DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

Learning Outcome-based Curriculum Framework (LOCF)

SYLLABUS

M.Sc. Zoology 2023 - 2024



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

MADRAS CHRISTIAN COLLEGE

VISION

Madras Christian College aspires to be an Institution of excellence transforming lives through 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 India and of the world.

Graduate Attributes

The Madras Christian College defines the philosophy underpinning its academic programs 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.

On suc	cessful con	pletion of t	he Undergr	aduate prog	gramme, the s	students will b	e able to
		1		1 0	3 /		

PO	PO	Description of PO	Mapped with GA
PO 1	Domain Knowledge	• Develop intensive and extensive knowledge and expertise in their respective domains	GA1, GA3, GA4
		• Evaluate and create/construct domain specific knowledge in areas of learning, research and industry	
		• Formulate and extrapolate the knowledge gained to apply in real – life situations and competitive examinations	
		• Develop an aptitude for self-directed learning for excellence in their chosen area within the domain of study	
		• Develop intensive and extensive knowledge and expertise in their respective domains	
		• Evaluate and create/construct domain specific knowledge in areas of learning, research and industry	
		• Formulate and extrapolate the knowledge gained to apply in real – life situations and competitive examinations	
		• Develop an aptitude for self-directed learning for excellence in their chosen area within the domain of study	
PO 2	Applicative knowledge and Lateral Thinking	Translate theoretical understanding to experimental knowledge and solve complex problems using Systems/Design Thinking	GA1, GA3, GA4
		• Apply advanced knowledge and approaches to solve concrete and abstract problems in domain-related and multi-disciplinary issues.	
		 Able to solve problems using unconventional and creative 	

	approaches	

PO 3	Innovation and Research	 Develop aptitude for innovation and entrepreneurship Identify contemporary research problems, analyze data and propose solutions 	GA1, GA4, GA5, GA6
PO 4	Scientific Communication skills	 Document, prepare and present scientific work as reports and research articles in academic forums Critically assess, review and present theories, principles and concepts 	GA1, GA4, GA5, GA6
PO 5	Digital skills	 Use of domain-related advanced softw Ethically apply digital skills to creatively 	GA1, GA2, GA3, GA4 are resources, computationa communicate a wide range
PO 6	Ethical practices	• Apply domain specific ethical principles and practices in academic, professional and social engagements	GA2, GA6, GA7
PO 7	Career readiness and higher education	 Choose from diverse career options available in local, national and international realms. Carry out further research or pursue higher education in the country or abroad 	GA1, GA2, GA5

PROGRAM SPECIFIC OUTCOMES (PSO's)*

At the time of graduation, they would be able to:

PSO #	Statement	Mapped with PO#
PSO 1	Understand the biological diversity and grades of complexity of various animal forms through their systematic classification and comparative structural studies.	PO1. PO2
PSO 2	Understanding the morphology and functional characteristics at cellular. and sub-cellular (molecular) level.	PO2. PO3, PO4
PSO 3	Understood how the chemistry and structure of the major biological macromolecules, including proteins and nucleic acids, determines their biological properties.	PO3, PO6
PSO 4	Acquire knowledge on the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Inheritance Biology, Physiology, Developmental Biology, Immunology, Microbiology, Aquaculture, Endocrinology, Evolution, Biotechnology and Nanoscience.	PO5. PO6
PSO 5	Understand and analyse the ecological and evolutionary significance of different taxa of animals.	PO6, PO7

Madras Christian College (Autonomous) Department of Zoology M.Sc. ZOOLOGY

Curriculum

(For the students admitted during the academic year 2023 – 24 onwards)

Course Code				Hours		Maximum Marks		
	Paper	Title of the Course		The ory	Practi cal	CIA	ESE	Total
		FIRST SE	MEST	ER				
232ZO1M01	Core I	Systematics, Functional Morphology and Phylogeny of Invertebrates and Vertebrates	4	6		50	50	100
232ZO1M02	Core II	Cellular Organization, Communication and Signaling	4	6		50	50	100
232ZO1M03	Core III	Molecular Biology	4	6		50	50	100
232ZO1M04	Core IV	Inheritance Biology	4	6		50	50	100
232ZO1M05	Practical I	Systematics, Functional Morphology and Phylogeny of Invertebrates and Vertebrates	2		3	50	50	100
232ZO1M06	Practical II	Iolecular Biology, Inheritance Biology and astrumentation2		3	50	50	100	
		Total	20	30				
		SECOND SE	EMEST	ER				
232ZO2M01	Core V	General & Applied Entomology	3	5		50	50	100
232ZO2M02	Core V	Faunal Diversity and Conservation	3	4		50	50	100
232ZO2M03	Core VI	Bioinformatics, Biostatistics and Research Methodology	4	6		50	50	100
232ZO2M04	Core VII	Developmental Biology	3	5		50	50	100
232ZO2M05	Practical III	General and Applied Entomology Practicals	2		3	50	50	100
232ZO2M06	Practical IV	Bioinformatics, Biostatistics and Research Methodology Practicals	2		3	50	50	100
232ZO2M07	Practical V	Developmental Biology Practicals	2		2	50	50	100
		Soft Skill	-	2				
232ZO3M08		Dissertation	3	-				
		Total	22	3	30			
		THIRD SE	MEST	ER	, , , , , , , , , , , , , , , , , , , 			
232ZO3M01	Core VIII	Animal Physiology	3	5		50	50	100
232ZO3M02	Core IX	Environmental Biology	3	5		50	50	100
232ZO3M03	Core X	Applied Zoology and Aquaculture	4	6		50	50	100

232ZO3M04	Core XI	Biochemistry and Biophysics	3	5		50	50	100
232ZO3M05	Practical VI	Animal Physiology and Biochemistry Practicals	2		3	50	50	100
232ZO3M06	Practical VII	Environmental Biology Practicals	2		2	50	50	100
232ZO3M07	Practical VIII	Applied Zoology and Aquaculture Practicals	2		2	50	50	100
		Soft Skill		2				
232ZO3M08		Dissertation						100
		Total	19	3	30			
		FOURTH S	EMEST	ſER				
232ZO4M01	Core XII	Biotechnology and Nanoscience	5	6		50	50	100
232ZO4M02	Core XIII	Microbiology and Immunology	5	5		50	50	100
	Practical IX	Biotechnology and Microbiology Practicals	3		3	50	50	100
232ZO4E01/ 232ZO4E02	Elective I	Ethology / Endocrinology	5	5		50	50	100
232ZO4E03/ 232ZO4E04	Elective II	Restoration Ecology/ Nutrition & Dietetics and Kinesiology	5	5		50	50	100
232ZO4E05/ E06	E I Practicals	Ethology / Endocrinology Practicals	3		3	50	50	100
232ZO4E07/ E08	E I Practicals	Restoration Ecology/ Nutrition, Dietetics and Kinesiology Practicals	3		3	50	50	100
		Total	29	3	30			
		Grand Total	90	1	2			
					0	1		

	Curriculum Overview Table	
Part	Credits	Hours / Cycle
Core papers + Dissertation	74 Credits	88
Elective Papers	16 Credits	16
Soft Skill	8 Credits	2
Internship	2 Credits	-
Total	100 Credits	

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	3
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SYSTEMATICS, FUNCTIONAL MORPHOLOGY AND PHYLOGENY OF INVERTEBRATES AND VERTEBRATES

Cou	rse Title	SYSTEMATICS, FUNCTIONAL MORPHOLOGY AND PHYLOGENY					
Course Code		232ZO1M01					
Cour	redits	4					
Нош	s / Cycle	5					
Ca	tegory	Part I	Core	Theory			
Se	mester	I	0010				
Y	ear of	- From the acad	emic year 2023 - 2024	onwards (this is	s required as some of the		
Implei	mentation	courses may no	ot be revised during p	articular revisio	n)		
		 To be Listed in bullet points /Describe in 100 words 1. To understand the principles behind taxonomy and the hierarchy of taxa. 2. To bring out the origin of organ systems, evolution of organisms and their 					
Course Objectives		relationship with the different groups in taxonomy.3. To also understand the reasons behind the different minor phyla and the their affinities with similar groups.					
CO #	Course Outcome(s)		ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)		
On comj	pleting the co	urse successfully	y, the student will be a	ble to			
CO 1	Focusses on of various ta	the subtle differe xa	nces in the definition	PSO1	K1		
CO 2	Summarizes the origin, path and destiny of evolution of different invertebrate phyla with suitable examples			PSO2	K2		
CO 3	Understand the phylogeny of various chordate groups			PSO3	K3		
CO 4	Illustrates the different groups of animals with evidences that ruled the world through time			PSO4	K4		
CO 5	Evaluates the as a minor pl	e reason for desig hyla	gnating an organism	PSO5	K5		

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL
Ι	PRINCIPLES OF ANIMAL TAXONOMY Terminology: systematics, nomenclature, taxonomy, classification, identification, taxon, phenon, cladon and siblings; biological species concepts: definition of species, genus, variety, race, strain and breed; naming of species, sub-species, genera; Zoological Commission and Congress, International code for Zoological Nomenclature; Keys: definitions and types; Atlas, Checklist, catalogue; Biosystematics; definitions: classical, experimental and numerical taxonomy	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	PHYLOGENY OF INVERTEBRATES Phylogenetic trees and their significance; Origin of Metazoa, Symmetry, Bilateria; Phylogeny of Coelom and Metamerism: theories and inter- relationship; Arthropod phylogeny; Molluscan phylogeny; Echinoderm larvae and evolutionary significance	18 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
Ш	PHYLOGENY OF VERTEBRATES Phylogenetic importance of prochordates: theories of origin and evolution of Chordates; Fossil history of Fishes (origin and early evolution), Amphibians, Reptiles (major groups), Birds and Mammals (origin and evolution of three sub classes)	18 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	GEOLOGICAL TIMESCALE Eon, era, epoch, period, age, representative animals, reasons for change and succession	8 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	EVOLUTIONARY TRENDS AMONG MINOR PHYLA General characters, anatomy, affinities of the minor phyla Rotifera, Acanthocephala, Pogonophora, Sipunculida, Entoprocta, Ectoprocta, Brachiopoda and Chaetognatha	16 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
Prescrib 1. A 2. T 3. L 4. k	Ded Books/Textbooks(1-5 books) Arthropod Phylogeny – Gupta, A.P. The Evolution of metazoan – Hadzi Lower Metazoa: comparative Biology and phylogeny – I Kotpal series, Rastogi Publication	Dougherty, E	C.	

References (3 – 5)

- 1. Evolution of Vertebrates Colbert
- 2. Life of Vertebrates Young
- 3. The Invertebrates (Vol I to Vol II) Hyman, L.H.

Web Resources (3-5)

- 1. <u>https://www.coursera.org/lecture/emergence-of-life/4-5-invertebrates-successes-of-life-without-a-backbone-WQHqS</u>
- 2. https://www.coursera.org/learn/early-vertebrate-evolution

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

	Course Articulation Matrix													
Course			Pr	ogram	me Ou	tcomes	5	Pro	ogramme	Specifi	ic Outco	mes	Cognitive Level	
Outco m es	PO 1	PO 2	PO 3	PO 3	PO 4	PO 5	PO6	PO7	PSO 1	PSO2	PS O3	PSO 4	PSO 5	
CO 1	2	2	3	2	2	1	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	2	1	2	2	3	2	-	1	3	K2
CO 3	2	2	3	2	2	1	2	2	2	2	2	3	3	К3
CO 4	2	2	3	2	2	1	2	2	-	1	2	-	3	K4
CO 5	2	2	3	2	2	1	2	2	1	1	-	2	3	К5
Wt. Avg.	2	2	3	2	2	1	2	2	2.2	1.8	2	2.4	3	
	2.4 22													
	Overall Mapping of the Course 2.3													

CELLULAR ORGANIZATION COMMUNICATION AND SIGNALING

Course 7	litle	CELLULAR ORGANIZATION COMMUNICATION AND SIGNALING										
Course C	Code	232ZO	1M02									
C	redits	4										
Hour	rs / Cycle	6	6									
Ca	itegory	Part	Part I Core Theory									
Se	mester											
Y	ear of	From the academic year 2023-2024 onwards (this is required as some of the courses										
Imple	mentatio	may n	ot be rev	vised during particu	ılar revision)							
n												
		The m	ain objec	tives of this course a	are to:							
		1.	1. Enable the learner to understand the beauty of cellular organization.									
C		2. Appreciate cellular communication and the intricacies in cell signaling.										
Course	Objectives	3.	3. Understand the importance of extracellular matrix and cell migration									
		4.	Build a	hierarchy showing r	elationships betw	ween levels of intra and	inter					
			cellular	communication.	-							
	r	Learn	recent sc	ientific advancemen	ts in this area of	science						
CO #		C	0 (PSO	Bloom's Taxor	nomy					
CO #		Cou	rse Outc	ome(s)	Address	ed Levels	s (K1 to K5)					
On comj	pleting the co	urse su	ccessfully	y, the student will b	e able to							
CO 1	Get an overv and function	view of i ing of o	nternal c rganelles	omponents	PSO3	K1						
CO 2	Differentiate signaling mo	e and dis	stinguish	the specific roles of	PSO4	K2						
CO 3	Establish the cell function	e link be	tween ce	llular components in	PSO5,6	K3						
CO 4	Critically an organelles in	alyze th a cell	e individ	ual roles of specific	PSO7	K4						
CO 5	Incorporate knowledge f	recent te or resea	echnology rch	with existing	PSO8	K5						

	SYLLABUS			
UNIT	CONTENT	HOUR S	COs	BLOOM'S TAXONOM Y LEVEL
Ι	Cell Basics and Organization	15	CO1	K1
	Cellular properties – Discovery, Chemical basis, Different classes of cells and Origin of the Eukaryotic Cell		_ CO5	
	Structure and function of Plasma membrane – Types, Structure, Composition, Function, Movement across membrane, Electrical properties - Membrane potential and Nerve impulse			
	Internal organization of the Cell –Intracellular compartments, Cytoplasmic components, protein sorting, Cytoskeleton, Mitochondria, Intra and Inter cellular traffic			
II	Cellular Signaling	20	CO1-	K2
	 Receptors: Cell surface receptors, Ion Channel- Linked Receptors, G-Protein Linked Receptors and Enzyme-Linked Receptors 		CO5	
	 Cells in the social context: Cell Junctions – Occluding, Anchoring, Communicating, Desmosomes, Hemidesmosomes, Plasmodesmata and Gap junctions, Cadherins, Neural Cell Adhesion Molecule (N-CAM), Non-junctional contacts 			
	 Extracellular messengers, G-coupled receptors and second messengers, Protein phosphorylation and signal transduction, Role of calcium as intracellular messenger 			
	 Autophagy signaling, Inflammasome signaling, NF-kB signaling, mTOR signaling and Notch signaling 			

III	Extracellular Matrix and Cell Migration	12	C01-	K3						
	> Polysaccharides: Glycosaminoglycans		CO5							
	(GAGs) and Proteoglycans									
	 Proteins: Collagen, Elastin, Fibronectin, Laminin 									
	> Influence of extracellular matrix on Cell									
	Shape, Cell Survival and Cell proliferation									
	> Matrix degradation and cell migration:									
	Hyaluronan, Matrix Metalloprotease (MMP),									
187	Activation and Inhibition (TIMP's)	12								
IV	Intra and Inter cellular communication	12	CO	1 K4						
	> Endomembrane system: Endocytic pathway,			5						
	Biosynthetic pathway, Secretory pathway, Constitutive secretion, Regulated secretion									
	> Approach to study Endomembranes:									
	Autoradiography, Green Fluorescent Protein (GFP), Subcellular fractions									
	> Endoplasmic reticulum: Rough Endoplasmic									
	Reticulum, Smooth Endoplasmic Reticulum,									
	Ribosomes, Signal Recognition Particle									
	(SKP), Signal Peptidase									
	(CGN) trans Golgi Network (TGN)									
	Vesicular transport, G-protein recruitment,									
	Protein Sorting and transport									
	 Exocytosis: Lysosomes – Phosphatases, 									
	Nucleases, Proteases,									
	Hydrolases, Polysaccharides, Sphingolipids, and Lipids, Disorders resulting from defects									
	in Lysosomal function									
V	Recent Scientific Advancements	10	CO	l- K5						
	Interactome – String analysis									
	Exosome, Peroxisome, Phosphoproteomics		COS	5						
	> Chromatin Immunoprecipitation, ELISA,									
	Flow Cytometry,									
	Immunofluorescence, Immunohistochemistry									
D "	> RNA interference									
	ed Books/Textbooks(1-5 books)									
	ell Biology – N. Arumugam									
3.0	ell Biology – Verma Aggarwal									
Referen	$\cos(3-5)$									
1. C	ell and Molecular Biology – Gerald Karp									
2. 0	ell Biology – Stephen R. Bolsover et al									
3 N	folecular Biology of The Cell – Alberts et al									

Suggested Reading (2 - 5)

- 1. Molecular Cell Biology Harvey Lodish et al.,
- 2. DNA the Secret of Life James D. Watson
- 3. Genetics: Principles and Analysis Hartly & Jones

Web Resources (3-5)

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

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	3						

	Course articulation matrix													
Programme Outcomes Programme														Cognitiv
											Speci	ific		e skill
									Outco	mes				
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO	D2	PSO3	PSO4	PSO5	
CO1	1	1	3	2	3	1	2	3	2		2	1	2	K1
CO2	1	1	3	2	3	1	2	3	2		-	1	2	K2
CO3	1	1	3	2	3	1	2	3	2		2	1	2	K3
CO4	1	1	3	2	3	1	2	3	2		2	1	2	K4
CO5	1	1	3	2	3	1	2	3	2		-	1	2	K5
AVG	1	1	3	2	3	1	2	3	2		2	1	2	
Overa	ll Mappi	ing of th	ne Cour	se		1.8	75						1.935	

MOLECULAR BIOLOGY

Cou	rse Title	MOLECULAR BIOLOGY										
Cou	rse Code	232ZO1M03										
С	redits	3										
Hour	rs / Cycle	5	5									
Ca	itegory	Part I	Core	Theory								
Se	mester											
Y	ear of	From the academic year 2023 onwards (this is required as some of the courses may										
Imple	mentatio	not be revised during particular revision)										
- 11												
Course	Objectives	 To be Listed in bullet points /Describe in 100 words To understand the convergence of work by Geneticists, Physicists, and Structural Chemists Expound Genomics and Post-Genomics. Molecular Biology Unravelling the basic principles laid out by Mendel To uncover many secrets concerning the ultimate units of the living cell To learn Human Molecular Genetics 										
CO #		Course Outco	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)							
On com	pleting the co	urse successfully	, the student will be a	ible to								
CO 1	Define basic	function of the n	ucleus	PSO1	K1							
CO 2	To Identify a reproduction	and explain the ba	sis of cell cycle and	PSO2	K2							
CO 3	To discover expression	the mechanism ar	id control of gene	PSO3	K3							
CO 4	To recognize and gene edi	e the importance of ting	f the regulome	PSO4	K4							
CO 5	To assess the molecular to	e function of the g ols	enome using	PSO1	K5							

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM
				Y
т	Collular Donroduction	17 hours	CO1	LEVEL
1	Cenular Reproduction	17 nours	CO1,	K1, K2, K3, K4 K5
	> The Cell Cycle: Phases of the cell cycle,		,	,
	Control of the cell cycle - Cyclins, Cdk's, Checkpoints M-phase Cytokinensis		CO3	
	 Meiosis, Genetic recombination, Homologous 		, CO4	
			04	
			, CO5	
	recombination, Holiday model			
	 Dysregulated Cell cycle, Apoptosis, Cancer - 			
	TSG and Oncogene	1 - 1	001	171 170 170
11	DNA replication and repair	15 hours	CO1,	K1, K2, K3, K4 K5
	 Proteins involved in replication – Structure, 		,	114, 115
	I ypes and Function Mechanism: Chromosomal		CO3	
	replication Bacterial replication Replicon		, CO4	
	replication, Dacterial replication, Replicon		04	
			, CO5	
	 Replicative errors, DNA repair – NER, BER, 			
	MR, DS-BR			
	> Consequence of DNA repair deficiencies	20.1	001	171 170 170
111	. Control of Gene Expression	20 hours	CO1,	K1, K2, K3, K4 K5
	> The Cell Nucleus: Nuclear Envelope,		,	114, 115
	chromosomes (Chromosomal Aberrations and Human Disorders) and Chromatin		CO3	
	Telomeres		, CO4	
	> Prokaryotic transcription, Eukaryotic		04	
			, CO5	
	Transcription, RNA splicing, processing,			
	mRNA stability and Translation			
	> Role of 1 ranscription factors in gene expression: The zinc-finger motif helix-loon-helix			
	(HLH) motif			
	> Gene expression in Bacteria – Operon (Lac			
	operon & Tryptophan operon)			
	 Gene expression in Eukaryotes – Control at the 			
	Transcriptional, Processing, Translational, Post			
IV	Regulome	12 hours	CO1.	K1. K2. K3.
- ·		12 Hours	,	,,,

 Epigenetics – Heterochromatin, CpG island, DNMTs, HDACs, Transgenerational epigenetics Non-coding genome: ncRNA, lncRNA, miRNA, piRNA, siRNA, circRNA 	CO2 K4, K5 , CO3 , CO4 , CO5
 Manipulating the genome: CRISPR/Cas9 system, mod RNA 	

V	. Analyzing the Genome and Proteome	8 hours	CO1	K1, K2, K3,					
	PCR, Q-PCR, Cytogenetics, CGH, Microarray		,	K4, K5					
	> GWAS, GWS, Next-Gen Sequencing,		CO 2						
	Transcriptomics, Metabolomics, Multiplex- Proteomics, MALDI-TOF, Proteome.		, CO3						
	 Single Cell Genomics, Single Cell Proteomics 		,						
	 Microbiome, Mycobiome and Virobiome 		CO4						
			, CO5						
Prescrib	ed Books/Textbooks(1-5 books)								
1. Cell ar	nd Molecular Biology – Gerald Karp								
2. Genes	XII – Benjamin Lewin								
3. Molec	ular biology of the Gene – Watson et al.,								
4. Molec	ular Biology - David P. Clark and Nanette J. Pazdernik	- 2013							
Referen	$\cos(3-5)$								
1. Humai	n Molecular Genetics - Tom Strachan Andrew Read								
2. Molec	ular biology - David P. Clark, Nanette J. Pazdernik, Mic	helle R. Mc	Gehee						
3. Princip	bles of Gene Manipulation and Genomics - Sandy B. Pri	mrose, Rich	ard Twy	man					
Suggeste	ed Reading (2 -5)								
1. Genon	nes 4 - T.A. Brown								
2. DNA t	he Secret of Life – James D. Watson								
3. Geneti	cs: Principles and Analysis – Hartl & Jones								
Web Res	sources (3-5)								
1. e dX: E	edX: DNA Replication and Repair; Transcription and Transposition; RNA Processing and								
Transla	Franslation								
2. Course	Coursera: Genomics: Decoding the Universal Language of Life; WGS - tools and								
applicati	ons Coursera								
3. NPTE	L: Molecular Cell Biology								

	Course Articulation Matrix													
Course				Progra	mme O	outcome	es		Pro	gramme S	pecific	Outcom	es	
Outco m es	PO 1	P 0 2	PO 3	PO 3	PO 4	PO 5	PO6	PO7	PSO1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	2	1	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	2	1	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	2	1	2	2	2	2	2	-	3	K3
CO 4	2	2	3	2	2	1	2	2	-	1	2	-	3	K4
CO 5	2	2	3	2	-	1	2	2	1	1	-	2	3	K5
Wt. Avg.	2	2	3	2	1.6	1	2	2	2.2	1.8	2	1.5	3	
2.275 2.5														
								С	verall Mapp	ing of the	Course	2	2.3	

INHERITANCE BIOLOGY

Cou	rse Title	INHEF	RITAN	CE BIOLOGY								
Cou	rse Code	232ZO1	M04									
C	redits	3										
Hour	s / Cycle	5		1								
Ca	ategory	Part	Ι	Core	Theory							
Se	mester											
Y	'ear of	From the academic year 2023-2024 onwards (this is required as some of the courses										
Imple	mentatio	may no	ot be rev	vised during particula	r revision)							
n												
		The ma	in objec	tives of this course are	to:							
		6.	6. To understand the existence of a species									
Course	• Objectives	7. Expound the genetics of genetic traits from one individual to the other										
		8. Unravelling the basic principles laid out by Mendel										
		9.	To leari	n sex inheritance patter	ns and Gene							
		mappin	g To lea	rn bacterial, Viral and	Human genetic an	d						
		disease	se	C								
CO #		Cour	se Outc	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the co	urse suco	cessfull	y, the student will be a	able to							
CO 1	Describe and	l define b	oasic pri	nciples of heredity	PSO3	K1						
CO 2	To Identify a disease	and Expla	ain the b	asis of hereditary	PSO4	K2						
CO 3	To discover	the basis	of gene	mapping	PSO5,6	К3						
CO 4	To recognize the importance and application of InheritancePSO7K4											
CO 5	To criticize a	and create	e meani	ngful conclusions	PSO8	K5						

	SYLLABUS										
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL							
Ι	 Heredity and Genetics Chromosome – Variation, Rearrangements, Aneuploidy, Polyploidy, Mutation, Syndromes 	15	CO1 - CO5	K1							

	>	Royal Hemophilia - Romanov DNA,			
		Alkaptonuria Importance of Genetics,			
		Variation and Evolution			
	>	Single locus Cross, Multiple Loci Cross,			
		Dihybrid Test Cross, Trihybrid Cross,			
		Incomplete Dominance, Epistasis and			
		Meiosis			
	>	Observed and expected ratio - The Goodness-			
		of-Fit of Chi-Square Test			
	Dom	inance. Incomplete dominance.			
	Co-	dominance. Penetrance and			
	Expr	essivity			
II	Sex li	nked Characters			
	П	Chromosomal Genic and Environmental		CO1	K2
		Sex– Determination systems	10	-	
	п	Sex determination in Drosophila and Humans		CO5	
		X-linked Y-linked Z-linked Dosage			
		Compensation Non-disjunction Sex linked			
		Characters			
	п	Lethal alleles Multiple alleles – Duck feather			
		natterns ABO Blood Grouping Cytoplasmic			
		inheritance Genomic imprinting			
	п	Pedigree analysis Autosomal recessive and			
	Ц	dominant X-linked recessive and dominant			
		Twin studies Adoption studies Genetic			
		testing			
		amniocentesis Chorionic villus sampling			
		and counselling			
Ш	Cono	Manning			
111	Gene	Genetic Man Linkage and Recombination			К3
		Linkage and recombination between Two and	15	CO1	110
	>	Linkage and recombination between 1 wo and three games. Crossing over with linkage	10		
		Becombination frequency		CO5	
		Homogyacosity Manning Dediction Hybrid		000	
	~	Manning Manning with molecular markers			
		Physical chromosome mapping Deletion			
		mapping In-situ hybridization and Mapping			
		hy DNA sequencing SNP			
	~	Karvotyping: G-banding C-banding Spectral			
		Karyotyping. C banding, C banding, Spectral			
TX7	D 4 .				
1V	Басте	rial and viral Genetics			KA
	\triangleright	Bacteria - Genome and Plasmid	11	CO1	774
	\succ	Gene transfer – Conjugation, Transformation-	11	-	
		Natural Gene Transfer and Antibiotic		CO5	
		Resistance			
	\succ	Virus – Bacteriophage, Transduction, RNA			
		viruses, Prions-Pathogens without gene			
V	Huma	n Molecular Genetics			
					K5

	Human Genetic Diseases – Disorders of	10	CO1							
	Muscle, Eye, Mitochondria and Neurologica	1	-							
	disorders		CO5							
	Human Population Genetics- Hardy- Weinberg Equilibrium	-								
	 Epigenetics: Genome imprinting Methylation, Parent origin effect, Generation 	-								
	 Etiopathogenesis of disease, Counselling Diagnostics, Pharmacogenetics and Management 	, 1								
Prescrib	ed Books/Textbooks(1-5 books)									
4. G	enetics: A conceptual approach – Benjamin A. Pierce									
5. Ir	ntroduction to Genetic Analysis – Griffiths et al.,									
6. P	rinciples of Genetics – Tamarin									
7. G	enetics: Principles and Analysis – Hartl & Jones									
Reference	$\cos(3-5)$									
4. G	enes IX – Benjamin Lewin									
5. C	olor Atlas of Genetics – Eberhard Passarge									
6. D	NA the Secret of Life – James D. Watson									
Suggeste	ed Reading (2 -5)									
4. N	Iolecular Cell Biology – Harvey Lodish et al.,									
5. D	5. DNA the Secret of Life – James D. Watson									
6. G	6. Genetics: Principles and Analysis – Hartly & Jones									
Web Res	sources (3-5)									

Course articulation matrix														
	Programme Outcomes									Programme Specific Outcomes				Cognitiv
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	-	PSO2	PSO3	PSO4	PSO5	e skill
CO1	1	1	3	2	3	1	2	3		2	2	1	2	K1
CO2	1	1	3	2	3	1	2	3		2	-	1	2	K2
CO3	1	1	3	2	3	1	2	3		2	2	1	2	K3
CO4	1	1	3	2	3	1	2	3		2	2	1	2	K4
CO5	1	1	3	2	3	1	2	3		2	-	1	2	K5
AVG	1	1	3	2	3	1	2	3		2	2	1	2	
Overa	ll Map	oing of	the Co	urse			1.87						2.0	

SYSTEMATICS, FUNCTIONAL MORPHOLOGY AND PHYLOGENY OF INVERTEBRATES AND VERTEBRATE PRACTICAL

Cou	rse Title	SYSTEMATICS, FUNCTIONAL MORPHOLOGY AND PHYLOGENY OF									
		INVERTEBRA	TES AND VERTEBR	ATE PRACTI	CAL						
Cou	rse Code	232ZO1M05									
C	redits	2									
Hou	rs / Cycle	2									
Ca	ategory	Part	Part Core Practical								
Se	mester										
Y Y	ear of	From the academic year $2023 - 24$ onwards (this is required									
	ementati	as some of the courses may not be revised during particular									
n		revision)									
Course	e Objectives	To be Listed in 1. To study th	n bullet points /Descril e various forms of inve	be in 100 words	ordate						
Course Objectives		2. To discuss their classification, structural and functional aspects of invertebrates and Chordate									
		3. To understand the systemic and morphological features of animals.									
		4. Students can identify the phylogenetic significance of invertebrates.									
		5. To understand the concepts of diversity, adaptations, organization and taxonomic status of chordates.									
CO #		Course Out	come(s)	PSO Address ed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the co	ourse successful	ly, the student will be	able to							
CO 1	Understand the animals.	e structure and org	anization of invertebrate	PSO1	K1						
CO 2	Know the vari from invertebr	ous functions of a ates to vertebrates	nimals during transition	PSO2	K2						
CO 2	Understand the invertebrates.	e significance of la	arval forms of	PSO2	K2						
CO 4	Know the mic: invertebrate pl mount observa	roscopic animals any la through the post ny la through the post ntion.	nd larva of different ermanent slide/ whole	PSO4	K4						
CO 5	Dissect the g	rasshopper, toad	and fish	PSO5	K5						

SYLLABUS			
CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL
 Study of selected protozoans (omitting those studied in UG) to understand the increasing complexity of organization. Opalina, Actinophrys, Radiolaria, Volvox, Ceratium, Euglena, Paramecium, Vorticella and Monocystis 	16	CO1 , CO2 , CO3 , CO4 , CO5	K1, K2, K3, K4 , K 5
2. Study of sections of certain animals from Porifera Cnidaria, Platyhelminthes, Nemathelminthes and Annelida to understand the evolution of different types of coelome. T.S. of <i>Grantia</i> , T.S. of <i>Metridium</i> , T.S. <i>Fasciola</i> , T.S. of <i>Ascaris</i> , T.S <i>Nereis</i> and T.S. of <i>Peripatus</i>			
3. Study of larval forms or all phyla of invertebrates. Ephyra, Miracidium, Redia, Cercaria, Nauplius Metanauplius, Zoea, Mysis, Veliger, Alima Phyllosoma, Pluteus, Ophiopluteus, Phoronis Cyphonautes, and Salpa (sexual & asexual) and Doliolum			
4. Invertebrate slides and specimen from minor phyla to study their structure and functions. Nemertea worm, Polyzoan colony, <i>Pedicellina</i> , <i>Echinorhynchus, Phoronis, Sagitta</i> and Rotifers			
5. Identification of fossils to understand their phylogenetic significance. Favosites, Trilobites Spirifera, Chama, Alectryonia, Ammonite, Belemnite, Cidaris, Micraster, Graptolite and Monograptus.			
6. Invertebrate dissections – Digestive, Nervous and Reproductive systems of Grasshopper			
7. Vertebrate dissection – Portal, Urinogenital/Reproductive and nervous in fish/toad			

	8. Chordate slides and specimen – Balanoglossus Ascidian Tadpole larva, Amphioxus, Petromyzon, Myxine, Chimaera, Acipenser, Polyodon and Salamander									
Referen	ce books: Fextbook of Practical Zoology - Invertebrate by S.S. Lal									
2. N	2. Manual of Practical Zoology – Vertebrate by S.S. Lal									

3. History of life by Richard Cowen

	Course Articulation Matrix												Cogniti v e Leve I
COS	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO	PSO	PSO	
	1	2	3	4	5	6	7	1	2	3	4	5	
CO1	2	2	3	2	1	2	2	3	3	2	2	3	K1
CO2	2	2	2	2	1	2	3	3	2	2	2	3	K2
CO3	2	2	2	2	3	3	2	3	2	2	2	3	K3
CO4	3	2	3	2	1	2	2	3	1	2	2	1	K4
CO5	2	2	3	2	3	3	3	3	1	2	2	3	K5
AV G	2.2	2	2.6	2	1.8	2.4	2.4	3	1.8	2	2	2.6	
							2.2					2.2	
Overall Mapping of the Course – 2.2													

INHERITANCE BIOLOGY AND MOLECULAR BIOLOGY PRACTICAL

Cou	urse Title	INHERITANCE	BIOLOGY AND	MOLECULA	R BIOLOGY PRACTICAL				
Cou	irse Code	232ZO1M06							
	Credits	2							
Hou	rs / Cycle	2							
(Category	Part I	Core	Practical					
S	Semester								
Y C	ear of	ear of From the academic year 2023 – 24 onwards (this is required as some							
Imple	mentation	of the courses m	ay not be revised	during partici	ular revision)				
Course Objecti	To be Listed in bullet points /Describe in 100 words6. To understand the molecular basis of genetic processes7. To provide with the core principles of molecular biology.8. To impart basic knowledge on Inheritance Biology9. Interpret, analyse and present experimental results and conclusions in a smanner								
CO #		Course Out	come(s)	PSO Addressed	Bloom's Taxonomy Levels(K to K5)				
On com	pleting the	course successful	ly, the student w	ill be able to					
CO 1	Define bas	ic principles of her	redity	PSO1	K1				
CO 2	Identify an disease	d Explain the basis	s of hereditary	PSO2	K2				
CO 2	Discover t	he basis of gene ma	apping	PSO2	K2				
CO 4	Analyze th Inheritance	e importance and a	application of	PSO4	K4				
CO 5	Criticize a	nd create meaning	ful conclusions	PSO5	K5				

SYLLA	ABUS				
CONTENT	HOURS	COs	BLOOM'S TAXONON Y LEVEL		
 Introduction to Molecular Biology Techniques, Instrumentation and Handling Drosophila culture and identification of mutants Pedigree analysis – Sex-linked and Autosomal disorders Preparation of Metaphase chromosomes from Mouse Bone Marrow Human Metaphase chromosomes for analysis of Cell cycle and Chromosomal aberrations Extraction of DNA and Spectrophotometric estimation of DNA Gel Electrophoresis and DNA fragmentation assay Primer designing and Optimizing of annealing temperature PCR, PCR trouble shooting and RT PCR Lab Visit 		CO1 , CO2 , CO3 , CO4 , CO5	K1 , K2 K3 , K4 , K5		
Reference books: 4. Genes IX – Benjamin Lewin					
 Color Atlas of Genetics – Eberhard Passarge DNA the Secret of Life – James D. Watson 					

					Cou	rse Artic	ulation N	Iatrix					C
												Ĺ	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	1	2	2	2	3	3	2	1	2	K1
CO2	2	2	2	1	2	2	3	3	2	2	2	2	K2
CO3	2	2	2	3	2	3	2	3	2	2	1	2	K3
CO4	3	2	3	1	2	2	2	3	1	2	1	2	K4
CO5	2	2	3	3	2	3	3	3	1	2	2	2	K5
AVG	2.2	2	2.6	1.8	2	2.4	2.4	3	1.8	2	1.4	2	
2.2 2.4													
	Overall Mapping of the Course – 2.3												

GENERAL AND APPLIED ENTOMOLOGY

Cour	se Title	GENERA	L	AND APPLIED ENTOMOLOG	Y					
Cour	se Code	232ZO2M	01							
Cr	redits	3								
Hours	s / Cycle	5		1	I					
Cat	tegory	Part I		Core		Theory				
Sen	nester	II Enorm 4h								
Imploy	ear or	From the	a	cademic year 2023 onwards						
n	nentatio									
		To be Listed in bullet points /Describe in 100 words.								
		1. To gain knowledge on the different kinds of insects								
		2. Understand the different parts of the insects and study the systematics.								
		3. To the study the pests infesting the cash crops and various other vegetables								
Course	Objectives	4. To learn about the Host- plant interaction in nature.								
		5. To understand the various biological control methods used to eradicate								
		insect	pe	ests.						
		6. Ci	eat	e awareness amongst individuals a	bout conservat	ion of insects and				
		prese	va	tion.						
		I			DGO	Bloom's Taxonomy				
CO #		Co	uı	rse Outcome(s)	Addressed	Levels (K1 to K5)				
On com	pleting the	course suc	ce	ssfully, the student will be able to		· · · · ·				
<u> </u>		- 1 C4 1 41-			DCO1	17.1				
01	Identify ar	ia Study th	e 11	issects and their importance and its	PSOI	KI				
	taxonomic	position.								
CO 2	Understan	d the morp	10	ogy from the taxonomic and	PSO2	K2				
	evolutiona	ry point of	vi	ew for the various insect species						
	that exist.									
CO 3	Appreciate	e and Appl	/ tł	ne various technologies and	PSO5	K3				
	study the o	lamage and	c	ontrol measures.						
CO 4	Analyze th	ne physiolo	gic	al aspects of insects.	PSO4	K4				
CO 5	Develop v the status.	arious met	100	Is to eradicate pests and to evaluate	PSO5	K5				

SYLLABUS										
UNIT	CONTENT	HRS	COs	BLOOM'S TAXONOM Y LEVEL						
I	CLASSIFICATION & IDENTIFICATION OF INSECTS Reason for insects as a successful group; Outline classification of insects with examples; Basic knowledge of the following orders of insects with special reference to Indian examples: Apterygota:Thysanura, Protura, Collembola, Diplura. Pterygota:Exopterygota: Ephemeroptera, Odonata, Orthoptera, Thysanoptera, Mallophaga, Anoplura, Hemiptera. Endopterygota: Lepidoptera, Coleoptera, Diptera, Hymenoptera.	10	CO1 , CO2	K1, K2,						
Π	MORPHOLOGY & ANATOMY Morphology of Head: Sulci, tentorium, types of mouth parts, type of antenna; Morphology of wing, hearing segment, wing venation of generalized insect, region of wings, wing coupling mechanism; Legs and External genitalia; types of larvae and pupae; Anatomy of internal organs: Elementary histology of alimentary canal, respiratory structure, circulatory organs; Brain and sub- oesophageal ganglia; Internal organs of reproduction.	10	CO2 , CO4 ,	K2, K4						
III	INTERNAL PHYSIOLOGY Structure and composition of integument; Moulting; Metamorphosis and Role of hormones in metamorphosis; Insect digestion: Digestion of carbohydrates, fats, proteins, role of microorganisms in digestion; Elimination of nitrogenous wastes; Mechanism of respiration; Composition of Haemolymph and its function; Course of circulation, heartbeat.	10	CO2 , CO4 ,	K2, K4						

IV	APPLIED ENTOMOLOGY	15	CO2	K2,K3, K4							
	Agricultural Entomology: Types of Insect pests, Life		,								
			CO3								
			,								
	cycle, nature& extent of damage and control of pests with		CO4								
	special reference to Paddy, Sugarcane, Cotton, Pest of										
	Stored products: Life cycle, nature of damage and control of										
	external and internal feeders of stored products.										
	Economic Entomology:										
	Veterinary Entomology: Life cycle, nature of damage and										
	control of insect pests of Cattle, Fowl, Sheep and Goat.										
	Medical Entomology: Life cycle, nature of damage and										
	control of insects associated with human beings: Mosquito,										
	Fleas and Head louse.										
	Beneficial insects: Kinds of Honey bees, care and										
	management of an apiary, uses of Honey; Types of silk										
	worms and silkworm rearing, uses of Silk; Biology and										
	behaviour of Lac insect and lac cultivation, uses of Lac.		~~								
V	PEST CONTROL	15	CO5	K5							
	Pest control methods: Prophylactic, Cultural, Mechanical,										
	Chamostarilants Insect attractants Repellents Insect										
	growth regulators and Genetic control. IPM concepts and										
	strategies; Current trends in Quarantine Entomology.										
	Insecticides: Classification based on mode of entry, mode										
	of action, Hazards of insecticides; Resurgence and outbreak;										
	Plant protection appliances: Sprayers and Dusters.										
Prescri	Prescribed Books/Textbooks										
1.	The Insects Structure and Function - Chapman, R.F.										
2. General and Applied Entomology -Nayar, K.K. and David.											
3. The Principles of Insect Physiology -Wigglesworth, V.B.											
4. Elements of Economic Entomology - B. Vasantharaj David, V. V. Ramamurthy.											
References											
1. Applied Entomology - P. G. Fenemore and Alka Prakash, 2009, revised 2 nd Ed.											
2. General Entomology- Mani, M.S, 1973, 2 nd Ed.											
3. Destructive and Useful Insects. Their Habits and Control - Metcalf C.L. 1984,											
4th Ed. McGraw Hill Book Co. Inc. N.Y.											
1. Applied Entomology, An Introductory Textbook of Insects in their Relation to Man - Fernald,											
n.1. 2000. 2. January Constant Joseph and Enternalisaty Val. 19: Val. H., Dishard O.W.											
$2. \ln 2$	2. minis General Text books of Entomology, Vol. 1& Vol. II - Kichard O.W.										
3. General Text Book of Entomology, Vol. II -Richard O.W and Davies, R.G.											

Web Resources

1. Applied Entomology: <u>https://onlinecourses.swayam2.ac.in/cec20_bt02/preview</u>

2. Insect-HumanInteractions: https://www.mooc-list.com/course/bugs-101-insect-human-interactions-coursera

3. https://www.coursera.org/learn/bugs-101

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	3	1	1	3	1	2	2	2	3	3	1	3	-	K1
CO2	3	1	2	2	2	1	3	2	3	3	1	3	-	K2
CO3	3	2	1	1	1	2	2	2	2	2	2	-	1	K3
CO4	3	2	2	1	1	1	1	2	-	1	3	2	2	K4
CO5	3	2	1	2	2	2	2	2	1	1	-	1	1	K5
AVG	3	1.6	1.4	1.8	1.4	1.6	2	2	2.2	2	1.7	2.2	1.3	
							1.8						1.8	
Overall Mapping of the Course								1.8						
FAUNAL DIVERSITY AND CONSERVATION

Course Title		FAUNAL DIVERSITY AND CONSERVATION						
Cou	rse Code	232ZO2	2M02					
С	redits	2						
Hour	s / Cycle	4		-				
Ca	itegory	Part	Ι	Core	Theory			
Se	mester	II						
Y	ear of	From	the acad	emic year 2023 onwar	ds			
Imple	mentatio							
n								
Course Objectives		• • • • • • • • • • • • • • • • • • • •	 Acquire the knowledge of biodiversity in different geographical areas. Understand the strategies evolved to conserve biodiversity and their habitat. Know the measures in vogue to restore the biodiversity and environment. Levels of organization in animals. Analyze the evolutionary affinities of vertebrates. Create awareness against wildlife crimes and Laws in conserving biodiversity. 					
CO #		Course Outcome(s)		PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)			
On com	pleting the co	urse suc	ccessfully	, the student will be a	ble to			
CO 1	Identify and	l the imp	portance	of faunal diversity.	PSO1	K1		
CO 2	CO 2 Understand evolutionar that exist.		ematics f of view	from the taxonomic and for the various species	PSO2	K2		
CO 3	Apply Conservation strategies to protect endangered animals.			ategies to animals.	PSO3	K3		
CO 4	Analyze the wildlife crimes through forensics and toxicological methods			through forensics	PSO4	K4		
CO 5	Evaluate the for conservation	e legal is ation	ssues for	creating awareness	PSO5	K5		

SYLLABUS							
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL			
Ι	Biodiversity - India as mega diversity nation – Diversity at global, national and local levels. Protected areas – national parks, wildlife sanctuaries, marine parks & Sanctuaries, conservation reserves and community reserves. 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.	10	CO1 , CO2 , CO3 , CO5	K1, K2, K3, K5			
II	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, modern developments (database and expert identification systems).	10	CO1, CO2 , CO3	K1, K2, K3			
Ш	Threats to Biodiversity, HIPPO Analysis- In-situ and Ex-situ conservation. Endangered, Endemic and Invasive species of India. Animals in human lives. Deforestation, Afforestation and Forest fire. Animal ethics – Ethical committee.	10	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5			
IV	 Wildlife forensics and its applications in detecting wildlife crimes. Wildlife toxicology: Types of contaminants - methods of toxicity evaluation. Bio concentration, bio accumulation and bio magnification. Impacts of pesticides and heavy metals on fishes, amphibians, reptiles, aves and mammals. 	8	CO1, CO3, CO4	K1, K3,K4			

3. Comparative Anatomy of Vertebrates (2021) – H C Nigam, Vishal Publications.							
4. Manual of Zoology (1964)– M EgambaranatharIyyer, S Chand Publications, New Delhi							
Web Resources:							
1. Ecology and Wildlife Conservation (FutureLearn):							
https://www.mooc- list.com/course/ecology-and-wildlife-							
_							

	Course Articulation Matrix													
Course	Programme Specific Outcomes											Cognitive Level		
S Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	3	2	3	2	1	2	3	3	3	3	2	1	2	K1
CO 2	3	2	3	2	1	2	3	3	3	2	-	2	2	К2
CO 3	3	2	3	3	1	2	3	3	3	2	2	1	2	К3
CO 4	3	2	3	2	1	2	3	3	3	1	2	-	2	K4
CO 5	3	2	3	-	1	2	3	3	1	1	-	2	2	К5
Wt. Avg.	3	2	3	1.8	1	2	3	3	2.6	1.8	1.2	1.2	2	
								2.47					1.76	
Overall Mapping of														
the														

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

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	3			

course 2.115

BIOINFORMATICS, BIOSTATISTICS & RESEARCH METHODOLOGY

From the academic year 2023 - 2024 onwards (this is required as some of the courses							
may not be revised during particular revision)							
 The main objectives of this course are to: To provide an integrative approach to the understanding of both theory and practice of bioinformatics To apply biological concepts at different levels to study gene, protein analysis, and the proteins implicated in diseases and Perform Computer Assisted Drug Designing and Drug Discovery. To provide an insight into the genome sequences of a few organisms as wellas the Human genome through Comparative and Functional genomics To provide the basic concept of Biostatistics and interpret results of descriptive statistical methods effectively; communicate the results of statistical analyses accurately and effectively. To develop understanding of the basic framework of research process and identify various sources of information for literature review and data collection 							
Course Outcome(s)PSO AddressedBloom's Taxonomy Levels (K1 to K5)							
On completing the course successfully, the student will be able to							

CO 3	Apply functional genomics techniques to analyze data for biological system and statistical methodology, before going on to apply statistical skills to solve real-life problems in various fields	PO3	К3
CO 4	Analyse and perform a complete analysis of the genes and protein and compare and identify the differences in sequences	PO4	K4
CO 5	Solve the biological problems and put more emphasis on understanding the disease related problems at molecular level.	PO5	K5

SYLLABUS								
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL				
Ι	INTRODUCTION TO BIOINFORMATICS Aims, Tasks and Applications of Bioinformatics. Information Retrieval System, Data submission Tools.Nucleic acid sequence data banks. Databases of patterns, motifs and profiles: Metabolic Pathway Databases. Literature Databases. Database Similarity Searches: BLAST, FASTA, Sequence Alignment - Pair wise sequence alignment - Needleman and Wunsch, Smith Waterman algorithms; Multiple sequence alignments – CLUSTAL Omega, PRAS; Patterns, motifs and Profiles in sequences. Homology and similarity, Phylogeny analysis and relationships. Hidden Markov Models for Homology modeling	14	CO-1 -CO5	K1-K5				
II	Genomics, Proteomics and Evolutionary Analysis Aims, Tasks and Applications of Bioinformatics. Information Retrieval System, Data submission Tools.Nucleic acid sequence data banks. Databases of patterns, motifs and profiles: Metabolic Pathway Databases. Literature Databases. Database Similarity Searches: BLAST, FASTA, Sequence Alignment - Pair wise sequence alignment - Needleman and Wunsch, Smith Waterman algorithms; Multiple sequence alignments – CLUSTAL Omega, PRAS; Patterns, motifs and Profiles in sequences. Homology and similarity, Phylogeny analysis and relationships. Hidden Markov Models for Homology modeling	14	CO-1 -CO5	K1-K5				

III	. Data Collection and Analysis	20	CO-1	K1-K5
	Collection and classification of data – Representation and Tabulation of data –Diagrammatic and Graphic representation of data –frequency distribution. Elements of probability. Theoretical distributions – fundamentals of Binomial, Poisson and Normal distribution – Central Limit Theorem. Student's t- distribution – characteristics. Use of t-test for small samples. Chi-square test. Correlation – characteristics. Types, methods of study of correlation – scatter diagram method, graphic method, Karl Pearson's coefficient of correlation – rank correlation – concurrent deviation method – significance. Regression – characteristics, dependent and independent variables – slope and intercept – method of least squares. Analysis of variance (ANOVA) characteristics – F-distribution, types and concepts of ANOVA – simple classification (one- way) of ANOVA and Two way ANOVA - Statistical Data Analysis using SPSS		-CO5	
IV	Introduction to Research Methodology	12	CO-1	K1-K5
	Meaning, Objectives, types and significance – Research process. Research problem: Selection, selection criteria, necessity techniques in selecting a problem. Research design: Definition – Basics of experimental designs – Developing research plan. Source of literature – INSDOC, MEDLINE, Biological abstracts, Current Contents, Pubmed and Online Journals (Scopus, web of science and orcid) – Types of literature: reviews, abstracts, short notes, journal articles, magazines, periodicals, books and proceedings. Data Collection: Methods of data collection- Questionnaires/schedule, Selection of appropriate method for data collection – Guidelines for constructing questionnaires – Guidelines for interviewing – Sample questionnaires – Data Analysis and interpretation		-CO5	
V	. Dissertation, Reporting/ Publication	12	CO-1	K1-K5
	Preparation of Dissertation (Different steps in the preparation – Layout, structure and Language of typical reports - Illustrations and tables –Major findings,Conclusions and suggestions-		-CO5	

Bibliography,Referencing and foot notes)-	
Documentation. Scientific paper writing - Types of	
Reports - Layout of a Research Paper - Interpretation	
of Data - Correction of manuscripts- Impact factor of	
Journals, (citation Index, ISBN & ISSN) When and	
where to publish? Ethical issues related to publishing,	
Intellectual Property Rights (IPR) and Patents,	
Plagiarism and Self-Plagiarism, reproducibility and	
accountability.Library cataloguing, definition, need,	
objectives and function of catalogue (Colon	
Classification, Dewey, ISBS, ISSN, Bar Coding and	
Accession Number) – Internet Resources: What is	
Internet, World Wide Web, Navigating the Internet,	
Electronic mail, and Electronic publication. Funding	
Organizations: World Health organization (WHO),	
Department of Science and Technology (DST),	
Indian Council for Medical Research (ICMR) -	
Structure of Research Proposals: Origin, Objectives,	
Existing Knowledge	
of the problem, Current status of the problem,	
Methodology, Budget and expected outcome.	
Text Book(s)	

Basic Bioinformatics 2005, S.Ignacimuthu, SJ., Narosa Publishing House

Bioinformatics- Methods and Applications- Genomics, Proteomics & Drug Discovery- 2005

S.C. Rastogi, N. Mendiratta& P. Rastogi, Prentice Hall of India Private Ltd.

Introduction to Bioinformatics (Fourth Edition) – 2003. T.K. Attwood & D.J. Parry-Smith, Pearson Education (Singapore) Pvt. Ltd.

R.C. Campbell, 1973, Statistics for Biologists

Lewis, A.W., 1974, Biostatistics.

Suggested Readings

Bioinformatics- Databases and Algoriths - 2006N. Gautham - Narosa Publishing House

Biostatistics, N.Gurumani

Research Methodology, Paliniswamy and Shanmugavel.

Research Methodology, N. Gurumani

Doing Your Masters Dissertation, Chris H, 1st edition, Vistaar publications, 2005

Reference Books

1. Introduction to Bioinformatics 2003, Arthur M. Lesk , Oxford University Press

2.	Discovering Genomics, Proteomics & Bioinformatics- 2003 A. Malcolm Campbell & Laurie
	J. Heyer, realson Education (Singapore) PVI. Elu.
3.	Bioinformatics- Managing Scientific Data- 2003. Zoe Lacroix & Terence Critchlow, Morgan
	Kaufmann Publishers.
4.	N.T.J. Bailey, 1985, Statistical Methods in Biology
5.	W.C. Shester, 1982, Statistics for biological Sciences
6.	S.N. Schneider 1980, Statistical Methods in biology
7.	Research Methodology Methods & Techniques, C. R. Kothari
Rela	ated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	www.Bioinformatics.org.
2	www.biology.ucsd.edu/others/dsmith/Bioinformatics.html
3	https://www.probabilitycourse.com
4	http://mste.illinois.edu/hill/dstat/dstat.
5	http://www.palgrave.com/studentstudyskills/page/choosing-appropriate-
	researchmethodologies
6	https://explorable.com/research-methodology

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	3				

	Mapping with Programme Specific													
		Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	2	2	1	3	1	1	2	3	3	2	1	1	K1	
CO2	2	2	1	2	3	3	2	3	2	-	-	2	K2	
CO3	2	2	-	2	-	1	-	2	2	2	-	1	K3	
CO4	2	2	1	2	2	1	3	-	1	2	-	1	K4	
CO5	2	2	1	2	-	1	1	1	1	-	2	1	K5	
AVG	2	2	0.8	2.2	1.2	1.4	1.6	1.8	1.8	1.2	0.6	1.2		
							1.6					1.32		

DEVELOPMENTAL BIOLOGY

Course co	ode M.Sc.	DEVELOPMENTAL BIOLOGY	L	Т	Р	С					
232ZO2N	104										
Core		Core Paper X	Core Paper X55								
Pre-requ	uisite	Basic knowledge about the developmental	Syllab	us Vers	ersion 2021-						
		changes that occur in our body.				2022					
<u> </u>											
Course O	bjectives:				Sem I	1					
The main	objectives of t	his course are to:									
1. To	equip students	s to face competitive examinations and by using	g creat	ive thin	ıking sl	kills and					
an	alytical skills in	the lab.									
2. Ui	nderstand the co	ncepts on development and the techniques.									
3. Kı	now the recent a	dvancement in developmental science.									
 The de Study 	e students will velopment and ic udents will be al	be attain a basic conceptual knowledge of the pr lentify the genetic and molecular elements that are in ble to learn about the comparative development fro	inciple volved. m lowe	cellular er to hig	mecha her anir	nisms of nals.					
Expected	Course Outcon	nes:									
On the s	successful comp	letion of the course, student will be able to:									
CO1	Students will be	e able to study the basic concepts in development.		1	X1						
CO2	Comprehensive	understanding of the concepts on early development	opment	of	K2						
	organisms.										
CO3	Students would	appreciate the development of the various organs.		1	K2						
CO4	To analyze and	study the differentiation of cells in embryology.		1	K 3						
CO5	To develop the	e skills for modern trends in development and the te	echniqu	ies.	K4 & K	5					
K1 - Rei	member; K2 - U	Understand; K3 - Apply; K4 - Analyze; K5 – Ev	aluate;	K6-Cr	eate						
Total Lecture Hours -60											
Unit:1	Unit:1 BASIC CONCEPTS OF DEVELOPMENT 12 classes										
Basic con differentia cytoplasm	Basic concepts of development : Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenic in analysis of development										

TI	nit	.)
U	Πī	• 4

Gametogenesis: Spermatogenesis and Oogenesis— role of hormones in gametogenesis. Fertilization and early development: cell surface molecules in sperm-egg recognition in animals; zygote formation, cleavage, blastula, gastrula (Amphioxus, Frog, Chick & Man) embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, sexual cycles (estrus and menstrual).

Morphogenesis and organogenesis: Axes and pattern formation in Drosophila, Amphibia and chick; Organogenesis in mammals – eye lens induction, limb development – development of central nervous system, heart and alimentary canal.

Unit:4

EMBRYONIC DIFFERENTIATION

12 classes

Regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination. Programmed cell death, aging and senescence.

Unit:5	ADVANCED TECNIQUES IN EMBRYOLOGY	10 classes	

Assisted Reproductive technology- Superovulation, ICSI, GIFT,ZIFT, Embryo transfer, Preservation of gametes, Amniocentesis- Screening for genetic disorders, Preimplantation genetic screening-contraception –Ethical issues related to IVF-Surrogacy- PCOS and cloning

Text B	ook(s)									
1.	Introduction to Embryology – Balinsky.									
2										
	Reltimore									
	Battinore.									
3	Gary C.S. Steven B.B. Philip P.B. and Philippa H.F. (2014) Larsen's Human Embryology (5th									
	edition) Elsevier.									
Refere	nce Books									
1.	Developmental Biology Paperback – 20 February 2020-by Michael J.F. Barresi, Scott F. Gilbert.									
2.	Comparative Vertebrate Embryology- Mceven									
3.	Developmental biology - Berril									
4	Schatten and Schatten- Molecular biology of fertilization.									
Relate	d Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]									
1	MOOC: Introduction to Developmental Biology, Prof. Subramaniam K, IIT Madras,									
	https://nptel.ac.in/courses/102/106/102106084/]									

Mapp	Mapping with Programme Specific Outcomes											
COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10		
CO1	S	S	S	L	S	S	Μ	Μ	Μ	S		
CO2	S	S	S	L	S	S	Μ	Μ	Μ	S		
CO3	S	S	S	L	S	S	S	S	S	S		
CO4	S	S	S	L	S	М	Μ	Μ	S	S		
CO5	S	S	S	L	S	S	S	S	S	S		

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

GENERAL AND APPLIED ENTOMOLOGY PRACTICALS

Course Title		GENERAL AND APPLIED ENTOMOLOGY PRACTICALS									
Course C	ode	232ZO2M05									
Credits 2											
Hours	/ Cycle	2									
Cat	egory	Part I	Core	Pra	ctical						
Sen	nester	II									
Ye	ar of	From the ac	ademic year 2023 onwards								
Implen	nentatio										
n											
		To be Listed	in bullet points /Describe in 10	UU words.							
		1. 10 impart	d the life avale and its control ma								
Course	Objectives	2. Understan	2. Understand the lifecycle and its control measures								
		4. Interpret, analysis and present experimental results and conclusions in a									
		scientific manner.									
CO #		Course Ou	tcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On com	pleting the	course succes	sfully, the student will be able t	to							
CO 1	Identify t	he insects and	their importance	PSO1	K1						
CO 2	Adopt preservat	methods for ion of insects	or collection and	PSO2	K2						
CO 3	Analyse	the physiologi	cal characteristics of insects.	PSO3	К3						
CO 4	Apply the caused an	e various techn id to adopt cor	niques to study the damage ntrol measures.	PSO4	K4						
CO 5	Study the	e nature of pes	sticide to be used for pest control	PSO4	K5						

SYLLABUS											
UNIT	CONTENT	HRS	COs	BLOOM'S TAXONOMY LEVEL							
Ι	Dissection of digestive, nervous and reproductive systems – <i>Lepisma</i> , House fly/ <i>Caliphora</i> , Wasp, Naiad of dragonfly, Honey bee, Dragonfly (Any three)	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5							

2 Mounting of mouth marks and other service							
2. Mounting of mouth parts and other special							
morphological modifications of the following species:							
Naiad of Dragon fly, Adult Dragon fly, Honeybee &							
Housefly.							
3. Collection, pinning and preservation of Insects.							
4. Identification of some common insects or their							
damages on MCC (at least 10 insects)							
5. Collection, identification and study of any three insect							
pests of crops grown in MCC farm.							
6. Identification of any three stored product insect pests.							
7. Identification of beneficial insects: Honey bee, Silk							
worm larval stage and cocoon, Chandraki.							
8. Insects of medical importance – mosquito,							
housefly and head louse							
9. Insecticides: Knowledge of any Organochlorine- DDT.							
Organophosphorus – Monocrotophos. Carbamate –							
Carbofuran, Synthetic Pyretheroid – Cypermethrin.							
10 Insect Box submission							
References Books	·						
8. Applied Entomology, An Introductory Textbook of Insects in their Relation to Man - Fernald,							

- H.T. 2008.
- 9. Imms' General Text books of Entomology, Vol. I & Vol. II Richard O.W.
- 10. General Text Book of Entomology, Vol. II Richard O.W and Davies, R.G.

Course articulation matrix														
Programme Outcomes Programme Specific Outcomes													omes	Cognitiv
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	e skill
CO1	1	1	3	2	3	1	2	2	3	2	2	1	2	K1
CO2	1	1	3	2	3	1	2	2	3	2	-	1	2	K2
CO3	1	1	3	2	3	1	2	2	3	2	2	1	2	K3
CO4	1	1	3	2	3	1	2	2	3	2	2	1	2	K4
CO5	1	1	3	2	3	1	2	2	3	2	-	1	2	K5
AVG								1.87					2	
	Overall Mapping of the Course 1.7													

BIOINFORMATICS, BIOSTATISTICS & RESEARCH METHODOLOGY PRACTICAL

Cou	rse Title	BIOINFORMATICS, BIOSTATISTICS & RESEARCH METHODOLOGY PRACTICAL								
Cou	rse Code	232ZO2M06								
С	redits	4								
Hour	rs / Cycle	6								
Ca	itegory	Part I	Core	Pra	octical					
Se	mester									
Y	ear of	From the acad	lemic year 2023-2024	onwards (thi	s is required as some of the					
Imple	mentatio	courses may n	ot be revised during]	particular rev	vision)					
n										
Course	Objectives	The main object 5. understa comput 6. Understa data for statistic 4. Analyse compare and id 5. Solve th understanding	ctives of this course are and genomic data and is ationally tand existing computer tand and apply function biological system and al methodology, and perform a comple lentify the differences is e biological problems a the disease related pro	to: interpret biolo modelling nal genomics t te analysis of n sequences and put more of blems at mole in this area of	egical information techniques to analyze the genes and protein and emphasis on ecular level.					
CO #		Course Outc	come(s)	PSO Addresse	ed Bloom's Taxonomy Levels (K1 to K5)					
On com	pleting the co	urse successfull	y, the student will be	able to						
CO 1	Identify gene biological in	omic data and int formation compu	erpret utationally	PSO3	K1					
CO 2	Understand of information	existing software in computer mod	to use this lelling	PSO4	K2					
CO 3	Apply functi data for biolo methodology	ional genomics te ogical system and y,	echniques to analyze d statistical	PSO5,6	K3					
CO 4	Analyse and perform a complete analysis of the genes and protein and compare and identify theK4differences in sequencesPSO7									
CO 5	Solve the bid emphasis on problems at	ological problems understanding th molecular level.	s and put more ne disease related	PSO8	K5					

	<u> </u>											
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL								
	1. Searching a nucleotide sequence in	36	CO1	K1-K5								
	GenBank database, Pair-wise and Multiple		-									
	sequence alignment by using ClustalW.		CO5									
	2. Finding the protein families, domains and											
	functional sites, amino acid patterns and											
	profiles of aprotein sequence using Pfam											
	3. Searching a pathway of a disease											
	protein from KEGG database											
	4. Structure visualization using											
	PYMOL software											
	5. Primer3 - Tool to design and											
	analyze primers for PCR.											
	6. Molecular docking programs:											
	HEX/ARGUS LAB											
	7. Graphical representation of data by											
	Histogram, Pie chart and frequency curves											
	8. Calculation of multiple and partial											
	correlation coefficients for three											
	variables											
	9. Designing a questionnaire for a survey /											
	Designing an experimental work (field or											
	10. Analysis of references and citation for											
	at least 10 documents (books, journals,											
D 11	reports/thesis, etc.)											
Prescrib	ed Books/Textbooks(1-5 books)	NT	D-11.1									
	iostotistics. N.Cummoni	iam - Narosa	i Publishi	ing House								
9. E	esearch Methodology Paliniswamy and Shanmugayal											
Deferen	and Shallhugavel.											
7 P	ioinformatics- Databases and Algoriths - 2006N Gauth	am - Narosa	Publishi	ing House								
8. E	iostatistics. N.Gurumani	ani - 19a1036	u uonsin	ing House								
9. R	esearch Methodology, Paliniswamy and Shanmugavel.											
Suggest	ed Reading (2 -5)											
7. E	ioinformatics- Databases and Algoriths - 2006N. Gauth	am - Narosa	u Publishi	ing House								
8. E	iostatistics, N.Gurumani											
9. R	esearch Methodology, Paliniswamy and Shanmugavel.											
Web Re	sources (3-5)											

Web Resources (3-5)

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	3						

Course articulation matrix													
			Progr	amme	Outcon	nes		Pro	mes	Cognitiv			
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	e skill
CO1	1	1	3	2	3	1	2	3	2	2	1	2	K1
CO2	1	1	3	2	3	1	2	3	2	-	1	2	K2
CO3	1	1	3	2	3	1	2	3	2	2	1	2	K3
CO4	1	1	3	2	3	1	2	3	2	2	1	2	K4
CO5	1	1	3	2	3	1	2	3	2	-	1	2	K5
AVG							1.87					2	
								Over	rall Mappi	ng of the	Course	1.935	

DEVELOPMENTAL BIOLOGY PRACTICAL

Cour	se Title	DEVELOPM	IENTAL BIOLOGY I	PRACT	[CAL						
Cour	se Code	232ZO2M07									
Cı	redits	2									
Hours	s / Cycle	2									
Cat	tegory	Part I	Core			Practical					
Sen	nester	II D. (1)	1								
	ear of	From the ac	ademic year 2023 - 20	24 onwa	ards						
Impler	nentatio										
- 11		To be Listed in bullet points /Describe in 100 words									
Course	Objectives	 To impart basic knowledge on embryology Understand the molecular and genetic background of animal Describe the evolutionary history of complex multicellular life forms Compare environmental influence on the development and homeostasis of animals Interpret, analyse and present experimental results and conclusions in a scientific manner. 									
CO #		Course Ou	tcome(s)	P Add	SO ressed	Bloom's Taxonomy Levels (K1 to K5)					
On com	pleting the	course succes	sfully, the student wil	l be able	e to						
CO 1	Study the	basic concepts	in development.	PSO1		K1					
CO 2	Understan early deve	d Comprehens lopment of org	ively the concepts on ganisms.	PSO2		K2					
CO 3	Appreciate	e the different	developmental stages.	PSO3		К3					
CO 4	Analyze and in embryo	nd study the di logy.	fferentiation of cells	PSO4		K4					
CO 5	Develop	the skills fo in developmen	r modern trends nt and techniques.	PSO4		K5					

	SYLLABUS				
UNIT	CONTENT	HOURS	COs	BLOOM'S	
				TAXONOM	
				Y LEVEL	
Ι	10. Semen collection from Bull, Sperm count.	12	CO1,	K1, K2, K3,	

11. Egg diameter measurement, volume	CO2,	
and density of microscopic eggs.	001	T7 4 T7 F
	CO3,	к4, к5

	 Blastodisc mounting of chick embryos. Study of the developmental stages of chick embryo-24, 36, 48, 60,72,84,96 hours. (any5) Observation of developmental stages of frog and Amphioxus (slides) Dissection of tadpoles to show the anatomical peculiarities and transitions. 		CO4, CO5	
	 16. Effect of thyroxine on amphibian metamorphosis 17. Tail regeneration studies using tadpole/Lizard. 18. Study of placentation in goat/pig and human. 10. Oviparity, ovoviviparity and parental care (spotters) 			
Reference 11. Ir 12. T W 13. G E	ces Books (3 – 5) htroduction to Embryology – Balinsky. homas W.S. (2014) Langman's Medical Embryology (1 Villiams & Wilkins, Baltimore. Hary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2 mbryology (5th edition) Elsevier.	13th edition) 014) Larsen	Lippinco 's Human	ott,

Course articulation matrix													
			Prog	ramm	e Outc	omes		Pro	Cognitiv				
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	e skill
CO1	1	1	3	2	3	1	2	3	2	2	1	2	K1
CO2	1	1	3	2	3	1	2	3	2	-	1	2	K2
CO3	1	1	3	2	3	1	2	3	2	2	1	2	K3
CO4	1	1	3	2	3	1	2	3	2	2	1	2	K4
CO5	1	1	3	2	3	1	2	3	2	-	1	2	K5
AVG							1.87					2	
								Over	all Mappi	ng of the	Course	1.735	

ANIMAL PHYSIOLOGY

Cour	rse Title	ANIMAL PHY	SIOLOGY								
Cou	rse Code	232ZO3M01									
С	redits	3									
Hour	rs / Cycle	5									
Ca	itegory	Part I	Core	Theory	y						
Se	mester	3									
Y	ear of	From the academic year 2023 onwards (this is required as some of the courses may									
Imple	mentatio	not be revised during particular revision)									
n											
Course	Objectives	 To be Listed in bullet points /Describe in 100 words 1. To understand the role of organs in the smooth functioning of the body. 2. To know the adaptations that takes place in the body to maintain homeostasis. 3. To be aware of the different receptors, organs and their functions. To understand the interrelation of organs and organ systems 									
CO#		Course Outc	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)						
On comj	pleting the co	urse successfully	y, the student will be al	ble to							
CO 1	To understar varying osm	nd the mechanism o-ionic environm	n of adjusting with nents	PSO1	K1						
CO 2	1										
	Gain knowle and tempera	edge on respiration ture in our body	on and regulation of air	PSO2	K2						
CO 3	Gain knowle and tempera Enhanced kr functioning	edge on respiratio ture in our body nowledge and app of the heart	on and regulation of air	PSO2 PSO3	K2 K3						
CO 3 CO 4	Gain knowle and tempera Enhanced kn functioning To understau the working	edge on respiratio ture in our body nowledge and app of the heart nd the physiologi of the organ syst	on and regulation of air preciation of the cal mechanism in ems	PSO2 PSO3 PSO4	K2 K3 K4						

UNIT	CONTENT	HOUR	COa	DLOOMG
			COS	BLOOM'S
		S		TAXONOM
т	OSMOTIC AND IONIC DECUL ATION	(<u>CO1</u>	Y LEVEL
I	OSMOTIC AND IONIC REGULATION	6	COI,	KI, K2, K3, K4 K5
	(AQUATIC & TERRESTRIAL ANIMALS)	hours	CO_2 , CO_3	к4, кз
			CO4	
	Maintenance of Osmotic and Ionic balance in animals			
	nving in hypo-osmoue, hyper-osmoue and iso-osmoue		CO5	
	environment. Electrolyte balance, acid-base balance.			
II	RESPIRATION AND THERMOREGULATION	12	CO1	K1, K2, K3,
			, 	K4, K5
	Integumentary respiration; Branchial respiration: External & Internal: Aquatic to Aerial breathing I unge:	hours	02	
	Anatomy and Histology of lung and airways Ventilation		, CO3	
	lungs: Bird and Mammalian lungs, Perfusion ratio,		,	
	Chemical regulation of respiration, Mechanism of		CO4	
	breathing, Role of muscles & glottis, Lung volume and		,	
	capacity. Heat disorders and its preventive measures.		005	
	Caisson disease: Preventive measure for hypobaric and			
	hyperbaric effects.			
	Acclimation, acclimatization; Thermoregulation in man			
	and other animals; Acclimatization to high altitudes.			
III	CARDIOVASCULAR SYSTEM	12	CO1	K1, K2, K3,
	Vascular channels: Open and Closed systems, Vascular	hours	, CO2	к4, к5
	fluids; haemodynamics, Vascular pump: Tubular hearts	nours	02	
	of arthropods, Sac-like hearts of crustaceans, Suction		, CO3	
	pump, Chambered heart, Lymph hearts of vertebrates;		,	
	of neurogenic heart Factors modifying cardiac rhythm:		CO4	
	Chemical, Mechanical and Thermal effects.		, CO5	
IV	NEUROMUSCULAR AND NEUROENDOCRINE	15	$\frac{C05}{C01}$	K1 K2 K3
••	INTEGRATION AND REGULATION	10	CO2,	K4, K5
		hours	CO3,	,
	Neuromuscular Co-ordination; Myoneural junctions,		CO4,	
	Mechanism of neuromuscular action, Membrane		CO5	
	potential , Action membrane potential , Resting			
	potential, Patterns of efferent innervation of muscles;			
	Motor units in vertebrate muscle, Fast and slow			
	contractions, Peripheral inhibition, Neuromuscular			
	Metabolism and functional significance of			
	neurotransmitters. Neuroendocrine circuits			
II	environment. Electrolyte balance, acid-base balance. RESPIRATION AND THERMOREGULATION Integumentary respiration; Branchial respiration: External & Internal; Aquatic to Aerial breathing, Lungs: Anatomy and Histology of lung and airways, Ventilation lungs: Bird and Mammalian lungs, Perfusion ratio, Chemical regulation of respiration, Mechanism of breathing, Role of muscles & glottis, Lung volume and capacity. Heat disorders and its preventive measures. Effects of hypobaric and hyperbaric environment; Caisson disease; Preventive measure for hypobaric and hyperbaric effects. Acclimation, acclimatization; Thermoregulation in man and other animals; Acclimatization to high altitudes. CARDIOVASCULAR SYSTEM Vascular channels: Open and Closed systems, Vascular fluids; haemodynamics, Vascular pump: Tubular hearts of arthropods, Sac-like hearts of crustaceans, Suction pump, Chambered heart, Lymph hearts of vertebrates; Cardiac rhythm: Pacemakers of myogenic heart, Rhythm of neurogenic heart, Factors modifying cardiac rhythm: Chemical, Mechanical and Thermal effects. NEUROMUSCULAR AND NEUROENDOCRINE INTEGRATION AND REGULATION Neuromuscular Co-ordination; Myoneural junctions, Mechanism of neuromuscular action, Membrane potential , Action membrane potential , Resting potential , Patterns of efferent innervation of muscles; Motor units in vertebrate muscle, Fast and slow contractions, Peripheral inhibition, Neuromuscular transmission, Neurotransmitters and neuromodulators, Metabolism and functional significance of neurotransmitters, Neuroendocrine circuits,	12 hours 12 hours 15 hours	CO1 , CO2 , CO3 , CO4 , CO5 CO1 , CO2 , CO3 , CO4 , CO5 CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5 K1, K2, K3, K4, K5 K1, K2, K3, K4, K5

	Neuroimmune circuits. Mechanism of hormone actions: Steroid hormones and Cascade amplification system. Endocrine glands its secretion and their functions: Invertebrates & Vertebrates.									
V	VRECEPTORS AND SPECIAL ORGANS15CO1K1, K2Types of sensory receptors: Somatosensory system, Thermoreceptors, Nociceptors: Pain perception, Sense pathway; Sense of taste: Taste pathway, Taste disorders; Sense of smell: Smell pathway, Smell disorders; Receptors for sound: The organ of Corti, Signal transduction, Neural pathway for sounds, Types of hearing loss; Sight receptors: Sight disorders; Mechanoreceptors tactile response; Electric organs: Morphology, Physiology; Bioluminescence: Luminagent ergons Distribution of hieluminagenet15CO1K1, K2VK4, K5K4, K5Norphology, Physiology; Bioluminescence:,CO2,VCO4,,YYY,YY,,YY,,Y,,,									
Prescribe Animal P General a Compara Animal P Osmotic a Reference Compara Animal P Principles	Luminescent organs, Distribution of bioluminescence.Prescribed Books/Textbooks(1-5 books)Animal Physiology - E. O. Wilson, 2014.General and Comparative Physiology - William Hoar, 3rd edition, 2003.Comparative Animal Physiology - Prosser and Brown, 2nd edition, 1962.Animal Physiology - Kunt and Schmidt Nielson, 1974.Osmotic and Ionic regulation - Potts and Parry, 1st edition, 1964.References (3 – 5)Comparative Animal Physiology - Philip C. Withers, Revised, 1992.Animal Physiology - Richard Hill, Gordon A.Wyse, Margaret Anderson, 4th Ed, 2016.									
 Animar Physiology - Krenard Phil, Gordon A. wyse, Margaret Anderson, 4th Ed. 2016. Principles of Animal Physiology - Christopher Moyes and Patricia Schulte, 2015. Suggested Reading (2 -5) Essentials of Animal Physiology - S. C. Rastogi, 2019. Animal Physiology - Goyal and Sastry,7th edition, 2017. Web Resources (3-5) https://www.blinkcourse.com/Animal-Physiology-p-8983 https://swayamprabha.gov.in/asset/new_team/images/course_files/ch-16/G24- SP_Ch16_Animal- Physiology_Prof-Mainak-Das.pdf https://www.udemy.com/course/animal- physiology-1/ 										

	Course Articulation Matrix													
Course			Pr	ogramme	Outcor	nes			Pr	ogramme				
Outcom e s	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	2	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	2	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	2	2	1	2	3	3	2	2	2	-	3	К3
CO 4	2	2	2	2	1	2	3	3	-	1	2	-	3	K4
CO 5	2	2	2	2	1	2	3	3	1	1	-	2	3	К5
Wt. Avg.	2	2	2	2	1	2	2.6	2.6	2.2	1.8	2	1.5	3	
	2.025 2.5											•		
								Overa	ll Mappi	ing of the	Course	2.2	625	

ENVIRONMENTAL BIOLOGY

Course Title ENVIRONMENTAL BIOLOGY										
Cou	rse Code	232ZO3M02								
С	redits	3								
Hou	rs / Cycle	5								
Ca	itegory	Part I	Part I Core Theory							
Se	mester	III	Ш							
Y	ear of	From the academic year 2023 onwards (this is required as some of the courses may								
Imple	mentatio	not be revised during particular revision)								
n										
		To be Listed in	bullet points /Descri	be in 100 wo	rds					
		1. Underst	and the different ecosy	stems, their c	omponents, their interrelationship					
Course	Objectives	and fund	ctions.	amustion of ra	courses that halp to sustain life					
	Ū	2. Comprehend the need for conservation of resources that help to sustain life								
		5. Wrake people aware of their part in the degradation of the environment through pollution								
		4. Move towards sustainable ecosystem								
				PSO	Bloom's Taxonomy					
CO #		Course Outc	ome(s)	Address	ed Levels (K1 to K5)					
On com	pleting the co	urse successfully	y, the student will be a	able to						
CO 1	Comprehend	the interdisciplin	nary (e.g.	PSO1	K1 & K2					
	agricultural	science, biology,	chemistry, ecology,							
	economics,	geology, etc.) con	cepts integral to							
	environment	tal science								
CO 2	Understand	the various habita	ts and its impact on	PSO2	K2					
	the habits of	its communities.								
CO 3	Assess the c	osts/benefits of co	onservation vs.	PSO3	K3 & K4					
	remediation	or technological	solutions.							
CO 4	Recognize th	he impact of glob	alization on the	PSO4	K2					
	health of ma	in and environme	nt							
CO 5	Analyze the	effect of urbanization	ation, evaluate	PSO1	K4 & K5					
potential solutions and strive for			tor							
	developmen	t								

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL
Ι	COMPONENTS OF ECOSYSTEM Abiotic Components. Matter: Land, soil, water, air and light. Biotic components. Species: endemic, native, cosmopolitan, exotic, alien, invasive, keystone and climax. Trophic levels: Producers, Consumers and Decomposers; Concept of productivity: primary productivity, Gross, Net, Energy flow, Multitrophic relationships: Food chain and Food web; Ecological pyramids, Production and decomposition in nature; Bio- geo Chemical cycles.	10 hours	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5
Ш	ECOSYSTEMSANDPOPULATIONDISTRIBUTIONEcosystem components; concept (Aquatic: Freshwater, Mangrove, Coral, Marine, Deep Sea, Terrestrial, Terrarium, Polar, Micro and Space ecosystem); Distribution and abundance: factors that limitdistribution; Population and community - Species interactions: competition, predation, mutualism; Behavioural ecology: territorial defence, Optimal foraging, optimal migration, group living – advantages and disadvantages.	12 hours	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5
III	RESOURCEANDRESOURCEMANAGEMENTForest, grasslands and agriculture; capture and cultureForest, grasslands and agriculture; capture and culturefisheries; land, soil and water; energy of biological originand non-conventional energy resources, minerals;conservation biology: Role of fauna in bio remediationand ecological restoration, conservation of biodiversity,wildlife conservation, national programs on conservation.Climate change effects on biosphere	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	ENVIRONMENTALHEALTHANDTOXICOLOGYEcology and health care, global disease burden, toxins in environment:allergens, endocrine disruptors, neurotoxins, mutagens, teratogens, xenobiotics,carcinogens; movement, distribution and fate of toxins; bioaccumulation, bioaugmentation, biomagnification, persistant organic pollutants, measuring toxicity, Environmental diseases	12 hours	CO1, CO2, CO3 , CO4 , CO5	K1, K2, K3, K4, K5

V	URBANIZATION AND SUSTAINABILITY	14 hours	CO1,	K1, K2, K3,				
	Urbanization: reasons challenges impacts on health		CO2	K4, K5				
	environment and society. Model for sustainable urban		, CO3					
	environment: rainwater harvesting, world population,		005					
	world food production, Global warming, biotechnology		, CO4					
			,					
			CO5					
	and nature management as a way to sustainable							
	development. Sustainable villages and homes.							
	Sustainable Agroecosystems. Environment Impact							
	Assessment.							
Prescrib	ed Books/Textbooks							
Fundame	tals of Environmental Sciences – G S Dhaliyal, G S Sangha	P K Ralhan	2000 Kal	vani Publishers				
Ecology a	nd Environment – P.D.Sharma 1999. Rastogi Publications.	, 1 .IX.IXaIIIaII.	2000 IXai	yam r dominers				
2001085								
Referen	ces							
Fundame	ntal of Ecology – Eugene P. Odum W.B.Saunders							
Company	. Elements of Ecology – Clarke Animal Population –							
Browning								
Environm	ent: The Science Behind the Stories, Withgott & Laposata, 5	th edition						
Suggeste		T 1 NT ' /	71 1.0					
Animal E	cology and Environmental Biology – H.R. singh 2001, Shoba	in Lai Nagin (chand & c	20				
Essential Web Dec	Environment, 4th edition by Jay withgou and Matthew Lapo	osata.						
Environm	vw.coursera.org/learn/ecosystem-services							
https://on	tinal subucs.							
https://ww	www.coursera.org/learn/ecology							
Ecology a	and Environment, Prof. Abhijit Deshpande and Prof. R. Ravi	Krishna . IIT	Madras.					
https://sw	https://swavam.gov.in/nd1_noc19_ge23/previe							
W								
https://ww	vw.coursera.org/learn/sustainability							

Cor	Correlation of POs/PSOs to each CO and make a corresponding mapping table. Course Articulation Matrix													
Course		Programme Outcomes							Programme Specific Outcomes				~	
Outcom e s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	K3
CO 4	2	2	3	2	1	2	2	3	-	1	2	2	3	K4
CO 5	2	2	3	-	1	2	2	3	1	1	3	2	3	K5
Wt. Avg.	2	2	3	2	1	2	2	2.6	2.2	1.8	2.25	1.6	3	

Г

2.075	2.17				
Overa	Overall Mapping of the Course				

APPLIED ZOOLOGY AND AQUACULTURE

Cou	rse Title	APPLIED ZOOLOGY AND AQUACULTURE							
Cou	rse Code	232ZO3M03							
С	redits	4	4						
Hou	rs / Cycle	6							
Ca	itegory	Part I	Part I Core Theory						
Se	mester	III							
Y	ear of	From the academic year 2023 onwards (this is required as some of the courses may							
Imple	mentatio	not be revised	during particular rev	(SION)					
n									
Course	Objectives	 To be Listed in bullet points /Describe in 100 words To understand the scope, importance and prospects of animals in commerce. To gain knowledge on the different products from animals. To experiment on ornamental and edible fish culture. To acquire knowledge on the breeding techniques of ornamental and edible finfishes and shell fishes. To develop business oriented skill among the students in farming. 							
CO#		Course Outco	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)				
On com	pleting the co	urse successfully	r, the student will be a	ble to					
CO 1	Knowledge commerce.	of the importance	of animals in	PSO1	K1				
CO 2	Understanding the well-being	ng on the role of ing of man.	invertebrates in	PSO2	K2				
CO 3	It offers a wide range of employment opportunities and research options in the fields of animal husbandry and aquaculture.			PSO3	K3				
CO 4	Will be able ways of sust	to develop new a ainable farming.	nd innovative	PSO4	K4				
CO 5	Will explore and their ma	the recent trends nagement.	in aquaculture	PSO1	K5				

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S
				TAXONOM Y LEVEL
Ι	INTRODUCTION TO APPLIED ZOOLOGY	4 hours	CO1,	K1, K2, K3,
	Scope and functions: History: Trends and potentials		CO2, CO3	K4, K5
	of Applied Zoology; Introduction to economic		CO3, CO4,	
	importance of different groups of animals.		CO5	
II	ECONOMIC INVERTEBRATESIMPORTANCEOFHuman diseases and their control: Protozoan diseases: Malaria, Amoebiasis and Leishmaniasis; Economic importance of sponges; Importance of Coral in enhancing biodiversity (Ecotourism); Helminth diseases: Elephantiasis, Ascariasis and Taeniasis. Vermitechnology: Vermiculture, Vermicompost and Vermiwash. Insect pests of Mango, Citrus, Coconut, Pulses and Cabbage. Insect pollinators: Economic importance of Molluscs,	16 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
	Shrimp culture, Pearl culture and its economics.			
III	ECONOMICIMPORTANCEOFVERTEBRATESOFBy products of fishing industry;Identification ofSnake and Snake venom; Poultry: breeds, breedingtechniques and poultry products. Dairy industry:breeds, breeding techniques, dairy products; Leatherindustry; Wool & Fur industry: types and products;Piggery: rearing of pigs and economic importance;Pharmaceuticalsfrom animals;Economicimportance of mammals: usefulness of mammals,mammalianproducts, commercialproducts,laboratory animals.Ornamental fish production and management: Scope	28 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
	and importance of ornamental fishes; Freshwater and marine ornamental fishes of India; Sexual dimorphism in live bearers and egg layers; Types of			

	breeding; Challenges in breeding of ornamental			
	fishes; Food and feeding: live and artificial feeds;			
	Common diseases and their management; Types and			
	uses of aquatic plants; Scope for entrepreneurs in			
	ornamental fish farming.			
IV	ADVANCESINAQUACULTUREPRODUCTION SYSTEMSScope and importance of aquaculture; World andIndian aquaculture production and trends; Role oforganizations in research and developmentofaquaculture;Advancesaquaculture;Advancesin farmingsystems - semi intensive and intensive culturesystems - Recirculatorysystem - Flow-throughsystem; Codeofsustainableaquaculture: Cluster farming - OrganicFarming - SatelliteFarming and Co-operativefarming; Recent trends in aquaculture: Aquaponics -Biofloc technology.	12 hours	CO1, CO2, CO3 , CO4 , CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species: Pond	12 hours	CO1, CO2, CO3,	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management:	12 hours	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5
v	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management:	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches: Nutritional	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae: Use of	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries;	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods.	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods. ed Books/Textbooks	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V Prescrib Applied	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods. ed Books/Textbooks and Economic Zoology - Shukla	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V Prescrib Applied Upadhya 2008.	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods. ed Books/Textbooks and Economic Zoology - Shukla sy,2014. Applied Zoology - Nagendra S. Pawar,	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V Prescrib Applied Upadhya 2008. Text boo	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods. ed Books/Textbooks and Economic Zoology - Shukla y,2014. Applied Zoology - Pradeep V. Jabde.	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V Prescrib Applied Upadhya 2008. Text boo Aquacult	FARM AND HATCHERY MANAGEMENT Criteria for the selection of cultivable species; Pond preparation and stocking; Feed management: Broodstock and larval nutrition - Live feed and artificial feed; Water quality management; Disease management: important fish and shell fish diseases and their control measures. Hatchery management: Water quality management in hatcheries - Chemical, Physical and Biological approaches; Nutritional requirement of larvae and post larvae; Use of Probiotics and Immunostimulants in hatcheries; Seed transportation methods. ed Books/Textbooks and Economic Zoology - Shukla y,2014. Applied Zoology - Nagendra S. Pawar, k of Applied Zoology - Pradeep V. Jabde. ture: An Introductory Text - Robert R.	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

References Integrated concepts of Zoology - Kenneth Hayes. Economic Zoology - Herbert Osborn, 2015. Principles of Aquaculture - Robert R. Stickney. Aquaponics for Beginners - Andrew Mc Deere.

Suggested Reading

Aquaculture - Principles and Practices - T.V.R. Pillai.

Ornamental Fish Breeding, Culture and Trade - Mahapatra, B.K., Dutta S., Pailan,

G.H. Ornamental Fish culture and Aquarium Management - Dholakia A.D.

Web Resources

Applied Zoology - https://onlinecourses.swayam2.ac.in/cec20_ge23/preview

Applied Zoology - https://www.mooc-list.com/course/tropical-parasitology-protozoans-

worms- vectors-and-human-diseases-coursera

Aquaculture Expert - Part I, II and III: https://www.udemy.com/

ATOLL PRO : Introduction to Aquaculture

https://www.udemy.com/

Aquaponics - The circular food production system (edX): https://www.mooc-list.com/

	Course Articulation Matrix													
Course		Programme Outcomes							Programme Specific Outcomes					
Outcom e s	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	К3
CO 4	2	2	3	2	1	2	2	3	-	2	2	-	3	K4
CO 5	2	2	3	-	1	2	2	3	2	1	-	2	3	K5
Wt. Avg.	2	2	3	1.6	1	2	2	2.6	2.5	2	2	1.5	3	
	2.025 2.2													
								Overa	all Mapp	ing of the	Course	2.	112	

BIOCHEMISTRY AND BIOPHYSICS

Cou	rse Title	BIOCHEMISTRY AND BIOPHYSICS								
Cou	rse Code	232ZO3M04	232ZO3M04							
С	redits	3								
Hour	rs / Cycle	5								
Ca	tegory	Part I	Part I Core Theory							
Sei	mester	III								
	ear of	From the academic year 2023 onwards (this is required as some of the courses may								
Imple	mentatio	not be revised during particular revision)								
n										
		To be Listed in	bullet points /Describ	e in 100 words						
		1. To have	1. To have an understanding on the biological molecules within our body							
		2 Underst	and the various reaction	s that would occ	our through the diet					
		2. Understa	2. Understand the various reactions that would occur through the diet.							
Course	Objectives	3. Know the metabolic pathways in detail.								
		4. To help the students to understand the physical principles involved in								
		biological sciences.								
		5. Students would be able to learn the recent techniques in biophysics.								
		5. Students would be usie to ream the recent teeninques in biophysics.								
					Bloom's Taxonomy					
CO#		Course Outco	ome(s)	PSO	Levels (K1 to K5)					
				Auuresseu						
On com	pleting the co	urse successfully	y, the student will be al	ble to						
CO 1	Understand	ling the importance	e of biomolecules and	PSO1	K1					
	its interacti	on.								
	100 11001 00 01									
CO 2	Helps to cle	early analyze the l	hiosynthesis that	PSO2	K2					
001	1101p5 to en	· 16	ologinalogis alac	1502						
	occurs with	in oneself.								
CO 3	Enables on	e to apply as to he	ow the diet would be	PSO3	K3					
	broken dou	in and absorbed in	n the body							
	broken down and absorbed in the body.									
CO 4	Understand	the role of physic	al principles	PSO4	K4					
	and their rol	e in biological sci	ences							
CO 5	Helps the stu	udents to analyze	and study	PSO1	К5					
	the techniqu	es in imaging								

	SYLLABUS									
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL						
Ι	BIOMOLECULES Integration of biomolecules - intermediary metabolites – phosphorylation, types, biological oxidation, energy rich compounds – oxidative phosphorylation. Enzymes: Classification, mechanism of enzyme action, Structure of Lysozyme, Michaelis-Menten reaction, enzyme inhibitors, Inborn errors of metabolism	8 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5						
Π	 ANABOLISM & CATABOLISM Anabolism & Catabolism – biosynthesis: Carbohydrates: central pathway, bypass reactions, gluconeogenesis and glycogenesis. Lipids – Mitochondrial synthesis of fatty acids, non- mitochondrial synthesis of fatty acids, synthesis of triglycerides, synthesis of phospholipids, synthesis of cholesterol, errors in lipid metabolism. Carbohydrates – glycolysis, TCA cycle, HMP pathway, glycogenolysis, energetics of the cycles. Proteins – overview of protein catabolism – Transamination, deamination, fate of ammonia and carbon skeleton, urea cycle. 	13 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5						
III	SIGNAL TRANSDUCTION, NUCLEIC ACIDS AND PORPHYRINS Signal transduction, Nucleic acids and Porphyrins: Hormones and their receptors, steroid hormone receptor and gene action. Peptide hormone receptor (cell surface receptors), signaling through G-protein	15 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5						

	coupled receptors, signal transduction pathways, cAMP, cGMP, phosphatidyl inositol and calcium as second messengers, regulation of signaling pathways. Free nucleotides – structure, properties and functions of RNA and DNA. Synthesis and degradation of purine and pyrimidine (De novo and salvage pathways). Porphyrins: Hemoglobin synthesis and Sickle cell anemia			
IV	THERMODYNAMICS, BIOPOLYMERS AND PHYSIOLOGICAL BIOPHYSICS Thermodynamics: Laws of thermodynamics, thermodynamics related to chemical reactions – internal free and bond energy. Biopolymer, polymerization of organic molecules. Structure and function of bio-membranes – ion channels – Gates – Pores and Pumps. Biophysical aspects of vision and its Aberrations, nerve impulse transmission, Action potential, muscle contraction and hearing.	12 hours	CO1, CO2, CO3 , CO4 , CO5	K1, K2, K3, K4, K5
V	RADIOACTIVITYANDBIOPHYSICALMETHODSIsotopes, Isobars, Radioactivity and Properties of α β and γ rays, detection of Radiation, Hazards ofRadiation, and tracer techniques. Non-Ionizingradiation, UV and infrared – definition andproperties of Laser. ECG, EEG and EMG Imagingtechniques. Photography, X-ray and Ultrasound.Therapeutic applications Diathermy, Radiotherapyand Laser -Principles of CT scan and MRI scan.Physical principles involved in Centrifugation,Chromatography,Electron microscopy,spectrophotometry and NMR – spectroscopy,Optical principles of Fluorescence, Polarizing,Phase contrast and interference. Microscope colloidssol/gel changes – emulsions – Tyndall effect.	12 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
Prescribed Books/Textbooks

Lehninger, Albert L. 1970. Biochemistry Worth Publishers, Inc., New York, pp.833. Jain, L.L. Sunjay Jain & Nitin Jain 2005.

Ambika Shanmugam 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition (Revised), Aries Agencies, Chennai, pp.647. Life Science Physics – Joseph W Kane and Morton M. Sternheim, John Wiley and Sons, New York Biophysical Science – Eugene Ackerman.

References

Wilson, Jean, D. Foster Daniel W., Kronenberg Henry M and Larsen Reed, P. 1998.
Williams Test book of Endocrinology. W.B. Saunders Company, London, p.1819. 65
West,Edward Staunton, Todd Wilbert R. Mason Howard, S. and Bruggen John T. Van.
1974. Textbook of biochemistry Amerind Publishing Co. Pvt. Ltd, New Delhi, pp.1595.
Biophysics: An Introduction. Rodney M.J. Cotterill. Published by John Wiley & Sons Ltd,

Suggested Reading

Biophysical Chemistry - James P Allen

Biophysics by Vasanth Pattabhi and N

Gautham

Biophysical Chemistry: Principles and Techniques. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath

Baffins Lane, Chichester, West Sussex PO19 1UD, England

Web Resources

Biochemistry: https://swayam.gov.in/nd1_noc20_cy10/preview

Biochemistry & Molecular Biology: https://swayam.gov.in/nd2_cec19_bt02/preview

Biochemistry: Biomolecules, Methods, and Mechanisms (edX): https://www.mooc-

list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx

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

	Course Articulation Matrix													
Course	Programme Outcomes Programme Specific O										c Outco	mes		
Outcom e s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K 1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	К3
CO 4	2	2	3	2	1	3	3	3	-	1	2	-	3	K4
CO 5	2	2	3	-	1	3	3	3	1	1	-	2	3	К5
Wt. Avg.	2	2	3	1.6	1	2.4	2.4	2.6	2.2	1.8	2	1.5	3	
				2.125							2.5			
												23	3125	
				Overall Mapping of the Course										

Course Code 232ZO3M	M.Sc.	ANIMAL PHYSIOLOGY AND BIOCHEMISTRY - PRACTICAL		L		Р	С	
Core/Ele	ctive	Core Paper I		_		2	2	
/ Suppor	tive					2	2	
Pre-rea	uisite	Knowledge on	and	Sylla	bus	2023-2	2024	
		Physiological Biochemical processes in the body		Versi	on	onwai	rds	
Practical	S	biochemiear processes in the body.						
					Blo	om's		
COS	Course Out	comes	PS	os	Ta	xonom	y	
000	Course Out	comes	10	00	Le	vels (K	1 to	
001	D (* 1 *	· · · · · · · · · · · · · · · · · · ·	DC	01	K5)		
	Define basi	c principles of heredity	PS DC		KI V1			
02	disease	Explain the basis of hereditary	P50	02	KI			
CO3	Discover th	e basis of gene mapping	PS	03	K2			
CO4	Analyze the	importance and application of	PS	03	K3			
	Inheritance							
CO5	Criticize an	d create meaningful conclusions	PS	04	K4			
 Salivary Amylase activity in relation to Temperature. Salivary Amylase activity in relation to pH. Rate of activity in relation to body mass / weight in an aquatic organism - Fish. (Oxygen consumption) Estimation of Erythrocyte Sedimentation Rate, Estimation of Partial Thromboplastin Time, Bleeding Time, Clotting Time. Study of Ciliary activity in relation to temperature and calculation of Q10 (mussel). Quantitative Estimation of Blood Glucose. Quantitative Estimation of Total Protein. Quantitative Estimation of Creatinine in Urine and Serum. Quantitative Estimation of Urea in Serum and Urine. 								
Referen	books							
Comparative Animal Physiology - Philip C. Withers, Revised, 1992. Animal Physiology - Richard Hill, Gordon A.Wyse, Margaret Anderson, 4th Ed, 2016. Principles of Animal Physiology - Christopher Moyes and Patricia Schulte, 2015.								

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY - PRACTICAL

			Mappi	ing wit	th Prog	gramn	ne Speo	cific Ou	tcomes			
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	2	2	3	2	2	1	2
CO5	1	1	3	2	3	2	2	3	2	-	1	2
AVG	1	1	3	2	3	1.4	2	2	2	1.2	1	2
							1.91					1.64

Course	M.Sc.	ENVIRONMENTAL		L		P		С
232ZO3M0	6	PRACTICAL						
Core/Elec	tive			2				
/ Support	ive	Core Paper VII			2			
		Knowledge about components and types	of	а н. I		202		24
Pre-requ	isite	ecosystems and factors		Syna	bu	202.)-20 and	24
		influencing biodiversity		s Versi	on	onw	ага	S
Practicals					1			
cos	Course Out	comes	PS	OS	Blo Tax Lev K5	om's kono vels (my K1 1	to
CO1	Qualitative a	and quantitative analysis of plankto	PS	01	K1			
CO2	Understand	soil organisms	PS	02	K1			
002	Understand	soil characteristics: - colour, texture.	10	-				
CO3	moisture, pH	I, carbonate and nitrate.	PS	03	K2			
CO4	Analyze the	BOD in pond water and polluted water	PS	03	K3			
CO5	Analyze the an ecosystem	Intra and Interspecific relationship in n	PS	04	K4			
 Qu Qu Int De Stu Est Ide Scu Stu Me fro Vis and Stu Pla con foo 	 Qualitative and quantitative analysis of freshwater and brackish/marine plankton sample Intra and Interspecific relationship in an ecosystem. Determination of hardness of water – calcium, magnesium. Study of soil organisms using Quadrat method Estimation of BOD in pond water and polluted water. Identify and analyse four Food chains and a food web from a typical forest ecosystem – Scrub jungle of MCC campus. Study of soil characteristics: - colour, texture, moisture, pH, carbonate and nitrate. Measurement of particulate air pollutants - dust fall and suspended particulate matter from different areas. Visit to sandy shore, muddy shore and rocky shore to collect and study the organisms and their adaptation to the environment. Study of pond / estuarine ecosystem (Estuarine Biological Laboratory, Pulicat): Plankton collection, estimation of primary productivity, pH, salinity, dissolved oxygen content, free carbondioxide content, analysis of biotic community and construction of food chain and food web. 							
Reference	books							
Elements (nal of Ecology –	gy – Eugene P. Odum W.B.Saunders Comp Clarke Animal Population – Browning	any.					
Environme	Environment: The Science Behind the Stories, Withgott & Laposata, 5th edition							
Essential I	Environment: The Science Bennid the Stories, withgott & Laposata, 5th edition Essential Environment, 4th edition by Jay Withgott and Matthew Laposata.							

	Mapping with Programme Specific Outcomes											
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	3
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	3
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	3
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2
							1.85					2.6

Course Code		M.Sc.	APPLIED ZOOLOGY AND AOUACULTURE -		L		Р	С
232ZO3M	[07		PRACTICAL					
Core/Ele	ctive/		Cone Donen I				2	2
Supporti	ive		Core Paper 1		-	2		
Pro-roa	nicito		Knowledge about Basic Allied zoology	gy Syllabu 2023-2024				
110-104	uisite		and Aquaculture		S	0	onward	S
					Versio	n		
Practical	ls							
COS	Сош	rse Out	comes	PS	OS	Bloo	m's	
000	004			10	00			Taxonom
						y Le	vels (K	1 to K5)
CO1	Know	vledge o	of the importance of animals in	PS	01	K1		
	Comr	nerce.	ng on the role of invertebrates in the					
CO2	well-	. stanul		PS	02	K1		
	being	g of mai	۱.					
	It off	^f ers a w	ide range of employment opportunities					
CO3	and	arch ont	tions in the fields of animal husbandry	PS	03	K2		
	and	aguacul	ture.					
CO4	Will	be able	to identify cultivable finfishes and	PS	03	K3		
	shell	fishes						
CO5	Will	be able	to identify ornamental fishes	PS	04	K4		
1. Identi	ificatio	on of dis	ease causing agents Entamoeba, Plasmodiu	m, T	rypand	osoma	ı, Leishi	mania,
Taenia ,	Fasci	iola, Wu	chereria, Ascaris, Enterobius.		• •			
2. Benef	ficial h	nigher In	vertebrates – Earthworm, Bombyx mori, Ap	ois, L	.ac inse	ect, Pi	inctada,	
Crassos	trea, N	Vautilus	, Octopus, Loligo, Sepia.					
3. Anim	al by-j	product	s - Pearl, Silk, Honey, Shellac, Wool, Fur. A	Artifi	cial fee	eds - I	Fish, Po	ultry,
Pig, Cat	tle. Ins	sect Pol	linators – Carpenter bee, Bumble bee, Horne	et wa	asp, Po	olistes		
1 Idort	fication	n of Inc	post posts Dhippopros hostle Dad Dalas Wa		Mana	0 101	woor:1	Mongo
4. Identi		on of ins	boror Cabhaga amileonar Citrus asternill		, Mang	o nut	weevii	, Mango
	ici, Ul	ampou	ooren, Caubage semmooper, Chrus caterpina	ar, C	iu us ie	amm	101.	
5 Vicit	to Dai	rv/I eatl	per industry Poultry and Piggery Farm & V	ermi	compo	st I In	it (MC	<u>C)</u>
J. VISIC		i y/LCati	ter medistry, i outry and i iggery i ann & v	CIIII	compo	st On	n. (wie	<i>C)</i> .
1. Identi	ificatio	on of cu	tivable finfishes and shellfishes					
2. Identi	ificatio	on of \overline{co}	mmon freshwater ornamental fishes (live be	arer	s and e	gg lay	vers)	
3. Colle	ction a	and iden	tification of plankton from fish farm.					

4. Management aspects (feeding, water quality and disease) in rearing and breeding of ornamental fishes at Ornamental Fish Unit , MCC Farm

5. Field visit to Pulicat: To learn the culture techniques - Physicochemical parameters -

Management aspects in feeding - water quality – disease in aqua farms.

1. Reference books

Integrated concepts of Zoology - Kenneth Hayes.

Economic Zoology - Herbert Osborn, 2015.

Principles of Aquaculture - Robert R.

Stickney. Aquaponics for Beginners - Andrew

Mc Deere.

	Mapping with Programme Specific Outcomes											
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2
							2.6					1.64

BIOTECHNOLOGY AND NANOSCIENCE

Cou	rse Title	BIOTECHNO	LOGY AND NANOS	SCIENCE	
Cou	rse Code	232ZO4M01			
C	redits	4			
Hou	rs / Cycle	6			
Ca	ntegory	Part III	Core	Theory	7
Se	mester	IV			
Y Imple n	ear of mentatio	From the acadenot be revised	emic year 2023 onward during particular revis	ds (this is requi sion)	red as some of the courses may
Course Objectives1. Apply the knowledge of Molecular Biology into use 2. Learn the protocols applied to Biotechnological advancements 3. Unravelling the process and conversion of science into product 4. To learn sex basics of Nanoscience in the modern context To learn application of nanoscience in drug discovery and therapy					
CO #		Course Outco	ome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)
On com	pleting the co	urse successfully	, the student will be al	ole to	
CO 1	Describe ar biotechnolo	nd define basic p ogy processes in	orinciples industry	PSO1	K1
CO 2	To identify methods ar	and Explain the id its use	different cloning	PSO2	K1 & K2
CO 3	To discover biotechnolo	different fields	of ploitation	PSO3	K3
CO 4	Focus on recombinant technology and its safe			PSO4	K4
CO 5	Choose an a work and a	appropriate tool lso learn IPR an	for a specific d patenting	PSO1	K3 & K5

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S
				TAXONOM V I EVEI
Ι	Gene Cloning and Applications	15 hours	CO1	K1. K2. K3.
-	Restriction Endonucleases, Ligation and End		,	K4, K5
	modification; Cloning: Vectors - Plasmids,		CO2	
	Bacteriophages, Introduction of DNA into		,	
	Bacterial cells and Clone Selection; Gene		CO3	
	Expression using Cloning, Production of recombinant proteins Pharming Recombinant		, CO4	
	Pharmaceuticals: Gene Cloning in Agriculture.		004	
	Forensic Science and Archaeology		, CO5	
II	Agricultural, Industrial and	20 hours	C01	K1, K2, K3,
	Aquatic Biotechnology		,	K4, K5
	Microbial Biotechnology: Microbial Enzymes -		CO2	
	Specificity, Types, Substrates, Enzyme		,	
	Immobilization and types, Biofuels, and Drugs		CO3	
	Protein Engineering and Molecular Evolution		, CO4	
	Phytoremediation,		CO4	
	Bioremediation Genomics, Biosensors,		, CO5	
	Challenges; Aquatic: Improving Strains for		000	
	Aquaculture, Bioprospecting,			
TTT	Antifouling agents, Barriers and limitations	12 hours	<u>CO1</u>	V1 V2 V2
111	Transgenic animals Creation of Knockout	12 nours	COI	K1, K2, K3, K4 K5
	animals: Molecular Diagnostics of Genetic		, CO2	114, 115
	Diseases, Recombinant Vaccines, Stem cells –		•	
	Laboratory to Clinic, Nanotechnology for disease		CO3	
	detection; Genome Editing and CRISPR,		,	
	Diagnostics, Therapeutics – Protein and Nucleic		CO4	
	Acius; Gelle Therapy Regenerative Medicine		, CO5	
IV	Biotechnology and Society	9 hours	$\frac{C03}{C01}$	K1 K2 K3
1,	Regulation of Recombinant DNA technology.			K4, K5
	Genetically Engineered – Food, Livestock and		CO2	, .
	Crops; Concerns and Safety of consumption of		,	
	Genetically		CO3	
	Modified Food; Research – New discoveries,		,	
	ratenting and Irk		CO4	
			, CO5	

V	Nanoscience	9 hours	CO1	K1, K2, K3,
	Introduction: Bottom-up Synthesis, Top-down		,	K4, K5
	approach; Nanomaterials: Nanoforms of Carbon		CO2	
	- Single Wall Carbon Nanotubes (SWCNT) and		,	
	Multi Wall Carbon Nanotubes (MWCNT),		CO3	
	Nanometal oxides-ZnO, TiO ₂ , Quantum wires,		,	
	Quantum dots- preparation, properties and		CO4	
	applications; Applications: Nanobiotechlogy:		•	
	nanoprobes in medical diagnostics and		CO5	
	biotechnology, Nano medicines, Targeted drug			

delivery and Nano-bioimaging; Micro Electro Mechanical Systems (MEMS), Nano	
Electr	
0	
Mechanical Systems (NEMS), Nanosensors and its utility.	

Prescribed books/Text books

- 1. Gene Cloning and DNA Analysis: An Introduction T. A. Brown
- 2. Molecular Biotechnology Principles and Applications of Recombinant DNA -Bernard R. *et al.*,
- 3. Nanomaterials: Synthesis, Properties and Applications, A.S. Edelstein and R.C. Cammearata

References

- 1. Introduction to Biotechnology William J. Thieman and Michael A. Palladino
- 2. Nanoscale Characterization of surfaces & Interfaces N John Dinardo
- 3. Nanotechnology G Timp

Suggested Reading

- 1. Gene Cloning and DNA Analysis: An Introduction T. A. Brown
- 2. Nanoscale Characterization of surfaces & Interfaces N John Dinardo

Web Resources

- 1. NPTEL: <u>Experimental Biotechnology</u>; <u>Bioreactor Design and Analysis</u>; <u>Nanotechnology</u>, <u>Science and Applications</u>
- 2. Coursera: <u>Nanotechnology and Nanosensors</u>; <u>Materials Data Sciences and</u> <u>Informatics</u>
- 3. edX: Introduction to the Modern Nanotechnology; Principles of Biomanufacturing

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	3					

	Course Articulation Matrix													
Course			P	rogramme	Outcor	nes	Programme Specific Outcomes					~		
Outcom e s	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	K3
CO 4	2	2	3	2	1	2	2	3	-	2	2	-	3	K4
CO 5	2	2	3	-	1	2	2	3	2	1	-	2	3	K5
Wt. Avg.	2	2	3	1.6	1	2	2	2.6	2.5	2	2	1.5	3	
2.025 2.2														
	Overall Mapping of the Course 2.112													

Course co	ode	M.Sc.		M	BIOTE IICROF	CHNOI BIOLO	LOGY, GY AND		L	Т	Р	С		
232ZO4M0	03			111	IMM	UNOL	OGY							
Col	re			Sem	ester IV	V - PRA	ACTICAL	IX	-	3 2				
Pre-requis	ite			Knowl	ledge ge	enetics,	Biotechnol	ogy	Sylla	abu	2021	-2022		
1				pr	otocols	, and In	nmunology		S Ver	sion				
Course Obj	ectives	5:							VCI	51011				
The main o	bjectiv	ves of this	is co	ourse a	are to:									
1. Appl	1. Apply the knowledge of Molecular Biology into use													
2. Learn the protocols applied to Biotechnological advancements														
3. Unra	3. Unravelling the process and conversion of science into product													
4. To le	earn se	ex basics	s of N	Nanos	cience	in the	modern co	ntext						
5. To le	earn ap	pplication	on of	fnano	science	e in dru	ig discover	y and th	nerapy	7				
l														
Expected Course Outcomes:														
On the successful completion of the course, student will be able to:														
CO1. Describe and define basic principles biotechnology processes K1														
in industry														
CO2.	CO2. To identify and Explain the different cloning methods and its K1 & K2													
000	use	aarran dif		and fin] +]- o;		Vo				
003.	exploi	tation	mere	ent ne		biotech	nology and	ı their		КЗ				
CO4.	Focus	on recon	mbii	nant t	echnol	ogy an	d its safety	,		K4				
COE	Choos	e an appi	prop	oriate t	tool for	a spec	ific work a	nd also		K3	& K5			
003.	learn	IPR and p	pate	enting	5									
K1 - Reme	ember;	; K2 - Un	nder	rstand	; K3 - A	Apply;	K4 - Analy	ze; K5 -	- Eval	uate; l	K6- Cr	eate		
Total num	ber of	hours -36	<u>36</u>											
1. Restriction	on and	Ligation (1 OT L	DNA.	- 4 f - 11 - 11	:11 4								
2. Food Sal	Immok	1000000000000000000000000000000000000	eauct	tion tes	st for m	ilk cont	amination.							
3. Enzyme	of bloc	offer ober	l.	ation o	flymp	hoovtoo								
 4. Staining of blood for observation of lymphocytes. 5. Dissoction and localization of lymphoid organs (any vortabrate). Observation of normanant 														
slides of lymphoid organs / tissues.														
6. Precipitin test - Radial and Double diffusion.														
7. Culture of bacteria from different sources.														
8. Simple and Gram staining to study bacteria.														
9. Identification of bacteria using biochemical tests MMTPC and VP														
10. Hydrogen peroxide test and carbohydrate fermentation														
Visit to lab	Visit to lab													

R	deference Books
1.	Introduction to Biotechnology - William J. Thieman and Michael A. Palladino
2.	Nanoscale Characterization of surfaces & Interfaces - N John Dinardo
3.	Nanotechnology - G Timp
4.	Nanoscience for Dummies

	Course Designed By: Dr. Allen J. Freddy											
	Mapping with Programme Specific Outcomes											
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2

MICROBIOLOGY AND IMMUNOLOGY

Cou	rse title	MICROBIC	DLOGY AND IMN	MUNOLOGY	Y					
Cour	rse Code	232ZO4M02								
C	redits	2								
Hour	s / Cycle	2								
Ca	tegory		Core	Theory						
Sei	mester	IV								
Yo Implei n	ear of mentatio	From the academic year 2023-2024 onwards								
C Obj s	ourse jective	 To expose the students to the world of micro-organisms. To help students understand the applied aspects of microbiology. To help the students to understand human body and immunity To analyze immune system and its interactions with self and non-self. To gain knowledge on clinical immunology. 								
CO #		Course Outo	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On cor	npleting th	e course suco	cessfully, the stude	ent will be ab	le to					
CO 1	Students physiolog of microb	will gain kı y, genetic and es.	nowledge on the d medical aspects	PSO1 PSO5	K4 & K5					
CO 2	Students application commerci	will learn n of microbes ally important	about Industrial for production of molecules.	PSO2	K3 & K4					
CO 3	Upon con will have essential e	npletion of th a better und elements of the	le course students lerstanding of the e immune system.	PSO8	К2					

CO 4 CO 5	The students will be able to identify the cellular and molecular basis of immune responsiveness and understand how the innate and adaptive immune responses coordinate to fight invading pathogens. Understand the immunomodulatory strategies essential for generating or suppressing immune responses as required in hypersensitivity reactions, transplantation, autoimmune diseases and	PSO8 PSO4	K	K4 2 & K3
		<u></u>		
	SYLLABU	>		1
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL
Ι	 MICROBIAL PHYSIOLOGY, GENETICS & MEDICAL MICROBIOLOGY Outline classification of microorganisms. Microbiome. Microbial Physiology - Growth yield and characteristics, strategies of cell division, stress response. Microbial genetics - Methods of genetic transfers – transformation, conjugation, transduction and sex- duction. Medical Microbiology – study of common bacterial, fungal and viral diseases of man and their preventive measures. Bacterial- Meningitis, Tetanus, Botulism, Gonorrhe a, and Syphilis; Fungal – Cryptococcosis, Aspergillosis, Blastomycosis, Fungal Eye Infections, Invasive Candidiasis; Viral – Hepatitis, Rotavirus, Measles, Polio & COVID-19. 	12	CO1	K1

Π	APPLIED & INDUSTRIAL MICROBIOLOGY Food Microbiology: Microbiology of milk and milk products, Microbial fermentation: Process of fermentation; Types-Lactic acid, alcohol and acetic acid fermentation; Stages of fermentation- Primary and secondary; production of small and macro molecules; Advantages. Food biopreservatives of microbial origin; Food spoilage by microbial enzymes, SCP, Microbial foodborne infections – Staphylococcal food poisoning, mycotoxicosis. Soil Microbiology: Soil microbiome- Importance and function, Symbiosis, Nutrient cycling, Micro-organisms and agriculture. Aquatic Microbiology: Methodology of bacterial analysis of water; Sewage- biological sewage purification methods; Chlorination of water- by-products and implication.	10	CO2	К2
III	INNATE AND ADAPTIVE IMMUNITY History of development of immunology and scope. Classification of immunity – natural, induced, innate, acquired, specific, non-specific. Immune response- primary and secondary. Heideberger- Kendall reaction.	6	CO3 & CO4	K3 & K5
IV	COMPONENTS OF THE IMMUNE SYSTEM Cells and Organs of the Immune system. Immunoglobulins – structure, classification, theories of formations and functions. Separation of T and B lymphocytes. Antibody-mediated and cell-mediated immunity. Cytokines. Antigen presentation. Compliment system. Major histocompatibility complex. Phagocytosis. Tolerance.	10	CO4 & CO5	K4 & K5

V	IMMUNE RESPONSES &	10	CO4	K4 & K5						
	CLINICAL IMMUNOLOGY		&							
	protozoan and helminth infections		005							
	Natural response and immunological									
	mechanism against such infectious									
	agents; immune mechanisms of host.									
	Primary and secondary									
	primary and secondary									
	immunodeficiencies with examples.									
	Hypersensitivity Reaction.									
	Transplantation and Rejection.									
	Autoimmunity. vaccinology; monocional									
Presc	cribed Books/ Lextbooks	1 (1)								
1. T	 Text Book: Microbiology – Pelczar, Reid and Chan Microbiology – Armo K, Joshua 									
2. N	 Microbiology – Anna K. Joshua Microbiology – Norten C F. 									
4. T	ext Book of Microbiology – Ananthanaraya	nan and Ja	ayaram							
5. A	Text Book of Immunology – Dr. Madhave	e Latha								
6. B	6. Basic Immunology – Abul K Abbas, Andrew H. Lichtman, Shiv Pillai									
7. C	 Cellular and Molecular Immunology. V Edition. Abbas, K. Abul and Lechtman H. Andrew (2003) Saunders Publication 									
Refere	ences									
1. C	General Microbiology – Boyd									
2. N	Aicrobiology – Atlas – Biology of Microorg	anisms – l	Brock and Ma	digan						
3. 0	General Microbiology – Stainer, John, Mark									
4. N	Aicrobiology – Zinsser									
5. In	mmunology, VI Edition. Kindt, T. J., Golds	by, R.A., 0	Osborne, B. A	. and Kuby,						
6 II	(2006). W.H. Freeman and Company. mmunology VII Edition David M. Jonath	an B. Da	vid. R. B. and	Ivan R						
(2	2006). Mosby, Elsevier Publication.	, D., Du	, it, it, Di uild							
Sugg	ested Reading									
1. Iı	mmunology, VI Edition. Kindt, T. J., Golds	by, R.A., (Jsborne, B. A	. and Kuby,						
2	J (2006). W.H. Freeman and Company.	han R D	avid R R an	d Ivan R						
2.	(2006). Mosby, Elsevier Publication.	, D., D	u i i u, i v. D. all							
3.	Microbiology – Atlas – Biology of Microon	ganisms –	Brock and M	adigan						
4.	General Microbiology – Stainer, John, Mar	k								

Web Resources

General Microbiology -

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

14088

Intro to Medical Microbiology 1: Bacteriology https://www.classcentral.com/course/canvas-network-intro-to-medicalmicrobiology- 1-bacteriology-12514

Fundamentals of Immunology -

https://www.classcentral.com/course/immunology-23214

Vaccinology:

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	3						

	Course Articulation Matrix													
Course			Prog	gramme (Outcom	es			F	rogramm	e Specific	Outcome	es	Cognitive Level
Outcome s	PO1	PO2	PO3	PO4	PO5	Р О 6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	3	3	3	2	2	1	2	2	2	3	3	2	3	K4 & K5
CO 2	3	3	2	3	2	2	2	2	3	3	2	2	3	K3 & K4
CO 3	3	3	3	2	3	2	3	3	3	3	2	3	3	K2
CO 4	3	2	3	3	2	3	3	3	2	2	2	2	3	К4
CO 5	3	3	3	2	3	2	3	2	3	3	1	3	3	K2 & K3
Wt. Avg.	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$									2.8	2	2.4	3	
2.55 2.56														
								Ove	erall Map	ping of th	e Course	2.	55	

ETHOLOGY

Cou	rse Title	ETHOLOGY							
Cou	rse Code	232ZO4E01							
С	redits	5							
Hou	rs / Cycle	4							
Ca	itegory	Part I Core	Theory						
Se	mester	III							
Y	ear of	From the academic year 2023 onward	ds (this is requi	red as some of the courses may					
Imple	mentatio	not be revised during particular revis	sion)						
Course	Objectives	 draw attention to the behaviour of animals and provide a strong foundation on the core animal behaviour principles elucidate the behavioural concepts and pattern of animals; model the process of conducting scientific research in the field of animal behaviour from hypothesis formulation, to design, sampling, analysis and dissemination of findings 							
		3. Enlighten the importance in understanding the behaviour for animal welfare and conservation of animal diversity.							
CO #		Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On com	pleting the co	urse successfully, the student will be al	ble to						
CO 1	Conceptualiz	ze how species profitably inhabit in the	PSO1	K1					
	temporal env	vironment and space out for their							
	activities at o	different times of the day and							
	seasons.								
CO 2	Skillfully im animals, des statistics and behavioural ecology, and	prove their role while working with ign experiments, understand l pursue research in behaviour, ecology, conservation, evolutionary l animal welfare.	PSO2	K2					
CO 3	Apply know situations an critique data Critically evaluate the	ledge of behavioural theory to new d interpret, summarise, validate and from the scientific literature; work of peers.	PSO3	K3					
CO 4	Understand a current polic conservation programmes of both dome	and objectively evaluate the ties proposed for successful al and in regulation of the welfare estic and wild animals	PSO4	K4					

CO 5	Consider and evaluate behaviour of all animals,	PSO1	K5
	including humans, in the complex ecological		
	world, including the urban environment		

SYLLABUS			
CONTENT	HOURS	COs	BLOOM'S
			TAXONOM
			Y LEVEL
INTRODUCTION TO ANIMAL BEHAVIOUR	10 hours	CO1,	K1, K2, K3,
History and scope (An outline on classical and		CO2,	K4, K5
modern ethological theory); Introduction to		CO3,	
concepts and patterns: Development of behaviour		CO4,	
(Innate/Instinct Vs Learning, Imprinting, FAP),		005	
sumuli and communication. Diverse sensory			
Communication: Motivation: Characteristics			
Models of motivation (Lorenz's (Psychobydraulic)			
Tinbergen's (Hierarchial): Patterns of behaviour			
Kinds (foraging Territorial Mate selection and			
courtship. Parental care and Defensive)			
Allelomimetic and maladaptive (abnormal)			
behaviour. Stereotyped behaviour (orientation.			
reflexes); Approaches & Methods: The description			
and measurement of behaviour: Description by its			
function and form (Continuous process, Series of			
discrete events). Describing the causes of			
behavioural changes (kinds of causal explanation,			
motivational models)			
COMMUNICATION; SOCIAL	14 hours	CO1,	K1, K2, K3,
ORGANIZATION		CO2,	K4, K5
Communication: (Types, Design of signals,		CO3,	
Variability in signals (bees, birds-owl, toad-prey		CO4,	
capture, Pigeon and bats); Social Organization: The		C05	
adaptive significance of benaviour (aggregation,			
limitations (Costs, henefits and entimality model):			
Sociobiology: (The elements of socio-biology:			
Selfishness cooperation altruism kinshin and			
inclusive fitness): social organization in insects			
(Termites), vertebrates (naked mole rats), Primate			
(monkey), Parental care and mating systems:			
parental manipulation, evolutionarily stable strategy,			
cost benefit analysis of parental care. Sexual			
selection: intra sexual selection (male rivalry), inter-			
sexual selection (female choice), infanticide, sperm			
competition, mate guarding, consequences of mate			
choice for female fitness, monogamous verses			
polygamous sexual conflict. Altruism: reciprocal			
fitness. An over view of sociality in animal systems			
Cooperation and conflict: Conflicts in the animal			
world (Protist- Mammals). Stress. Territorial			
	SYLLABUS CONTENT INTRODUCTION TO ANIMAL BEHAVIOUR History and scope (An outline on classical and modern ethological theory); Introduction to concepts and patterns: Development of behaviour (Innate/Instinct vs Learning, Imprinting, FAP), Stimuli and communication: Diverse sensory capacities, Sign stimuli, Stimulus filtering (IRM), Communication; Motivation: Characteristics, Models of motivation (Lorenz's (Psychohydraulic), Tinbergen's (Hierarchial); Patterns of behaviour: Kinds (foraging, Territorial, Mate selection and courtship, Parental care and Defensive), Allelomimetic and maladaptive (abnormal) behaviour, Stereotyped behaviour (orientation, reflexes); Approaches & Methods: The description and measurement of behaviour: Description by its function and form (Continuous process, Series of discrete events). Describing the causes of behavioural changes (kinds of causal explanation, motivational models) COMMUNICATION; SOCIAL ORGANIZATION Communication: (Types, Design of signals, Variability in signals (bees, birds-owl, toad-prey capture, Pigeon and bats); Social Organization: The adaptive significance of behaviour (agregation, group selection, kin selection, altruism) and its limitations (Costs, benefits and optimality model); Sociobiology: (The elements of socio-biology: Selfishness, cooperation, altruism, kinship and inclusive fitness); social organization in insects (Termites), vertebrates (naked mole rats), Primate (monkey), Parental care and mating systems: parental manipulation, evolutionarily stable strategy, cost benefit analysis of parental care. Sexual selection: intra sexual selection (male rivalry), inter- sexual selection (female choice), infanticide, sperm competition, mate guarding, consequences of mate choice for female fitness, monogamous verses polygamous sexual conflict. Altruism: reciprocal altruism, group selection, kin selection and inclusive fitness. An over view of sociality in animal systems. Cooperation and conflict. Conflicts in the animal world (Protist-Mammals). Stress, Territorial	SYLLABUSCONTENTHOURSIntrRODUCTION TO ANIMAL BEHAVIOURHistory and scope (An outline on classical and modern ethological theory); Introduction to concepts and patterns: Development of behaviour (Innate/Instinct vs Learning, Imprinting, FAP), Stimuli and communication: Diverse sensory capacities, Sign stimuli, Stimulus filtering (IRM), Communication; Motivation: Characteristics, Models of motivation (Lorenz's (Psychohydraulic), Tinbergen's (Hierarchial); Patterns of behaviour: Kinds (foraging, Territorial, Mate selection and courtship, Parental care and Defensive), Allelomimetic and maladaptive (abnormal) behaviour, Stereotyped behaviour (orientation, reflexes); Approaches & Methods: The description and measurement of behaviour: Description by its function and form (Continuous process, Series of discrete events). Describing the causes of behavioural changes (kinds of causal explanation, motivational models)14 hoursCOMMUNICATION; SOCIAL ORGANIZATIONAlt hoursCommunication: (Types, Design of signals, Variability in signals (bees, birds-owl, toad-prey capture, Pigeon and bats); Social Organization: The adaptive significance of behaviour (aggregation, group selection, kin selection, altruism) and its limitations (Costs, benefits and optimality model); Sociobiology: (The elements of socio-biology: Selfishness, cooperation, altruism, kinship and inclusive fitness); social organization in insects (Termites), vertebrates (naked mole rats), Primate (monkey), Parental care and mating systems: parental manipulation, evolutionarily stable strategy, cost benefit analysis of parental care. Sexual selection: intra sexual selection (male rivalry), intersexual selection (female choice), infanticide, sperm competition, mate guarding, consequences of mate choice for female fitness, monogamous verses polygamous sexual conflict. Conflicts in the animal world (Protist-Mammals). Stress, Territorial	SYLLABUSCONTENTHOURSCOsINTRODUCTION TO ANIMAL BEHAVIOURI9 hoursCO1,History and scope (An outline on classical and modern ethological theory); Introduction to concepts and patterns: Development of behaviour (Innate/Instinct vs Learning, Imprinting, FAP), Stimuli and communication: Diverse sensory capacities, Sign stimuli, Stimulus filtering (IRM), Communication, Motivation: Characteristics, Models of motivation (Lorenz's (Psychohydraulic), Tinbergen's (Hierarchial); Patterns of behaviour: Kinds (foraging, Territorial, Mate selection and courtship, Parental care and Defensive), Allelomimetic and maladaptive (abnormal) behaviour, Stereotyped behaviour (orientation, reflexes); Approaches & Methods: The description nat measurement of behaviour: Description by its function and form (Continuous process, Series of discrete events). Describing the causes of behavioural changes (kinds of causal explanation, motivational models)14 hoursCO1, CO2, CO3, CO3, CO3, CO3, CO3, CO3, CO3, CO3, CO3, Variability in signals (bees, birds-owl, toad-prey capture, Pigeon and bats); Social Organization: The adaptive significance of behaviour (aggregation, group selection, kin selection, altruism) and its limitations (Costs, benefits and optimality model); Sociobiology: (The elements of socio-biology: Selfishness, cooperation, altruism, kinship and inclusive fitness); social organization in insects (Termites), werebrates (naked mole rats), Primate (monkey), Parental care and mating systems: parental manipulation, evolutionarily stable strategy, cost benefit analysis of parental care. Sexual selection (intar sexual selection (male rivalry), inter- sexual selection (file: Altruism: reciprocal altruism, group selection, kin selection and inclusive

	conflict, Attack and escape, Treat displays, Displacement activities			
III	BIOLOGICAL CLOCKS	10 hours	CO1,	K1, K2, K3,
	Advantages and types of rhythms (circadian,		CO2,	K4, K5

	Ultradian, tidal/lunar, circaannual), Photoperiodism.		CO3,	
	Characteristics of circadian rhythms and Biological		CO4.	
	oscillation: Zeitgeber, phase, phase shifts, phase		CO5	
	angle difference, entrainment, freerunning rhythm.			
	Circadian Time (CT), phase response curve (PRC)			
	Actogram) Role of melatonin: Chronobiology:			
	Molecular clockworks in Cyanobacteria			
	Neurospora Drosophila and mammals			
	Applications (Chronopharmacology			
	Chronomodicing Chronotherapy): Orientation and			
	Migration (Types and Courses) Migratory behaviour			
	in hinds and fishes			
	In birds and lisnes		601	X 24 X 26 X 26
IV	TECHNIQUES IN ETHOLOGY	8 hours	CO1,	K1, K2, K3,
	Design and Analytical techniques: Research and		CO2,	K4, K5
	Experimental design, Management and analysis of		CO3,	
	wildlife ecology data; Capture and handling		CO4,	
	techniques: Capture and handling wildlife,		CO5	
	Chemical immobilization, Use of dogs in wildlife			
	research and management; Identification and			
	markings techniques: Criteria for determining sex			
	and age (Birds, Mammals), Techniques for marking			
	wildlife. Wildlife radiotelemetry and remote			
	monitoring: Research on individual animals:			
	Behavioural Genetics (Ethogenetics): Single genes			
	and behaviour. Chromosomal mutations influencing			
	behaviour Polygenic inheritance of behaviour			
	Behaviour, of inbred and recombinant strains			
	Molecular basis of circadian rhythms:			
	Neuroethology: Neurol control of Behaviour:			
	Language of the nervous system Brain centers and			
	their functions Learning and moment			
	Ethoendooringloory Harmones and heboriour			
T 7	Euroendocrinology: Hormones and benaviour		001	171 170 170
V	HUMAN BEHAVIOUK	6 nours		K1, K2, K3, V4 V5
	An introduction to numan behaviour. Human non-		CO_2 ,	м4, мэ
	discoursed showhod trained and mixed). Costumes		CO3,	
	discovered, adsorbed, trained and mixed), Gestures		CO4,	
	(primary and secondary), Greeting signals, Baton		005	
	signals]; mate selection and sexual strategy, family			
	relationships and altruism; Linking behaviour to the			
	brain, genes, hormones and environment. The			
	biology of human aggression: Identification of			
	biological roots of human behaviour, Defining and			
	measuring human aggression, Causes, Genes,			
	Environment and the development of agnostic			
	behaviour, Cost and benefits of aggression,			
	dominance and territoriality. Prevention, prediction			
	and control			

Prescribed Books/Textbooks

- 1. The study of Animal Behaviour- Huntingford, Felicity
- 2. Hand Book of Ethological Methods- Leher P. N.
- 3. Animal Behaviour (Ethology)- V K Agarwal

References

- 1. Introduction to Animal Behaviour- Manning, A
- 2. Companion to Animal Behaviour- McFarland, D
- 3. Manwatching- Morris, Desmond
- 4. Essential Animal Behavior- Scott, Graham
- 5. Animal Behaviour: an evolutionary approach Alcock, John
- 6. Curious Naturalists Tinbergen, Niko
- 7. King Solomon's Ring- Lorenz, Konrad Z
- 8. The Foundations of Ethology- Lorenz, Konrad Z
- 9. Biological Timekeeping: Clock, Rhythms and Behaviour- Vinod Kumar
- 10. The wildlife techniques Manual Vol 1,2 Nova J Silvy The wildlife techniques Manual

Vol 1,2 - Nova J Silvy

Suggested Reading

- 1. The study of Animal Behaviour- Huntingford, Felicity
- 2. Hand Book of Ethological Methods- Leher P. N.
- 3. Animal Behaviour: an evolutionary approach Alcock, John

Web Resources

- 1. Introduction to Animal Behaviour <u>https://www.mooc-list.com/course/introduction-animal-behaviour-edx</u>
- 2. Human Behaviour https://onlinecourses.nptel.ac.in/noc20_hs28/preview

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	3					

	Course Articulation Matrix													
Course	Programme Outcomes								Pr	ogramme	e Specifi	ic Outco	mes	~
Outcom e s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	K3
CO 4	2	2	3	2	1	3	3	3	-	1	2	-	3	K4
CO 5	2	2	3	-	1	3	3	3	1	1	-	2	3	K5
Wt. Avg.	2	2	3	1.6	1	2.4	2.4	2.6	2.2	1.8	2	1.5	3	
	2.125 2.5								•	•				
	Overall Mapping of the Course 23125													

ENDOCRINOLOGY

Cou	irse Title	ENDOCRINO	LOGY						
Cou	rse Code	232ZO4E02							
C	Credits	5							
Hou	rs / Cycle	4							
Ca	ategory	Part I Core Theory							
Se	emester	IV							
Y	ear of	From the academic year 2023 onwards (this is required as some of the courses may							
Imple	ementatio	not be revised during particular revision)							
n									
Course	e Objectives	 To enab the endo To prov dysregut To gain hormone To gain hormone To gain hormone 	le the student to under ocrine glands, their loca ide in-depth knowledg lation leading to variou knowledge about the H es. insight about the neuro es and diseases origina art knowledge in advan	stand and acqu ation and secre e about hormo is disease cond Pancreatic regu pendocrine phy ting in the neu ce concepts in	ire fundamental knowledge about ation. ne mechanism and also its lition. llation and energy balance of vsiology and function of roendocrinologic system. reproductive endocrine system.				
CO #		Course Outc	ome(s)	PSO Addresse	d Bloom's Taxonomy Levels (K1 to K5)				
On com	pleting the co	urse successfully	, the student will be a	able to					
CO 1	To understar with their sp	nd and identify th ecific cell type.	e endocrine glands	PSO1	K1				
CO 2	They will un action.	derstand the mec	hanism of hormone	PSO2	K2				
CO 3	They will ap development	ply to relate horn tal process and in	none on nmune system.	PSO3	K3				
CO 4Will help the students to focus and understand thePSO4K4					K4				
	clinical disor	rder related to end	locrine system.						
CO 5	Student will mechanism u function.	access to evaluat underlining horm	e the physiological one action and	PSO1	К5				

	SYLLABUS			
UNIT	CONTENT	HOURS	COs	BLOOM'S
				TAXONOM
				Y LEVEL
Ι	ENDOCRINE GLANDS, HORMONE	9 hours	CO1,	K1, K2, K3,
	AND MECHANISM OF ACTION Endocrine glands_ anatomical location_structure		CO2,	K4, K5
	Endocrine giands- anatomical location, structure,		CO3,	
	function and secretion; Pituitary- structure,		CO4,	
	nypotnatamic- nypophysial regulation, pituitary cell		005	
	types and their secretion. Over view of the			
	neuroendocrine system - chonnergic and			
	Harmone: Types Transport and metabolism: Types			
	of hormone recentor and their mechanism of action			
	steroid hormone action and nuclear recentors:			
	peptide hormone action and cell surface receptors,			
п	THYROID AND ADRENAL	12 hours	CO1	K1 K2 K3
	Thyroid: Thyroid hormone – hypothalamic	12 110015	CO1, CO2.	K4. K5
	regulation of synthesis, secretion, physiological		CO3,	, -
	action: Thyroid hormone disorders: Goiter.		CO4.	
	Myxedema and Cretinism- cause, sign & symptoms,		CO5	
	diagnosis and remedial methods.			
	Parathyroid gland and its effect on calcium - the			
	importance of calcium in life and diseases resulting			
	from the imbalance in it.			
	Adrenal gland- corticoids and medullary hormones,			
	physiological action- renin angiotensin aldosterone			
	system, mechanism of thirst physiology; Stress:			
	stress and physiology of ease response. Sympatho-			
	adrenal system, Hypothalamic – pituitary axis, effect			
	of stress on reproduction, growth and immune			
	function.			
	Adrenal disorder: Cushings syndrome and			
	Addison's disease cause, sign & symptoms,			
	diagnosis and remedial methods.		~~~	
111	PANCREAS AND ENERGY BALANCE	9 hours	CO1,	K1, K2, K3,
	Pancreas: Structure and cell types of islets of		CO_2 ,	к4, кэ
	(CPA) signal transduction pathways glucose		CO3,	
	(OBA), signal transduction pathway, glucose homeostastis: IDDM NIDDM and diabetes		CO4, CO5	
	management.			
	Obesity causes and consequences : Leptin:			
	synthesis, secretion and its role in adipogenesis.			
	Amylin: synthesis, secretion and its role in food			
	intake.			

IV	MALE REPRODUCTIVE SYSTEM Sex determination- genetic control of sex determination, sexual differentiation- hormonal regulation of sexual differentiation. Influence of hormone on testicular functions- steroidogenesis and germ cell development and function. Epididymis processing and epididymosomes. Disorders – Cryptochrism, Varicocoele and sertoli cells syndrome cause, sign and symptoms, diagnosis and remedial methods.	9 hours	CO1, CO2 , CO3 , CO4 , CO5	K1, K2, K3, K4, K5
V	GYNECOLOGICAL ENDOCRINOLOGY Overview of female reproductive system- primodial germ cell development, germ cell migration and nest cell breakdown, ovarian epigenetic programming and reprogramming, ovarian hormones and their hypothalamic regulation, physiological function. Reproductive cycle - hormonal regulation of menstrual cycle, folliculogenesis. Influence of the sex hormones on Vaginal cell's cytology and the composition of vaginal microbiome. Ovarian health - Amenorrhea, Polycystic ovary, Hirsutism and menopause. Preganancy and lactation – Placental hormone and their physiological function, hormones during parturition. Biological significance of placental programming.	9 hours	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Prescribed Books/Textbooks

- 1. Vertebrate Endocrinology- Norris- IV th Edition 2008- Lea & Febiger
- 2. Applied Animal Endocrinology E.J. Squires 2009- CABI Publication.
- 3. Essential Endocrinology 3rd edition Charles G.D. Brook & Nicholas J Marshall.

References

- 1. Text Book of Endocrinology- Williams- XII edition 2012- W.B. Saunders, USA.
- 2. Endocrinology- Mac E. Hadley 2006 Edn. Prentice Hall International Inc.
- 3. Comparative Vertebrate Endocrinology- B.J. Bentely V th Edition 2012- Cambridge University Press.
- 4. Harrison's endocrinology J. Larry Jameson, Dennis Kasper and Anthony Fauci Rockwell enterprises, revised 4th edition, Mc graw hill Education.

Suggested Reading

- 1. Harrison's endocrinology J. Larry Jameson, Dennis Kasper and Anthony Fauci Rockwell
- 2. Essential Endocrinology 3rd edition Charles G.D. Brook & Nicholas J Marshall

Web Resources

- 1. <u>https://www.mooc-list.com/initiative/edx</u>
- 2. <u>https://www.mooc-list.com/initiative/coursera</u>
- 3. <u>https://youtu.be/vaROO113qq0</u>

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	3					

	Course Articulation Matrix													
Course	Programme Outcomes								Pr	ogramme	e Specifi	c Outco	mes	
Outcom e s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PSO 4	PSO 5	Cognitive Level
CO 1	2	2	3	2	1	2	2	2	3	3	2	1	3	K1
CO 2	2	2	3	2	1	2	2	2	3	2	-	-	3	K2
CO 3	2	2	3	2	1	2	2	3	2	2	2	-	3	K3
CO 4	2	2	3	2	1	3	3	3	-	1	2	-	3	K4
CO 5	2	2	3	-	1	3	3	3	1	1	-	2	3	K5
Wt. Avg.	2	2	3	1.6	1	2.4	2.4	2.6	2.2	1.8	2	1.5	3	
	2.125 2.5													
	Overall Mapping of the Course 23125													

RESTORATION ECOLOGY

Course title RESTORATION ECOLOGY								
Cour	rse Code	232ZO4E03						
C	redits	5						
Hour	s / Cycle	4						
Ca	tegory		Core	The	Theory			
Sei	nester	IV						
Yo Implei n	ear of nentatio	From the ac	ademic year 2023	-2024 onv	vards			
 Course Objective s 1. To understand the principles and concepts of ecosystems 2. To understand the reasons for degradation of an ecosystem 3. To foresee the results and the remedial measures for restoration. To restore the degraded ecosystem to its near-original status. 						of ecosystems of an ecosystem sures for em to its near-		
CO #		Course Outo	come(s)	PSO Address	ed T	Bloom's axonomy Levels (K1 to K5)		
On cor	npleting th	e course suco	cessfully, the stude	ent will be	able to			
CO 1	Awarenes	s of import	ant factors	PSO1		K1		
	ecosystem	that contril	oute to healthy	PSO5				
CO 2	Understan for restora	ding the facto tion	rs responsible	PSO2		K2		
CO 3	Overall id in the succ	ea of the princ cess of restora	ciples involved tion	PSO8		K4		
CO 4	The metho in restorat	olving Microbes	PSO8		K3 & K4			
CO 5	Evaluation happened	n of the restor in the ecosyst	ation that has em	PSO4		К5		

	SYLLABUS	5		
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL
Ι	ECOLOGICAL CONCEPTS	12	CO1	K1
	Ecosystem: physical, chemical and biological parameters; Ecosystem functions, energetics; Ecological succession: colonization, hierarchy; Keystone species, Flagship species of eight different ecosystems: Lake, stream, marshland, coral reef, wasteland, sandy beach, scrub jungle, forest.			
II	UNDERSTANDING RESTORATION Definition, scope, global survey of restoration ecology; Ecological stressors: biological, physical and chemical; biodiversity, role of keystone species and ecological succession in restoration, basics to restoration: rehabilitation, restoration, remediation, vegetation: maximum habitat, shelter, food, oxygen, biodiversity attraction, RS/GIS	12	CO2	K2
III	RESTORATION CASE STUDIES	12	CO3	K3 & K5
	Habitat loss, estimation of degradation; case studies: MCC campus, Adyar		&	
	poonga, Auroville, Pitchandikulam (Pondy), Pulicat lake, Andaman Coral reef; traditional practices in restoration in India. Constraints in Restoration: People participation, official permission, choice of biodiversity; Invasive species and challenges		CO4	
IV	BIOREMEDIATION Insitu remediation (at site), Exsitu remediation (treating elsewhere), bioremediation technologies: bioventing, bioreactor, composting, bioaugmentation, biostimulation, rhizofilteration	6	CO4 & CO5	K4 & K5

V	MEASURE OF RESTORATION Community structure, functions, hydrology, soil; Monitoring restoration:	6	CO4 & CO5	K4 & K5
	and after (progress) restoration, people			
	diversity, abundance, distribution, the goal of restoration			
Prescribed Books/Textbooks				
 Foundations of Restoration Ecology, by D.A. Falk, M.A. Palmer and J.B. Zedler (2006 Island Press) 				
2. Primers of Ecological Restoration y Karen D. Holl				
 Introduction to Restoration Ecology by E.A. Howell, J.A. Harrington and S.B. Glass 				
 Environmental Science - A Global Concern by W.P. Cunningham and M.A. Cunningham, Mc Graw Hill Publications 				
References				
 New Models for Ecosystem Dynamics and Restoration by R.J. Hobbs and K.N. Suding (2009 Island Press) 				
Suggested Reading 1. Introduction to Restoration Ecology by E.A. Howell, J.A. Harrington and S.B.				
Glass				
Web Resources 1. <u>https://www.coursera.org/lecture/landscape-restoration-</u> <u>sustainable-</u> <u>development/what-is-ecological-restoration-ZaszH</u>				

2. <u>https://ecosystemrestorationcamps.org/ecosystem-restoration-design-online- course/</u>
| | 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 | 3 |

	Course Articulation Matrix													
Course			Prog	gramme (Outcom	es			I	Programm	e Specifi	c Outcom	es	Cognitive Level
Outcome s	PO1	PO2	PO3	PO4	PO5	P 0 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	K4
CO 4	3	2	3	3	2	3	3	3	2	2	2	2	3	K3 & K4
CO 5	3	3	3	2	3	2	3	2	3	3	1	3	3	K5
Wt. Avg.	3	2.8	2.8	2.	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	

NUTRITION, DIETETICS AND KINESIOLOGY

Cou	rse Title	NUTRITION, I	DIETETICS AND KIN	ESIOLOGY						
Cou	rse Code	232ZO4E04								
С	redits	5								
Hou	rs / Cycle	4								
Ca	ntegory	Part III	Elective	Theory						
Se	mester	IV								
Y	ear of	From the acad	lemic year 2023 onward	ds (this is requir	red as some of the courses may					
Imple	mentatio	not be revised	during particular revis	sion)						
n										
		 Use of a technol fitness, Examin on exer 	 Use of scientific principles, scientific investigation, and current technological advances to assess the relationship between diet, physical fitness, and disease. Examine scientific literature to evaluate the effects of nutritional intervention on exercise performance. 							
Course Objectives		 3. Students will cultivate knowledge of the scientific study of the physical universe or its life forms. 4. Students will understand and appreciate the interrelationship of science. 								
		4. Student and hur	4. Students will understand and appreciate the interrelationship of science and human beings to each other.							
		5. Exercises are needed for every individual, hence a basic knowledge as to why we require it and to analyze its significance.								
CO #		Course Outo	come(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)					
On com	pleting the co	urse successfull	y, the student will be al	ble to						
CO 1	Explain how nutrition (su- intake and ex- physical cha nutrition) co	the principles of ch as body comp xpenditure, acute nges related to ex mplement each o	f fitness and position, energy e and chronic xercise and other.	PSO1	K2					
CO 2	Identify soci environment and exercise	al, cultural, ethn tal factors that in /activity patterns	ic, and fluence food habits	PSO2	K4 & K5					

CO 3	Examine the biochemical and physiological effects of exercise and various nutritional practices.	PSO3	K2
CO 4	Describe the different exercise guidelines and nutritional requirements related to gender and diverse populations. Assess the advantages/disadvantages of recent advances in new food formulations, and new exercise and fitness equipment for the general population	PSO4	K3 & K4
CO 5	To understand and analyze the role of bones, joints and muscles in their day to day life.	PSO1	K4 & K5

	SYLLABUS				
UNIT	CONTENT	HOURS	COs	BLOOM'S TAXONOM Y LEVEL	
I	NUTRITION- INTRODUCTION Definition of food, nutrition, health, Nutraceuticals and Nutrigenomics. Dimension of health and function of food- Physical, social and mental health. Food guide – Basic food groups, my plate- food pyramid- balanced diet.	8	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5	
П	ENERGY REQUIREMENTS Factors affecting energy requirements, BMI - activity, age, climate, diet induced thermo genesis (SDA), Calories- malnutrition and Obesity- Normal levels Physiological conditions. RDA (ICMR) - formation, uses. Macro Nutrients - Protein, Carbohydrate, Fat-Classification, functions, Digestion & absorption (in brief), RDA, sources and deficiencies. Micronutrients -Macro minerals- Calcium, Phosphorus and magnesium: Functions, absorption, Recommended Dietary Allowance (RDA), sources and deficiencies.	10	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5	

III	 MINERALS AND VITAMINS Micro Minerals: Iron, Zinc, Fluorine and Iodine: function, absorption, RDA, sources and deficiency. Vitamins Fat-soluble Vitamins (A, D, E & K) Function, RDA, sources and deficiency and excess. Water soluble vitamins: Thiamin, Riboflavin, Niacin, B12, Folic acid, Biotin and Vitamin C: functions, Recommended Dietary Allowance, food sources, deficiencies and excess. Water and Electrolytes. Water: Functions, requirements, sources, water balance Electrolyte and acid base balance: Electrolyte- Sodium, Chloride, Potassium sources and RDA, function 	10	CO1, CO2, CO3, CO4 , CO5	K1, K2, K3, K4, K5
IV	KINESIOLOGY Movements-plane of movements-lateral-away from the median line- superior-nearer to the head-inferior- nearer to the foot-posterior-nearer to the back surface of the body – proximal –nearer to the origin of the structure –distal – away from the origin of the structure, superficial – nearer to the skin surface – deeper plane and axis of human body- classification of joints – movement of the joints – flexion, Extension, adduction, abduction, rotation, medial rotation, lateral rotation, circumduction.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	MUSCLES, POSTURES & EXERCISE Classification- voluntary, involuntary-smooth – cardiac- skeletal muscle structure-myosin. Major muscles- trapezium- latissimus dorsi- rower's muscle gluteus group of muscles- hamstring group of muscles-tibia – fibula – gastrocnemius group of muscles- pectoralis major and minor- rectus abdominis – triceps brahii- biceps – deltoid – thrower's muscle-forearms –Quadriceps group of muscles- sartorius muscle. Origin, insertion and movements. Posture & Gait: Characteristics of Normal posture and common postural abnormalities - Characteristics of Normal Gait and factors influencing it - Characteristics of Normal Running/jogging Gait and factors influencing it - Characteristics of Normal sprinting and factors influencing it.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Prescribed books/Text books

- 1. Anita F.P., Philip Abraham, Clinical Dietetics and Nutrition, Oxford University Press; 4 th edition.
- 2. Kathleen Mahan L., Sylnia Escott-Stump, Krause's food, nutrition and diet therapy (11th edition). Saunders Company, London.
- Passmore R. and Davidson S. (1986) Human nutrition and Dietetics. Liming stone publishers. 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. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
- 7. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
- 8. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.

References

- 1. Basic Anatomy and Physiology-Dr. N. Murugesh, Sathya publishers.
- 2. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.
- 3. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.
- 4. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New AgeInternational (P) Ltd.

Suggested Reading

- 1. Basic Anatomy and Physiology-Dr. N. Murugesh, Sathya publishers.
- 2. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.
- Passmore R. and Davidson S. (1986) Human nutrition and Dietetics. Liming stone publishers. Robinson C.H. Careme, Chenometh W.L., Garmick A.E. (1986) 16th edition.

Web Resources

- 1. NPTEL: Experimental Biotechnology; Bioreactor Design and Analysis; Nanotechnology, Science and Applications
- 2. Coursera: <u>Nanotechnology and Nanosensors</u>; <u>Materials Data Sciences and</u> <u>Informatics</u>
- 3. edX: Introduction to the Modern Nanotechnology; Principles of Biomanufacturing

	Weightage for Correlation	
$o \leq C \leq 5\%$	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	3

Mapping with Programme Specific Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2

Course	M. Sc.	ETHOLOGY	L	Т	Р	С	
code							
232ZO4E0	5						
Core/Elect	ive/Supportive	Practical	0	0	2	3	
Pre-requ	lisite	Knowledge about the behaviour of animals	Syllabu s Version				
Course Ob	jectives:						
The main of 1. draw a behavion 2. elucida scientific samplin 3. Enlight of anin	bjectives of this ttention to the be our principles te the behaviour fic research in the ng, analysis and over the importance nal diversity.	course are to: haviour of animals and provide a strong fo al concepts and pattern of animals; mode be field of animal behaviour from hypothe dissemination of findings be in understanding the behaviour for anim	undatior l the pro esis forr al welfa	n on th ocess nulati re and	he core of con ion, to d conse	animal ducting design, ervation	
Expected	Course Outcome	es:					
On the s	accessful comple	tion of the course, student will be able to:					
CO1	Conceptualize h environment and the day and sease	emporal imes of	K	1			
CO2	Skillfully impro experiments, und behavioural eco animal welfare.	ve their role while working with animals, lerstand statistics and pursue research in bel logy, conservation, evolutionary ecolog	design naviour, gy, and	K	2		
CO3	Apply knowleds interpret, summa literature; Critica	ge of behavioural theory to new situation rise, validate and critique data from the so ally evaluate the work of peers.	ons and cientific	K	3		
CO4	Understand and o successful conse welfare of both d	bjectively evaluate the current policies proprotion programmes and in regulation omestic and wild animals	posed for of the	K	4		
CO5 i	Consider and eva n the complex ec	luate behaviour of all animals, including he cological world, including the urban enviro	umans, nment	K	5		
K1 - Rer	nember; K2 - Ur	derstand; K3 - Apply; K4 - Analyze; K5 -	Evaluat	te;K6	-Creat	e	
Total ho	urs:24						
1. Identit behaviou	fication of comm ur. (10 nos.)	on birds in MCC campus to study the feed	ing and p	perchi	ing		

Mapping with Programme Specific Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2

2. Orientation of animals (cockroach, ant-lion larvae, maggots, earthworm, grasshopper and butterfly)

3. Mounting of mouthparts to study division of labour in termites.

4. Study of habituation in spider and in snail

5. Study of *Drosophila* eclosion rhythms.

6. Study of mouth parts in insects and feeding strategies

7. Study of learning in mice.

8. Establishment of the relation between brain and behaviour. (Fish to Mammals)

9. Human actions and gestures

10. Case study: Study of behaviour of animals in captivity/any one organism from MCC campus

Reference Books

1	Introduction to Animal Behaviour- Manning, A
2	Companion to Animal Behaviour- McFarland, D
3	Manwatching- Morris, Desmond
4	Essential Animal Behavior- Scott, Graham
5	Animal Behaviour: an evolutionary approach - Alcock, John
6	Curious Naturalists - Tinbergen, Niko
7	King Solomon's Ring- Lorenz, Konrad Z
8	The Foundations of Ethology- Lorenz, Konrad Z
9	Biological Timekeeping: Clock, Rhythms and Behaviour- Vinod Kumar
10	The wildlife techniques Manual Vol 1,2 - Nova J Silvy
Course	designed by: Dr. Anulin Christudhas

AVG	1	1	3	2	3	1	2	2	2	1.2	1	2
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Course	M.Sc.	ENDOCRINOLOGY - PRACTICAL	L	P	С		
code							
232ZO4E06							
Core/Elective/	/Supportive	Elective I	0	0	2	2	
D		Basic knowledge about Endocrine system and	Syllabus 2021-				
Pre-requisite	•	its management.	Version 2022				

Course Objectives:

The main objectives of this course are to:

- To enable the student to understand and acquire fundamental knowledge about the endocrine glands, their location and secretion.
- To provide in-depth knowledge about hormone mechanism and also its dysregulation leading to various disease condition.
- To gain knowledge about the Pancreatic regulation and energy balance of hormones.
- To gain insight about the neuroendocrine physiology and function of hormones and diseases originating in the neuroendocrinologic system.
- To impart knowledge in advance concepts in reproductive endocrine system. **Expected Course Outcomes:**

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

CO1	To understand and identify the endocrine glands with their specific cell	K1							
	type.								
CO2	They will understand the mechanism of hormone action.	K2							
CO3	They will apply to relate hormone on developmental process and immune	К3							
	system.								
CO4	Will help the students to focus and understand the clinical disorder related	K4							
	to endocrine system.								
CO5	Student will access to evaluate the physiological mechanism underlining	K5							
	hormone action and function.								
K1 - Re	member; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate; K6 -Cr	eate							
Total h	ours:24								
1. Observation of histological slides: Pituitary, Thyroid, Adrenal, Pancreas, Thymus,									
2. 01	vary and Testis.								

- 3. Dissection and localization of endocrine glands in, Rat/ Mice/ frog / Wall lizard/ Japanese quail.
- 4. Ectomy experiments: Adrenalectomy, Castration, Ovariectomy in lab mice/ wall lizard (any one)
- 5. Glucose Tolerant Test experiments used to find out prediabetes, diabetes and gestational diabetes.
- 6. Role of Thyroxin hormone in the metamorphosis of frog
- 7. Study of estrous cycle in mice by performing vaginal smear.
- 8. Pregnancy test- human Chorionic Gonadotropin ELISA
- 9. Paper chromatographic separation of corticoids.
- 10. HPLC demonstration to acquire knowledge about isolation and collection of hormone fraction.
- 11. Visit to Endocrinology lab at ALMPGIBMS, Taramani, Chennai.

R	Reference Books									
1.	Text Book of Endocrinology- Williams- XII edition 2012- W.B. Saunders, USA.									
2.	Endocrinology- Mac E. Hadley – 2006 Edn. Prentice Hall International Inc.									
3.	Comparative Vertebrate Endocrinology- B.J. Bentely – V th Edition 2012- Cambridge University Press.									
4.	Harrison's endocrinology – J. Larry Jameson, Dennis Kasper and Anthony Fauci Rockwell									
	enterprises, revised 4 th edition, Mc graw hill Education.									
Co	ourse Designed By: Dr. M.Akila									

Mapping with Programme Specific Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5

CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2
							2.6					1.64

Col	irse	M.Sc.	RESTORATION ECOLOGY	L	T P							
232	1e ZO4F0'	7	PRACTICAL									
<u>252</u> Co	re/Elec	tive		_								
/ S	upport	ive	Core Elective	0	0	2	3					
	••		Adequate understanding of the concepts	Syllaby								
P	re-requ	isite	of ecosystem, biodiversity and	2021-2022								
			the reasons for their degradation	s Version								
Co	ourse O	bjectives:										
	1. To	understand	the principles and concepts of ecosystems									
2. To understand the reasons for degradation of an ecosystem												
	3. To foresee the results and the remedial measures for restoration.											
4. To restore the degraded ecosystem to its near-original status.												
Ex	pected	Course Ou	tcomes:									
C	01	Awareness	of important factors that contribute to healthy	7	K	1						
		ecosystem										
CC)2	Understand	ling the factors responsible for restoration		K	2						
CC)3	Overall ide	ea of the principles involved in the success of		K4							
		restoration										
CC)4	The metho	dology of involving Microbes in restoration pr	rocess	K3 & K4							
CC)5	Evaluation	of the restoration that has happened in the ecc	the ecosystem K5								
K	1 - Ren	nember; K2	- Understand; K3 - Apply; K4 - Analyze; K5	– Evaluate	e;K6	-Crea	ate					
Т	otal Le	cture hours	::24									
	1. Iden	tifying stres	ssors in a degrading (aquatic) ecosystem									
	2. Iden	ntifying stre	essors in a degrading (terrestrial) ecosystem									
	3. Idei	ntification o	of species of significance (keystone, pioneer,	climax, fl	agsh	ip) iı	n					
	diff	erent ecosy	stems									
	4. Ene	rgetics plot	ting of an ecosystem									
	5. Exp	erimenting	in a degrading ecosystem									
	6. Kes	toration de	sign and process for this ecosystem									
	7. B101	remediation	1 of oil spill using microbes $(2+2 \text{ hrs})$									
	0. KIII 0. Fiol	d visit to ro	stored access to study the process of re-	storation								
	7. FICI	sure of res	toration	5101 411011								
R	eferenc	e Book(s)	*******									
1.	Found	ations of Re	storation Ecology, by D.A. Falk, M.A. Palmer	and J.B. 2	Zedle	r						
	(2006)	Island Press)									
2.	Primer	s of Ecolog	ical Restoration y Karen D. Holl									
3.	Introdu	iction to Re	storation Ecology by E.A. Howell, J.A. Harrin	gton and S	S.B. (Glass	5					
4.	Enviro	nmental Sci	ence - A Global Concern by W.P. Cunningha	am and M.	A.							

Cunningham, Mc Graw Hill Publications

Course Designed by: Dr. J. Logamanya Tilak & Dr. Niren Andrews (Microbiology)

Mapping with Programme Specific Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2

Course	M Sc	NUTRITION, DIETETICS	т	C								
code	WI.SC.	AND KINESIOLOGY		1		C						
232ZO4E0 Core/Elec	8 ctive/Supportive	Practical EII	0	0	2	3						
		Basic knowledge about the diet intake of		buc	202	1_						
Pre-requ	uisite	individuals and the need for daily evention	Зупа Мат	bus	202	1-						
		individuals and the need for daily exercise.	versi	lon	202.	2						
Course O	bjectives:											
The main objectives of this course are to:												
 Use of scientific principles, scientific investigation, and current technological advances to assess the relationship between diet, physical fitness, and disease. 												
2. Ex ex	amine scientific l ercise performand	literature to evaluate the effects of nutritional interver ce.	ntion o	on								
3. St life	tudents will cultive forms.	vate knowledge of the scientific study of the physical	unive	rse oi	r its							
4. Stube	 Students will understand and appreciate the interrelationship of science and human beings to each other. 											
5. Ex it a	aercises are neede and to analyze its	d for every individual, hence a basic knowledge as to significance.	why	we re	equir	e						
Expected	Course Outcom	es:										
On the su	uccessful complet	tion of the course, student will be able to:										
CO1	Explain how the composition, ene physical changes other.	principles of fitness and nutrition (such as body orgy intake and expenditure, acute and chronic related to exercise and nutrition) complement each		K2	2							
CO2	Identify social, cr influence food ha	ultural, ethnic, and environmental factors that abits and exercise/activity patterns.		K∠	& K	5						
CO3	Examine the bioc and various nutri	chemical and physiological effects of exercise tional practices.		K2	2							
CO4	Describe the diff	erent exercise guidelines and nutritional requirements	3	K	3 & K	(4						
	related to gender	and diverse populations.										

	Assess the advantages/disadvantages of recent advances in new food										
	formulations, and new exercise and fitness equipment for the general										
	population										
CO	5 To understand and analyze the role of bones, joints and muscles in K4 & K5										
	then day to day me.										
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate: K6-Create											
Total lecture hours-24											
1. Weights and measures											
2.	Standardization of recipes.										
3.	Introduction to Recommended Dietary Allowances/Nutritive value of foods.										
4.	Calculation of energy balance among college students.										
5.	Enhancing the traditional recipes with specific nutrients (protein, carbohydrate, fat, vitamin										
	A, vitamin C, calcium and iron).										
6.	6. Carbohydrate, protein and fat estimation										
7. Analysis of forces on the shoulder, elbow, wrist, hand during activity.											
8.	Mechanics and Pathomechanics of intrinsic of the muscles of the hand, pinch and grasp.										
9.	Analysis of the forces on the Tempero-mandibular joint (TMJ) during activity.										
10	Analysis of different Postures- Pulling, pushing, jumping, balancing, Running, Jogging.										
Fa	culty members from Physical Education will be involved in handling few practical.										
Re	ference Books										
1.	Basic Anatomy and Physiology-Dr. N. Murugesh, Sathya publishers.										
2.											
	Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.										
3.	Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic										
	Excellence.										
4.	Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New AgeInternational (P) Ltd.										
Co	Course Designed By: Dr. Ananthi Rachel Livingstone										

Mapping with Programme Specific Outcomes												
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	2	3	1	2	3	2	2	1	2
CO2	1	1	3	2	3	1	2	3	2	-	1	2
CO3	1	1	3	2	3	1	2	3	2	2	1	2
CO4	1	1	3	2	3	1	2	3	2	2	1	2
CO5	1	1	3	2	3	1	2	3	2	-	1	2
AVG	1	1	3	2	3	1	2	2	2	1.2	1	2

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