CO 1	Understand animals wor influenced t niches	course succes how invertebrat k and how these by the different e	sfully, the student will b e and vertebrate e animals' biology is environments of their	<b>e able to</b> PSO1 & PSO5	K1, K2					
On com CO 1 CO 2	Describe, id physiologic to the integr	course succes how invertebrat of and how these by the different e entify, and/or exal al organ-systems ative functions of	sfully, the student will b e and vertebrate e animals' biology is environments of their splain the various s and their importance of the human body.	e able to PSO1 & PSO5 PSO1 & PSO5	K1, K2 K1, K2					
On com CO 1 CO 2 CO 3	Describe, id physiologic to the integr	course succes how invertebrat of and how these by the different e entify, and/or es al organ-systems ative functions of nalyze and reports in physiology a	sfully, the student will b         e and vertebrate         e animals' biology is         environments of their         splain the various         s and their importance         of the human body.         rt on experiments and         and endocrinology.	e able to PSO1 & PSO5 PSO1 & PSO5 PSO1 & PSO5	K1, K2 K1, K2 K4 & K5					
On com CO 1 CO 2 CO 3 CO 4	<b>pleting the</b> Understand         animals wor         influenced t         niches         Describe, id         physiologic         to the integr         Correlate, at         observation         Recognize at         and structur	course succes how invertebrat fk and how these by the different e lentify, and/or es al organ-systems ative functions of nalyze and report s in physiology a and identify prince es.	sfully, the student will b         e and vertebrate         e animals' biology is         environments of their         xplain the various         s and their importance         of the human body.         rt on experiments and         and endocrinology.         cipal tissue, cell type	e able to PSO1 & PSO5 PSO1 & PSO5 PSO1 & PSO5 PSO1 & PSO5	K1, K2 K1, K2 K4 & K5 K2 & K3					

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
Ι	DIGESTION, CIRCULATION AND RESPIRATION	18	<b>CO1</b>	K1 K2 K3 K4 K5
	Types of nutrition: Autotropic/Holotypic, Heterotropic (Holozoic, Saprozoic); Digestion: Types (intracellular, extracellular), Digestive system and physiology: invertebrate (Prawn) and mammal (Human), Mechanism of feeding and control- Role of associated gastrointestinal glands and hormones- Effect of starvation - symptoms and dysfunction. Types of circulatory systems: Water circulation system, Blood vascular system [open circulatory system (Cockroach, Prawn, Earthworm) - closed circulatory system (mammalian heart)], Lymphatic system; Cardiac cycle: Events in the cardiac cycle, Heart rate and pulse, automatic rhythmicity of the heart, refractory period, cardiac output, ECG; Regulation of heartbeat (nervous, chemical)- Double circulation- Portal system- Arterial blood pressure (measurement, regulation and abnormal variation in BP)- Blood flow in vein; Diseases of the cardiovascular system: Disorders of cardiac rhythms and conduction- Cardiac failure- Acute circulatory failure- Diseases of the heart valves- Congenital heart disease- Heart disease in pregnancy. Types of respiration- anaerobic, aerobic (external, internal); Organs and systems of respiration: Organs of respiratory exchange (general body surface, specialised respiratory organs (invertebrates and lower vertebrates), Mechanism of respiration in lower vertebrates (bony fish, frog) and mammals (Human); Respiratory system and mechanism of breathing in mammals; metabolic and respiratory system: infections of the respiratory tract - allergic diseases- intrathoracic tumours			

Π	<b>EXCRETION AND THERMOREGULATION</b> Nitrogen Excretion: Types (ammonotelism, urotelism, uricotelism); Excretory system: excretory organs and systems of Invertebrates and vertebrates (including accessory excretory organs); Urinary system and mechanism of urine formation in mammals; physiology of intercellular communication, Osmoic and ionic regulations (maintaining water and electrolyte balance in isoosmotic, hyposmotic and hyperosmotic media and problems of terrestrial living. Disorders of urinary system: Glomerulonephritis- Infection of urinary tract- Renal failure (Uremia)- Tumours of kidney; Haemodialyis; Thermoregulation: Temperature compensation in poikilotherms and homeotherms - physiology of hibernation - aestivation.	16	CO2	K1 K2 K3 K4 K5
III	<b>NEUROMUSCULAR COORDINATION</b> The Nervous system: Central, Peripheral, Autonomic (sympathetic, parasympathetic); Neurons: structure- types- Nerve impulse- Synaptic transmission- Neurotransmitters. Receptors: Classification, Phonoreception - Photoreception - Chemoreception (olfaction, gustation); electric organ, Bioluminescence, sound production; Locomotion: Movements in invertebrates, the vertebrate skeleton system (axial and appendicular), Joints (fixed, fibrous, cartilaginous, synovial); The Muscular system: Muscles (Structure and Types and Physiological properties of muscle contraction- Mechanism/Biochemical events of muscle contraction) - Muscle Adaptations in invertebrates and vertebrates; Diseases of the nervous system: Infections of brain, spinal cord and meninges, Nutritional neurological syndromes, Disorders of peripheral nerves, Diseases of muscles.	15	CO3	K1 K2 K3 K4 K5

IV	CHEMICAL COORDINATION AND STRESS REGULATION Endocrine glands and hormones; Human endocrine system- Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action, second messangers, Role of hormones as messengers and regulators. Stress, Homeostasis, Hypo-and hyperactivity of hormone. Disorders (Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease)	15	CO4	K1 K2 K3 K4 K5
V	<b>REPRODUCTIVE ENDOCRINOLOGY</b> Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin, Development and differentiation of gonads, hormonal control of ovulation, Reproductive cycle (Estrous and menstrual cycle) and Menopause; Hormones of insects	8	CO5	K1 K2 K3 K4 K5
Prescr	ibed Books/Textbooks		eth <b>D</b> 11.1	

- Tuttle, W.W. And Schottelius, B.1969. Text book of Physiology, 16th Edition, C. V. Mosby Co, Missouri, US
- 2. WILLIAMS S. HOAR,1976. General and Comparative Physiology, Prentice Hall of India Pvt.Ltd., New Delhi.
- 3. TURNER, C.D.1969. General Endocrinology, 5th Edition, W.B. Saunders Co., Philadelphia
- WILSON, J.A. 1979. Principles of Animal Physiology, 2nd Edition. MacMillan Publishing Company.
- 5. PROSSER, C.L. and BROWN, F.A.1962. Animal Physiology, W.B. Saunders Co. Philadelphi

#### References

- 1. Withers, P.C. (1983): "Comparative Animal Physiology" International Ed. Saunders College Publishing.
- 2. K. Schmidt Niel (1983): "Animal Physiology: Adaptation & Environmental" 3rd Ed. Cambridge Univ. Press.
- 3. R. W. Hill (1978): "Comparative Physiology of Animals An EnvironmentalApproach" Harper & Row Publ.
- 4. Text Book of Endocrinology- Williams
- 5. Outlines of Animal Physiology- Parameswaran, Ananthakrishnan T.N. et a

#### Suggested Reading

- 1 General and comparative physiology Hoar
- 2 Animal physiology- Wilson
- 3 Animal Physiology- Prosser and Brown
- 4 Osmotic and ionic regulation- Potts and Parry
- 5 Animal Physiology: Adaptation and Environmental- Nielsen K. S.

#### Web Resources

- 1. Animal Physiology https://onlinecourses.nptel.ac.in/noc20_bt42/preview
- 2. Physiology and Biochemistry https://onlinecourses.swayam2.ac.in/cec20_bt19/preview
- 3 . Endocrinology https://www.classcentral.com/course/swayam-endocrinology-19855

	Overall Mapping of the Course													
Course Articulation Matrix														
Course	Course Programme Outcomes											Outcon	nes	Cognitive
Outcome														Level
S	PO	PO	PO	PO	PO	PO	<b>PO7</b>	PO8	PSO	PSO	PSO	PSO	PSO	
	1	2	3	4	5	6			1	2	3	4	5	
CO 1	3	2	1	3	2	3	2	3	2	2	2	3	2	K1 & K2
CO 2	3	2	2	3	3	3	2	3	2	3	3	3	2	K2 & K3
CO 3	3	2	2	3	3	2	3	3	3	3	3	3	3	K4 & K5
CO 4	2	3	3	2	3	2	2	2	3	3	3	3	3	K4 & K5
CO 5	2	4	3	3	3	1	2	3	3	3	3	2	3	K3 & K5
Wt. Avg.	2.6	2.6	2.2	2.8	2.8	2.4	2.2	2.8	2.6	2.8	2.8	2.8	2.6	
	2.55								2.72					
												2.63		

## ENVIRONMENTAL BIOLOGY & BIODIVERSITY

Course title		ENVIRONMENTAL BIOLOGY & BIODIVERSITY						
Course Code		231ZO6M02						
Credits		5						
Hours / Cycle		72						
Category		Part – I	Core	Theor	Theory			
Semester		V						
Year of Implementation		From the academic year 2024 onwards						
Course Objectives		<ul> <li>Understand the different ecosystems, their components, their interrelationship and functions. Comprehend the need for conservation of resources that help to sustain life</li> <li>Make people aware of their part in the degradation of the environment through pollution</li> <li>Move towards sustainable ecosystem</li> <li>Acquire the knowledge of biodiversity in different geographical areas.</li> <li>Understand the strategies evolved to conserve biodiversity and their habitat.</li> </ul>						
CO #	Course Outcome(s)		PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)				
On completing the course successfully, the student will be able to								
CO 1	It enables the	e students to reme	dents to remember the various		K1, K2, K3			
	concepts in an ecosystem			PSO2				
CO 2	To understand the population dynamics in an ecosystem.			PSO1 & PSO2	K1, K2			
CO 3	Enables the stakeholders to know about the various habitats that they live in			PSO1 & PSO2	K4 & K5			
CO 4	To analyze the Taxonomic need for characterization of species			PSO1 & PSO2	01 & K2 & K3 O2			
CO 5	Conservation awareness is created among young minds.			PSO1 & PSO2	K3 & K5			

SYLLABUS								
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL				
Ι	ECOSYSTEMCONCEPT,BIOGEOCHEMICALCYCLES&POLLUTIONEcosystem concept – Pond as an Ecosystem –Energy flow – Ecological pyramids – Food chain –Significance of food-web. Biogeochemical cycles –Nitrogen – Phosphorous and Carbon cycles.Ecological factors: Water, pH, salinity, temperatureand light as factors. Atmospheric pressure –Hydrological cycle – Humidity. Airpollution – sources, Acid rain, Ozone layer depletionPrevention and control of air pollution. Waterpollution; Sources of Pollution and Pollutants;Prevention and control of water pollution. Landpollution: Solid waste Pollution; Radioactivepollution; noise pollution	15	C01	K1 K2 K3 K4 K5				
Π	POPULATION ECOLOGY Basic concepts of population ecology – Characteristics of population – Inter and intra specific relations among populations. Community: Characteristics of a community, Ecological succession – causes of succession, Basic types of succession – General process of succession – Hydrosphere or hydrarch; Lithosphere – xerosphere - climax concept in succession.	15	CO2	K1 K2 K3 K4 K5				
ш	HABITAT ECOLOGY Lentic community- Lake zonation, Eutrophication; Lotic community-streams & rivers; Stream zonation and communities. Marine Habitat: Characteristics of ocean, -Ocean zones- Biotic communities of oceanic zone-Pelagic life of marine organisms and their adaptations – Plankton as a community – Benthic life and adaptations – Intertidal, rocky, sandy and muddy shores. Biomes – Latitudinal and Altitudinal life zones- Desert, grassland, Tropical rain forests, temperate, deciduous forests, Taiga and Tundra	16	CO3	K1 K2 K3 K4 K5				
IV	<b>BIODIVERSITY &amp; SYSTEMATICS</b> Defining Biodiversity-Biodiversity from taxonomic and evolutionary perspective: Origin of scientific taxonomy, basics of taxonomic characterization, characterizing, species (morphological species concept, biological species concept, phylogenetic species concept). Taxonomic measures of species diversity, genetic diversity, Keystones species, umbrella species, K selected animals, flagship species, priority species, and indicator species, modern developments (database and expert identification systems). Methods of measuring species diversity, molecular methods of assessing levels of genetic diversity.	13	CO4	K1 K2 K3 K4 K5				
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V	VALUES OF BIODIVERSITY & CONSERVATION Human society & Cultural diversity, Man- Animal conflict- values of biodiversity- Legislation- A review of national and international treaties, conventions and laws, Biological Diversity Act 2002, CBD, People's Biodiversity Register, biodiversity and international environmental law, intellectual property rights over biological products. Threats to Biodiversity-Hot spots- Biodiversity conservation – In situ and Ex situ, Wild life sanctuaries- Zoos-Mega diverse nations, protected areas and biosphere reserves in India, NBA, ENVIS, IUCN categories of threat – Marine Park, sustainable use of resources.	13	CO5	K1 K2 K3 K4 K5				
Prescr 1. Fund 2000 Ka	ibed Books/Textbooks lamentals of Environmental Sciences – G.S.Dhalival alyani Publishers	l, G.S.Sangh	na, P.K.R	talhan.				

3. Animal Ecology and Environmental Biology – H.R.singh 2001, Shoban Lal Nagin Chand & amp; co

4. . Glimpses of Biodiversity (2002) - B.Blosetti

5. Biodiversity: An Introduction (2004), 2nd Edition- Kevin J. Gaston, John I. Spicer, Wiley-Blackwell

### References

- 1. Fundamental of Ecology Eugene P. Odum W.B.Saunders Company.
- 2. Elements of Ecology Clarke Animal Population Browning
- 3. Environment: The Science Behind the Stories, Withgott & amp; Laposata, 5th edition
- 4. William MN (2019) Biodiversity, CBS Publishers

### **Suggested Reading**

1. Biodiversity- Perception, peril and preservation- Edn 2011, ISBN-978-81-203-4380-1, Baba Barkha Nath Printers

2. Textbook of Biodiversity - K V Krishnamurthy, by Science Publishers (2003).

2. Essential Environment, 4th edition by Jay Withgott and Matthew Laposata.

### Web Resources

- 1. https://www.coursera.org/learn/ecosystem-services
- 2 Environmental Studies: https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
- 3 https://www.coursera.org/learn/ecology
- 4 Ecology and Environment, Prof. Abhijit Deshpande and Prof. R. Ravi Krishna , IIT

	Course Articulation Matrix													
Course Outcomes			Pı	rogramr	ne Outc	omes			P	rogramm	e Specific	Outcome	es	Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	2	1	-	2	2	-	3	3	-	-	-	2	K1 & K2
CO 2	-	2	2	-	3	2	-	3	2	-	-	-	2	K2 & K3
CO 3	-	2	2	-	3	3	-	3	3	-	-	-	3	K4 & K5
CO 4	-	3	3	-	3	3	-	2	3	-	-	-	3	K4 & K5
CO 5	-	4	3	-	3	2	-	3	2	-	-	-	3	K3 & K5
Wt. Avg.	-	2.6	2.2	-	2.8	2.4	-	2.8	2.6	-	-	-	2.6	
	2.56 2.6													

## ANIMAL PHYSIOLOGY & ENDOCRINOLOGY PRACTICAL

Cou	rse title	ANIMAL PHYSIOLOGY & ENDOCRINOLOGY PRACTICAL										
Cour	rse Code	231ZO6M03										
C	redits	2										
Hour	rs / Cycle	24										
Ca	tegory	Part – I	Core		Practical							
Sei	mester	V	V									
Ye Impler	ear of mentation	From the academic year 2024 onwards										
C Obj	ourse jectives	<ul> <li>basic understanding of the fundamental processes and mechanisms that serve and control the various functions of the body.</li> <li>Integrate our understanding of physiology across levels, from molecular to organismal, and understand interactions between different physiological systems</li> <li>In-depth knowledge of sex hormones in the regulation of reproduction.</li> <li>Detailed knowledge of major endocrine hormones: origin, structure, regulation of synthesis, mode of actions, physiological functions, abnormalities</li> <li>Understanding of different physiology and the interrelations among them</li> </ul>										
CO#		Course Outo	ome(s)	A	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On con	npleting the	e course succe	ssfully, the student	will k	be able to							
CO 1	Understand breathing, o determinati	the mechanism oxygen consump on of respirator	and regulation of otion and y quotient.	PS	O1 & PSO5	K1, K2, K3						
CO 2	Remembers and understands the organs and the physiology of excretionPSO1 & PSO5K1, K2											
CO 3	Study and understand the importance of the various biological instrumentsPSO1 & PSO5K4 & K5											
CO 4	Learn the d content, blo	the determination of hemoglobin PSO1 & PSO5 K2 & K3 t, blood groups and blood pressure.										
CO 5	Identify the slides and to	Identify the organs by studying the histological slides and to study the various hormones       PSO1 & PSO5       K3 & K5										

SYLLABUS										
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL						
1.	Estimation of oxygen consumption in fish with reference to body weigh	24	CO1 CO2	K1 K2						
2.	Detection of nitrogenous waste products in fish tank water, bird excreta and mammalian urine		CO3 CO4 CO5	K3 K4 K5						
3.	Estimation of salt loss or gain in an aquatic animal in heterosmotic media									
4.	Study of human salivary activity in relation to temperature									
5.	Study of human blood parameter using Neubauer chamber									
6.	Study of blood clotting and bleeding time using capillary method									
7.	Use of Kymograph unit, BP apparatus Respirometer.									
8.	Estimation of Hemoglobin by enzymatic method									
9.	Observation of histological studies of endocrine organs a) Pituitary, b) Thyroid, c) Thymus, d) Adrenal cortex & Medulla, e) Pancreas – islets of langerhans, f) Testis, e). Ovary									
10.	Estrous cycle - observation in vaginal smear of Mice									
Presc	ribed Books/Textbooks	J I								
1.	Tuttle, W.W. And Schottelius, B.1969. Text book of Co, Missouri, US	Physiology, 16	5 th Edition, C	2. V. Mosby						
2.	<ol> <li>WILLIAMS S. HOAR,1976. General and Comparative Physiology, Prentice Hall of India Pvt.Ltd., New Delhi.</li> </ol>									
3. 4.	TURNER, C.D.1969. General Endocrinology, 5 th Edit WILSON, J.A. 1979. Principles of Animal Physiology, Company.	ion, W.B. Sau 2 nd Edition. M	nders Co., P acMillan Pul	hiladelphia blishing						

5. PROSSER, C.L. and BROWN, F.A.1962. Animal Physiology, W.B. Saunders Co.

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#### References

- 6. Withers, P.C. (1983): "Comparative Animal Physiology" International Ed. Saunders College Publishing.
- 7. K. Schmidt Niel (1983): "Animal Physiology: Adaptation & Environmental" 3rd Ed. Cambridge Univ. Press.
- 8. R. W. Hill (1978): "Comparative Physiology of Animals An EnvironmentalApproach" Harper & Row Publ.
- 9. Text Book of Endocrinology- Williams

Course	Prog	ramm	e Outc	omes					Progr	amme S	Specific	Outcon	nes	Cognitive
Outcome														Level
S	PO	PO	PO	PO	РО	PO	PO7	PO8	PSO	PSO	PSO	PSO	PSO	
	1	2	3	4	5	6			1	2	3	4	5	
CO 1	3	2	2	3	2	3	2	3	1	2	3	3	2	K1
CO 2	3	2	3	2	2	1	2	3	2	3	2	3	2	K2
CO 3	3	3	3	2	3	3	3	3	2	3	2	3	3	K3
CO 4	2	3	3	2	2	2	3	2	3	3	3	3	3	K4
CO 5	3	3	3	3	3	1	3	3	3	3	3	2	3	К5
Wt. Avg.	2.8	2.6	2.8	2.4	2.4	2.4	2.6	2.8	2.2	2.8	2.6	2.8	2.6	
	2.6													
												2.6		

## ENVIRONMENTAL BIOLOGY & BIODIVERSITY PRACTICAL

Course title	ENVIRONMENTAL BIOLOGY & BIODIVERSITY PRACTICAL										
Course Code	231ZO6N	/104									
Credits	2										
Hours / Cycle	24										
Category	Part – I	Core	Practical	I							
Semester	V	V									
Year of Implementation	From th	From the academic year 2024 onwards									
Course Objectives	<ul> <li>To develop basic understanding of Fundamentals of Environmental Science as a discipline.</li> <li>To bring sensitization towards the environment and also increase student competency &amp; employability.</li> <li>To inculcate a sense of responsibility among students about various principles and laws of environment</li> <li>To encourage students about applicability of knowledge and Interdisciplinary approach in day today's life</li> <li>Knowledge about Environmental (Resource, Energy) Management, Monitoring, introductory aspects of Environmental Biotechnology</li> </ul>										
CO #		Course Outcome(s)		PSO Addresse d	Bloom's Taxonomy Levels (K1 to K5)						
On completing	the cours	e successfully, the stude	ent will be	able to							
CO 1	Estimation Salinity	Estimation of Oxygen, Carbondioxide & PSO1 & PSO5 K1, K2, K3 Salinity									
CO 2	Plankton analysisPSO1 & PSO5K1, K2										
CO 3	Soil organism studyPSO1 & PSO5K4 & K5										
CO 4	Virtual tour of protected areasPSO1 & PSO5K2 & K3										
CO 5	Identifyi Ecosyste	Identifying organisms from different     PSO1 & PSO5     K3 & K5       Ecosystems									

	SYLLABUS										
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL							
1.	Estimation of oxygen content in any two water samples.	24	CO1 CO2	K1 K2							
2.	Estimation of salinity in any two water samples.		CO3 CO4 CO5	K3 K4 K5							
3.	Estimation of carbondioxide in any two water samples.										
4.	Qualitative analysis of plankton from any one sample.										
5.	Identification of corals – Meandrina, Favia, Gorgonia, Pennatula, Fungia.										
6.	Study of Termitarium.										
7.	Identification of Rocky shore fauna – Balanus, Mytilus, Sea anemone, Sea urchin, Patella.										
8.	Identification of Sandy shore fauna- Emerita, Donax, Murex, Limulus, Octopus.										
9.	Study of soil organisms - Species richness, abundance, density, frequency, species evenness.										
10.	Study of physical characteristics (Temperature, colour & texture) of the soil.										
11	Virtual tour of protected areas with special reference to marine parks to study the fauna.										
Presci 6. 7. 8. 9.	<ul> <li>Prescribed Books/Textbooks</li> <li>6. Odum E.P., Fundamentals of Ecology, Nataraj Publisher, Dehradun 1996</li> <li>7. Kormondy E. J., Concepts of Ecology, Prentice Hall of India, 1994</li> <li>8. Bell J.N.B., Air Pollution and Plant Life, 2nd Edition, John Wiley and Sons, 2002</li> <li>9. Ming-Ho Yo., Environmental Toxology-Biological and Health Effects of Pollutant, Third Edition, CRC Press, 2011.</li> </ul>										
<ul> <li>10. Mari S. Golub (Ed), Metals, Fertility and Reproductive Toxicity, CRC Press, 2005.</li> <li><b>References</b> <ol> <li>Smith, R.L. and Smith T.M.(2001). Ecology and Field Biology, 6 ed. Benjamin Cummings. San Francisco.</li> </ol> </li> </ul>											

- 2. Robert, E. Ricklefs and Gracy L. Miller. (2000). Ecology (4th Edition), WH Freeman and Company England.
- 3. Bingro, H. (2007). Plants- Environment Interaction (3rd Edition), Taylor & Francis Group.
- 4. Gurevitch, J., S.M. Scheiner, and G.A. Fox. (2002). The Ecology of Plants. Sinauer Associates, Inc. Sunderland, MA, U.S.A.
- 5. Stanley, E.Manahan, Environmental Chemistry, Eightedition, CRC Press, 2004.

#### **Suggested Reading**

- 1. Saradhi P.P., Biophysical processes in living systems, Oxford & IBH Publishing, 2008.
- 2. Prosser C. Ladd., (editor). Comparative Animal Physiology, fourth edition, Wiley-Liss, New York, 1991.
- 3. Krishnamurthy, K.V., An Advanced Text Bookon Biodiversity- Principle and Practices, Oxford & IBH Publishing, 2004.
- 4. Bertold, Hock and Erich, F. F. Elstner. (eds), Plant Toxicology, Fourth Editon, CRC Press, 2004

#### Web Resources

- 1. Introduction to Aquaculture https://www.udemy.com/
- 2. https://aquavitaeproject.eu/mooc-on-sustainable-aquaculture-for-low-trophic-species/
- 3. https://www.mooc-list.com/tags/fishing-industry

						Cour	se Articu	lation Ma	atrix					
Course Outcomes			P	rogramr	ne Outc	omes			Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	2	1	-	2	2	-	3	3	-	-	-	2	K1 & K2
CO 2	-	2	2	-	3	2	-	3	2	-	-	-	2	K2 & K3
CO 3	-	2	2	-	3	3	-	3	3	-	-	-	3	K4 & K5
CO 4	-	3	3	-	3	3	-	2	3	-	-	-	3	K4 & K5
CO 5	-	4	3	-	3	2	-	3	2	-	-	-	3	K3 & K5
Wt. Avg.	-	2.6	2.2	-	2.8	2.4	-	2.8	2.6	-	-	-	2.6	
		2.56 2.6												
Overall Mapping of the Course 2.58														

## AQUARIUM SCIENCE AND MANAGEMENT THEORY

Cou	rse Title	AQUARIUM SC	IENCE AND MANAGE	MENT THE	ORY						
Cou	rse Code	231ZO6M05									
C	redits	4									
Hou	rs / Cycle	4									
Ca	itegory	Part I	Elective III B	Theory							
Se	mester	VI									
Y	ear of	From the acade	mic year 2024 - 2025 onw	ards							
Implei	mentation				1 01 1						
Course Objectives       To know the techniques involved in construction and maintenance of aquariu         To understand the breeding techniques of livebearers and egg layers.         To know the common diseases and their control.         To develop business-oriented skill among the students.         PSO       Bloom's Taxonomy Ley											
CO #		Course Out	come(s)	PSO Addresse d	Bloom's Tax (K1	xonomy Levels to K5)					
On com	On completing the course successfully, the student will be able to										
CO1	The studen important fr their sexual	ts will learn to eshwater and mari dimorphism	identify commercially ine ornamental fishes and	PSO1 & PSO5	K1, K2						
CO2	The students aquarium tan the proper n	will be equipped and learn about the maintenance of aqu	to model and construct an the accessories needed for arium.	PSO1 & PSO5	K1, K2						
CO3	Acquire kno	wledge on the bree	eding techniques.	PSO1 & PSO5	K4 & K5						
CO4	This course opportunitie trading and s	offers a wide rang s in the field of setting up of aquar	e of employment ornamental fish farming, iums.	PSO1 & PSO5	K2 & K3						
CO5	Motivate the setting up of	e students to take aquariums and farr	up entrepreneurship in ning.	PSO1 & PSO5	K3 & K5						
	SYLLABUS										
UNIT		CONTENT HOURS COS BLOOM TAXONO LEVEL									
Ι	History - Sc Indigenous - India; Benef	ope and importanc - endamic and exot its of ornamental fi	e of ornamental fishes; tic ornamental fishes of sh keeping as a hobby;	10	CO1	K1, K2, K3, K4, K5					

	Global and national status of ornamental fish farming			
	and trading; Marine aquarium fishes and other			
	ornamental organisms (sea anemone, lobster and star			
	fish).			
II	Different types of fish tanks; Materials required for	15	CO2	K1, K2, K3,
	construction of tanks: glass cover - hood - aquarium stand			
	- pebbles - sand crystals – rocks - gravel bed and other			K4, K5
	decors; Aquarium accessories: air pumps – filters:			
	mechanical filter - chemical filter - biological filter: foam			
	filter - power filter - UG filter - lighting and aquarium			
	heaters; Aquarium plants: live and artificial plants -			
	benefits – propagation: sexual - asexual and artificial			
	propagation; Factors affecting the growth of aquatic			
	plants; Choosing the place to set the aquarium;			
	Monitoring physico chemical parameters in an aquarium;			
	Setting up of marine aquarium.			
III	Criteria for the selection of ornamental fishes; Sexual	10	CO3	K1, K2, K3,
	dimorphism in live bearers and egg layers; Selecting the			<b>T</b> 7 A <b>T</b> 7 <b>P</b>
	parent; Conditioning the fish to breed; Broodstock			K4, K5
	egg depositors- egg buriers – mouth brooders – nest			
	builders ; Challenges in breeding; Applications of			
	biotechnology for producing quality strains.			
IV	Food and feeding of ornamental fishes; Nutritional	15	CO4	K1, K2, K3,
	requirements; Types of fish feed : dry feed			TZ A TZ E
	(Pellets - Flakes - Freeze dried feed - Tablet form -			K4, K5
	Granular or crumble feed) - moist feed – semi moist or			
	paste feed; live food organisms; Feeds for fry; Feeding			
	frequency; Common diseases and their control: bacterial			
	– protozoan - fungal and parasitic; Water quality			
	management: Physico chemical parameters – pH –			
	chlorine - hardness – temperature – carbon dioxide -			
	nitrate – nitrite and oxygen; Conditioning - packing and			
	transport of ornamental fishes; Constraints in ornamental			
	fish production.			
V	Scope for entrepreneurs in ornamental fish culture and	10	CO5	K1, K2, K3,
	trade; Starting an aquarium shop - a business			K4. K5
	opportunity; Small scale ornamental fish farming			13-T, 13.J
	business; Training and promotion schemes for the			
	entrepreneurs; Endangered species; Conservation and			
	management of ornamental fishes; laws and regulation			

(	GM orna	mental	fishes.														
1. Mał	napatra,	B.K., I	Dutta S.,	Pailan,	G.H.(2	2015) Ori	namental	Fish 1	Breedin	g, Cult	ure and	Trade.					
2. Dho	olakia A	.D. (20	10) Orn	amental	Fish c	ulture an	d Aquariu	ım M	anagem	nent							
3. Ahi	lan, B.,	Felix, N	N., Santl	nam, R.	, (2008)	) A text 1	book of A	quari	culture								
Reference l	Books																
<ol> <li>Nol bea</li> <li>Pete</li> <li>Axe</li> </ol>	an Mart utiful aq er Hiscoe elrod, H.	in (202 Juarium ck (200 R., 196	0) Guid ls 03) Ency 57. Breed	es to A vclopedi ding aqu	quascar a of Ac uarium	oing: A s quarium I fishes. T	step-by-sto plants FH public	ep gu cation	ide to p s Inc.E	olanting ngland	, stylin	g and	maint	aining			
Suggested 5. Ma 6. Jhi 7. Ma Web Reso 4. https://	ary Baile ingran, A ary Baile <b>ources</b> conlineco	ng y & Gin A.V.G, y & Gin urses.sy	a Sandfo 1991. F a Sandfo yayam2.	ord. Enc. ish and ord (199 ac.in/cec	ycloped Fisheri 99) Prac 21 bt0	ia of Aqu es of Ind tical Fish 1/preview	arium Fish ia. Hindus keeping	ı & Fis stan H	sh Care Publishi	ng Co.	New D	elhi.					
5. Aquap	onics – tł	ne circul	lar food j	producti	on syste	m (edX):	https://ww	w.mc	oc-list.	com/							
Correlation	of POs/	PSOs to	b each C	CO and	make a	correspo	onding ma	apping	g table.								
					Cours	se Articu	ilation M	atrix									
Course				Programm	e Outcom	es			Programme Specific Outcomes				Programme Specific Outcomes Cogni ive				
Outcomes										-				ive Level			
Outcomes	PO1	PO2	РОЗ	PO4	PO5	PO6	PO7	P 0 8	PSO1	PSO2	PSO3	PSO4	PSO5	ive Level			
Outcomes CO 1	PO1	<b>PO2</b>	<b>PO3</b>	PO4	<b>PO5</b>	<b>PO6</b>	P07	P O 8 3	<b>PSO1</b>	PSO2	PSO3	PSO4	<b>PSO5</b>	ive Level K1 & K2			
CO 1 CO 2	P01	<b>PO2</b> 2 2 2	<b>PO3</b> 1 2	PO4	<b>PO5</b> 2 3	<b>PO6</b> 2 2 2	P07 -	<b>P</b> <b>O</b> <b>8</b> 3 3	<b>PSO1</b> 3 2	PSO2	PSO3	PSO4	<b>PSO5</b> 2 2 2	ive Level K1 & K2 K2 & K3			
CO 1 CO 2 CO 3	P01	PO2 2 2 2 2 2	PO3 1 2 2	PO4	PO5 2 3 3	PO6           2           2           3	P07 - -	<b>P</b> 08 3 3 3	<b>PSO1</b> 3 2 3	PSO2	PSO3		<b>PSO5</b> 2 2 3	ive Level K1 & K2 K2 K3 K4 & K5			
Outcomes           CO 1           CO 2           CO 3           CO 4	P01	PO2 2 2 2 3	PO3 1 2 2 3	PO4	PO5 2 3 3 3	PO6           2           2           3           3	P07	<b>P</b> <b>O</b> <b>8</b> 3 3 3 2	PSO1 3 2 3 3 3	PSO2	PSO3	PSO4	<b>PSO5</b> 2 2 3 3 3	ive Level K1 & K2 & K3 K4 & K5 K4 & K5			
Outcomes           CO 1           CO 2           CO 3           CO 4           CO 5	P01	PO2 2 2 2 3 4	PO3           1           2           2           3           3	PO4	PO5 2 3 3 3 3 3	PO6           2           2           3           3           2	P07	P         O         8         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3         3	PSO1 3 2 3 3 2 2 2	PSO2	PSO3	PSO4	PSO5 2 2 3 3 3 3	ive Level K1 & K2 & K3 & K4 & K5 K4 & K5			
OutcomesCO 1CO 2CO 3CO 4CO 5Wt. Avg.	P01	PO2 2 2 2 3 4 2.6	PO3           1           2           2           3           3           2.2	PO4	PO5 2 3 3 3 2.6	PO6           2           2           3           2           .	P07	P 08 3 3 3 2 2 3 -	PSO1 3 2 3 3 2 2 2.6	PSO2	PSO3	PSO4	PSO5           2           2           3           3	ive Level K1 & K2 & K3 & K4 & K5 K3 & K5			
CO 1         CO 2         CO 3         CO 4         CO 5         Wt. Avg.	P01	PO2 2 2 2 3 4 2.6	PO3           1           2           2           3           3           2.2	PO4	PO5 2 3 3 3 2.6	PO6       2       3       3       2       -       2.56	P07	P 08 3 3 3 2 2 3 -	PSO1 3 2 3 2 2 2.6	PSO2	PSO3	PSO4	PSO5         2           2         2           3         3           -         -	ive Level K1 & K2 & K3 & K4 & K5 K3 & K5			

*3-Strong; 2-Medium; 1-Low

## VERMICULTURE

Cours	se Title	le VERMICULTURE									
Cours	se Code	231ZO6M06									
Cr	edits	4									
Hours	s / Cycle	4									
Cat	egory	Part IIIb Skill Based Elective I		Theory							
Sen	nester	V									
Ye	ar of	From the academic year 2024 onwards									
Course	Objectives	<ul> <li>To be Listed in bullet points /Describe in 100 words.</li> <li>1. To understand the status of organic waste pollution and its impact</li> <li>2. Gain knowledge about the biology of earthworms</li> <li>3. To inculcate concepts of biofertilizers and understand the techniques in Vermicomposting.</li> <li>4. To develop knowledge in establishing a Vermiculture unit and maintenance of the unit.</li> <li>5. To increase employability of the students and also to improve the soil</li> </ul>									
5. To increase employability of the students and also to improve the so quality by promoting the biofertilizers.											
CO #		Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)							
On com	pleting the	course successfully, the student will be able to									
CO 1	Students g and highli way of org	ain a detailed knowledge on the soil organisms ght the benefits of eco-friendly agriculture by ganic farming and Vermicomposting	PSO1	K1							
CO 2	They undo changes c	erstand the classification of the earthwormand aused by the earthworm to the environment	PSO2	K2							
CO 3	Students 1 handle the	earn vermicomposting technique and alsoto problems in the unit	PSO3	К3							
CO 4	It helps to fields othe	o understand the benefits of earthworm in the er than Vermicomposting	PSO4	K4							
CO 5	Students v also under	will be able to establish a vermiculture unitand stand the cost benefit analysis of the culture	PSO5	K5							
	SYLLABUS										

UNIT	CONTENT	Hrs.	COs	BLOOM'S
				TAXONOMY
				LEVEL
Ι	SOIL & SOIL ORGANISMS	14	CO1	K1, K2, K3, K4,
	Introduction: Definitions and concept of		•	
	vermiculture. Application and scope of		CO2	K5
	vermiculture. Soil:major types (red soil, black soil,		•	
	alluvial soil). Influence of soil organisms in		<b>CO3</b>	
	vermitechnology - bacteria, earthworms,			
	entomofauna, mites etc. Litter degradation and		cO4	
	decomposition. Green revolution, Impact of		•	
	chemical fertilizers on human health and		co5	
	environment. Fertilizers use and deterioration of		000	
	soil environment.			
II	EARTHWORMS & IMPACT ON SOIL	12	CO1	K1, K2, K3, K4,
	Types of earthworms: Native and exotic species of		,	K5
	earthworms. Ecological classification of earthworms		CO2	
	- epigeic, anecic and endogeic forms. Metamerism,		,	
	Morphology of the earthworm, Clitellum, digestive		CO3	
	system and male and remain reproductive system,		,	
	copulation and cocoon formation, focomotion in		CO4	
	earthworm. Physical, chemical and biological		,	
	deilogenhores and segminests		CO5	
TTT	VEDMICOMPOSTINC	14	CO1	K1 K7 K3 KA
111	Vermicomposting vermicomposting meterials	14	COI	K1, K2, K3, K4, K5
	verificoniposting - verificoniposting inaterials,		, CO2	KJ
	selection of earthworms for vermicomposting,		002	
	preliminary treatment of organic wastes, feeds not		, CO2	
	to be red to earthworms, vermicomposting methods,		COS	
	(raised bed method, pit method, tank method).		, CO4	
	Vermicompost - quality, properties and advantages		CU4	
	over chemical fertilizers. Vermicompost applications		, CO5	
	- Gardens, Horticulture and Agriculture. Problems		COS	
	in vermiculture and its remedial solutions.			
	Vermiwash set up and its uses			
IV	ENEMIES OF EARTHWORMS & USES IN	8	<b>CO1</b>	K1, K2, K3, K4,
	OTHERFIELDS		,	K5
	Natural enemies of earthworms - Pests, parasites		CO2	
	and pathogens affecting earthworms and its		,	
	remedies. Uses of earthworms in food and medicine		CO3	
	- ayurvenc and unam medicine. Recycling of food		,	
	wastes in vermitechnology.		CO4	
			,	
			CO5	
V	ESTABLISHMENT OF VERMICULTURE UNIT	12	<b>CO1</b>	K1, K2, K3, K4,
	Establishment of vermiculture unit: materials		,	K5
	required, conditions for maintenance of vermicultureunit,		CO2	
	harvesting of vermicompost - Manual sorting,		,	

	bait, screening and light method, packaging and	<b>CO3</b>										
	marketing - cost benefit analysis - man power,											
	infrastructure and other raw materials.	CO4										
		,										
		CO5										
Prescribed	Books/Textbooks											
1. Vermicomposting - P.K.Gupta. Published by Agrobios, Jodhpur, 2005												
2. Vermiculture and Organic Farming - Jan 2022 by T.V.Sathe. Daya Publishing House												
3. The Complete Technology Book on Vermiculture and Vermicompost (Earthworm) with Manufacturing Process, Machinery Equipment Details & Plant Layout January 2022 by <u>Dr. Himadri Panda</u> . Asia Pacific Business Press Inc.												
References												
1. Vermiculture And Vermicomposting - Veerabhadra Swamy M L Ranjith Y Lambert Academic Publishing (2023-01-28)												
2. Handbook of Vermicomposting Technology - October 2018. Sreenivasan EttammalPublisher: <u>www.free-ebooks.net</u>												
3. Worms Appelhof, J	Eat My Garbage: How to Set Up and Maintain a Worm C Joanne Olszewski, Amy Stewart - December 26, 2017 by	omposting System - Mary Storey Publishing, LLC										
Suggested	<b>Reading</b> Iture Technology: Earthworms, Organic Wastes, and Enviro	onmental Management -										
Clive A. E	uwards, Norman Q. Arancon, Rhonda L. Sherman CRC	Press, 20 Dec 2010 - Nature										
2. The Wor Businesses, Publishing	rm Farmer's Handbook Mid- to Large-Scale Vermicomposti Municipalities, Schools, and Institutions by Rhonda Sher 2018	ng for Farms, man. Chelsea Green										
3. Earthwor R.K. Kalya	rm-Vermi Culture and Vermi Composting [Jan 01, 2017] ani Publishers	Bhatnagar R.K., Palta										
Web Resou 1. Municip https://www	rces al Solid Waste Management in Developing Countries. w.coursera.org/learn/solid-waste-management.											
2. Discover	r Best Practice Farming for a Sustainable 2050.											
https://wwv	v.coursera.org/learn/best-practice-farming-sustainable-2050.											

3. Population, Food, and Soil

https://www.coursera.org/learn/population-food-and-soil.

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

					Co	urse ar	ticulati	ion mat	trix					
			Prog	gramm	e Outco	omes			Programme Specific Outcomes					Cognitive
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	Skill
CO1	2	3	3	1	3	2	2	2	3	2	1	1	3	K1
CO2	2	3	2	1	2	2	2	2	3	3	3	1	2	K2
CO3	2	3	3	1	3	3	3	3	2	2	1	1	3	K3
CO4	2	3	3	1	3	3	3	3	2	2	1	1	3	K4
CO5	2	3	3	1	3	3	3	3	2	2	1	1	3	K5
AVG	2	3	2.8	1	2.8	2.6	2.6	2.6	2.4	2.2	1.4	1	2.8	
								2.4					1.96	
				Ov	verall N	lappin	g of the	e Cours	e				2.18	

## APICULTURE

Course	title	APICULTU	RE								
Course	e Code	231ZO6M07									
Credit	S	4									
Hours	/ Cycle	5									
Catego	ory	Part - III b	Skill Enhanced E (SEE)- 2	lectives	Theory						
Semest	ter	VI									
Year o Implen	f nentation	From the academic year 2023-2024 onwards									
Course Object	e ives	• To teach st keeping an	• To teach students about the identification of honey bees, Bee keeping and their management.								
CO #		Course Outc	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On cor	npleting th	e course succ	essfully, the stude	ent will be a	ble to						
CO 1	To unders different s bees	tand and ident pecies of Hon	ify the ey	PSO 2	K2						
CO 2	Learning t	the systematic cation in bees	s and the	PSO 2	K2						
CO 3	Conservation the technic	ion of honeyboques.	ees by learning	PSO 3	К3						
<b>CO 4</b>	Analyze	e the life cycle	and rearing	PSO 4	K4						
CO 5	Apply i	t as Startups -	marketing	PSO 5	K5						

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOMY LEVEL
Ι	HISTORY OF BEEKEEPING & IDENTIFICATION Definition, Beekeeping - worldwide, In India. Traditional beekeeping, Modernbeekeeping, urban or backyard beekeeping. Honey bee species identification: Introduction to honey bee;Origin, systematics, life cycle, sting apparatus and distribution; Types of honey bees- Bee identification. Social organization in honey bees: Colony life and social organization –Queen, drone, worker.	14	CO 1	K1, K2, K3, K4, K5
Π	COMMUNICATION IN HONEY BEES Bee-communication – Learning - Color learning in honeybees, Color discrimination, Color learning rates and preferences, Color memory, Timing in color learning, Neurobiology of color vision; Communication - Odor plume, Trophallaxis. Adaption of honey bees: Structural, Behavioral, Ecological and Physiological Adaptations of Bees.	10	CO 2	K1, K2, K3, K4, K5
ш	<b>BEEKEEPING</b> <b>TECHNIQUES</b> Getting Started in Beekeeping - Land and Buildings, Precautionary andremedial measures in case a bee stings-Equipment and supplies - Vehicle, hives. General management practices in beekeeping: Best management practice – definition, swarms and bee enquiries, hive densities, hive placement, water provisions, queens and robbingbehavior, disease control, Enemies of honeybees, transportation of hives	12	CO 3	K1, K2, K3, K4, K5

IV		12	CO 5	K1, K2, K3,
	<b>BEE</b> PASTURAGE, POLLINATION & QUEEN REARING Definition, types of bee pasturage – single year productive, multiyear productive, permanent productive. Installing a bee pasture. Pollination by bees – pollinator. Seasonal management of honey bees: Honey bees on Canola, Spring management of bees, Wintering bees, Apiary management for winter/earlyspring pollination. Summer management -honeyproduction. Queen rearing andcolony multiplication: Raisinghoney bee queens.Developmental stages of queen bee, Requirements for rearing good queens, Methods of rearing queens, Hopkins Method, Alley Method, Miller Method, Dequeening Method, Raising Queen on double and Whole Brood Comb.			K4, K5
V	ECONOMICS AND MARKETING Honey, pollen, royal jelly, beeswax, propolis & venom - Significance of bee products - Properties of honey - Nutrients and composition of honey, Acid content and flavor effects. Types of value added honey products. Economics of beekeeping: Economics in small scale and large scale beekeeping. Economic Value of Commercial Beekeeping. Marketing of Apiculture products: Marketing	12	CO 5	K1, K2, K3, K4, K5

	Honeycomb and Honey, Pollination Services, Wax, Propolis, Pollen, Royal Jelly, Bee Venom, Adult and Larval bees, Costing and Financing theMarketing Activities												
Presc	ribed Books/Textbooks												
1.	ABROL, D. P. 1997 Bees and Beekeeping. Kalyani Publisher, New Delhi.												
2.	ABROL, D. P. 2010 A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.												
3.	WITHHEAD, S. B. 2010, Honey bees and their management Axis books												
	Publishers.												
4.	TED HOOPER, 2010. Guide to Bees & Honey: The World's Best Selling Guide to												
	Beekeeping. Northern Bee Books, Oxford.												
Refe	rences												
1.	ALISON BENJAMIN, BRIAN MCCALLUM, 2008. Keeping Bees and Making												
	Honey. David & Charles, Newton Abbot.												
2.	CRAIG HUGHES, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City.												
3	Ine Good Life Press, Preston. KIM DE77A 2013 Backward Farming: Kaaping Honey Baas: From Hive												
5.	Management to Honey Harvesting and More Hatherleigh Press U.S.												
4.	LAIDLAW, H.H., 1997. Contemporary queen rearing. Published by Dadant and												
	Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.												
5.	TED HOOPER, CLIVE DE BRUYN, MARGARET THOMAS, 2014. The												
	Beginner's Bee Book. Stenlake Publishing, Ayrshire.												
Sugg	ested Reading												
1.	ALETHEA MORRISON, MARS VILAUBI, 2013. Homegrown Honey												
	Bees: An Absolute Beginner's Guide to Beekeeping Your First Year, from												
	Hiving to Honey Harvest. Storey Publishing, LLC; 1 st edition.												
2.	DEWEY M. CARON, 2013. Honey Bee Biology and Beekeeping, Revised												
	Edition. Wicwas Press, Kalamazoo.												
3.	HUNT, G.J., 2000. Using honey bees in pollination Purdue University.												
4.	KIM FLOTTUM, 2014. The Backyard Beekeeper: An Absolute Beginner's												
	Guide to Keeping Bees in Your Yard and Garden. Quarry Books.												
5.	ROGER A. MORSE, KIM FLOTTUM, 1998. Honey Bee Pests, Predators												
	and Diseases. Wicwas Pr; 3 rd edition.												
Web	Resources												
Applie	d Entomology: <u>https://onlinecourses.swayam2.ac.in/cec20_bt02/preview</u>												

	Course Articulation Matrix													
Course			Pro	ogramn	1e Outc	omes			Programme Specific Outcomes					Cognitive
es	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	Level
CO 1	3	3	2	1	3	-	-	3	3	3	2	-	1	K2
CO 2	3	3	2	-	1	-	-	2	3	3	2	-	1	K2
CO 3	3	3	3	1	3	3	3	2	1	1	3	3	3	К3
CO 4	3	3	3	2	2	3	3	2	1	1	3	3	3	K4
CO 5	3	2	3	2	3	3	3	3	1	2	1	3	3	К5
Wt. Avg.	3	2. 8	2 6	1 2	2 4	1.8	1.8	2.4	1.8	2	2.2	1.8	2.5	
				-	3.6				2.06					
	Overall Mapping of the Course 2.83													

## POULTRY SCIENCE

Course	Title	POUL	TRY SCIE	NCE										
Course	Code	231ZO	6M08											
Cred	its	4												
Hours /	Cycle	5												
Categ	ory	Part	E	lective	Theor	y								
Semes	ster	VI												
Year	of	From	the acader	nic year	2024 on	nwards								
Implemen	ntation													
		1.	The syllab	ous would	l introdu	ice the studer	nt to the ba	sics of poultry farming						
		2.	2. To understand the management practices											
Course Ob	niectives	3. To understand the nutrition requirement of poultries												
Course On	jeeuves	4. To be able to identify value added products												
		5. To understand the economic status of poultries												
	1						1							
CO #		Cou	rse Outcon	ne(s)		PSO Addre ssed	Bloom's Taxonomy Levels(K1 to K5)							
On completing the course successfully, the student will be able to														
CO1	An unde Poultry	erstandi farming	ng of the im g.	nportance	of	PSO1	K1							
CO2	Holistic and mar	understa nagemei	anding of Po nt	oultry fari	ming	PSO2	K2							
CO3	Knowl and dis manager	edge on sease ment of	nutritional i poultry.	requireme	ents	PSO3	K3							
CO4	Appreci products	ation of s and wa	Poultry pro-	ducts, by- ment	-	PSO4	K4							
CO5	Enhance	es entrep	preneurial op	oportuniti	es in	PSO5	K5							
	Poultry	industry	/.											
					SY	LLABUS								
UNIT			CONTENI	Г		HOURS	COs	BLOOM'S TAXONOMY LEVEL						

Ι	INTRODUCTION TO POULTRY SCIENCE Introduction to Poultry keeping; Importance of Poultry farming; Poultry Industry in India; Past and Present scenario of Poultry industry; Domestication of Poultry; Important breeds of Poultry: Desi, Chittagong and Leghorn (Broiler breeder and Layer Breeder).	8	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5
Π	<b>FARMING, BREEDING</b> & <b>MAINTAINANCE OF POULTRY</b> Construction of Poultry house; System of rearing: Range, Semi intensive, Intensive rearing, advantages and disadvantages; Poultry housing and incubation; Broiler and Layer farm equipment and brooding; Broiler and Layer management; Breeder flock management; Free range farming; Deep litter farming and Battery cage farming; Broiler and Layer performance indices and farm records; Hatchery and Hatchery management; Artificial insemination; Effects of inbreeding and cross breeding, Introduction to rearing of Turkeys, Ducks, Japanese Quails, Guinea fowls and Geese for meat and egg production.	19	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5
III	NUTRITION & DISEASE MANAGEMENT OF POULTRY Poultry feeds: Essential nutrients, Protein, Carbohydrates, Lipids, Vitamins and Minerals, Feed additives, feed formulation and their effects; Ration for Chick: Growers, Layers, Broilers and Breeders; Feed management in breeders; Common	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5

	diseases and their control of Poultry: Viral, Bacterial, Fungal and Protozoan diseases, Parasitic diseases: ectoparasites and endoparasites, deficiency diseases; Miscellaneous disorders: cannibalism, crop bound, egg bound humble foot and prolapse of the											
	uterus;Vaccination Program.											
IV	POULTRY PRODUCTS, BY- PRODUCTS & WASTE MANAGEMENT Nutritional value of egg, Marketing of eggs; Industrial use of egg, egg products and by - products of poultry; Poultry products: Production and quality of clean eggs, Preservation of broiler meat, Grading of poultry meat; Poultry waste management; Poultry litter; Reutilization methods and Environmental advantages of Poultry	8	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5								
V	litter. <b>POULTRY ECONOMICS</b> Poultry and Japanese Quails entrepreneurship; Marketing of eggs and birds, Marketing activities: collection, cleaning, grading, candling, packing; major problems in marketing, factors influencing market price; Technical support by government in marketing of eggs; Poultry enterprises; Poultry insurance and financial management; Poultry & Quails Economics. Backyard to industrial farming of Poultry, Future perspective and constraints of Indian Poultry	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5								
Prescribed	Books/Textbooks	<u> </u>	1	1								
1. R.A 2. P.N 3. Bel	<ol> <li>Prescribed Books/Textbooks</li> <li>R.A. Singh, 2009. Poultry Production. New Delhi. Kalyani Publishers.</li> <li>P.M.N. Naidu, 1964. Poultry keeping in India. Indian Council of Agricultural Research, New Delhi.</li> <li>Bell, Donald, D., Weaver, William, D., 2002. Commercial Chicken Production Manual, 5th Ed. Publication</li> </ol>											
References												
1. J. Pra	sad, 2015. Poultry production and management. k	Kalyani publishers	5.									

- 2. G.C. Banerjee, 2010. A text book of animal husbandry. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi, 8th Edition.
- 3. Burr Charles, Homer, O. Stuart, 2011. Commercial poultry farming. Biotech Books. 544p.
- 4. E. Jane, 2012. Henkeeping: Inspiration and practical advice for would be smallholders. National trust. 96p.
- 5. S. David, 2009. Popular poultry breeds. The crowood press ltd., 288 p.

#### **Suggested Reading**

- 1. Keith Wilson, 2007. A Handbook of Poultry practice. Published by Agrobios. 152p.
- 2. Shai Barbut, 2001. Poultry product processing: An Industry guide. CRC Press. 560p.
- 3. Vikas Nanda, 2013. Meat, Egg and Poultry Science and Technology. IK International Publishing House. 375p.
- 4. Nilotpal Gosh, 2015. A text of Poultry Science and Practice. CBS Publishers & Distributiors. 492p.
- 5. J. Prasad, 2015. Poultry production and management. Kalyani Publishers.
- 6. C.G. Scanes and K.D. Christensen, 2019. Poultry Science, 5th edition. Waveland Press Inc. 475p.

#### Web Resources

- 1. https://www.classcentral.com/course/swayam-introduction-to-poultry-farming-14160
- 2. https://www.coursera.org/learn/chickens?action=enroll
- 3. https://www.classcentral.com/course/sustainablefood-1402

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

### **Course Articulation Matrix**

Course Outcomes		P	rogra	mme (	Outco	mes		Programme Specific Outcomes						Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS O1	PSO2	PSO3	PSO4	PSO5	
CO 1	2	2	1	1	2	2	2	2	2	3	2	2	2	K1
CO 2	2	2	3	2	2	2	2	2	2	2	2	2	2	K2
CO 3	2	2	2	2	1	2	2	3	2	2	2	-	3	K3
CO 4	2	2	2	2	2	2	3	2	3	2	2	3	2	K4
CO 5	2	2	2	3	3	2	2	2	2	2	3	2	3	K5
Wt. Avg.	2	2	2	2	2	2	2	2	2.2	2.2	2.2	1.8	2.4	
								2					2.4	
		Ove	erall N	Iappin	g of th	ne Cou	rse					2		

# PRACTICAL - AQUARIUM SCIENCE AND MANAGEMENT (On-site Training)

Course code	231ZO6M09	PRACTICAL - AQUARIUM SCIENCE AND MANAGEMEN (On-site Training)	L	Р	С			
Elective	2			-	2	2		
Pre-re	quisite	To provide the students with knowledge on identification freshwater and marine ornamental f and aquarium plants. Acquire hand training on construction and maintenance of aquarium	Syllabus 2024-2025 Version Onwards					
Practica	als							
COS	Course Out	comes	PSOS	Bloom (K1 to	's Taxo K5)	onomy Levels		
CO1	The students and marine of	s will learn to identify freshwater ornamental fishes	PSO1 , K1 PSO2					
CO2	Students w freshwater a	rill be equipped to construct nd marine aquarium	PSO1 , PSO2	PSO1 , K1 PSO2				
CO3	Acquire know	owledge on the preparation of ds	PSO1 , K2 PSO2					
CO4	Gain knowler egg layers.	dge on breeding of live bearers and	PSO4	PSO4 K3				
CO5	Learn the n & disease).	nanagement aspects (water quality	<b>PSO4</b> , <b>PSO5</b>					

1.	Identification of common freshwater livebearers and egg layers	CO1 CO2 CO3 CO4	K1 K2 K3 K4 K5
2.	Identification of common marine ornamental fishes	COS	
3.	Identification of common aquarium plants		
4.	Identification of parasites and diseases of ornamental fishes		
5.	Preparation of artificial feeds – wetmash/pellets/powder		
6.	Construction and seeting up of aquarium		
7.	Breeding techniques of live bearers and egg layers at ornamental fish unit, MCC farm		
8.	Water quality, feed and disease management in rearing of ornamental fishes at ornamentalfish unit, MCC farm		

9.	Field	visit to	Kolatl	hur to k	now v	arious								
	aquari	ium acc	essorie	es and c	lecors	_								
10.	Visit	to a pul	olic fre	shwate	er and r	narine								
	aquar	ium												
Referen	ce bool	KS		<b>D</b>	1.0			2015		. 1. 0			1.	
1.	<ol> <li>Mahapatra, B.K., S. Dutta and G. H. Pailan, 2015. Ornamental fish breeding, culture and trade. Publisher: ICAR – Central Institute of Fisheries Education (Kolkata Centre)</li> </ol>													
<ol> <li>Dholakia, A.D., 2010. Ornamental fish culture and aquarium management. Daya Publishing House.</li> </ol>														
3. 1	<ol> <li>Martin, N., 2020. Guides to aquascaping: A step-by-step guide to planting, styling and maintaining beautiful aquariums. Skyhorse publisher</li> </ol>													
4. 3	<ol> <li>Jagtap, V.K., S.N. Mukherjee and Garad, 2009. Text book of pisiculture and aquarium keeping. Daya Publishing House, New Delhi</li> </ol>													
Course Articulation Matrix														
Cour	Progr	amme	Outcor	nes						Prog	ramme	Specif	fic	Cog
se									Outcomes nit				nitiv	
Outc														e
omes														Lev
														el
CO	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO	PSO	PS	PS	PS	PS	
	1							8	1	O2	03	O4	05	
C01		2	2		2	_			2	2			-	K1
001		2	2		2				2	2				
CO2	-	2	2	-	2	-	-	-	3	2	-	-	-	K2
CO3	-	3	2	-	3	-	-	-	2	3	-	-	-	K3
CO4	-	-	-	2	3	-	3	-	-	-	-	3	-	K4
CO5	-	-	-	2	2	2	2	2	-	-	-	2	3	K5
Wt.	-	2.33	2	2	2.4	2	2.5	2	2.33	2.33	-	2.5	3	
Avg.														
Overal	l Mapp	oing of	the Co	ourse	<u> </u>	<u> </u>	I	2.3						

## PRACTICAL – VERMICULTURE (On-site Training)

Cour	se Title	PRACTICAL	- VERMICULTURE (On-sit	te Training)							
Cour	se Code	231ZO6M10									
Cı	redits	2									
Hours	s / Cycle	2									
Cat	tegory	Part IIIb	Skill Based Elective I		Practical						
Ser	nester	V									
Ye	ear of	From the ac	From the academic year 2024 onwards								
Implen	nentation	To be Listed in bullet points (Describe in 100 monds									
Co Obj	ourse ectives	<ol> <li>To impart basic knowledge on Vermiculture</li> <li>Understand the morphology and behaviour of earthworm</li> <li>Describe the process of culture</li> <li>Analyse the impact of soil organism in vermiculture</li> <li>Interpret, analyse and present experimental results and conclusions in a scientific manner.</li> </ol>									
CO #		Course	Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the	course succe	ssfully, the student will be al	ole to							
CO 1	Study morp	hology and beha	viour.	PSO1 K1							
CO 2	Understand	Comprehensive	ly the concepts on the roleof	PSO2	K2						
	soil organisms in soil fertility.										
CO 3	Appreciate	the role of earthy	worms.	PSO3	К3						
<b>CO 4</b>	Analyze and	l study the differ	rent organic wastes.	PSO4	K4						
CO 5	Develop ent	repreneurial skil	ls.	PSO4	K5						

	SYLLABUS										
UN	CONTENT	Hrs.	COs	Bloom's							
IT				Taxonomy							
				Level							
Ι	1. Study of external morphology of Earthworm	12	CO1,	K1, K2, K3,							
	2. Culture of earthworms - observation of their		CO2,								
	burrowing activity, formation of drilospheres and		CO3,	K4, K5							
	vermicasts		CO4.	,							
	3. Analysis of soil organisms using Berlesefunnel -		CO5								
	beetles, millipedes, mites, dermapterans, termites etc.		000								

	4. Study of natural enemies of earthworms - attack of
	vermieries by ante scorpion
	mites continued as analysis ato
	mites, centipedes, snakes etc
	5. Study of litter degradation and decomposition of
	farmyard wastes - agricultural and animal
	wastes
	6. Determination of soil pH.
	7. Collection of wastes and their segregation &
	processing
	8. Establishment of a vermiculture unit - an overview -
	preparation of vermibeds.
	9. Establishment of vermiwash unit
	10 Harvesting of vermicompost and packaging
	To. That vesting of verificompost and packaging.
Refer	ences Books
1. Ve	rmiculture And Vermicomposting - Veerabhadra Swamy M L Raniith Y Lambert
Acade	emic Publishing (2023-01-28)
Tieuue	and I donoming ( 2020 01 20 )
2 110	ndhook of Vermisonnosting Technology October 2018 Sreeniyesen
2. Па. Е	mubbok of vermicomposing recimology - October 2018. Sreenivasan
Ettam	malPublisher: <u>www.free-ebooks.net</u>
2 11	
3. Wo	orms Eat My Garbage: How to Set Up and Maintain a Worm Composting System - Mary
Appel	hof, Joanne Olszewski, Amy Stewart - December 26, 2017 by Storey Publishing, LL

Correlation of POS/PSOs to each CO and make a corresponding mapping table.	Correlation of POs/PSOs to each CO and make a corresponding mapping table.	
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Course articulation matrix														
COS			Pro	gramm	e Outco	omes			Programme Specific Outcomes					Cognitive skill
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	3811
CO1	1	2	2	1	2	2	2	2	3	3	1	1	2	K1
CO2	1	2	2	1	3	2	2	3	2	3	1	1	2	K2
CO3	1	2	2	1	3	2	2	3	2	3	1	1	2	K3
CO4	1	2	2	1	3	2	2	3	2	2	1	1	2	K4
CO5	1	2	2	1	3	2	3	3	2	2	1	2	3	K5
AVG	1	2	2	1	2.8	2	2.2	2.8	2.2	2.6	1	1.2	2.2	
								1.97					1.84	
	·	•	·	•		·	•	•	Overa	ll Mappi	ng of the	Course	1.9	

# APICULTURE PRACTICAL (On-site Training)

C	ourse title	APICULTU	APICULTURE PRACTICAL (On-site Training)										
Co	ourse Code	231ZO6M11											
	Credits	2											
Но	urs / Cycle	2											
(	Category	Part - III bSkill Enhanced Electives (SEE)- 2On-site Training Practical											
S	Semester	VI											
Imp	Year of lementation	From the academic year 2023-2024 onwards											
Cours	se Objectives	• To learn hands on about the basic culture and management techniques of honey bee colonies so as to enable the learner to practice Apiculture independently.											
CO #		Course Outc	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)								
On cor	npleting the co	urse successf	ully, the student will be	e able to									
CO 1	Identify differe	ent bee species	s and castes	PSO 2 K2									
CO 2	Understand hi techniques, div colonies Swar Supplementary	ve inspection viding and uni m managemer y feeding	iting bee ht &	PSO 5 K2									
CO 3	Manage bee di	seases and end	emies	PSO 3	К3								
CO 4	Develop skills harvest, post h techniques and to honey	: pre harvest, arvest value additio	n	PSO 4	K4								
CO 5	Utilize bee pro royal jelly, pol	oducts other the	an honey – wax, lis	PSO 5 K5									

SYLLABUS									
CONTENT HO URS	COs	BLOOM'S TAXONO MY LEVEL							
<ol> <li>Identification of different bee species and castes and Hive inspection.</li> <li>Dividing, uniting bee colonies.</li> <li>Supplementary feeding and honey extraction.</li> <li>Swarm management.</li> <li>Management of bee diseases and enemies.</li> <li>Honey extraction, processing, bottling.</li> <li>Beeswax rendering, purification</li> <li>Royal jelly preparation.</li> <li>Bee pollen, propolis extraction.</li> <li>Value added honey product preparation.</li> </ol>	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5							
eferences									

1. Essentials of Agricultural Entomology - Ram Singh, Chhillar & Dhaliwal, 2014.

2. Agricultural Insect Pests and their Control. Scientific Publishers (India) Jodhpur - Awasthi, V.B. 2007.

3. Fundamentals of Agricultural Entomology - Shravan. L. Haldhar, Hanuman. L. Deshwal, 2017.

	Course Articulation Matrix													
Course Outcome s			Pr	ogramı	ne Outo	comes			Programme Specific Outcomes					Comiting Long
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	Cognitive Level
CO 1	2	3	3	-	1	-	1	2	3	3	-	-	-	K1
CO 2	1	3	3	2	2	-	1	-	3	3	3	3	1	K2
CO 3	-	3	2	2	3	2	2	2	2	2	2	1	-	K3
CO 4	-	3	3	3	1	3	2	2	2	2	3	3	3	K4
CO 5	-	3	3	3	3	3	3	3	2	-	-	3	3	K5
Wt. Avg.	3	3	2 8	2	2	1.6	1.8	1.8	2. 4	2	1. 8	2	1. 4	
2.25 1.92														
	Overall Mapping of the Course 2.08											08		

## PRACTICAL – POULTRY SCIENCE (On-site Training)

	PRACTICAL – POULTRY SCIENCE (On-site Training)										
e Code	231ZO6M12										
edits	2										
/ Cycle	2										
egory	Part IIIb	Skill Based Elective I		Practical							
ester	VI										
ar of	From the aca	ademic year 2024 onwards									
entation											
urse ctives	<ol> <li>To be Listed in bullet points /Describe in 100 words.</li> <li>Study of the construction of the Poultry House and Egg collection procedures.</li> <li>Egg quality analyses, incubation procedure and Feed requirements of chicken</li> <li>Growth patterns in chicken and Identification of diseases, parasites and pests.</li> <li>Growth patterns in chicken and Identification of diseases, parasites and pests.</li> <li>Study on Kadaknath chicken breed.</li> </ol>										
	Course	Outcome(s)	PSO Bloom's Taxonom Addressed (K1 to K5)								
pleting the	course succes	ssfully, the student will be ab	le to								
Study the co	onstruction of the	Poultry house	PSO1, 4	K1							
Understand	comprehensively	the growth pattern and	PSO5,6	K2							
feed formula	tion										
Study the co symptoms	ontrol measure o	f diseases and pest with its	PSO3,6	К3							
Analyze and	study the Cost	benefit analysis	PSO5,4	K4							
Develop ent	repreneurial skill	ls.	PSO4,2	K5							
	e Code edits / Cycle egory ester r of entation urse ctives oleting the Study the co Understand feed formula Study the co Study the co Study the co Study the co Study the co Study the co Study the co	e Code       231ZO6M12         edits       2         / Cycle       2         egory       Part IIIb         ester       VI         or of       From the aca         entation       To be Listed         Irrse       1. Study of th         actives       2. Egg qualit         3. Growth path       2. Egg qualit         3. Growth path       2. Study on K         ctives       Study on K         oleting the course success         Study the construction of the         Understand comprehensively         feed formulation         Study the control measure or         symptoms         Analyze and study the Cost I         Develop entrepreneurial skill	e Code       231ZO6M12         edits       2         / Cycle       2         egory       Part IIIb       Skill Based Elective I         ester       VI         r of       From the academic year 2024 onwards         entation       To be Listed in bullet points /Describe in         Irse       To be Listed in bullet points /Describe in         Irse       Study of the construction of the Poultry Ho         2. Egg quality analyses, incubation procedur       Growth patterns in chicken and Identificati         4. Growth patterns in chicken and Identificati       Growth patterns in chicken breed.         Study on Kadaknath chicken breed.       Study on Kadaknath chicken breed.         Study the construction of the Poultry house       Course Outcome(s)         Study the construction of the Poultry house       Understand comprehensively the growth pattern and feed formulation         Study the control measure of diseases and pest with its symptoms       Analyze and study the Cost benefit analysis         Develop entrepreneurial skills.       Develop entrepreneurial skills.	e Code       231ZO6M112         edits       2         / Cycle       2         ester       VI         ester       VI         ar of       From the academic year 2024 onwards         entation       From the academic year 2024 onwards         arrot       From the academic year 2024 onwards         entation       To be Listed in bullet points /Describe in 100 words.         1. Study of the construction of the Poultry House and Egg co       2. Egg quality analyses, incubation procedure and Feed requ         3. Growth patterns in chicken and Identification of diseases, 1       4. Growth patterns in chicken and Identification of diseases, 1         4. Growth patterns in chicken breed.       Study on Kadaknath chicken breed.         5. Study on Kadaknath chicken breed.       PSO         Addressed       PSO         bleting the course successfully, the student will be able to       Study the construction of the Poultry house         Study the control measure of diseases and pest with its       PSO3,6         symptoms       PSO3,6         Analyze and study the Cost benefit analysis       PSO4,2							

SYLLABUS									
UNIT	CONTENT	Hrs.	COs	Bloom's					
				Taxonomy					
				Level					
Ι		12	CO1,	K1, K2, K3,					
	1. Study of the construction of the Poultry House		CO2,						
			CO3,	K4, K5					
	2. Egg collection procedures		CO4,						
			CO5						

3. Egg qua	lity analyses and incubation procedure	2					
4. Feed rec	juirements of chicken						
5. Growth	patterns in chicken						
6. Identific	ation of diseases, parasites and pests						
7. Pest con	itrol operations						
8. Cost ber	nefit analysis						
9. Study or	n Kadaknath chicken breed						
10. Visit to	o Poultry farm – MCC						
References Books							
1.							

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

Course articulation matrix														
COS	Programme Outcomes									Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	SKIII
CO1	1	2	2	1	2	2	2	2	3	3	1	1	2	K1
CO2	1	2	2	1	3	2	2	3	2	3	1	1	2	K2
CO3	1	2	2	1	3	2	2	3	2	3	1	1	2	K3
CO4	1	2	2	1	3	2	2	3	2	2	1	1	2	K4
CO5	1	2	2	1	3	2	3	3	2	2	1	2	3	K5
AVG	1	2	2	1	2.8	2	2.2	2.8	2.2	2.6	1	1.2	2.2	
								1.87					1.84	
Overall Mapping of the Course									1.8					

C Toyee Pc



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