

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.) Uthamapalayam, Theni District. Pin Code: 625 533.

DEPARTMENT OF ZOOLOGY

MASTER OF SCIENCE – ZOOLOGY

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE/MKU Guidelines)

with

Outcome Based Education (OBE)

(Academic Year 2020 - 2021 onwards)

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.) Uthamapalayam, Theni District. Pin Code: 625 533.

Name of the Programme: M.Sc. Zoology

Choice Based Credit System (CBCS) (As per TANSCHE/MKU Guidelines)

with Outcome Based Education (OBE)

(with effect from the Academic Year 2020 – 2021)

College Vision and Mission

Vision

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duty-bound citizens to take up the challenges of the changing times.

Mission

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons the Mission continues forever.

Programme Educational Objectives (PEO)

Our graduates will be progressive, efficient, value based, academically excellent, creative, collaborative, empowered and globally competent literates with the skills required for societal change.

They will demonstrate

PEO1	Comprehensive knowledge and expertise, employability, the acumen of creative and critical thinking, the spirit of enquiry and professional attitude required for a successful career
PEO2	Accountability, linguistic competence and communication skills in the work environment and beyond
PEO3	Perseverance, effective collaboration, team spirit, leadership and problem solving skills
PEO4	Keen sense of civility, professional ethics, receptivity and moral righteousness
PEO5	Commitment to address social and environmental threats and to act as responsible service-minded, duty-bound global citizens

Department Vision and Mission

Vision

We aim to attain excellence through high-quality education and research pertaining to local, regional and national requirements, and through collaboration with various researchers and educators across Tamil Nadu and India We look forward to indoctrinate the highest morals of life, respect for Mother Nature and concern for ethical values among students for establishing the sustainable environment. **Mission**

Mission

- To instigate an awareness of the need to explore, identify and conserve biodiversity To create an attractive and enthusiastic department where students want to come and study
- To train students in zoological sciences and to equip them to apply themselves in activities requiring zoological expertise (Certificate course). Ultimately, our mission is to make our students self employable
- Our Postgraduate level training aims to provide a clear understanding of the whole animal kingdom, its systematics, development, physiology, evolution and conservation. At postgraduate level, we strive to maintain a high level of scientific excellence in achieving hands on experience on various techniques (via internship programmes) along with budding research activities (Project work)
- To constantly improve the quality of our teaching and promoting research
- To involve the department in community-based and outreach activities, whenever and wherever possible Affordable quality education to weaker part of the society
- To elevate the post graduate department of Zoology as the class academic and research centre of Madurai Kamaraj University

Programme Outcomes (PO)

On the successful completion of M. Sc., Zoology programme, the students will be able to

P01	Students gain knowledge and skill in the fundamentals of animal sciences,
FUI	understands the complex interactions among various living organisms.
	Analyse complex interactions among the various animals of different phyla,
F U2	their distribution and their relationship with the environment.
	Apply the knowledge of internal structure of cell, its functions in control of
PO3	various metabolic functions of organisms & complex evolutionary processes
	and behaviour of animals.
	Correlates the environmental conservation processes & physiological processes
104	of animals and relationship of organ systems.
DOS	Gain knowledge of Agro based Small Scale industries like sericulture, fish
F 03	farming, butterfly farming and vermicompost preparation.

Program Specific Outcomes (PSO)

A graduate of M. Sc. Zoology after two years will

	Identify the major groups of organisms with an emphasis on animals and
DCO1	be able to classify them within a phylogenetic framework. Students will be
1301	able to compare and contrast the characteristics of animals that
	differentiate them from other forms of life.
	Understand the basic concepts in cell and its components which are used
F 302	to generate and utilize energy besides the development of various animals.
	Competence in distinguishing the anatomy of various animals and
PS03	understand the physiological process.
	Explicate the ecological interconnectedness of life on earth by tracing
F304	energy and nutrient flows through the environment.
	Ability to apply fundamental statistical tools and physical principles
P305	(Physics, Chemistry) to the analysis of relevant biological situations.

Programme Scheme Eligibility

A candidate who has passed B.Sc. degree examination conducted by the affiliated universities with Chemistry/ Botany as one of the subject accepted by the Syndicate as equivalent is eligible for the Master of Science – Zoology Degree. Duration of the Course: M.Sc., Zoology – 2 years (4 Semesters). Medium of instruction: English.

For Programme Completion

A Candidate shall complete:

- Part III Core papers in semesters I, II, III and IV respectively
- Part III Elective papers in semesters I, II, III and IV respectively
- Part IV Non- Major Elective papers in semester III

Scheme of Examinations under Choice Based Credit System

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examinations (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Seminar / Quiz / Assignment	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examinations (Max. Marks: 75 / Time: 3 Hours) External Examinations Question Paper Pattern

Section – A (10 X 1 = 10 Marks) Answer ALL questions.

- Questions 1 10
- Two questions from each unit
- Multiple choice questions and each question carries Four choices

Section – B (5 X 7 = 35 Marks)

Answer ALL questions choosing either A or B.

- Questions 11 15
- Two questions from each unit (either.... or.... type)
- Descriptive Type

Section – C (3 X 10 = 30 Marks) Answer any THREE out of five questions.

- Questions 16 20
- One question from each unit
- Descriptive Type

Passing Marks

Minimum 34 for External Exam Eligibility for the degree – passing minimum is **50%**

Practical Examination

Internal – 40 marks External – 60 marks Total – 100 marks Passing minimum is **40%**

Weightage

Waightaga for Bloom's Tayonomy	Porcontago	Marks		
weightage for bloom's raxonomy	reitentage	CIAE	TEE	
Knowledge (Remembering) – K1	10	2	7	
Understanding – K2	10	3	8	
Applying – K3	20	5	15	
Analyzing – K4	20	5	15	
Evaluating – K5	40	10	30	
Gross Total	100	25	75	

Assessment

Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total	
Knowledge(K1)	aowledge(K1) 3 (3)1 (a or b) (4)				
Understanding(K2)	3 (3)	1 (a or b) (4)		40 Marks	
Apply(K3)	1 (1)	1 (a or b) (4)	1 (8)		
Analyzing (K4)	1 (1)	1 (a or b) (4)	1 (8)		
CIA Examinations conducted for 40 marks and converted to 20 marks					
Evaluating (K5)	10/2 = 5				

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	7 (7)			
Understanding(K2)	1 (1)	1 (a or b) (7)		
Apply(K3)	1 (1)	2 (a or b) (14)		Total 75 Marks
Analyzing (K4)	1 (1)	2 (a or b) (14)		
Evaluating (K5)			3 out of 5 (30)	

Note: Figures in parenthesis are Marks

Course	Course	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits	
category	Coue	Semester – I				Marks		
Part – III (OBE)								
Core – I	20PZYC11	Biology of Non Chordates, Vertebrates & Palaeontology	5	25	75	100	5	
Core – II	20PZYC12	Genetics	5	25	75	100	4	
Core – III	20PZYC13	Cell & Molecular Biology	5	25	75	100	4	
Core – IV	20PZYP11	Biology of Nonchordates , Vertebrates, Palaeontology, Genetics, Cell and Molecular Biology and Biotechnology	10	40 60		100	5	
Flective - I	20PZYE11	Biotechnology	ц	25	75	100	5	
Liective - I	20PZYE12	Stem Cell Biology	J	23	75	100	5	
Total 30 500 23							23	
Semester – II								
	Part – III (OBE)							
Core – V	20PZYC21	Microbiology & Immunology	5	25	75	100	4	
Core – VI	20PZYC22	Animal Physiology	5	25	75	100	5	
Core – VII	20PZYC23	Ecology & Biodiversity	5	25	75	100	4	
Core – VIII	20PZYP21	Microbiology & Immunology, Animalphysiology, Ecology Biodiversity, Ethology & Vermitechnology.	10	40	60	100	5	
Flective - II	20PZYE21	Animal Behaviour	5	25	75	100	Ę	
	20PZYE22	Vermitechnology	5	23	75	100	J	
		Total	30			500	23	

Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits	
Semester – III								
	Part – III (OBE)							
Core – IX	20PZYC31	Developmental Biology	6	25	75	100	5	
Core – X	20PZYC32	Biological Chemistry & Biophysics	6	25	75	100	5	
Core – XI	20PZYP31	Developmental Biology, Biological Chemistry,104060100Biostatistics & Bioinformatics104060100					5	
Elective - III	20PZYE31	Biostatistics & Bioinformatics	5	25	75	100	5	
	20PZYE32	Cancer Biology						
Part – IV								
NME	20PZYN31	Aquarium Science	3	25	75	100	3	
Total 30 500 23								
Semester – IV								
Part - III (OBE)								
Core – XII	20PZYC41	General & Applied Entomology	5	25	75	100	4	
Core – XIII	20PZYC42	Parasitology	5	25	75	100	4	
Core – XIV	20PZYC43	Project	10	-	100	100	4	
Core – XV	20PZYP41	General and Applied Entomology	5	25	75	100	4	
	20PZYE41	Wild Life Management	-	25		100		
Elective - IV	20PZYE42	Aquaculture & Farm Management	5	25	/5	100	5	
		Tota	l 30			500	21	
		Grand Tota	l 120			2000	90	

Course Code	Course Title	Category	Total Hours	Credits
20D7VC11	Biology of Non Chordates,	Coro I	75	5
ZUFZICII	Vertebrates & Palaeontology		73	5

Nature of Course			
Knowledge Oriented	✓		
Skill Oriented			
Employability Oriented			
Entrepreneurship Oriented			

Course Relevance			
Local			
Regional			
National			
Global	\checkmark		

Students are enabling to get the knowledge on taxonomy, comparative biology of various organisms and the role of fossils in identifying the time of origin of species.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Identify, distinguish and categorize the non-chordates from chordates	K1,K2,K3,K4
	CO2	Compare and explain organ systems of animals according to the hierarchy	K1,K2,K3,K4,K5
	CO3	Compare the organisation of alimentary canal and heart in different vertebrates	K1,K2,K3,K4,K5
	CO4	Explain how animals belonging to different habitat will respire besides comparing the excretory system and influence of accessory glands in reproduction across vertebrates	K1,K2,K3,K4, K5
	CO5	Explain the less diverse minor phyla and estimate the time travel of organisms through time from the fossil deposits	K1,K2,K3,K4,K5
K	1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low 2-Medium		dium		3-Strong	

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
L-Low 2-Medium			3-Strong		

1-LOW

Syllabus

15 Hours

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 - International code of Zoological nomenclature. - Locomotion in Annelids, Nutrition in Polychaetes, Molluscs and Echinoderms.

UNIT II

UNIT I

15 Hours

Respiration: Respiration in Arthropods and Molluscs-Different types of excretory organs in Invertebrates and their structure and function -Nervous system in Arthropods and Echinoderms

UNIT III

15 Hours

Integumentary System: Integumentary system - Skin of Mammals -Glands - Hairs - Scales - Horns - Skin pigments. Comparative study of Digestive system and Circulatory system of Chordates. Dentition in Mammals, Stomach in Mammals, Evolution of Aortic arches.

UNIT IV

Respiration in Fishes – Pulmonary respiration in Tetrapods - Excretory system – types and Evolution of Kidneys-Reproductive system –Accessory reproductive glands- Appendicular skeleton – Pectoral and Pelvic girdles of different classes.

UNIT V

15 Hours

Minor Phyla: Rotifers, Phoronids and Chaetognatha Origin of Bilateria and evolution of Metazoans - Invertebrate fossils - Evolutionary trends and Phylogenetic importance of Trilobites, Ammonoids, Belemnoids, Nautiloids and Echinoid fossils. Vertebrate fossils: Dinosaurs and Archaeopteryx.

Text Books

Jordan, E.I. and Verma, P.S- *Invertebrate Zoology*, S.Chand & Co Limited, New Delhi, 2014.

Kotpal, R.L. *Modern Text Book of Zoology, Invertebrates* (Animal diversity – I), Rastogi Publications, Meerut, 2012.

Kotpal, R.L. *Modern Text Book of Zoology*, Vertebrates, Rastogi Publications 5th Edition ,Meerut, 2019.

Reference Books

Barnes, R.D. *Invertebrate Zoology*, Holf Saunders International edition, IV Edition, 2006.

Ekambaranatha Ayyar and Ananthakrishnan, T.N. *A manual of Zoology,* volume I, Invertebrate, Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2005. Ekambaranatha Ayyar and Ananthakrishnan, T.N, *A manual of Zoology,* volume II, Vertebrates, Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2005.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

15 Hours

Course Contents and Lecture Schedule

Module	lule		Content Delivery					
No.	Горіс	Lectures	Methods					
UNIT - I								
1.1	Principlesofanimaltaxonomy.Terminology - systematics - nomenclature-taxonomy - classification - identification -taxon - phenon - cladon and siblings	5	Chalk & Talk					
1.2	Biological species concepts - definition of species, genus, variety, race, strain and breed - Naming of species, sub-species, genera - International code of Zoological nomenclature.	5	E-Resources					
1.3	Locomotion in Annelids, Nutrition in Polychaetes, Molluscs and Echinoderms.	5	Discussion					
	UNIT - II							
2.1	Respiration in Arthropods and Molluscs	5	Chalk & Talk					
2.2	Different types of excretory organs in Invertebrates and their structure and function	5	E-Resources					
2.3	Nervous system in Arthropods and Echinoderms	5	Discussion					
	UNIT - III							
3.1	Integumentary system – Skin of Mammals - Glands – Hairs – Scales – Horns – Skin pigments	3	Chalk & Talk					
3.2	Comparative study of Digestive system	2	E-Resources					
3.3	Circulatory system of Chordates	4	Discussion					
3.4	Dentition in Mammals, Stomach in Mammals	3	E-Resources					
3.5	Evolution of Aortic arches	3	Discussion					
	UNIT - IV							
4.1	Respiration in Fishes – Pulmonary respiration in Tetrapods.	3	Discussion					
4.2	Excretory system – types and Evolution of Kidneys.	4	Chalk & Talk					
4.3	Reproductive system – Accessory reproductive glands.	4	E-Resources					

4.4	Appendicular skeleton – Pectoral and Pelvic girdles of different classes.	4	Discussion
	UNIT - V		
5.1	Minor Phyla: Rotifers, Phoronids and Chaetognatha	6	Chalk & Talk
5.2	Origin of Bilateria and evolution of Metazoans	3	E-Resources
5.3	Invertebrate fossils - Evolutionary trendsandPhylogeneticimportanceofTrilobites,Ammonoids,Belemnoids,Nautiloids and Echinoid fossils	4	Discussion
5.4	Vertebrate fossils: Dinosaurs and Archaeopteryx	2	Chalk & Talk
	Total	75	

Course Designer Dr. M. Ashiq Ur Rahman

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC12	Genetics	Core -II	75	4

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	✓

It educates the students on the patterns of inheritance, knowledge in simple Mendelian inheritance concept of linkage and disorders of genetic origin.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Demonstrate Mendel's laws of inheritance and recognize the deviations from them	K1, K2
CO2	Explain principles of genetic linkage and chromosome mapping	K1, K2
CO3	Justify the nature of various genetic disorders, their diagnosis and origin	K1, K2, K3, K4, K5
CO4	Categorize the genetic disorders which play a vital role in various metabolic activities	K1, K2, K3, K4
CO5	Identify the syndromes and develop knowledge on genetic counseling to treat various genetic disorders	K1, K2, K3
K1-Kno	owledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low 2		2-Me	dium	•	3-Strong

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
-Low 2-Medium				3-Strong	

Mapping of CO with PSO

1-Low

Syllabus

UNIT I

15 Hours

15 Hours

Genetic Linkage - Lod score for linkage, Epistasis, Lethality– Linkage in human beings testing- Somatic cell hybridization – Mechanism of crossing over – Gene mapping in chromosome by crossing over method. Structure of a Gene – cistron, muton, recon, introns, and exons – over lapping genes.

UNIT II

Gene families – RNA Splicing – Cis-trans splicing – tRNA processing – DNA recombination at the molecular level – Role of RecA and Rec B C D enzymes. Gene regulation: The Operon concept- *lac* operon, *trp* operon and *ara* operon system in bacteria – DNA replication – Gene regulation in eukaryotes: Short term regulation and Long term regulation.

UNIT III

15 Hours

Bacteria: Genetic material – Parasexual processes in bacteria: transformation, conjugation, sexduction, and transduction – Mapping of bacterial chromosomes – Biology of plasmids –Transposon – types and mechanism of transposition. Phages: Genetic material – recombination in phages – Fine structure of rII locus in T4 phage- mapping genes by interrupted mating.

UNIT IV

15 Hours

Chromosomal Aberrations – DNA Damage and repair mechanisms – Molecular basis of mutations. Inborn errors of metabolism: Phenylketonuria, Alkaptonuria, Albinism, Lesch-Nyhan syndrome, ADA deficiency, Galactosemia, G6PD deficiency, Tay Sachs disease and Gaucher's disease.

UNIT V

15 Hours

Human Karyotype: preparation and analysis- Chromosomal syndromes in man, Detecting genetic disease- Genetic counseling, Prenatal diagnosis, Genetic disease-Treating genetic disease- Altering genetic trait.

Text Books

Benjamin Levin, *Genes VIII*, Oxford University Press, New York, 2015. Verma., S. And Agarwal., V.K., *Genetics*, S. Chand & Co., New Delhi, 2009, Ninth Edition.

Reference Books

Ursula Goodenough, *Genetics*, Saunders College Publishing Co., London, 2014.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module	odule Topic		Content Delivery
No.	горіс	Lectures	Methods
	UNIT - I		
	Genetic Linkage - Lod score for linkage,		
1.1	Epistasis, Lethality– Linkage in human	3	Chalk & Talk
	beings testing		
1 2	Somatic cell hybridization – Mechanism of	2	Discussion
1.2	crossing over	5	Discussion
1 2	Gene mapping in chromosome by crossing	3	F-Resources
1.5	over method	5	E-Resources
	Structure of a Gene – cistron, muton,		
1.4	recon, introns, and exons – over lapping	6	E-Resources
	genes		
	UNIT - II		
21	Gene families – RNA Splicing – Cis-trans	2	Chalk & Talk
2.1	splicing – tRNA processing	L	Chair & Tair
22	DNA recombination at the molecular level	3	F-Resources
2.2	– Role of RecA and Rec B C D enzymes.	5	L Resources
	Gene regulation: The Operon concept- lac		
2.3	operon, trp operon and ara operon	5	E-Resources
	system in bacteria		
	DNA replication – Gene regulation in		
2.4	eukaryotes: Short term regulation and	5	E-Resources
	Long term regulation		

	UNIT - III				
3.1	Bacteria: Genetic material – Parasexual processes in bacteria: transformation, conjugation, sexduction, and transduction	6	E-Resources		
3.2	Mapping of bacterial chromosomes – Biology of plasmids –Transposon – types and mechanism of transposition.	4	Chalk & Talk		
3.3	Phages: Genetic material – recombination in phages	2	Discussion		
3.4	Fine structure of rII locus in T4 phage- mapping genes by interrupted mating.	3	E-Resources		
	UNIT - IV				
4.1	Chromosomal Aberrations – DNA Damage and repair mechanisms – Molecular basis of mutations.	5	E-Resources		
4.2	Phenylketonuria, Alkaptonuria, Albinism, Lesch-Nyhan syndrome, ADA deficiency	5	E-Resources		
4.3	Galactosemia, G6PD deficiency, Tay Sachs disease and Gaucher's disease	5	E-Resources		
	UNIT - V				
5.1	Human Karyotype: preparation and analysis	3	E-Resources		
5.2	Chromosomal syndromes in man	3	PPT		
5.3	Detecting genetic disease- Genetic counseling	3	Discussion		
5.4	Prenatal diagnosis, Genetic disease- Treating genetic disease- Altering genetic trait.	6	Discussion		
	Total	75			

Course Designer Ms. A. Syedali Fathima

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC13	Cell and Molecular	Core - III 75		1.
	Biology		JIE - III 75	т

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

In-depth knowledge and understanding on principles involved in the cell culture techniques and also students are enthusiastic to know molecular techniques.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Explain the structure, functions and properties of cell membrane	K1, K2
	CO2	Discuss the mechanisms and control of inter-cellular communication.	K1,K2
	CO3	Evaluate the events involved in transcription and post transcriptional modifications.	K1, K2, K3,K4,K5
	CO4	Demonstrate influence of cell communication, signalling and molecule transport	K1,K2
	CO5	Analyze regulation of gene expression and regulation.	K1,K2,K3,K4
K	1-Knov	vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	P02	PO3	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low	Low 2-Medium 3-Stro		3-Strong		

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
l-Low		2-Me	dium	•	3-Strong

Mapping of CO with PSO

1-Low

Syllabus

UNIT I

15 Hours

15 Hours

15 Hours

15 Hours

Methods of Cell Study: Introduction of Cell study: Micrometry - Cell culture methods - Cell fractionation techniques - Cytophotometry-Immunocytochemistry - Autoradiography - Cytochemical staining and detection methods of Carbohydrates- Protein- Lipids- DNA and RNA.

UNIT II

Cell Structure and Function: The nuclear envelope and traffic between the nucleus and cytoplasm: Structure of nuclear envelope - Nuclear pore complex - Nucleolus- Mitochondria- Energy Transduction. Protein sorting and transport: The endoplasmic reticulum- Golgi apparatus and lysosomes. **15 Hours**

UNIT III

DNA, RNA and Protein Synthesis: DNA replication- Mechanism in prokaryotes and Eukaryotes - Role of RNA primers in DNA replication-Satellite DNA - DNA damage and repair- DNA topology- DNA super coiling-Role of DNA topology in replication and transcription- Post-translational modifications and confirmations of proteins- Types of RNA- Mechanism of splicing in prokaryotic transcription and eukaryotic transcription.

UNIT IV

Cell Communication, Signaling and Molecule Transport: General principles of cell communication and adhesion- Signaling at the cell surface- Types of Signaling pathways that control gene activity- Integration of signals and gene controls- Movement of proteins into membranes and organelles- Metabolism and movement of lipids.

UNIT V

Gene Expression and Regulation: Regulation of gene expression in prokaryotes and eukaryotes - Attenuation and antitermination- DNA methylation - Heterochromatization - Transposition - Regulatory sequences and transacting factors - Environmental regulation of gene expression- Chi sequences in prokaryotes- Gene targeting- Gene disruption- FLP/FRT and Cre /Lox recombination.

Text Books

Watson JD, Baker TA, Bell SP, Alexander G and Levine M, *Molecular Biology of the Gene*, Benjamin-Cummings Pub Co., San Francisco, USA, 2013, 7th Edition. De Robertis EDP and De Robertis EMF, *Cell and Molecular Biology*, BI Waverly Pvt. Ltd, New Delhi, 2010, 7th Edition.

Reference Books

Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P, *Molecular Biology of the Cell*, Garland Science Publisher, New York, 2002, 3rd Edition.

Karp G, *Cell Biology*, John Wiley & Sons, New York, 2010, 6th Edition.

Brown TA, *Genomes*, Garland Science (Taylor & Francis Group), New York, 2017, 4th Edition.

Hartl DL and Jones WJ, *Genetics - Analysis of genes and genomes*, Jones & Barlett Publishers, Massachusetts, 2005, 6th Edition.

Krebs JE, Goldstein ES and Kilpatrick ST, *Lewin's Genes XI*, Jones and Barlett learning, Burlington, MA, 2014.

Geofferey M. Cooper and Robert E. Hausman, *The Cell – A Molecular approach*, Asm Press, Washington D.C. USA, 2004, 3rd Edition.

Alberts et al. *Molecular biology of the Cell*, Garland Science, a member of the Taylor and Francis group, New york, USA, 2002, 4th Edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module	Topic	No. of	Content Delivery
No.	Topic	Lectures	Methods
	UNIT - I		
1.1	Introduction of Cell study: Micrometry - Cell culture methods.	3	Chalk & Talk
1.2	Cell fractionation techniques.	2	E-Resources
1.3	Cytophotometry, Immunocytochemistry and Autoradiography.	5	Discussion
1.4	Cytochemical staining and detection methods of Carbohydrates.	2	E-Resources
1.5	Protein- Lipids- DNA and RNA.	3	Discussion

UNIT - II					
2.1	The nuclear envelope and traffic between the nucleus and cytoplasm.	2	Discussion		
2.2	Structure of nuclear envelope.	3	Chalk & Talk		
2.3	Nuclear pore complex – Nucleolus.	2	E-Resources		
2.4	The nuclear envelope and traffic between the nucleus and cytoplasm: Mitochondria.	3	E-Resources E-Resources		
2.5	Protein sorting and transport: The endoplasmic reticulum.	2	Discussion		
2.6	Golgi apparatus and lysosomes.	3	Discussion		
	UNIT - III				
3.1	DNA replication - Mechanism in prokaryotes and Eukaryotes.	2	E-Resources		
3.2	Role of RNA primers in DNA replication- Satellite DNA - DNA damage and repair	2	Chalk & Talk		
3.3	DNA topology- DNA super coiling- Role of DNA topology in replication and transcription	3	Discussion		
3.4	Post-translational modifications and confirmations of proteins	2	E-Resources		
3.5	Types of RNA- Mechanism of splicing	2	Discussion		
3.6	Prokaryotic transcription and eukaryotic transcription	4	Discussion		
	UNIT - IV				
4.1	General principles of cell communication and adhesion- Signaling at the cell surface.	4	Discussion		
4.2	Types of Signaling pathways that control gene activity.	4	E-Resources		
4.3	Integration of signals and gene controls- Movement of proteins into membranes and organelles.	4	Chalk & Talk		
4.4	Metabolism and movement of lipids.	3	E-Resources		
	UNIT - V				
5.1	Regulation of gene expression in prokaryotes and eukaryotes	2	E-Resources		
5.2	Attenuation and antitermination - DNA methylation.	2	Chalk & Talk		

5.3	Heterochromatization - Transposition - Regulatory sequences and transacting factors.	3	Discussion
5.4	Environmental regulation of gene expression- Chi sequences in prokaryotes-	2	E-Resources
5.5	Gene targeting- Gene disruption- FLP/FRT and Cre /Lox recombination.	3	E-Resources
5.6	Regulation of gene expression in prokaryotes and eukaryotes	3	E-Resources
	Total	75	

Course Designer

Ms. P. Vinnoli

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYP11	Biology of Nonchordates ,			
	Vertebrates, Palaeontology,	Coro IV	150	5
	Genetics, Cell and Molecular	core - Iv		
	Biology and Biotechnology			

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

To enable the students acquire knowledge on diversity of animals with or without backbones and improve the genetic, cellular, molecular, bio techniques and dissection techniques among the students.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Develop dissection technique and Explain the functional anatomy of selected invertebrates	K1,K2,K3,K4,K5
CO2	Compare the external Characters, classify the affinities and adaptive features of Various vertebrates.	K1,K2,K3,K4,K5
CO3	Identify the chromosome complement number of an individual, mutants and discuss the Principle of segregation, genotype frequency in a population	K1,K2,K3,K4,K5
CO4	Determine the membrane composition and elaborate the structural features of component macromolecules in different cells	K1,K2,K3,K4,K5
CO5	Evaluate the genomic organization of living organisms, Estimation of macromolecules, Blotting and amplification techniques	K1,K2,K3,K4,K5
K1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
1-Low	-	2-Me	dium		3-Strong

Manning of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
Laru		2 Ma	dimme) Christian a

1-Low

2-Medium

3-Strong

Syllabus

Biology of Nonchordates Vertebrates Palaeontology

- 1. Identification and study the selected Protozoans and Helminthes of medical importance.
- 2. Identification and study the larval forms all major phyla of Invertebrates.
- 3. Mounting: Honey bee Mouth Parts- Honey Stomach-Sting-Wings- Legs.
- 4. Mouth parts of Housefly-Thrips-Mosquito-Bed bug and Butterfly to relate structure and type.
- 5. Spotters: Invertebrate larval forms Minor Phyla : Rotifera- Phoronida-Chaetognatha
- 6. Dissections: Prawn- Appendages.
- Study of the following specimens to bring out their affinities: Amphioxus Balanoglossus - Ascidian – Peteromyzon.
- 8. Study of the following specimens with Reference to their adaptive features for their respective modes of life: Echeneis- Ichthyophis - Hyla- Draco-Pigeon- Bat.
- 9. Study of the following skull types with Reference / Books to jaw suspensions: Fish- Frog -Calotes Rat / Rabbit.
- 10. Mounting: Teleost: Scales.
- 11. Dissections: Frog: V Cranial and Spinal nerves using CD ROM animal alternatives-Crab: Nervous System.
- 12. Invertebrate fossils: Ammonoids- Belemnoids- Nautiloids- Echinoid.

Genetics

- 1. Drosophila culture Identification of mutants and sexes
- 2. Fish Karyotyping
- 3. Hardy-Weinberg Law and Calculation of gene frequency using Beads Codominance.
- 4. Trihybrid cross experiment.

Cell Biology & Molecular Biology

- 1. Micrometry, Human Buccal smear ,Barbody staining from buccal epithilial cells.
- 2. Blood smear Fish, Insect and Man- A comparative study
- 3. Isolation of DNA from animal tissue.
- 4. Isolation of plasmid DNA from Bacteria (Demonstration)
- 5. Meiosis in grasshopper testis.
- 6. Isolation of choloroplast from the spinach leaves.

Biotechnology

- 1. Isolation of Plasmid DNA from Eschericia Coli.
- 2. Isolation of Bacterial/ Cell DNA.
- 3. Isolation of Human DNA & Estimation.
- 4. Demonstration of Agarose Gel Electrophoresis.
- 5. Staining Gels with Coomossie Brilliant Blue.
- 6. SDS (Poly Acryl Amide Gel Electrophoresis.
- 7. Isolation of DNA from Chick liver cells.
- 8. Demonstration of PCR and Southern blotting.

Text Books

Dr. S. Rajan & R. Selvi Christy, *Experimental procedures in Life sciences*, Anjanaa Book House Chennai, 2010.

Reference Books

J. Sinha, A.K Chatterjee, P.Chattopadhyay, Arunabha Sen *Advanced Practical Zoology*, Book and allied (P) Ltd. 2011 3rd Edition

Rastogi,V.B, KedarNath and Ram Nath *Organic Evolution*, Meerat, 2013

Dr. David A Thompson (Author), Mrs. Cristina C. Thompson *Cell and Molecular Biology Lab Manual Paperback*, Create Space Independent Publishing Platform 2011.

Course Designer

Dr. P. Raja Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE11	Biotechnology	Elective -I	75	5

ature of Course		Course Relevance	
Knowledge Oriented	\checkmark	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	

Acquaint the students to the tools and techniques employed in genetic engineering and biotechnology. This course provides theoretical bases to properties and applications of versatile DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants. Illustrate the fundamental steps in gene cloning and its applications.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Select the various tools and techniques of genetic engineering.	К1
CO2	Explain various molecular cloning methods, cloning vectors and their hosts, and how to find the right vector for molecular cloning.	K1,K2,K3
CO3	Apply innovatively the techniques learnt in basic and applied fields of biological research.	K1,K2,K3,K4,K5
CO4	Explain the principles and techniques for industrial applications.	K1,K2,K3,K4,K5
CO5	Identify the Strategize research methodologies employing genetic engineering techniques in the field of environmental sciences.	K1,K2,K3
K1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Mapping of CO with PSO

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
l-Low		2-Me	dium	•	3-Strong

1-LOW

Syllabus

15 Hours

Recombinant DNA Technology: Gene cloning - the basic steps - tools of genetic engineering: Restriction enzymes - linkers and adaptors -Construction of rDNA - transformation - Selection of recombinants -Hybridization techniques - Chemical synthesis of oligonucleotides - Gene probe - PCR techniques - RFLP - DNA finger printing ; Blotting techniques: Southern blotting - Northern blotting - Western blotting; Genomic library.

UNIT II

UNIT I

15 Hours

Cloning Vectors Plasmid Biology: Cloning vector based on E. coli PBR 322 and bacteriophage. Cloning vector for yeast. Cloning vector for Agro bacterium tumefaciens. Cloning vector for mammalin cells - Simian virus 40 - Gene transfer technologies.

UNIT III

15 Hours

Animal Biotechnology Cell culture: Organ culture - whole embryo culture - Embryo transfer - In vitro fertilization (IVF) technology - Dolly embryo transfer in human. Transgenic animal. Human gene therapy. Cryobiology.

UNIT IV

Microbial Biotechnology Fermentation: Bioreactor - Microbial products -Primary & Secondary Metabolites - enzymes technology - single cell protein (SCP). Biopolymers, Biopesticides and Biofertilizers.

UNIT V

15 Hours

15 Hours

Environmental Biotechnology: Bioremediation of hydrocarbons - Industrial wastes - Heavy metals - Xenobiotics - bioleaching - biofuels. Genetically modified organism - GM foods.

Text Books

Dubey R.C., *A text book of Biotechnology*. S. Chand & Company, New Delhi, 2009. Satyanarayana U. *Biotechnology.* Books and Allied (P) Ltd., Kolkata.2010

Reference Books

Brown, T.A. *Gene Cloning & DNA Analysis: An introduction,* 5th edn. Blackwell Publishing, USA . 2012.

Glick, R and Pasternak, J. *Molecular Biotechnology*, Panima Publishers, New Delhi, 2012.

Balasubramanian, D., C.F.A. Bryce, K.Dharmalingam, Y.Green, Kunthala Jeyaraman. *Concepts in Biotechnology*, Universities (P) Ltd. Hyderabad, 2004.

Chawla, H.S. *Introduction to Biotechnology*, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 2012.

Mitra S. *Genetic Engineering Principles and Practice* Macmillan India Ltd. India, 2013.

Trehen, K. *Biotechnology,* New Age International (P) Ltd. New Delhi, 2002.

Trevan, M.D., S.Boffey, K.H. Goulding and P.Stanbury, *Gene Biotechnology* – Himalaya Publishing House, New Delhi. 2015

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models and Interactive White Board

Course Contents and Lecture Schedule

Module	Tonic	No. of	Content Delivery	
No.	Topic	Lectures	Methods	
	UNIT - I			
11	Recombinant DNA Technology Gene	2	Discussion	
1.1	cloning - the basic steps		Discussion	
	Various types of restriction enzymes -			
12	ligase linkers and adaptors - Construction	3	Chalk & Talk	
1.2	of rDNA - transformation - Selection of	0	onun a run	
	recombinants. Hybridization techniques			
	Chemical synthesis of oligonucleotides.			
1.3	Gene probe - PCR techniques – RFLP -	5	Chalk & Talk	
	DNA finger printing			
14	Blotting techniques: Southern blotting -			
1.1	Northern blotting - Western blotting;	5	E-Resources	
	Genomic library			
	UNIT - II	1		
2.1	Cloning Vectors: Plasmid biology	2	Chalk & Talk	
22	Cloning vector based on E. coli PBR 322	3	F-Resources	
2.2	and bacteriophage.	5		
2.3	Cloning vector for yeast.	3	Discussion	
24	Cloning vector for Agro bacterium	2	Chalk & Talk	
2.1	tumefaciens.			
	Cloning vector for mammalin cells -			
2.5	Simian virus 40 - Gene transfer	5	E-Resources	
	technologies			
	UNIT - III			
	Cloning vector for mammalian cells -			
3.1	Simian virus 40 - Gene transfer	2	Chalk & Talk	
	technologies			
3.2	Organ culture - whole embryo culture	3	E-Resources	
33	Embryo transfer - In vitro fertilization	3	Discussion	
5.5	(IVF) technology	5	Discussion	
34	Dolly - embryo transfer in human.	2	Chalk & Talk	
5.1	Transgenic animal.	<u> </u>		
3.5	Human gene therapy, Cryobiology	5	E-Resources	

	UNIT - IV				
4.1	Bioreactor	2	Discussion		
4.2	Primary & Secondary Metabolites	3	E-Resources		
4.3	Enzymes technology	3	Chalk & Talk		
4.4	Single cell protein (SCP).	2	E-Resources		
4.5	Biopolymers, Biopesticides and Biofertilizers	5	Chalk & Talk		
	UNIT - V				
5.1	Bioremediation of hydrocarbons - bioleaching - biomining - biofuels.	5	E-Resources		
5.2	Industrial wastes - Heavy metals – Xenobiotics.	3	Chalk & Talk		
5.3	bioleaching - biomining - biofuels.	2	Discussion		
5.4	Genetically modified organism - GM foods.	5	Chalk & Talk		
	Total	75			

Course Designer Dr. K. Arifa Banu

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE12	Stem Cell Biology	Elective -I	75	5

Nature of Course		Course Relevance	
Knowledge Oriented		Local	
Skill Oriented		Regional	
Employability Oriented	✓	National	
Entrepreneurship Oriented		Global	 ✓

To know the process of pathological alternation and contribution of stem cells to tissue and organ development.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	CO1	Define the concepts of stem cells and its niches	K1
	CO2	Select the theoretically the adult and embryonic stem cells	K1,K2
	CO3	Experiment the procedure for stem cell isolation, differentiation and maintenance	K1,K2,K3
	CO4	Explain about cell aging	K1,K2
	CO5	Summarize the case studies associated with stem cell therapy	K1,K2,K3,K4,K5
K	1-Knov	vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
L-Low		2-Me	dium	•	3-Strong

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low 2-Medium			3-Strong		

Mapping of CO with PSO

Syllabus

UNIT I

Introduction to Stem cell biology: Stem cell definition, origin and hierarchy; stem cell properties, Identification and Characterizationpotency and differentiation; niche of stem cell; overview of different stem cell types (embryonic stem cell, adult stem cell and induced pluripotent stem cells)

UNIT II

Embryonic stem (ES) cell: Characterization and properties of ES cells pluripotency and self-renewal of ES; molecular mechanisms regulating pluripotency and maintenance of the stem state; progressive differentiation of ES into ectoderm lineage organs (skin, brain and nerve), mesoderm lineage organs (Heart, kidney, muscle, bone and blood), and endoderm lineage organs (Lung, liver, stomach, pancreas and intestine).

UNIT III

Adult stem cell: Mesenchymal stem cell (MSC) – sources, properties (plasticity, homing and engraftment), potency and characterization; Haematopoietic stem cell (HSC) - sources, properties, potency and characterization; steps involved in production of induced pluripotent stem cell (iPSC); role of yamanaka factor in iPSC.

UNIT IV

Stem cell and aging – aging theory; cell cycle; telomere and telomerase ; senescence of stem cell; role of stem cell in aging; tissue repair and regeneration of adult stem cell.

UNIT V

Current stem cell therapies – advantages and disadvantages of ES and adult stem cell (MSC and HSC) therapy; Ethical concern on stem cell therapy; current stem cell therapy for various diseases; clinical outcome of stem cell therapy; state of clinical trials in adult stem cell for various disease.

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Reference Books

Kiessling, A.A. *Human Embryonic Stem Cells*, Jones & Barlett Publishers, 2nd Edition, 2016.

Lanza, R. *Essentials of stem cell biology*, Academic Press. 2015.

Turksen. K, *Adult stem cells.* Humana Press, Inc. 2014.

Thomson, J et al. *Handbook of stem cells: Embryonic/Adult and fetal stem cells Vol. 1* & Academic Press.2004.

Institute of Medicine Stem cells and the future of regenerative medicine. National Academy Press, 2012.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Course Contents and Lecture Schedule

Module	Module No. Topic		Content Delivery				
No.			Methods				
	UNIT - I						
1.1	Stem cell definition, origin and hierarchy; stem cell properties	5	Discussion				
1.2	Identification and Characterization- potency and differentiation; niche of stem cell	5	Chalk & Talk				
1.3	overview of different stem cell types (embryonic stem cell, adult stem cell and induced pluripotent stem cells)	5	Chalk & Talk				
	UNIT - II						
2.1	Embryonic stem (ES) cell - Characterization and properties of ES cells - pluripotency and self-renewal of ES	5	Chalk & Talk				
2.2	molecular mechanisms regulating pluripotency and maintenance of the stem state	3	E-Resources				
2.3	progressive differentiation of ES into ectoderm lineage organs (skin, brain and nerve)	3	Discussion				

2.4	Mesoderm lineage organs (Heart, kidney, muscle, bone and blood), and endoderm lineage organs (Lung, liver, stomach, pancreas and intestine.	4	Chalk & Talk
	UNIT - III		
3.1	Adult stem cell – Mesenchymal stem cell (MSC) – sources, properties (plasticity, homing and engraftment)	5	Chalk & Talk
3.2	potencyandcharacterization;Haematopoietic stem cell (HSC) – sources,properties, potency and characterization	5	E-Resources
3.3	steps involved in production of induced pluripotent stem cell (iPSC); role of yamanaka factor in Ipsc	5	Discussion
	UNIT - IV		
4.1	Stem cell aging theory; cell cycle.	4	Discussion
4.2	Telomere and telomerase	4	E-Resources
4.3	Senescence of stem cell.	3	Chalk & Talk
4.4	Role of stem cell in aging; tissue repair and regeneration of adult stem cell.	4	E-Resources
	UNIT - V		
5.1	Current stem cell therapies	2	E-Resources
5.2	5.2 advantages and disadvantages of ES and adult stem cell (MSC and HSC) therapy		Chalk & Talk
5.3	Ethical concern on stem cell therapy; current stem cell therapy for various diseases	4	Discussion
5.4	clinical outcome of stem cell therapy; state of clinical trials in adult stem cell for various disease	5	Chalk & Talk
	Total	75	

Course Designer Dr. K. Arifa Banu Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC21	Microbiology & Immunology	Core – V	75	4

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	\checkmark

The course deals with the microbiology in immunology ground as well lay a strong base in the field of immunology by explaining everything about Immunological system. It explains about the organs, cells and mechanism of functioning of immune system.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Outline the knowledge on microbial world in connection with pathogenicity and immunology	K1, K2
	CO2	Evaluate the conceptual basis of enlisted pathogens of humans and perceive the diagnostic skills and treating methods	K1, K2, K3,K4,K5
-	CO3	Identify various organs of immune system and types of antigens and immunoglobulins and its production	K1, K2, K3
	CO4	Categorize regulatory system involve in immune response and the technical application of knowledge as technique	K1,K2,K3,K4
	C05	Analyze the role of immune system in diseased conditions	K1,K2,K3,K4
K1-Knowledge K2-U		vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate
Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low	2-Medium				3-Strong

T-LOM

Syllabus

15 Hours

15 Hours

History of microbiology and its applied areas; Bacteria – Taxonomy, Structure Growth, Nutrition, Culture – Types of Media and Conditions for Culturing. Viruses – Taxonomy, Structure and life Cycle of Viruses – T4 Phage and HIV, Viroids and Prions.

UNIT II

UNIT I

Medical Microbiology: Infectious Diseases - Causative Agents, Modes of Transmission and control of Polio, Dengue, AIDS, Tuberculosis, Diphtheria, Typhoid, Syphilis and Gonorrhea. Prevention and control of microorganisms - Physical and Chemical Methods. Antibiotics and Other Anti - microbial Agents and Mechanism of Drug Resistance.

UNIT III

Scope of Immunology – Types of Immunity - Innate and Acquired, Passive and Active. Primary and Secondary Lymphoid Organs - structure and Function of Bone Marrow, Thymus, Spleen, Bursa of Fabricius, GALT, BALT, MALT and Lymph Nodes. Cells of Immune System – Origin and Differentiation of T & B Cells and Macrophage. Antigens - Class Determinants - Reactive Sites and **Receptor Sites.**

15 Hours

UNIT IV

Antibody – Immunoglobulin – Primary Structure – Classes, Functions, Synthesis. Hybridoma technology Monoclonal Antibodies and their Applications. Genetic Mechanisms in Generation of Antibody Diversity – Regulation of antibody Diversity. Complement – Classical and Alternative Pathways and Immunological Significance – Antigen antibody reaction.

UNIT V

15 Hours

15 Hours

Major Histo-compatibility Complex (HLA) and its Products in Man. Transplantation Immunology, Tumour Immunology – Immune Deficiency Diseases – AIDS – Autoimmune Diseases – Examples – Concept and Mechanisms – Types of Hypersensitivity.

Text Books

Dubey R.C. & Maheshwari, D.K, *A text book of Microbiology*, S. Chand & company Pvt. Ltd, New Delhi, 2013.

Prescott, Harley and Klein's, *Microbiology*, Tata McGraw Hill, International edition, Page 1-1086, 2018, 7th Edition.

David, Brostoff and Roitt, *Immunology*, Mosby & Elsevier Publishing, Canada, USA, 2016, 7th Edition.

Reference Books

C.V. Rao, *Immunology*, Narosa Publishing House, New Delhi. Reference Books, 2015, 2nd Edition.

Jeffrey C. Pommerville, *Alcamo's fundamental of microbiology*, Jones and Barlett, Boston, 2016.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Course Contents and Lecture Schedule

Module	Торіс	No. of	Content Delivery
NO.		Lectures	Methods
	UNII - I		
1.1	Alistory of microbiology and its applied areas; Bacteria – Taxonomy,	5	Chalk & Talk
12	Structure, Growth, Nutrition, Culture –	ц	F-Resources
1.2	Culturing.	5	L-Resources
	Viruses – Taxonomy, Structure and life		
1.3	Cycle of Viruses – T4 Phage and HIV,	5	Discussion
	Viroids and Prions.		
	UNIT - II		
	Infectious Diseases – Causative Agents,	4	
2.1	Modes of Transmission and control of	4	Discussion
	Polio, Dengue, AIDS.		
	Tuberculosis, Diphtheria, Typhoid,	_	
2.2	Syphilis and Gonorrhea. Prevention and	5	Chalk & Talk
	control of microorganisms.		
23	Physical and Chemical Methods.		
	Antibiotics and Other Anti – microbial	6	E-Resources
2.5	Agents and Mechanism of Drug	_	
	Resistance.		
	UNIT - III		
	Scope of Immunology – Types of		
3.1	Immunity Innate and Acquired, Passive	3	E-Resources
	and Active.		
	Primary and Secondary Lymphoid Organs		
2.2	structure and Function of Bone Marrow,	F	Challs 9 Talls
3.2	Thymus, Spleen, Bursa of Fabricius,	5	Chaik & Taik
	GALT, BALT, MALT and Lymph Nodes.		
	Cells of Immune System – Origin and		
3.3	Differentiation of T & B Cells and	5	Discussion
	Macrophage.		
2.4	Antigens – Class Determinants – Reactive	n	E Decouver
5.4	Sites and Receptor Sites.	Z	E-Resources
	UNIT - IV		
1 1	Antibody – Immunoglobulin – Primary	n	Diaguasian
4.1	Structure – Classes, Functions, synthesis	3	Discussion

4.2	Hybridoma technology Monoclonal Antibodies and their Applications.	4	E-Resources	
	Genetic Mechanisms in Generation of	0		
4.3	Antibody Diversity – Regulation of	3	Chalk & Talk	
	antibody Diversity			
	Complement – Classical and Alternative			
4.4	Pathways and Immunological	3	E-Resources	
	Significance			
4.5	Antigen antibody reaction.	2	E-Resources	
	UNIT - V			
Major Histo-compatibility Complex (HLA)		Λ	F Posourcos	
5.1	and its Products in Man.	4	E-Resources	
5.2	Transplantation Immunology	2	Chalk & Talk	
5.3	Tumour Immunology	2	Discussion	
	Immune Deficiency Diseases - AIDS -	C	E Decourses	
Autoimmune Diseases – Example		3	E-Resources	
55	Concept and Mechanisms – Types of	Л	E Docourcos	
5.5	Hypersensitivity.	4	E-Resources	
	Total	75		

Course Designer Ms. P. Vinnoli Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC22	Animal Physiology	Core – VI	75	5

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	√

To enable the students acquire knowledge on internal physical and chemical functions of animals and to explore the makeup of animals, including their behaviors and their biological structure.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Explain the feedback system and classify adaptive mechanisms of the animal body.	K1,K2,K3,K4,K5
CO2	Examine the removal of metabolic wastes and toxins from animal body and the mechanism in which body controls urine output.	K1,K2,K3,K4
CO3	List out the types of stimuli to which receptors respond	K1,K2,K3,K4
CO4	Determine the functioning of life, organization and coordination of behavior.	K1,K2,K3,K4K5
CO5	Classify the excitability and transmission of impulse in nerve cells and electrical organs in animals.	K1,K2,K3,K4
K1-Kno	owledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
-		0.14	1.		0.0

1-Low

3-Strong

	PS01	PSO2	PSO3	PSO4	PSO5	
C01	3	3	3	2	3	
CO2	3	3	3	1	3	
CO3	3	3	1	2	3	
CO4	3	2	3	3	3	
CO5	3	3	1	2	3	
1-Low	-	2-Me	dium	-	3-Strong	

Mapping of CO with PSO

Syllabus

UNIT I

Mechanisms: Thermoregulation – Homeostatic Temperature compensation in poikilotherms - Temperature regulations in homeothermshibernation and aestivation. Osmotic and ionic regulation: Response to hyperosmotic and hypoosmotic media with reference to crustaceans and fish- Adaptation to Pressure-High altitude-buoyancy.

UNIT II

Excretory System: Comparative physiology of excretion- kidney- urine formation- urine concentration- waste elimination- micturition- regulation of water balance-blood volume-blood pressure- electrolyte balance- acidbase balance.

UNIT III

Receptor Mechanism: Mechano reception- Muscle receptors- Pressure receptors – Gravity receptor – phonoreception- Tango receptor-Photoreception: Retinal pigments – photochemistry of vision.

UNIT IV

Bioluminescence: Occurrence - physical aspects - chemistry of light production - functional significance. Animal behavior: Biological clock endogenous rhythm - circadian rhythm - circannual and lunar periodicity -Zeitgeber - entrainment - physiological basis of learning and memory physiology of pain.

UNIT V

Nervous Co-ordination: Excitability and transmission of impulse in neuron and muscles - resting membrane potential - electrogenesis propagation of action potential - interneuron transmission - electrical synapses – chemical synapses – neurotransmitters. Animal electricity: Electric organs – production of electric discharge – functional significance.

Text Books

Christopher D. Moyes, Patricia M. Schulte -Principles of Animal Physiology, Publisher: Pearson, 2015, 3rd Edition.

2-Medium

3-Strong

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Reference Books

Christopher D. Moyes, Patricia M. Schulte-*Principles of Animal Physiology* (3rd Edition) - Publisher: Pearson (January 25, 2015).

Vander. *Human Physiology: The Mechanism of Body Function*, Eighth Edition, The McGraw–Hill Companies, 2001.

Guyton & Hall, *Textbook of Medical Physiology*, International Edition 2317-XElsevier Inc.

Gordon S. Maleon , *Animal Function –Principles and Adaptations* –.The Macmillan Company collier- Mamillan Ltd. Hen catalog.No.68-110218.

Hoar S.William , *General, Comparative Physiology* - prentice hall of Indian pvt ltd, New Delhi.

Philip H. Mitchel, *A Text book of General Physiology*, Mc Graw Hill Book.

Gordon, S.Maleon, *Animal Function – Principles and adaptations*, The Macmillan company.

Hoar, S.William, *General Comparative Physiology*, Prentice Hall of Indian Pvt Ltd, New Delhi, (2004).

P.S Verma, B.S. Tyagi, V.K. Agarwal, *Animal physiology*, Publisher: S Chand & Co (October 31, 2001).

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Module No.	Торіс	No. of Lectures	Content Delivery Methods
	UNIT - I		<u> </u>
1.1	Homeostaticmechanisms:Thermoregulation-Compensationinpoikilotherms-Temperature regulations in homeotherms	5	Discussion
1.2	hibernation and aestivation, Osmotic and ionic regulation: Response to hyperosmotic and hypoosmotic media with reference to crustaceans and fish	5	Chalk & Talk
1.3	Adaptation to Pressure-High altitude- buoyancy.	5	Chalk & Talk
	UNIT - II		
2.1	Excretory system: Comparative physiology of excretion.	5	Chalk & Talk

Course Contents and Lecture Schedule

2.2	Kidney-urineformation-urineconcentration.Wasteelimination-micturition-regulation of water balance.	5	E-Resources
2.3	Blood volume-blood pressure- electrolyte balance- acid-base balance.	5	Discussion
	UNIT - III		
3.1	Receptor mechanism: Mechano reception- Muscle receptors.	5	Chalk & Talk
3.2	Pressure receptors – Gravity receptor – phonoreception - Tango receptor.	5	E-Resources
3.3	Photoreception: Retinal pigments – photochemistry of vision.	5	Discussion
	UNIT - IV		
4.1	Bioluminescence: Occurrence – physical aspects – chemistry of light production , Functional significance	5	Discussion
4.2	Behavior: Biological clock – endogenous rhythm – circadian rhythm – circannual and lunar periodicity	5	E-Resources
4.3	Zeitgeber – entrainment – physiological basis of learning and memory -physiology of pain.	5	Chalk & Talk
	UNIT - V		
5.1	Nervous co-ordination: Excitability and transmission of impulse in neuron and muscles	4	E-Resources
5.2	Resting membrane potential – electrogenesis - propagation of action potential.	3	Chalk & Talk
5.3	Interneurontransmission-electricalsynapses- chemical synapses	3	Discussion
5.4	Neurotransmitters. Animal electricity: Electric organs – production of electric discharge – functional significance.	5	Chalk & Talk
	Total	75	

Course Code	Course Title	Category	Total Hours	Credits
20PZYC23	Ecology & Biodiversity	Core – VII	75	4

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	\checkmark

The course explains the basic concepts, components of ecosystems, types of Biodiversity and different indices.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Compare the biotic and abiotic interactions, theory and principles of ecosystem, ecology and Community Ecology	K1, K2, K3,K4,K5
CO2	Demonstrate an understanding of key ecological interactions and processes: Community Ecology	K1, K2, K3,K4,K5
CO3	Illustrate an compare of key ecological interactions and processes: Population Ecology – Characterization, growth curves.	K1, K2, K3,K4,K5
CO4	Classify scales and patterns and threats in biological diversity	K1, K2, K3,K4,K5
CO5	Assess the sustainable management aiming at the conservation of species and habitats	K1, K2, K3,K4,K5

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

	PSO1	PSO2	PSO3	PSO4	PSO5	
C01	3	3	1	3	3	
CO2	3	3	1	3	3	
CO3	3	3	2	3	3	
CO4	3	3	2	3	3	
CO5	3	3	2	3	3	
L-Low 2-Medium			·	3-Strong		

Mapping of CO with PSO

1-Low

Syllabus

UNIT I

15 Hours

15 Hours

15 Hours

15 Hours

Concepts in ecology - Ecology - Scope - history of ecology - its relevance to mankind Habitat Ecosystem: An overview of abiotic factors and Biotic factors - Concepts of habitat and Ecological niche - Ecotone and Edge effect - Food chains- Food-webs and their structures- Ecological Pyramids in aquatic and terrestrial Environments.

UNIT II

Community ecology - Concept of community - community structure and attributes-concept of climax - Species diversity in community and its measurement- Alpha diversity- Simpson's diversity index - Shannon index -Fisher's alpha -rarefaction - Beta diversity Sorensen's similarity index-Whittaker's index- Evenness- Gamma diversity.

UNIT III

Population ecology – Introduction - An overview of important population attributes - Density - Natality - Growth rates- Growth forms and concept of carrying capacity- Patterns in human population growth and its explosion -Remedial measures-Mortality - life tables and survivorship curve- sex ratioage distribution- dispersal and dispersion.

UNIT IV

Biodiversity - convention on biological diversity- patterns of diversity genetic-species- ecosystem- and guild diversity - alpha-beta-gamma diversity- diversity indices - dominance and evenness- landscape and its elements- endemism and hotspots- indicator species-key stone speciesvalue of biodiversity- ecotourism.

UNIT V

15 Hours

Biodiversity loss - Causes-IUCN categories of threaten species-red data book- Environmental Impact Assessment-Remote sensing in EIA biodiversity conservation-In situ conservation - biosphere reservesnational parks-wildlife sanctuaries- ex situ conversation - zoological botanical gardens-sacred grooves- cryopreservation.

Text Books

Odum, E.P. *Fundamentals of Ecology,* Nataraj Publishers, Dehradun, 1996. Stiling, P. *Ecology – Theories and applications*. Prentice Hall of India Pvt. Ltd., New Delhi, 2014.

Reference Books

Clarke, G.L., *Elements of Ecology*, John Wiley & Sons, 2017. Kendeigh, S.C. *Animal Ecology.* Prentice Hall, 2015. Odum, E.P. *Fundamentals of Ecology*, W.B. Saunder's Co. Philadelphia, 2013. Rastogi V.B and M.S. Jayaraj Animal *Ecology and distribution of animals*, Kedarnath Ramnath, 2014.

Sharma. P.D. *Ecology and Environment.* Rastogi Publications. Meerut, 2014 Southwick. C.H. *Ecology and the quality of Environment.* D.VasNostrand Co, 2016.

Verma, P.S. and V.K. Agarwal, *Principles of Ecology.* S.Chand & Co. NewDelhi, 2016.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module	Tonic	No. of	Content Delivery	
No.	No.		Methods	
	UNIT - I			
	Concepts in ecology - Ecology -Scope -			
1.1	history of ecology - its relevance to	3	Chalk & Talk	
	mankind Habitat Ecosystem.			
	An overview of abiotic factors and Biotic	5	E-Resources	
1.2	factors - Concepts of habitat and			
	Ecological niche			
12	Ecotone and Edge effect - Food chains-	2	Discussion	
1.5	Food-webs and their structures	5	DISCUSSION	
1 /	Ecological Pyramids in aquatic and	Λ	Discussion	
1.4	terrestrial Environments	4	DISCUSSION	

	UNIT - II						
2.1	Community ecology - Concept of community - community structure and attributes-concept of climax	5	Discussion				
2.2	Species diversity in community and its measurement- Alpha diversity- Simpson's diversity index -Shannon index - Fisher's alpha –rarefaction	4	Chalk & Talk				
2.3	Beta diversity Sorensen's similarity index- Whittaker's index- Evenness	4	E-Resources				
2.4	Gamma diversity	2	Chalk & Talk				
	UNIT - III						
3.1	Population ecology - Introduction- Anoverview of important populationattributes - Density- Natality	3	E-Resources				
3.2	Growth rates- Growth forms and concept of carrying capacity- Patterns in human population growth and its explosion	4	Chalk & Talk				
3.3	Remedial measures-Mortality	4	Discussion				
3.4	Life tables and survivorship curve- sex ratio- age distribution- dispersal and dispersion.	4	Chalk & Talk				
	UNIT - IV						
4.1	Biodiversity – convention on biological diversity- patterns of diversity – genetic- species- ecosystem- and guild diversity	5	Discussion				
4.2	alpha-beta-gamma diversity- diversity indices – dominance and evenness	5	E-Resources				
4.3	Landscape and its elements- endemism and hotspots- indicator species-key stone species-value of biodiversity- ecotourism.	5	Chalk & Talk				

	UNIT - V		
	Biodiversity loss- Causes-IUCN categories		
51	of threaten species-red data book-	Ę	F Posourcos
5.1	Environmental Impact Assessment-	5	E-Resources
	Remote sensing in EIA		
	biodiversity conservation-In situ		
5.2	conservation – biosphere reserves-	5	Chalk & Talk
	national parks-wildlife sanctuaries		
	ex situ conversation – zoological -		
5.3	botanical gardens-sacred grooves-	5	Discussion
	cryopreservation		
	Total	75	

Course Designer Dr. P. Raja Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
	Microbiology & Immunology,			5
20070021	Animalphysiology, Ecology	Core – VIII	150	
20721721	Biodiversity, Ethology &			
	Vermitechnology.			

Nature of Course		
Knowledge Oriented	√	
Skill Oriented		
Employability Oriented		
Entrepreneurship Oriented		

Course Relevance			
Local			
Regional			
National			
Global	✓		

Brief about different culture techniques and explain the basic concept components of different habitats and quantitative estimation of planktons. It also explains the ethogram of animal behaviour and vermibed preparation.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge
		Level
	Perform basic laboratory techniques in microbiology and	
C01	explain the importance of immunology, types of immune	V1 V2 V2 VA VE
	system, lymphoid organs and development of the	K1,K2,K3,K4,K3
	immune cells.	
CO 2	Appraise the significance of quantitative estimation of	K1 K2 K3 K4 K5
02	amylase activity, Ammonia and Urea.	N1,N2,N3,N 1 ,N3
CO3	Evaluate the importance of ecological collections in	K1 K2 K2 KA
03	different habitats.	N1,N2,N3,N4
CO 4	Gather an extempore knowledge on prepare an ethogram	
L04	of animal behavior.	K1,K2,K3,K4,K3
COF	Create the knowledge to preparation of Vermibed,	
603	Identification of earthworm species.	N1,N2,N3,N4,N3
K1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	apping of v					
		P01	PO2	P03	P04	P05
	C01	3	3	1	2	3
	CO2	3	1	3	3	1
ſ	CO3	3	3	3	3	2
ſ	CO4	2	3	1	3	2
	CO5	3	1	3	3	3
•	T		0.14	1.		0.0

Mapping of CO with PO

1-Low

2-Medium

3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	1	2	3
CO2	3	1	3	3	1
CO3	3	3	3	3	2
CO4	2	3	1	3	2
CO5	3	1	3	3	3
1-Low	·	2-Me	dium		3-Strong

Syllabus

Microbiology & Immunology: Differential staining: Gram staining - IMVIC (Indole - Methyl Red - Voges Proskauer - Citrate Utilization) Test. Culture techniques: Isolation of bacteria from Butter milk & Pickles - Bacterial growth curve. Lymphoidorgans in chick: Thymus - Bonemarrow – Spleen - Bursa of fabricius - Production of antiserum - Antibiotic sensitivity test. Demonstration of Immuno electrophoresis & Haemagglutination in fish.

Animal Physiology: Quantitative estimation of amylase activity: ammonia and urea. Rate of salt loss and salt gain in fish using different experimental media. Estimation of blood chloride - (Schales & Schales method).

Receptor Mechanism: Mechano reception - Muscle receptors- Pressure receptors – Gravity receptor – phonoreception- Tango receptor-Photoreception: Retinal pigments photochemistry of vision.

Ethology: Prepare an ethogram of animal behavior. Identify and comment on courtship display of Flying lizard- peacock - Sexual behavior of bonnet monkey and elephant.

Vermitechnology: Preparation of Vermibed: Identification of earthworm species- Identification of various vermicomposting material- Analysis of various life stages of earthworms. Field Trip: Visit to R & D labs and different natural habitats related to the above subjects and submission of report are compulsory.

Text Books

Krishnamurthy, K. V. *An Advanced Text Book of Biodiversity-principles, and practice,* II reprint, Oxford & IBH Publishing Co. Pvt. Lt. New Delhi, 2014.

Reference Books

Prescott, L.M., Harley, J.P. and Klein, D.A, *Microbiology*, MxGRAW Hill, New York, 7th edition, 2018.

Singh, H.R and Neeraj Kumarm, *Animal physiology and Biodiversity*, Visual Publishing Co, New Delhi, 2019.

Course Designer

Ms. A. Syedali Fathima

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE21	Animal Behaviour	Elective -II	75	5

Nature of Course		Γ	Course Relevance	
Knowledge Oriented	\checkmark		Local	
Skill Oriented 🗸			Regional	
Employability Oriented			National	
Entrepreneurship Oriented			Global	✓

To enable the students acquire knowledge on identify factors affecting animal behaviour. The influence of genes on animal behavior, how animals perceive and how they respond to various stimuli and influence of environment factors.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Develop basic concepts and importance of studying animal Behaviour	K1,K2,K3,K4,K5
	CO2	Justify the Classical theory and phases of instinct behavior	K1,K2,K3,K4,K5
	CO3	Evaluate the social and foraging behaviour among the animals	K1,K2,K3,K4,K5
	CO4	Classify play and reproductive behaviour of animals, explain parental care in animals	K1,K2,K3,K4
	C05	Examine the purpose and importance of animal communication	K1,K2,K3,K4
K	1-Knov	vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
		0.14	1.		0.0

1-Low

3-Strong

Mapping of CO with PSO

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
T					

1-Low

Syllabus

UNIT I

Animal Behavior: Purpose and the importance of the study of the animal behaviour and basic concepts of ethology. Analysis of behaviour: Taxes, kinesis and reflexes.

UNIT II

Instinct Behavior: Classical theory of instinct – Phases of instinct behaviour – models of instinct behaviour – Ritualization – Aggressive behaviour.

UNIT III

Social Behaviour: Social behavior of Bees, Primates, Elephant and Lion; Foraging behavior: Optimal foraging theory with special reference to elephants – Group foraging with special reference to elephants.

UNIT IV

Play Behavior: Types of play – Play in Mammals – biological effect of play. Reproductive behavior: Sexual selection, matting pattern, parental care in birds and mammals. Courtship and display in birds.

UNIT V

Animal Communication: Purpose and importance of communication – Types of communications - Visual, auditory, chemical and vocalization in birds & animals.

Text Books

Shukla, J.P. *Fundamentals of Animal Behaviour*, Atlantic Publishers, New Delhi, 2010.

2-Medium

3-Strong

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Reference Books

Mandal, Fatik Baran, *Textbook of Animal Behaviour*, PHI learning Publication, 3rd Edition, 2018.

Tristram Wyatt, *Animal Behaviour*: A Very Short Introduction Oxford University Press, 2017.

Jerry A. Hogan, *Study of Behavior: Organization, Methods, and Principles*, The Cambridge University Press, 2017.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models and Interactive White Board

Module	Tonia	No. of	Content Delivery							
No.	Горіс	Lectures	Methods							
	UNIT - I									
1.1	Purpose and the importance of the study of the animal behaviour	5	Discussion							
1.2	Basic concepts of ethology	5	Chalk & Talk							
1.3	1.3 Analysis of behaviour: Taxes, kinesis and reflexes		Chalk & Talk							
	UNIT - II									
2.1	Instinct Behavior - Classical theory of instinct.	5	Chalk & Talk							
2.2	Phases of instinct behaviour	3	E-Resources							
2.3	Models of instinct behaviour	5	Discussion							
2.4	Ritualization – Aggressive behaviour	2	Chalk & Talk							
	UNIT - III									
3.1	Social Behaviour: Social behavior of Bees, Primates, Elephant and Lion.	5	Chalk & Talk							
3.2 Foraging behavior: Optimal foraging theory with special reference to elephants		5	E-Resources							
3.3	Group foraging with special reference to elephants.	5	Discussion							

Course Contents and Lecture Schedule

	UNIT - IV			
<i>A</i> . 1	Play Behavior: Types of play – Play in	Б	Discussion	
7.1	Mammals – biological effect of play	5	Discussion	
4.2	Reproductive behavior: Sexual selection,	5	E Docourcos	
1.2	matting pattern.	5	L-Resources	
43	Parental care in birds and mammals.	5	Chalk & Talk	
т.5	Courtship and display in birds.	5		
	UNIT - V			
5 1	Animal Communication: Purpose and	7	F-Resources	
J.1	importance of communication	/	L-Resources	
	Types of communications: Visual,			
5.2	auditory, chemical and vocalization in	8	Chalk & Talk	
	birds & animals.			
	Total	75		

Course Designer Ms. P. Vinnoli

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE22	Vermitechnology	Elective -II	75	5

Nature of Course		Course	e Relevance	
Knowledge Oriented		Local		
Skill Oriented		Region	al	
Employability Oriented	✓	Nationa	al v	✓
Entrepreneurship Oriented		Global		

Vermiculture refers to the artificial rearing of earthworms for the production of vermicompost to benefit humans. The utility and variability of research work in this field could be great use to the agricultural community.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge
			Levei
	CO1	Select and preparing biocompost, vermicomposting and vermiculturing and get employment accordingly.	K1,K2,K3,K4,K5
	CO2	Importance technical awareness of vermitechnology, vermicomposting technique	K1,K2,K3,K4,K5
	CO3	Find the teach students to become life-long recyclers	K1,K2,K3,K4,K5
	CO4	Classify the different species of earth worms	K1,K2,K3,K4,K5
	CO5	Summarize practice of vermicomposting and vermiculturing	K1,K2,K3,K4
K	1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
l-Low		2-Me	dium	•	3-Strong

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Mapping of CO with PSO

1-Low

Syllabus

UNIT I

Soil Edaphalogy: Geography of soil – Soil groups – Soil genesis – Soil profile – Soil complex – Soil texture – structure – Physical properties – Organic matter – Humus – Soil water, aeration, temperature, pH and buffer action and Electraical conductivity – Soil bioreactive system – fauna, microflora and its role – Soil pollution – erosion and conservation – sustaining of soil fertility – fertilizer – organic and inorganic.

UNIT II

Vermibiology: Introduction – Historical perspectives – Taxonomy – Systemic position – Ecological types of earthworms, commonly occurring Indian Earthworms – Exotic earthworms – Earthworm as a natural bioreactor – Heavy metals uptake in earthworms.

UNIT III

Vermiculture: Introduction – State of Art of Vermiculture techniques (Laboratory and field) –Working model of typical vermiculture bed – Maintenance, monitoring and harvest – Vermiwash – Preparation and application – Vermibiotechnology for solid waste management.

UNIT IV

15 Hours

15 Hours

Vermicomposting: Introduction - Vermicomposting methods – Earthworm cast – its importance in soil amelioration – Physico – Chemical properties – Casts of different species – Green waste, animal waste composting – Evaluation of the best suited worm – Advantages of vermicompost over natural Farm Yard Manure.

UNIT V

15 Hours

Economic importance of Earthworms- Earthworm as a source of food – Live feed – Vermi meal preparation method – Chemical composition of vermimeal - earthworm as a source of drugs – Pharmacologically active materials derived from worms – Antipyretic and Anti-inflammatory activity of earthworm.

15 Hours

15 Hours

Text Books

Arvind Kumar. *Verms & Vermi Technology*, APH publishing house New Delhi. 2009.

Mary violet Christy, *Vermitechnology*, MJP Publisher, 2014.

Wallwork J.A. *Earthworm Biology*, Edwardd Arnold, Publisher Ltd. London. 1983.

Reference Books

Edwards and Bohlen, *Biology and ecology of Earthworms*, Chapman and Hall, London. 2011.

Bhawalkar and Bhawalka, *Vermiculture Biotechnology*. BERI, Puner, 2013.

Sultan. A, Ismail, K. L. Lee, *Text Book of Vermicology*, 2009.

Longman. *Earthworm, Academic Press,* London, 2013.

Esatchell, *Earthworm Ecology from Darwin to Vermiculture* Ed. J. Esatchell, Chapman and Hall, London, 2008.

A.M. Martin, *Bioconversion of waste materials to industrial products* Ed:

A.M. Martin, *Elserveir Applied Science*, London, New York, 2010.

U.S Bhawalkar, BERI, *Vermiculture Ecotechnology*, London. 1996.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Module	Topic	No. of	Content Delivery
No.	Topic	Lectures	Methods
	UNIT - I		
1.1	Soil edaphalogy, Geography of soil, Soil groups, Soil genesis, Soil profile, Soil complex Soil texture, structure	5	Discussion
1.2	Physical properties, organic matter, Humus Soil water, aeration, temperature, pH and buffer action and Electraical conductivity, Soil bioreactive system.	5	Chalk & Talk
1.3	Fauna, microflora and its role, Soil pollution erosion and conservation, sustaining of soil fertility, fertilizer, organic and inorganic.	5	Chalk & Talk

Course Contents and Lecture Schedule

	UNIT - II			
2.1	Vermibiology, Introduction, Historical perspectives, Taxonomy, Systemic position.	4	Chalk & Talk	
2.2	Ecological types of earthworms,	4	E-Resources	
2.3	commonly occurring Indian Earthworms, Exotic earthworms, Earthworm as a natural bioreactor	4	Discussion	
2.4	Heavy metals uptake in earthworms.	3	Chalk & Talk	
	UNIT - III			
3.1	Vermiculture, Introduction, State of Art of Vermiculture techniques, Laboratory and field.	3	Chalk & Talk	
3.2	Working model of typical vermiculture	3	E-Resources	
3.3	Bed maintenance, monitoring and harvest	3	Discussion	
3.4	Vermiwash, Preparation and application	3	Chalk & Talk	
3.5	Vermibiotechnology for solid waste management	3	E-Resources	
UNIT - IV				
4.1	Vermicomposting, Introduction Vermicomposting methods, Earthworm cast its importance in soil amelioration.	5	Discussion	
4.2	Physico, Chemical properties, Casts of different species, Green waste, animal waste composting.	5	E-Resources	
4.3	Evaluation of the best suited worm, Advantages of vermicompost over natural Farm Yard Manure.	5	Chalk & Talk	
	UNIT - V			
5.1	Economic importance of Earthworms- Earthworm as a source of food, Live feed.	5	E-Resources	
5.2	Vermimeal preparation method, chemical composition of vermimeal, earthworm as a source of drugs.	5	Chalk & Talk	
5.3	Pharmacologically active materials derived from worms – Antipyretic and Anti-inflammatory activity of earthwor.	5	Discussion	
	Total	75		

Course Designer Ms. P. Vinnoli Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC31	Developmental Biology	Core – IX	90	5

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	✓

This course provides knowledge on various stages and processes involved in the formation of embryo into development of organisms.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Explain how gametes are being formed inside their own body	K1, K2
	CO2	Determine the fusion of gametes and its progression into germ layers	K1, K2, K3
	CO3	Elaborate and compile the organs forming from each germinal layer	K1, K2, K3
	CO4	Evaluate the striking morphological changes adapted by the larva of various organisms to become adult	K1,K2,K3,K4,K5
	C05	Classify various reproductive technologies and methods being followed by fertility centers in recent times	K1,K2,K3,K4
K	1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium	•	3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Syllabus

UNIT I

18 Hours

Gametogenesis: Spermatogenesis and Oogenesis – role of Hypothalamo hypophyseal Gonadal axis. Types of gametes in animals – the developing egg and its environment – sexual cycles (estrus and menstrual) – role of hormones in gametogenesis.

UNIT II

Fertilization and Cleavage – physico-chemical events related to fertilization and cleavage – morphological aspects of gastrulation and primary organ formation – physiology of gastrulation.

UNIT III

18 Hours

18 Hours

18 Hours

18 Hours

Determination of primary organ rudiments. Embryonic adaptations. Organogenesis – morphogenetic process – development of central nervous system, heart and alimentary canal. Differentiation and growth – general considerations. Metamorphosis – regeneration and sexual reproduction.

UNIT IV

Reproductive technology: Synchronisation of estrus – control of ovulation embryo transplantation and storage – diagnosis of pregnancy – induction of parturition – out of season and prepuberal breeding – selection technique and sex pre determination – cloning.

UNIT V

Introduction and Applications of Stem cell –Origin and hierarchy; stem cell properties, Identification and Characterization- Potency and differentiation; Niche of stem cell; overview of different stem cell types (embryonic stem cell, adult stem cell and induced pluripotent stem cells)

Text Books

Balinsky, *An Introduction to Embryology*, Cengage Learning Publication, UP, 2012, 5th Edition.
K.V. Sastry and Vineeta Shukla, *Developmental Biology*, Rastogi Publications, Meerut, 2018.
P.S. Verma and V.K. Agarwal, *Chordate Embryology*, S. Chand Publications, New Delhi, 2010.

Reference Books

Kiessling, A.A, *Human Embryonic Stem Cells*, Jones & Barlett Publishers, 2006, Second Edition Lanza, R, *Essentials of stem cell biology*, Academic Press, 2005.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Module No.	Торіс	No. of Lectures	Content Delivery Methods	
	UNIT - I	I		
	Gametogenesis: Spermatogenesis and			
1.1	Oogenesis – role of	6	Chalk & Talk	
	Hypothalamohypophyseal Gonadal axis.			
	Types of gametes in animals – the			
1.2	developing egg and its environment -	7	E-Resources	
	sexual cycles (estrus and menstrual)			
1.3	Role of hormones in gametogenesis	5	Discussion	
UNIT - II				
	Fertilization and Cleavage – physico-			
2.1	chemical events related to fertilization	6	Discussion	
	and cleavage			
22	morphological aspects of gastrulation and	6	Chally & Tally	
2.2	primary organ formation	0	Chaik & Taik	
2.3	physiology of gastrulation	6	E-Resources	
	UNIT - III	-		
31	Determination of primary organ	5	F-Resources	
5.1	rudiments. Embryonic adaptations.	5	L-Resources	

3.2	Organogenesis – morphogenetic process.	2	Chalk & Talk
3.3	development of central nervous system,heartandalimentarycanal-Differentiation and growth	5	Discussion
3.4	General considerations - Metamorphosis – regeneration and sexual reproduction	6	E-Resources
	UNIT - IV		
4.1	Reproductive technology: Synchronisation of estrus.	4	Discussion
4.2	Controlofovulationembryotransplantation and storage	4	E-Resources
4.3	Diagnosis of pregnancy – induction of parturition	4	Chalk & Talk
4.4	Out of season and prepuberal breeding	4	E-Resources
4.5	Selection technique and sex pre determination – cloning.	2	E-Resources
	UNIT - V		
5.1	Introduction and Applications of Stem cells	5	E-Resources
5.2	Origin and hierarchy; stem cell properties, Identification and Characterization	4	Chalk & Talk
5.3	Potency and differentiation; Niche of stem cell	4	Discussion
5.4	Overview of different stem cell types (embryonic stem cell, adult stem cell and induced pleuripotent stem cells)	5	E-Resources
	Total	90	

Course Designer Ms. P. Vinnoli Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC32	Biological Chemistry and Biophysics	Core –X	90	5

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	\checkmark

To enable the students to elaborate the structure and function of biomolecules. Illustrates the metabolic pathways and regulation of biochemical process. Brief about vitamins, enzymes and their regulation.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Summarize the basic formation of biological compounds	K1,K2
CO2	Explain, identify and analyze the biosynthesis pathways and structure of nucleic acids and proteins	K1,K2,K3,K4
CO3	Assess and Interpret fat metabolism and their importance	K1,K2,K3,K4,K5
CO4	Categorize vitamins, Discuss the structure & function of vitamins and enzyme kinetics	K1,K2,K3,K4
CO5	Find out the reactions involved in cellular energy synthesis and their application of thermodynamic laws	K1,K2,K3

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate

Mapping of CO with PO

	P01	P02	PO3	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3

11 0						
	PS01	PSO2	PSO3	PSO4	PSO5	
C01	3	3	3	2	3	
CO2	3	3	3	1	3	
CO3	3	3	1	2	3	
CO4	3	2	3	3	3	
CO5	3	3	1	2	3	
-Low 2-Medium				3-Strong		

Mapping of CO with PSO

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Syllabus

UNIT I

18 Hours

Water: Molecular structure of water–Non-covalent bonding: Hydrogen bond, electrostatic interaction- Van de Waals forces thermal, solvent properties ionization of water– colligative properties of aqueous solution– Calculations of pH mixture-dissociation of water-pH-dissociation of weak acids– Henderson-Hasselbalch equation– Buffer solutions- Physiological buffers (Carbonate and phosphate buffers).

UNIT II

Nucleic acid structure: RNA and DNA, synthesis and metabolism (De nova and Salvage Pathway) - Amino acids: Basic structure and classification-Physical and chemical properties-Biosynthesis of amino acids. Proteins: Classification -Levels of organization – primary, secondary (Molecular α helix and β -pleated sheets, tertiary and quaternary. Ramachandran plot. Metabolism: Transamination, deamination and transmethylation.

UNIT III

Lipids: Classification-Structure of triglycerol, waxes, phospholipids, cholesterol and terpenes Properties and reactions- Biological importance. Biosynthesis of fatty acids and cholesterol. Degradation of fatty acids and cholesterol-Ketone bodies and lipid peroxidation.

UNIT IV

18 Hours

18 Hours

Vitamins: Structure, occurrence and biochemical functions. Enzymes: Properties, classification, enzyme action- regulation (Genetic control, Covalent modification, allosteric regulation, compartmentation), enzyme kinetics: Michaelis-Menten Lineweaver-Burk plots, enzyme inhibitors/activators Coenzyme, isoenzyme, allosteric enzyme, abzyme and ribozyme.

18 Hours

UNIT V

Diffusion – Fick's laws, constant laws– osmotic gradient– osmotic coefficient – Gibbs Donnan equilibrium – Active transport. Laws of thermodynamics – Concept of free energy and entropy – exergonic and endergonic reaction – rate of reactions – energy activation – Arrhenius expression- Bioenergetics – Role of ATP – biological oxidation reduction reaction – redox potentials in biological system – respiratory chain and oxidative phosphorylation – high energy compounds.

Text Books

Ambika Shanmugam, *Fundamentals of Biochemistry for Medical students*, Published by the Author, Chennai, 2004.

Narayanan, P., *Essential of Biophysics,* New Age international Publication Private Ltd., Chennai, 2000, First Edition.

Reference Books

Satyanarayana, U and Chakrapani, U., *Biochemistry*, Books and Allied Pvt. Ltd., Kolkata, 2009.

Jain, J.L., Sunjay Jain and Nitin Jain, *Fundamentals of Biochemistry,* S. Chand and Company Ltd, New Delhi, 2010, Fifth Edition.

Rastogi, S.C., *Biochemistry*, Tata McGraw Hill Edition, New Delhi, 2010, 3rd Edition.

William Bialek, *Biophysics*, Princeton University Press, New Jersey, 2012.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module	Tonic	No. of	Content Delivery
No.	No.		Methods
	UNIT - I		
1.1	Water: Molecular structure of water–Non- covalent bonding: Hydrogen bond, electrostatic interaction	4	Chalk & Talk
1.2	Van de Waals forces thermal, solvent properties ionization of water –colligative properties of aqueous solution	4	Discussion

	Calculations of pH mixture- dissociation of			
1.3	water-pH- dissociation of weak acids-	4	E-Resources	
	Henderson-Hasselbalch equation			
1.4	Buffer solutions- Physiological buffers	6		
1.4	(Carbonate and phosphate buffers)	6	E-Resources	
	UNIT - II			
	Nucleic acid structure: RNA and DNA,			
2.1	synthesis and metabolism (De nova and	3	Chalk & Talk	
	Salvage Pathway)			
	Amino acids: Basic structure and			
2.2	classification- Physical and chemical	4	E-Resources	
	properties-Biosynthesis of amino acids			
	Proteins: Classification - Levels of			
	organization – primary, secondary			
2.3	(Molecular α -helix and β -pleated sheets,	6	E-Resources	
	tertiary and quaternary. Ramachandran			
	plot			
24	Metabolism: Transamination,	Б	E Docourcos	
2.4	deamination and transmethylation	5	E-Resources	
	UNIT - III			
	Lipids: Classification - Structure of			
3.1	triglycerol, waxes, phospholipids,	6	E-Resources	
	cholesterol and terpenes.			
32	Properties and reactions - Biological	4	Chalk & Talk	
0.2	importance.	1		
3.3	Biosynthesis of fatty acids and cholesterol	4	Discussion	
3.4	Degradation of fatty acids and cholesterol-	4	E-Resources	
	Ketone bodies and lipid peroxidation	•		
	UNIT - IV			
4.1	Vitamins: Structure, occurrence and biochemical functions.	5	E-Resources	
	Enzymes: Properties, classification,			
4.2	enzyme action - regulation (Genetic	C	E Dessures	
4.2	control, Covalent modification, allosteric	6	E-Resources	
	regulation, compartmentation).			
	Enzyme kinetics: Michaelis-Menten,			
	Lineweaver-Burk plots, enzyme	_		
4.3	inhibitors/activators, Coenzyme,	7	E-Resources	
	isoenzyme, allosteric enzyme, abzyme and			
	11002y111C.			

	UNIT - V		
5.1	Diffusion – Fick's laws, constant laws– osmotic gradient– osmotic coefficient	4	E-Resources
5.2	Gibbs Donnan equilibrium – Active transport.	4	PPT
5.3	Laws of thermodynamics – Concept of free energy and entropy – exergonic and endergonic reaction – rate of reactions – energy activation – Arrhenius expression.	6	Discussion
5.4	Bioenergetics – Role of ATP – biological oxidation reduction reaction – redox potentials in biological system – respiratory chain and oxidative phosphorylation – high energy compounds	4	E-Resources
	Total	90	

Course Designer Dr. M. Mohiadeen Batcha

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
	Developmental Biology,			
20PZYP31	Biological Chemistry ,	Core – XI	150	5
	Biostatistics & Bioinformatics			

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

To enable the students acquire knowledge on diversity of animals with or without backbones and improve the genetic, cellular, molecular, biotechniques and dissection techniques among the students.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	C01	Develop dissection technique and Explain the functional anatomy of selected invertebrates	K1,K2,K3,K4,K5
	CO2	Compare the external Characters and classify the affinities and adaptive features of Various vertebrates.	K1,K2,K3,K4,K5
	CO3	Identify the chromosome complement number of an individual, mutants and explain the Principle of segregation, genotype frequency in a population	K1,K2,K3,K4,K5
	CO4	Determine the membrane composition and estimate the structural features of component macromolecules in different cells	K1,K2,K3,K4,K5
	CO5	Evaluate the genomic organization of living organisms, Estimation of macromolecules, Blotting and amplification techniques	K1,K2,K3,K4,K5
K1	-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Manning of CO with PSO

11 8					
	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Medium			3-Strong

1-LOW

Syllabus

Developmental Biology: Sperm count from bull semen. Egg diameter measurement, volume and density of microscopic eggs. Mounting of chick blastoderm Early hours-12, 24. Late hours - 48, 72, 96 hours.

Developmental Biology: Observation of developmental stages of frog (microscopic slides). Hormonal action in amphibian metamorphosis. Regeneration study in frog tadpoles. Oviparity, Ovoviviparuty and parental care (Spotters).

Biological Chemistry: Quantitative estimation of aminoacid in tissue samples, Quantitative estimation of Protein in tissue samples, Quantitative estimation of carbohydrate in tissue samples, Quantitative estimation of lipids in tissue samples

Biostatistics: Representation of data in one, two, three dimensional diagrams and pictograms. Graphic representation of data through graphs of time series and frequency distribution.

Bioinformatics: Basics of Bioinformatics, types of data base, Online sequence retrieval- NCBI., Literature database- Pub Med, Medline, OMIM., Homology study-Basic alignment- BLAST & FASTA., DNA & protein sequence analysis, pair wise (Emboss) alignment techniques, Multiple alignment techniques -Clustal W.

Text Books

Dr. S. Rajan and Mrs. R. Selvi Christy, *Experimental procedures in Life sciences*, Anjanaa Book House-2010.

Reference Books

John Evans, Laura R. Keller, and Thomas C, A, *Laboratory Manual -Experimental Developmental Biology*, S. Keller, Academic press, 1999. Arthur M. Lesk, *Introduction to bioinformatics Novel*, Oxford University Press, 4th Edition, 2014. Bernard Rosner, *Study Guide For Fundamentals of Biostatistics Book*, Cangage learning, 2016.

Course Designer

Ms. Athira sukumaran

Assistant Professor of Zoology
Course Code	Course Title	Category	Total Hours	Credits	
20D7VE21	Biostatistics and	Elective III	75	F	
ZUPZYE31	Bioinformatics	Elective -III	75	5	

Nature of Course		Course Relevance	
Knowledge Oriented 🖌		Local	
Skill Oriented 🖌		Regional	
Employability Oriented		National	
Entrepreneurship Oriented		Global	✓

To provide students with the ability to integrate and practice across biological and computing disciplines. To define the principles and concepts on biostatistics and bioinformatics.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Explain the type of variables, summarize the data and construct graphical and diagrammatic representation of data.	K1, K2
CO2	Apply probability principles for setting significance levels and testing hypothesis using statistical tests.	K1, K2, K3
CO3	Evaluate results of statistical test and interpret experimental conclusion.	K1, K2, K3,K4,K5
CO4	Design with network concepts, in silico approaches, biological databases available.	K1, K2, K3,K4,K5
C05	Make use of information from large databases and to use this information in computer modeling.	K1, K2, K3,K4

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
1 T		9 M -	1		0.0

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

Syllabus

UNIT I

Definition of biostatistics – samples and population – variables- derived Sources- classification- tabulation -Presentation of data variablesdiagrammatic representative of data - Calculation of Measures of central tendencies and dispersion- coefficient of variation.

UNIT II

Methods of sampling and sampling distribution - Probability - Events -Addition and Multiplication laws- Binomial and Normal distribution -Correlation - (scatter diagram) dot diagram - Karl Pearson's - Calculation of Correlation coefficient- Skweness and Kurtosis.

UNIT III

Calculation of Regression analysis – X on Y and Y on X - Student t' test-(mean difference and paired sample) Significance of Chi-square test- F test- ANOVA - One way analysis of variance- Statistical package SPSS.

UNIT IV

Introduction to Bioinformatics-Aims-Tasks and Applications of Bioinformatics- Information Retrieval System- Data submission Tools- Data Analysis and Prediction Tools- Biological databases- Nucleic acid sequence data banks.

UNIT V

Databases of patterns, motifs and profiles- Metabolic Pathway Databases-Literature Databases-Database Similarity Searches - BLAST- FASTA -PSI-BLAST algorithms-Pair wise sequence alignment - NEEDLEMAN and Wunsch - Smith Waterman algorithms- Multiple sequence alignments -CLUSTAL- PRAS-Patterns-motifs and Profiles in sequences.

2-Medium

3-Strong

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Text Books

Attwood, T.K. and Parry, D.J – Smith, *Introduction to Bioinformatics*, Pearson Education (Singapore) Pvt. Ltd. 2005.
Khan, I.A and Khanum, A., *Fundamental of Bio-statistics*, Ukaaz Publication, New Delhi, 2004.
Twyman, R.H. *Instant notes on Bioinformatics*, Viva Books Pvt. Ltd., New Delhi, 2003.

Reference Books

Arora, P.N. *Biostatistics,* Himalaya Publishing House, 1998.
Ignacimuthu S. J. S, *Basic Bioinformatics* Narosa Publishing House, 2005.
Murthy, C.S.V. *Bioinformatics*. Himalaya Publishing House. India, 2003.
ZAR, J. H, *Biostatistical Analysis*, Pearson Education Pvt. Ltd. Singapore, 2004.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Module	Topic	No. of	Content Delivery	
No.	Горіс	Lectures	Methods	
	UNIT - I			
	Definition of biostatistics – samples and			
1.1	population- variables-derived variables-	5	Chalk & Talk	
	Sources.			
1 2	Classification - tabulation -presentation of	ц	Chally & Tally	
1.2	data diagrammatic representative of data.	5	Chaik & Taik	
13	Measures of central tendencies and	5	Chally & Tally	
1.5	dispersion- coefficient of variation.	5	Chaik & Taik	
	UNIT - II			
21	Methods of sampling and sampling	ц	Chally & Tally	
2.1	distribution.	5	Chaik & Taik	
22	Probability – Events – Addition and	2	Chally & Tally	
2.2	Multiplication laws.	5	Chaik & Taik	
	Binomial and Normal distribution -			
2.3	Correlation - (scatter diagram) dot	4	Chalk & Talk	
	diagram.			

2.4	Karl Pearson's – Correlation coefficient- Skweness and Kurtosis.	3	Chalk & Talk
	UNIT - III		
3.1	Regression analysis – X on Y and Y on X - Student t' test	5	РРТ
3.2	Significance of Chi-square test- F – test	4	PPT
3.3	ANOVA – One way analysis of variance	3	Chalk & Talk
3.4	Statistical package SPSS.	3	Chalk & Talk
	UNIT - IV		
4.1	Introduction to Bioinformatics-Aims- Tasks and Applications of Bioinformatics	5	Chalk & Talk
4.2	Retrieval System- Data submission Tools- Data Analysis and Prediction Tools	5	Chalk & Talk
4.3	Biological databases- Nucleic acid sequence data banks.	5	Chalk & Talk
	UNIT - V		
5.1	Databases of patterns, motifs and profiles- Metabolic Pathway Databases- Literature Databases	5	Chalk & Talk
5.2	Database Similarity Searches-BLAST- FASTA- PSI-BLAST algorithms	3	Chalk & Talk
5.3	Pair wise sequence alignment - NEEDLEMAN and Wunsch	3	Chalk & Talk
5.4	Smith Waterman algorithms- Multiple sequence alignments	2	Chalk & Talk
5.5	CLUSTAL- PRAS-Patterns-motifs and Profiles in sequences	2	Chalk & Talk
	Total	75	

Course Designer

Ms. P. Vinoli Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE32	Cancer Biology	Elective -III	75	5

Nature of Course	Course Relevance		
Knowledge Oriented 🖌		Local	
Skill Oriented		Regional	Ī
Employability Oriented		National	Ī
Entrepreneurship Oriented		Global	Ī

To enable the students acquire knowledge on various genetic and molecular changes normal cells undergo during transformation into malignant cancer cells. These modifications include unregulated cell proliferation, evasion of cell death, and metastasis. This course will describe Factors that contribute to cancer development and discuss cancer prevention and currently available therapeutic treatments.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Explain the characteristics, morphological and	K1,K2,K3,K4,K5
CO2	Mark the role of tumor markers, growth factor and transcription factors	K1,K2,K3,K4,K5
CO3	Determine the Initiation, promotion and progression of cancer cells	K1,K2,K3,K4,K5
CO4	Discuss the types genes which regulate the cell cycle	K1,K2,K3,K4,K5
CO5	Evaluate the Strategies of Anticancer drug therapy	K1,K2,K3,K4,K5
K1-Kno	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

Mapping of CO with PO

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
C05	3	3	1	2	3
		0.14			0.0

1-Low

3-Strong

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low 2-Medium			•	3-Strong	

Syllabus

UNIT I

15 Hours

15 Hours

Introduction: Growth characteristics of cancers cells; Morphological and ultrastructural properties of cancer cells. Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Nomenclature of neoplasms. Differences between benign and malignant tumors. Epidemiology of cancer.

UNIT II

Cancer biology and biochemistry: Aberrant metabolism during cancer development; Paraneoplastic syndromes; Tumor markers; cellular protooncogenes- oncogene activation. Growth factors-EGF, TNF- α and TGF- β and growth factor receptors–Signal transduction in cancer – Role of transcription factors.

UNIT III

Carcinogenesis: radiation and chemical carcinogenesis- stages in chemical carcinogenesis- Initiation, promotion and progression. Free radicals, antioxidants in cancer; Viral carcinogenesis -DNA and RNA Viruses and human cancer; Cancer endocrinology.

UNIT IV

15 Hours

15 Hours

Cell Cycle Regulation: Tumor suppressor genes p53, p21 and Rb. Telomeres, Telomerase, and Immortality; cell- cell interactions, cell adhesion-invasion and metastasis - VEGF signaling, angiogenesis; Apoptosis in cancer-Cell death by apoptosis– role of caspases; Death signaling pathways-mitochondrial and death receptor pathways.

UNIT V

15 Hours

Strategies of anticancer drug therapy: chemotherapy - gene therapy. Immunotherapy and Radiotherapy; Stem Cells and Cancer.

Text Books

Lewis J. Kleinsmith, *Principles of Cancer Biology*, Pearson Benjamin Cummings, 2006.

Reference Books

R. G. McKinnell, R. E. Parchment, A. O. Perantoni, G.Barry Pierce, I. Damjanov. *The Biological Basis of Cancer:* Cambridge University Press, 2006. 2nd Edition.
R. A. Weinberg, *The Biology of Cancer:* Garland Science. 2006.
Malcolm R. Alison, *The Cancer Hand Book:* Nature Publishing Group. 2003.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models and Interactive White Board

Module No.	Торіс	No. of Lectures	Content Delivery Methods	
	UNIT - I	Lectures		
1.1	Introduction – Growth characteristics of cancers cells; Morphological and ultrastructural properties of cancer cells	5	Chalk & Talk	
1.2	Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Nomenclature of neoplasms.	5	E-Resources	
1.3	Differences between benign and malignant tumors. Epidemiology of cancer.	5	Chalk & Talk	
UNIT - II				
2.1	Cancer biology and biochemistry- Aberrant metabolism during cancer development; Paraneoplastic syndromes;	5	Chalk & Talk	
2.2	cellular protooncogenes- oncogene activation. Growth factors-EGF, TNF-α and TGF-β and growth factor receptors	5	E-Resources	
2.3	Signal transduction in cancer – Role of transcription factors.	5	Discussion	
	UNIT - III			
3.1	Carcinogenesis- radiation and chemical carcinogenesis.	5	Chalk & Talk	
3.2	stages in chemical carcinogenesis- Initiation, promotion and progression.	5	E-Resources	

3.3	Free radicals, antioxidants in cancer; Viral carcinogenesis -DNA and RNA Viruses and human cancer; Cancer endocrinology.	5	Discussion
	UNIT - IV		
4.1	Cell Cycle Regulation-Tumor suppressor genes p53, p21 and Rb	5	Discussion
4.2	Telomeres, Telomerase, and Immortality; cell- cell interactions, cell adhesion- invasion and metastasis	5	E-Resources
4.3	VEGF signaling, angiogenesis; Apoptosis in cancer-Cell death by apoptosis– role of caspases; Death signaling pathways- mitochondrial and death receptor pathways.	5	Chalk & Talk
	UNIT - V		
5.1	Strategies of anticancer drug therapy	5	E-Resources
5.2	hemotherapy - gene therapy. Immunotherapy and Radiotherapy	5	Chalk & Talk
5.3	Stem Cells and Cancer.	5	Discussion
	Total	75	

Course Designer

Ms. P. Vinnoli Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20D7VC41	General and Applied	Coro VII	75	Λ
20721041	Entomology	Core -XII 75	4	

Nature of Course	
Knowledge Oriented	
Skill Oriented	
Employability Oriented	\checkmark
Entrepreneurship Oriented	

The purpose of this course is to promote the students to develop the expertise in identifying the insects that we come across on regular basis and its biology.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Identify the taxonomy and morphological characters of insects.	K1, K2, K3
CO2	Elaborate the reproductive physiology and hormonal control of moulting in insects.	K1, K2
CO3	Assess whether the insects are beneficial or harmful with special reference to agricultural entomology.	K1, K2, K3
CO4	Explain the biology of insect vectors causing diseases irrespective of man.	K1,K2,K3,K4
CO5	Measure and develop policies pertaining to insect pest control measures.	K1,K2,K3,K4,K5
K1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	P01	PO2	PO3	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
C04	3	2	3	3	3
CO5	3	3	1	2	3

11 0					
	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
l-Low		2-Me	dium		3-Strong

1-Low

Syllabus

UNIT I

15 Hours

15 Hours

Insect Taxonomy- Salient features of insects, Basics of Insect classification. Key characters of five important insect orders (Odonata, Orthoptera, Coleoptera, Diptera, and Lepidoptera) with common examples. Morphology: Head, segmentation and sutures. Thorax and its appendages. Insect legs. Wings- venation. Abdomen and its appendages – Genitalia.

UNIT II

Physiology: Integumentary system – structure and chemistry – physiology of moulting. Reproductive system: Male and female reproductive systems – types of ovaries– vitellogeneis – mating –oviposition– viviparity – accessory reproductive glands – their secretions and functions. Endocrine system: Endocrine control of moulting and metamorphosis – role of hormones in male and female reproduction.

UNIT III

Beneficial insects – Honeybee and Silkmoth-Biology, Culture methods and Economic importance. Agriculture pests – Biology, damage and control methods of pests of paddy (*Scirpophaga incertulas*), sugarcane (*Chilo infuscatellus*), coconut (*Rhyncophorus ferrugineus*) and brinjal (*Leucinodes orbanalis*) – pests of stored products (*Sitophilus oryzae*).

UNIT IV

15 Hours

15 Hours

Medical and Veterinary entomology: Biology and control of house fly and mosquito. Biology and control of Cattle (Horse fly and Cattle fly) and Poultry pests (Shaft louse and Chicken flea).

UNIT V

15 Hours

Principles of Insect control – prophylatic measures – cultural, mechanical, physical Methods. Pesticides - classification – mode of entry, mode of action, chemical nature. Non-conventional methods: Pheromones and chemosterilants. Merits and Demerits of chemical methods of pest control – Biocontrol agents (List only) – Merits and Demerits – Integrated Pest Management (IPM).

Text Books

Nalina Sundari, M.S and Santhi, R, *Entomology*, MJP Publishers, Chennai, 2006. David B.V and Ananthakrishnan, T.N., *General and Applied Entomology*, Tata McGraw Hill Pub. Co., Ltd., New York, 2013.

Reference Books

Chapman, R.F., *The Insects: Structure and Function,* Hodder and Bhoughton Ltd., Kent, U.S.A, 2012.

Snodgrass, R.E., *Principles of Insect Morphology*, McGraw Hill and Co., New York, 2004.

Vasantharaj David B., *Elements of Economic Entomology*, Brillion Publishing, New Delhi. 2017.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Module	Торіс	No. of	Content Delivery Methods
110.	UNIT - I	Lettiles	Methous
1.1	Insect Taxonomy - Salient features of insects, Basics of Insect classification.	3	Chalk & Talk
1.2	Key characters of five important insect orders (Odonata, Orthoptera, Coleoptera, Diptera, and Lepidoptera) with common examples.	3	Discussion
1.3	Morphology: Head, segmentation and sutures. Thorax and its appendages.	5	E-Resources
1.4	Insect legs. Wings- venation. Abdomen and its appendages – Genitalia.	4	E-Resources

	UNIT - II				
2.1	Physiology: Integumentary system – structure and chemistry – physiology of moulting.	5	Discussion		
2.2	Reproductive system: Male and female reproductive systems	3	E-Resources		
2.3	Types of ovaries- vitellogeneis - mating- oviposition - viviparity - accessory reproductive glands- their secretions and functions.	3	E-Resources		
2.4	Endocrine system: Endocrine control of moulting and metamorphosis – role of hormones in male and female reproduction.	4	E-Resources		
	UNIT - III				
3.1	Beneficial insects – Honeybee- Biology, Culture methods and Economic importance.	5	E-Resources		
3.2	Silkmoth- Biology, Culture methods and Economic importance.	5	E-Resources		
3.3	Agriculture pests – Biology, damage and control methods of pests of paddy (<i>Scirpophaga incertulas</i>), sugarcane (<i>Chilo</i> <i>infuscatellus</i>)	2	Discussion		
3.4	Coconut (<i>Rhyncophorus ferrugineus</i>) and brinjal (<i>Leucinodes orbanalis</i>) – pests of stored products (<i>Sitophilus oryzae</i>).	3	Chalk & Talk		
UNIT - IV					
4.1	Medical and Veterinary entomology: Biology and control of house fly and mosquito.	7	E-Resources		
4.2	Biology and control of Cattle (Horse fly and Cattle fly)	4	E-Resources		
4.3	Poultry pests (Shaft louse and Chicken flea).	4	E-Resources		

	UNIT - V			
	Principles of Insect control – prophylatic			
5.1	measures – cultural, mechanical, physical	3	E-Resources	
	Methods.			
5.2	Pesticides - classification – mode of entry,	6	DDT	
5.2	mode of action, chemical nature.	0		
52	Non-conventional methods: Pheromones	2	Discussion	
5.5	and chemosterilants.	2		
	Merits and Demerits of chemical methods			
5.4 of pest control – Biocontrol agents (Lis		2	Discussion	
	only) – Merits and Demerits			
5.5	Integrated Pest Management (IPM).	2	E-Resources	
	Total	75		

Course Designer

Dr. M. Ashiq Ur Rahman

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC42	Parasitology	Core –XIII	75	4

Nature of Course		Course Relevance
Knowledge Oriented	\checkmark	Local
Skill Oriented		Regional
Employability Oriented		National
Entrepreneurship Oriented		Global

The students are enable to set the information in various kinds of parasites affecting the health of mankind.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Explain the relationship between a parasite and the host and their effects.	K1,K2,K3
CO2	Discuss in detail the classification of medically important parasites and prevention of transmission.	K1,K2,K3,K4
CO3	Explain the difference between the cestodes, Nematodes, Trematodes and Protozoan parasites and prevention.	K1,K2,K3,K4K5
CO4	To develop students with adequate knowledge about endemic parasite, national parasitic problems and common parasities worldwide.	K1,K2,K3
CO5	To extend students knowledge about laboratory examination and identification of parasitic infection in samples.	K1,K2

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate

	P01	PO2	PO3	P04	P05
C01	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3

	PS01	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	3
CO2	3	3	3	1	3
CO3	3	3	1	2	3
CO4	3	2	3	3	3
CO5	3	3	1	2	3
1-Low		2-Me	dium		3-Strong

1-Low

Syllabus

UNIT I

Scope and definition of parasites: parasitology-Animal Association, Types of Parasites and Hosts-Interrelationship between Host and Parasites responses and hosts to parasitic infection-Mode of transmission of parasite, Host specificity and parasitic adaptation.

UNIT II

Classification, Geographical distribution, Morphology, Life-cycle of Pathogenesis: Classification, Geographical distribution, Morphology, Lifecycle of Pathogenesis -Life cycle-Treatment and prevention of Transmission, Pathogenecity, Treatment and Prophylaxis of: Protozoan parasites: Entamoeba Sps, Trypanosoma Sps., Leishmania Sps.-Intestinal flagellates Giardia Sps, Trichomonus Sps.Insect parasite: plasmodium.

UNIT III

Cestodes: Taenia sp. Diphilabothrium sp. Pathogenesis-Life cycle-Prevention and treatment of protozoans and parasitic cestodes. Morphology, Classification, Trematodes: Life-cycle, Transmission, Pathogenecity, Treatment and Prophylaxis of Schistosomo Sp. Faciola Sp. Echinococcus Sp.

UNIT IV

Nematodes: Wuchereria sp. Ancylostoma Sp.Dracunculus Sp.plant & soil nematodes: Cyst nematodes, citrus nematode biodiversity & Taxonomic overview of Helminth Parasites. Parasites of Vetrinary importance.

UNIT V

Laboratory techniques in parasitology: Laboratory techniques in parasitology - Examination of faeces for Ova and cysts-concentration methods-Blood smear for parasites-Cultivation of protozoan parasites. Covid 19 Virus: Structure, function, Causative mechanism & transmission.

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Text Books

Anderson, O.R. *Comparative protozoology, Ecology, Physiology*, Life history. Springer verlag, Berlin, 2009.

Cox F.E.G, *Modem Parasitology*, Eds. Parasitology in focus, facts & trends, Melhorn h., Eds., Spriger Verlag, Beriin, 2013.

Piakarsky G. L. *Medical Parasitology*, Springer Verlag, Berlin, 2015.

Kelkar and Rohini S.Kelkar, *A Text book of Parasitology*, Bombay popular prakashan, 2010.

Chandler and Chands, *Parasitology*, 2012.

Ramni Sood, *Parasitology*, C.B.S. Publisher, New Delhi, 2014.

Reference Books

Soulsby, E. J. L. *Helminths, Arthropods and Protozoa of domesticated animals*, ELBS and Bailliere Tindall, London, 2008.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Module	Tonia	No. of	Content Delivery
No.	Горіс	Lectures	Methods
	UNIT - I		
	Scope and definition - Scope of		
1.1	parasites/parasitology-Animal	5	Chalk& Talk
	Association		
	Types of Parasites and Hosts -		
1.2	Interrelationship between Host and	5	E-Resources
	Parasites responses		
	Hosts to parasitic infection - Mode of		
1.3	transmission of parasite, Host specificity	5	Discussion
	and parasitic adaptation		
	UNIT - II		
	Classification, Geographical distribution,		
2.1	Morphology, Life-cycle-Pathogenesis-Life	F	E Docourcos
2.1	cycle-Treatment and prevention of	5	E-Resources
	Transmission		

2.2	Pathogenecity, Treatment and Prophylaxis	F	Discussion
2.2	Sps, Trypanosoma Sps., Leishmania Sps.	5	Discussion
	Intestinal flagellates Giardia		
2.3	Sps, <i>Trichomonus Sps</i> .Insect parasite:	5	Chalk & Talk,
	plasmodium.		
	UNIT - III		
	Cestodes: Taenia sp. Diphilabothrium sp.		
2.1	Pathogenesis-Life cycle-Prevention and	F	Challs 9 Talls
5.1	treatment of protozoans and parasitic	5	Chaik & Taik
	cestodes.		
2.2	Classification, Morphology, Life-cycle,	Ľ	E Deseurees
5.2	Transmission, Trematodes	5	E-Resources
	Pathogenecity, Treatment and		
3.3	Prophylaxis of Schistosomo Sp. Faciola Sp.	5	Discussion
	Echinococcus Sp.		
	UNIT - IV		
1 1	Nematodes: Wuchereria sp. Ancylostoma	Ę	Disquesion
4.1	Sp.Dracunculus Sp.plant & soil nematodes:	5	DISCUSSION
	Cyst nematodes,citrus nematode		
4.2	biodiversity&Taxonomic overview of	5	E-Resources
	Helminth Parasites.		
4.3	Parasites of Vetrinary importance	5	Chalk & Talk
	UNIT - V		
51	Laboratory course and techniques in	Б	F Pocourcos
5.1	parasitology	5	E-Resources
F 2	Examination of faeces for Ova and cysts-	Л	Challe & Talle
5.2	concentration methods	4	CHAIK & TAIK
5.2	Blood smear for parasites-Cultivation of	2	Discussion
5.5	protozoan parasites.	5	Discussion
51	Covid 19 Virus: Structure, function,	2	Chally & Tally
5.4	Causative mechanism & transmission.	3	UIIAIK & I AIK
	Total	75	

Course Designer Dr. M. Mohiadeen Batcha Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYC43	Project	Core – XIV	150	4

Nature of Course		C	Course Relevance	
Knowledge Oriented	\checkmark	L	Local	
Skill Oriented	\checkmark	R	Regional	
Employability Oriented	\checkmark	Ν	National	
Entrepreneurship Oriented		G	Global	\checkmark

The students pursuing this course would have to develop in depth understanding of the subject. The working principles, Design guidelines and experimental skills associated with different fields of zoology promote original thinking, innovation thoughts to the students.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	CO1	Identify, Define and apply the core knowledge related to	K1, K2
		their research topics.	
	CO2	Describe the materials using various analytical	K1 K2 K3
	602	techniques.	K1, K2,KJ
	CO2	Extend disciplinary knowledge and of a relevant	V1 V2 V2 VA
	LU3	secondary data.	N1, N2,N3,N4
		Demonstrate a systematic understanding of relevant	
	CO4	knowledge within the scope of their biological research	K1, K2,K3,K4
		project.	
		Examine relevant knowledge from available resources	
	CO5	and demonstrate progress toward assessing and	K1, K2
		validity.	
K	1-Knov	vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	P01	PO2	P03	P04	P05
C01	3	2	3	2	3
CO2	3	3	2	3	3
CO3	3	2	3	2	3
CO4	2	2	3	3	3
C05	2	1	2	3	2
T		0.14	1.		0.01

1-Low

2-Medium

3-Strong

Mapping of CO with PSO

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	2	3	2	3
CO2	3	3	2	3	3
CO3	3	2	3	2	3
CO4	2	2	3	3	3
CO5	2	1	2	3	2
l-Low	·	2-Me	dium		3-Strong

1-LOW

Marks

External Examiner: Viva: 100

Course Code	Course Title	Category	Total Hours	Credits
20PZYP41	General and Applied Entomology	Core – XV	75	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

This course is designed to understand the structure and functional aspects of insects and their economic importance. This course covers the four major aspects: insect taxonomy, functional morphology, impact of insects in human welfare and pest control measures.

Course Outcomes (CO)

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

	No.	Course Outcome	Knowledge Level
	CO1	Compare the external morphological features of insects.	K1,K2,K3,K4,K5
	CO2	Identify the different orders of insects with taxonomy.	K1,K2,K3,K4,K5
	CO3	Outline the organ systems in insects.	K1,K2,K3,K4,K5
	CO4	Discuss the beneficial and harmful aspects of insects and insecticides.	K1,K2,K3,K4,K5
CO4 CO5	CO5	Assess integrated pest management and use of insecticides.	K1,K2,K3,K4,K5
K1	1-Knov	vledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	P01	P02	PO3	P04	PO5
C01	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	3	1	3	2
CO5	3	1	3	3	3
1-Low	·	2-Me	dium		3-Strong

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	1	2	3
CO2	3	2	3	3	1
CO3	3	3	3	3	2
CO4	2	3	1	3	2
CO5	3	1	3	3	3

1-Low

2-Medium

3-Strong

Syllabus

General Entomology

Dissection of digestive, nervous and reproductive systems- Mounting of mouth parts and other special morphological modifications of the following species: *Lepisma*, Dragon fly, *Apis*, and Butterfly

- 1. Collection, pinning and preservation of Insects
- 2. Identification of some common insects (at least 10 insects)
- 3. Submission of record and insect library

Applied Entomology

- Collection, identification and study of any four insect pests of crops grown in and around Uthamapalayam – Paddy, vegetables – Brinjal and Lady's finger etc. (any two)
- 2. Identification of two insect pests of mango
- 3. Identification of any two stored product insect pests.
- 4. Identification of beneficial insects: Honey bee, Silk worm larval stage and cocoon.
- 5. Insects of medical importance mosquito, housefly and head louse
- 6. Insecticides : Knowledge of any organochlorine- DDT/HCH, Organophosphorous – Monocrotophos/ Chloropyriphos, Carbamate – Carbofuran, Synthetic pyretheroid – Fenvalerate / Cypermethrin
- 7. Submission of record

Text Books

Ambrose D. P, **The Insect Structure, Function and Biodiversity**, Kalyani publications, New Delhi, 2004.

Reference Books

Chapman RF, Simpson SJ and Douglas A.E, *The Insects: Structure and Function*, 5th Edition, Cambridge University Press, London. 2012.

David BV and Ananthakrishnan TN, *General and Applied Entomology*, Tata McGraw Hill Publishing Company Limited, New Delhi. 2004.

Course Designer Ms. A. Syedali Fathima

Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20PZYE41	Wild Life Management	Elective -IV	75	5

Nature of Course		Course Relevance	
Knowledge Oriented	✓	Local	
Skill Oriented		Regional	
Employability Oriented		National	\checkmark
Entrepreneurship Oriented		Global	

This course is designed to understand the structure and functional aspects of wild life and their economic importance. This course covers the four major aspects: wild taxonomy, functional morphology, impact of wild life in human welfare and its control measures.

Course Outcomes (CO)

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

	No.Course OutcomeKnowledge LevelC01Scope of wild life biology.K1,K2,K3,K4,C02Study of aquatic, terrestrial, forest and mountain ecosystems. Food chain and food web.K1,K2,K3,K4,C03Outline of the Wildlife protection Act.K1,K2,K3,K4,C04Discuss the Role of preservation and conservation management of wild life management.K1,K2,K3,K4,C05Indian forestry, wildlife and to equip him/her to undertake minor projects in this area.K1,K2,K3,K4,K1-KnowledgeK2-UnderstandK3-ApplyK4-AnalyseK5- Evaluate	Knowledge	
		course outcome	Level
	CO1	Scope of wild life biology.	K1,K2,K3,K4,K5
	CO2	Study of aquatic, terrestrial, forest and mountain	K1.K2.K3.K4.K5
		ecosystems. Food chain and food web.	
	CO 3	Outline of the Wildlife protection Act.	K1,K2,K3,K4,K5
	CO4	Discuss the Role of preservation and conservation	K1 K2 K3 K4 K5
	LUT	management of wild life management.	N1,N2,N3,N7,N3
	COE	Indian forestry, wildlife and to equip him/her to	
C05		undertake minor projects in this area.	K1,K2,K3,K4,K3
K	1-Knov	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	P01	PO2	P03	P04	P05
C01	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
1-Low		2-Me	dium	·	3-Strong

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
1-Low		2-Me	dium		3-Strong

Syllabus

UNIT I

15 Hours Introduction: Definitions, ancient history of wild life in India and its present status. Scope of wild life biology. Relationship between animals and man: Man and Elephant conflict.

UNIT II

Wildlife Monitoring: Remote sensing methods: Habitat mapping: Biopyracy and Bioprospecting, Indigenous population and exotic Species: Patenting in wildlife.

UNIT III

Wildlife in India: Endangered species and economically important fishes. Amphibiology – endangered species and economically important amphibians. Herpetology – endangered species and economically important reptiles; special emphasis on Olive Ridley, Crocodiles and snakes. Ornithology - endangered species and economically important birds; bird migration, nesting, bird watching, birds in relation to humans. Mammalogy - endangered species and economically important mammals, Mammals in human life.

UNIT IV

15 Hours

Wildlife management, conservation and legislation: Concepts and principles; planning and execution. Habitat conservation and protection. Wildlife conservation and Legislation: Administrative set up - Central, State, Quasigovernmental. Statuary bodies (IBWL, BNHS, ZSI, WWF, etc). Wildlife protection Act (1972), Indian Forest Act (1927) - Forest Conservation Act (1985). Rules, regulations and punishment, "Red Data Book".

2-Medium

3-Strong

15 Hours

15 Hours

UNIT V

List & location of Zoos, Sanctuaries, Parks and Biosphere reserves of India: Role of these in preservation and conservation management. Rehabilitation programmes (eg. Project Tiger). National parks – Khaziranga, Gir, Bandhipur, Kanha, Guindy, Corbett, etc. Marine National Parks – Mannar, Kutch, Point Kalimer, etc. Sanctuaries – Periyar, Mudumalai, Vedanthangal, Bhandipur, etc. Zoos – Mysore, Trivandrum, Vandalur, Hyderabad, etc.

Reference Books

Stephen H. Berwick and U. B. Sahania *The Development of International Principles and Practices of Wildlife Research Management.*Mark B. Bush *Ecology of a changing planet*Trivi and O'Hore *Human import on ecosystem*S. M. Nair *Endangered Animals of India and their Conservation*

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Module No.	Торіс	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Definitions, ancient history of wild life in India and its present status.	5	Chalk & Talk
1.2	Scope of wild life biology.	5	E-Resources
1.3	Relationship between animals and man. Man and Elephant Conflict	5	Discussion
	UNIT - II		
2.1	Remote sensing methods: Habitat mapping	5	Discussion
2.2	Biopyracy and Bioprospecting	5	Chalk & Talk
2.3	Indigenous population and exotic Species:	2	E-Resources
2.4	Patenting in wildlife	3	Discussion
	UNIT - III		
3.1	Endangered species and economically important fishes. Amphibiology – endangered species and economically important amphibians.	5	E-Resources

	Herpetology – endangered species and					
3.2	economically important reptiles; special emphasis on Olive Ridley, Crocodiles and snakes.	5	Chalk & Talk			
	Ornithology – endangered species and					
33	economically important birds; bird	3	Discussion			
0.0	migration, nesting, bird watching, birds in	5	Discussion			
	relation to humans.					
34	economically important mammals	2	Chalk & Talk			
5.1	Mammals in human life.		Chaix & Faix			
	UNIT - IV					
	Concepts and principles; planning and					
4.1	execution. Habitat conservation and	5	Discussion			
	 4.1 execution. Habitat conservation and protection. 4.2 Wildlife conservation and Legislation: Administrative set up - Central, State, 5 Quasigovernmental. Statuary bodies (IBWL, BNHS, ZSI, WWF, etc). Wildlife protection Act (1972). 					
	Wildlife conservation and Legislation:					
3.2 3.3 3.4 4.1 4.2 4.3 5.1 5.2 5.3	Administrative set up – Central, State,	5	E-Resources			
	Quasigovernmental.					
	Statuary bodies (IBWL, BNHS, ZSI, WWF, etc) Wildlife protection Act (1972)					
4 0	Indian Forest Act (1927) – Forest	_				
4.3	Conservation Act (1985) Rules,	5	Chalk & Talk			
	regulations and punishment, "Red Data	ations and punishment, "Red Data				
	Book".		L			
	UNIT - V					
E 1	Role of these in preservation and	Ę	E Docourcos			
5.1	programmes (eg. Project Tiger)	5	E-Resources			
	National parks – Khaziranga, Gir.					
F 2	Bandhipur, Kanha, Guindy, Corbett, etc.	F	Challs 9 Talls			
5.2	Marine National Parks – Mannar, Kutch,	5	Chaik & Taik			
	Point Kalimer, etc.					
	Sanctuaries – Periyar, Mudumalai,					
5.3	vedantnangal, Bhandipur, etc. Zoos –	5	Discussion			
4.2 4.3 5.1 5.2 5.3	Hyderabad etc					
	Total	75				

Course Designer Ms. P. Vinnoli Assistant Professor of Zoology

Course CodeCourse Title20PZYE42Aqua Culture and Farr Management	Category	Total Hours	Credits	
2007VE42	Aqua Culture and Farm	Floctivo -IV	75	ц
201 21 L42	Management		73	5

Nature of Course		Course Relevance	
Knowledge Oriented		Local	
Skill Oriented		Regional	
Employability Oriented	✓	National	1
Entrepreneurship Oriented		Global	

This course is designed to understand the structure and functional aspects of aquaculture and farm management and their economic importance. This course covers the four major aspects: impact of aquaculture and farm management welfare and its control measures.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Design and layout, structure and construction of aquaculture.	K1,K2,K3,K4,K5
CO2	Discuss about the economical importance of aquaculture and farm management	K1,K2,K3,K4,K5
CO3	Control of parasites, predators, weeds and diseases in culture ponds.	K1,K2,K3,K4,K5
CO4	Discuss about the water quality management.	K1,K2,K3,K4,K5
CO5	Promote provision of quality aquaculture input including high quality fish seeds and fish feeds	K1,K2,K3,K4,K5
K1-Kno	wledge K2-Understand K3-Apply K4- Analyse	K5- Evaluate

	P01	PO2	P03	P04	P05
C01	3	3	3	2	3
CO2	3	2	3	1	3
CO3	1	3	1	2	3
C04	3	3	3	3	3
CO5	3	3	3	2	3

	PS01	PSO2	PSO3	PSO4	PSO5
C01	3	3	3	2	3
CO2	3	2	3	1	3
CO3	1	3	1	2	3
CO4	3	3	3	3	3
CO5	3	3	3	2	3
1-Low	2-Medium				3-Strong

Syllabus

UNIT I

Introduction to Aquaculture: Importance of aquaculture, Global scenario, Present status in India - Prospects and scope. Aquaculture Farms: Site selection, topography, water availability and supply, soil conditions and quality. Design, layout, structure and construction.

UNIT II

Biology of Important Cultivable Species and their Economics: Standard guidance for choosing cultivable species - Seaweeds, Crustaceans (Prawns & Lobsters), Molluscs (Clams, Cockles, Mussels and Oysters) and fishes biological criteria - Environmental adaptability and compatibility -Economic importance - economics, market values, by-products and availability in adjacent region.

UNIT III

Survey of Seed Resources and Seed & Feed Production: Distribution and abundance of natural seed resources, collection methods and segregation. Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation. Live feed - Microalgae, Rotifer and Artemia - their culture. Feed formulation - Conventional and non-conventional ingredients, feed additives, feed attractants and feed formulations.

UNIT IV

Culture Systems: Traditional, Extensive, Semi-intensive and intensive systems, composite fish culture, paddy-cum-fish culture, integrated fish culture, sewage water fish culture, raceway culture, cage, pen and rack culture; Culture system management - pond preparation, production and economics.

UNIT V

Farm Management: Water quality management - temperature, salinity, pH, O₂, Co₂ levels, nutrients and trace elements. Control of parasites, predators, weeds and diseases in culture ponds. Disease diagnosis - ELISA, Western blotting - DNA based diagnosis of diseases and fish vaccines.

2-Medium

3-Strong

15 Hours

15 Hours

15 Hours

15 Hours

15 Hours

Text Books

Balugut, E. A, *Aquaculture system and practices*, a selected review Publishing House, New Delhi.1989.

Reference Books

Dash, M.C. and Patnik, P.N. *Brackish water culture*. Palani Paramount publications, Palani, 1994 Michael, B.N. and Singholka, B. *Freshwater Prawn Farming, A manual of culture of Macrobrachiumrosenbergii*, Daya Publishing House, New Delhi.1985. Paul Raj, S. *Shrimp Farming techniques, Problems and solutions,* Plani Paramount Publications, Palani.1995.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Module	Tonic	No. of	Content Delivery		
No.	Торіс	Lectures	Methods		
	UNIT - I				
	Importance of aquaculture, Global	_			
1.1	scenario, Present status in India -	5	Chalk& Talk		
	Prospects and scope.				
1.2	Aquaculture Farms Site selection,		Chalk & Talk		
	topography, water availability and supply,	5			
	soil conditions and quality.				
1.3	Design and layout, structure and	5	Chalk & Talk		
	construction.	5	Chaik & Faik		
UNIT - II					
	Standard guidance for choosing cultivable		Chalk &Talk		
2.1	species - Seaweeds, Crustaceans (Prawns	3			
	& Lobsters)				
2.2	Molluscs (Clams, Cockles, Mussels and	Λ	Challs 9 Talls		
2.2	Oysters) and fishes	4	CHAIK & TAIK		
2.2	biological criteria - Environmental	4	Chalk & Talk,		
2.3	adaptability and compatibility	4			

2.4	Economic importance - economics, market values, by-products and availability in adjacent region.	4	Chalk & Talk,			
	UNIT - III					
3.1	Distribution and abundance of natural seed resources, collection methods and segregation.	5	Chalk & Talk			
3.2	Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation.	5	Chalk & Talk			
3.3	Live feed - Microalgae, Rotifer and Artemia - their culture. Feed formulation - Conventional and non-conventional ingredients, feed additives, feed attractants and feed formulations.	5	Chalk & Talk			
UNIT - IV						
4.1	Traditional, Extensive, Semi-intensive and intensive systems.	5	Chalk &Talk			
4.2	composite fish culture, paddy-cum-fish culture, integrated fish culture, sewage water fish culture.	5	Chalk & Talk			
4.3	raceway culture, cage, pen and rack culture Culture system management - pond preparation, production and economics.	5	Chalk & Talk			
	UNIT - V					
5.1	Water quality management - temperature, salinity, pH, O ₂ ,CO ₂ levels, nutrients and trace elements	5	Chalk &Talk			
5.2	Control of parasites, predators, weeds and diseases in culture ponds.	5	Chalk & Talk			
5.3	Disease diagnosis - ELISA, Western blotting - DNA based diagnosis of diseases and fish vaccines.	5	Chalk & Talk			
	Total	75				

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