

**ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN
(AUTONOMOUS)
NATIONALLY RE-ACCREDITED WITH B⁺⁺ GRADE BY NAAC
(Affiliated to Mother Teresa Women's University, Kodaikanal)
Chinnakalyamputtur, Palani**



**UNDER
CHOICE BASED CREDIT SYSTEM
ACADEMIC YEAR 2022-2023
P.G DEPARTMENT OF ZOOLOGY
B.SC. ZOOLOGY
SYLLABUS
BATCH: 2022-2025**

**P G DEPARTMENT OF ZOOLOGY
FACULTY MEMBERS**

Dr.R.Muthulakshmi M.Sc.,M.Phil.,Ph.D Associate Professor & Head

Dr.R.UmaMaheswari M.Sc.,M.Phil.,Ph.D Assistant Professor

Mrs.P.Pavatharini M.Sc.,M.Phil., Assistant Professor

Mrs.M.Latha Santhi M.Sc.,M.Phil., Assistant Professor

Dr.S.Subhashini M.Sc.,M.Phil.,Ph.D Assistant Professor

Dr.M.Mohanasundari M.Sc.,M.Phil.,Ph.D Assistant Professor

Mrs.K.P.Sasikala M.Sc.,M.Phil., Assistant Professor



**ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN
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PREAMBLE

The Department of Zoology are established as undergraduate Department in the year 1974 and upgraded as postgraduate in 1987. The Department is enriched by altruistic contribution of a galaxy of teachers. The Department is noted for its good academic record and well-established laboratories. The highlight of the Department is the active participation of the faculty members in Research with many International and National papers in reputed Journals, received many awards and Research grants from various funding agencies such as UGC, DST etc., Our Department tirelessly strives to work towards women's education at all level in the State to be a pioneer in the field of Women Empowerment by introducing relevant papers in the Curriculum to fulfill their local needs through the Board of Studies.

COLLEGE VISION

- **Enlightenment and Empowerment of Rural Women.**

COLLEGE MISSION

- **Providing high quality teaching learning environment with practical exposure**
- **Imbibing research culture and collaborate programs with local communities**
- **Imparting strong and supportive education to promote employability**
- **Encouraging questioning spirit and self – reliance**

P.G DEPARTMENT OF ZOOLOGY

VISION

- **To create self confidence among the students through up-to-date curriculum designing.**
- **To develop and maximize the learning competency.**
- **To inculcate the social and moral values that enables the students to become a good citizen.**
- **To develop true research attitude**

MISSION

- **To provide the students with good quality education.**
- **That integrates science, technologies and society and to perform value based real-time research activities and there by leaping to excellence.**

BLOOM'S TAXONOMY IN FIXING THE LEARNING OBJECTIVES

Since the Academic year 2019 – 2020, the curriculum for Part – III Zoology, B.Sc, has been designed and the learning objectives and outcomes of the programmes are set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into six levels of learning objectives of each course. They are -

K1 / Knowledge = Remember

K2 / Comprehension = Understand

K3 / Application = Apply

K4 / Analysis = Analyze

K5 / Evaluation = Evaluate

K6 / Synthesis = Create

BLOOM'S TAXONOMY ACTION VERBS:

K1/ KNOWLEDGE: Arrange, Define, Describe, Duplicate, Identify, Label, List, Match, Memorize, Name, Order, Outline, Recognize, Relate, Recall, Repeat, Reproduce, Select, State.

K2/COMPREHENSION: Classify, Convert, Defend, Describe, Discuss, Distinguish, Estimate, Explain, Express, Extend, Generalize, Give example(s), Identify, Indicate, Infer, Locate, Paraphrase, Predict, Recognize, Rewrite, Review, Select, Summarize, Translate.

K3/APPLICATION: Apply, Change, Choose, Compute, Demonstrate, Discover, Dramatize, Employ, Illustrate, Interpret, Manipulate, Modify, Operate, Practice, Predict, Prepare, Produce, Relate, Schedule, Show, Sketch, Solve, Use, Write.

K4/ANALYSIS: Analyze, Appraise, Breakdown, Calculate, Categorize, Compare, Contrast, Criticize, Diagram, Differentiate, Discriminate, Distinguish, Examine, Experiment, Identify, Illustrate, Infer, Model, Outline, Point out, Question, Relate, Select, Separate, Subdivide, Test.

K5 / EVALUATION: Appraise, Argue, Assess, Attach, Choose, Compare, Conclude, Contrast, Defend, Describe, Discriminate, Estimate, Evaluate, Explain, Judge, justify, Interpret, Relate, Predict, Rate, Select, Summarize, Support, Value.

K6/ SYNTHESIS: Arrange, Assemble, Categorize, Collect, Combine, Comply, Compose, Construct, Create, Design, Develop, Devise, Explain, Formulate, Generate, Plan, Prepare, Rearrange, Reconstruct, Relate, Reorganize, Revise, write, Set up, Summarize, Synthesize, Tell.

MAPPING COS WITH POs:

For each programme, the Educational objectives and the Specific objectives are specified. The programme outcomes are designed according to the curriculum, teaching, learning and evaluation process. For each course, the definite outcomes are set, giving challenge to the cognitive domain. The course outcomes are mapped with the programme outcomes. The performance of the stakeholders is assessed and the attainment rate is fixed, by using the measurements 'high', 'medium' and 'low'. The restructuring of the curriculum is done based on the rate of attainment.

PROGRAMME EDUCATIONAL OBJECTIVE (PEOs)

PEO 1 Graduates of the program will develop a strong and competent knowledge in basic biological science required for critical learning and research.

PEO 2 Graduates students will develop diversified basic professional skills through various laboratory technical training, communicational and presentation skills.

PEO 3 They will possess an ability to identify, formulate, and solve biological problems to contribute to service efforts to communicate in both the professional and private realm.

PEO 4 Graduates will integrate related topics from separate parts of the course such as levels of organization, cell biology, ecology, evolution, biochemistry, genetics, embryology, basic biotechnology, physiology, molecular biology for successful career.

PROGRAM OUTCOME

Upon completion of B.Sc., Zoology Degree Programme the graduates will be able to

PO 1	Develop a broad fundamental knowledge of the animal diversity especially local fauna pattern of evolution, morphology, adaptations and classification.
PO 2	Analyze the relationship between plants, animals, microbes and deal with the deal with the local national global environment issues by realizing the right of the individuals and also need to conserve our biosphere.
PO 3	Understand how organisms function at the level of gene, genome, cell tissue, organs, organ system, drawing upon this knowledge, they are able to give specific examples of the physiological adaptations developed, reproduction and behavior of different forms of life.
PO 4	Gain knowledge about the application of biological sciences in aquaculture, apiculture, vermiculture, poultry farming, pest management, there by impart skill as well a source of income and self employment
PO 5	Generate innovative ideas for performing experiments in the areas of biochemistry, physiology, genetics, microbiology, Developmental biology, Bioinformatics, Biostatistics, anatomy, taxonomy, economic zoology, and ecology.
PO 6	Explain the recent developments in genetic engineering, biotechnology, immunology, informatics, for research activities in the department or in collaboration with other research institutions.
PO 7	Organize and deliver relevant applications of knowledge through effective written verbal, graphical/virtual communications and interact with people from diverse background.

**ACADEMIC STRUCTURE IN AUTONOMY
EFFECT FROM THE ACADEMIC YEAR 2022-23 ONWARDS**

Part No	Course code	COURSE TITLE	Lecture/ Practical	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER I								
I		Tamil paper I	6	3	25	75	100	3
II		English paper I	6	3	25	75	100	3
III		Core paper I - Invertebrata I	4	3	25	75	100	4
		Core paper II - Invertebrata II	4	3	25	75	100	4
		Core practical I - Invertebrata and Chordata. (Non-semester)	2	-	-	-	-	-
		Ancillary Botany paper I Invertebrata and Chordata	3	3	25	75	100	3
		Ancillary Botany Practical I (Paper I & II - Non semester)	2	-	-	-	-	-
IV		SBC I – Apiculture	2	3	25	75	100	2
		VBE-Value Education	1	3	25	75	100	2
TOTAL			30					21

Part No	Course code	COURSE TITLE	Lecture/ Practical	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER II								
I		Tamil paper II	6	3	25	75	100	3
II		English paper II	6	3	25	75	100	3
III		Core paper III - Chordata	8	3	25	75	100	4
		Core practical I (Non-Semester)	3	3	40	60	100	4
		Ancillary Botany paper II Integrated Zoology	3	3	25	75	100	3
		Ancillary Botany Practical I Sem I & II (Non-semester)	2	3	40	60	100	4
IV		SBC II – Dairy farming	2	3	25	75	100	2
TOTAL			30					23

Part No	Course code	COURSE TITLE	Lecture/ Practical	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER III								
I		Tamil paper III	6	3	25	75	100	3
II		English paper III	6	3	25	75	100	3
III		Core paper IV – Cell Biology	6	3	25	75	100	5
		Core practical Sem II & III (Non-Semester)	3	-	-	-	-	-
		Ancillary chemistry Theory paper I	3	3	25	75	100	3
		Ancillary chemistry Practical paper I	2	-	-	-	-	-
IV		SBC III - Vermiculture	2	3	25	75	100	2
		NME I - Sericulture	2	3	25	75	100	2
TOTAL			30					18

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER IV								
I		Tamil paper I	6	3	25	75	100	3
II		English paper IV	6	3	25	75	100	3
III		Core paper V - Genetics	5	3	25	75	100	4
		Core paper VI – Biostatistics and Bioinformatics	4	3	25	75	100	4
		Core practical II –Cell Biology, Genetics Biostatistics and Bioinformatics. (Non-Semester)	2	3	40	60	100	4
		Ancillary chemistry Theory paper II	3	3	25	75	100	3
		Ancillary chemistry Practical paper I	2	3	40	60	100	4
IV		SBC IV - Sericulture	2	3	25	75	100	2
V		Extension Activity	-	-	100	-	100	1
TOTAL			30					28

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER V								
III		Core paper VII - Biochemistry	6	3	25	75	100	5
		Core paper VIII – Developmental Biology	6	3	25	75	100	5
		Core practical III - Biochemistry & and Developmental Biology (Non-Semester)	6	-	-	-	-	-
		Elective I – Immunology/ Biophysics and Instrumentation/online MOOCS Endocrinology	5	3	25	75	100	4
		Elective II - Microbiology/ Human Genetics and Counseling/ online MOOCS Health psychology	5	3	25	75	100	4
IV		SBC V- Aquaculture	2	3	25	75	100	2
TOTAL			30					20

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER VI								
III		Core paper IX - Animal Physiology	6	3	25	75	100	5
		Core paper X - Biotechnology	6	3	25	75	100	5
		Core practical III - Biochemistry & Developmental Biology (Semester III)	-	3	40	60	100	5
		Core Practical IV - Animal Physiology & Biotechnology (Semester IV)	6	3	40	60	100	5
		Elective III – Evolution/ Animal behavior/ online MOOCS Introduction to Climate change	5	3	25	75	100	4
IV		Environmental Studies	2	3	25	75	100	2
		NME II Economic Zoology	2	3	25	75	100	2
		SBC VI - Project	3	-	75	25	100	2
TOTAL			30					30

TOTAL CREDITS: 140
TOTAL MARKS: 4200

EXTRA CREDIT PAPER

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER I, III, V								
IV		Paper I: Wildlife Conservation	-	-	-	100	100	2
		Paper II: Medical Emergency Management	-	-	-	100	100	2
		Paper III: Parasitology	-	-	-	100	100	2

VALUE ADDED COURSE

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER II, IV, VI								
IV		Paper I: First aid and safety management	30	-	-	100	100	
		Value added course II: Ornithology	30	-	-	100	100	
		Value added course III: Forensic biology	30	-	-	100	100	

Internal Question pattern Part III

Section	Pattern	Marks	Total
A	1-6 MCQ (Answer all)	6x1	6
B	7-8 (either or pattern)	2x4	8
C	9-12 (any two out of four)	2x8	16
		TOTAL	30

Components of internal assessment

Components	Calculation		Marks
Test I	30/2	<u>15+15</u>	15
Test II	30/2	2	
Assignment			5
Seminar			5
TOTAL INTERNAL MARKS			25

Internal Question pattern Part IV (SBC & NME)

Section	Pattern	Marks	Total
A	1-3 (any two out of three)	2x2	4
B	4-5 (any one out of two)	1x4	4
C	6-7 (any one out of two)	1x7	7
		TOTAL	15
Assignment			5
Seminar			5
Total Internal marks			25

External Question pattern Part III

Section	Pattern	Marks	Total
A	1-10 MCQ (Answer all)	10x1	10
B	11-15 (Either or pattern)	5x7	35
C	16-20 (any three out of five)	3x10	30
		TOTAL	75

External Question pattern Part IV

Section	Pattern	Marks	Total
A	1-8 (any five out of eight)	5x3	15
B	9-16 (any five out of eight)	5x6	30
C	17-21 (any three out of five)	3x10	30
		TOTAL	75

Question Pattern

Section – A: (10X1=10)

Ten questions are to be given, testing K1. All questions are to be answered. Each question carries ten marks. Questions must be taken from all units.

Section – B: (5X7=35)

Either or pattern questions are to be given, testing K2 and K3. Five questions are to be answered. Each question carries seven marks. Questions must be taken in this order.

Q.No. – 11 (a or b) from Unit – I

Q.No. – 12 (a or b) from Unit – II

Q.No. – 13 (a or b) from Unit – III

Q.No. – 14 (a or b) from Unit – IV

Q.No. – 15 (a or b) from Unit – V

Section – C: (3X10=30)

Five questions are to be given, testing K4 and K5. Three questions are to be answered. Each question carries ten marks. Questions must be taken in this order.

Q.No. – 16 from Unit – I

Q.No. – 17 from Unit – II

Q.No. – 18 from Unit – III

Q.No. – 19 from Unit – IV

Q.No. – 20 from Unit – V

VALUE ADDED COURSE

SUMMATIVE EXAMINATION

Marks : 100

Section A **4x20=80**----- 4 out of 8 questions

Section B **1x20=20**----- 1 out of 2 questions

EXTRA CREDIT COURSE

SUMMATIVE EXAMINATION

Marks : 100

Section A **5x20=100**----- 5 out of 8 questions

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	4 Hrs/Week	SEMESTER	I
CREDITS	4	COURSE TITLE	CORE I: INVERTEBRATA - I
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand the principles of animal classification and the salient features of Invertebrates.➤ To know the economic importance of Invertebrates.➤ Outline the rules of taxonomy and principles of animal classification.➤ To explain body Organizations and unique characters of Helminthes and Annelida📖➤ To identify the general characteristics of Porifera and Coelenterate.			
UNIT	CONTENT		HRS
I	Introduction to Invertebrates Principles of taxonomy – Binomial Nomenclature – Outline classification of animal kingdom. Types of Coelom and Symmetry General characters and outline classification up to class level with examples – Protozoa, Porifera, Coelenterate, Helminthes and Annelida.		10
II	Protozoa Type study: <i>Paramecium</i> – General organisation, Nutrition and Reproduction only. General topic: Life cycle of <i>Plasmodium</i> . Porifera Type study: Ascon sponges – <i>Leucosolenia</i> – External morphology- Body wall and Reproduction General topic: Canal system in Sponges.		15
III	Coelentrata Type study: Obelia colony – structure – medusa and nematocyst, Reproduction and development (metagenesis) General topic: Polymorphism in Coelenterates, Discolouration of coral reef and global warming.		10
IV	Platyhelminthes Type study: Liver fluke – External morphology, Excretion, Reproduction and life cycle. General Topic: Parasitic adaptations of Platyhelminthes. Aschelminthes Type study: <i>Ascaris</i> – External morphology – Reproduction and Life cycle. General Topic: Parasitic adaptations and control measures of <i>Wuchereria bancrofti</i>		15
V	ANNELIDA Type study: <i>Megascolex</i> – external morphology –setae, nephridia, nervous system and reproductive system General topic: Metamerism in Annelida.		10
TOTAL CONTACT HOURS			60

TEXTBOOK	
1. N.C Nair, S.Leelavathy, N. Soundrapandian, T. Murugan. N. Arumugam (2012). A Textbook of Invertebrates. Saras Publication.	
REFERENCE BOOKS	
1. A Manual of Zoology, Volume I Invertebrata Ekambaranatha Ayyar. M and T.N. Ananthakrishnan, 2003, (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai.	
2. Invertebrate, Phylum series, Kotpal, R L Rostagi Meerut (1990).	
3. Jordan: Invertebrate Zoology (S.Chand&co).	
4. R.D.Barnes: Invertebrate Zoology (Saunders.)	
5. Dhami and Dhami: Invertebrate Zoology.	
6. E.J.W.Barrington: Invertebrata structure and functions (Borton Houghton) (Miffin & ELBS).	
E REFERENCE	
1. https://biologydictionary.net/invertebrate	
2. http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf	
3. file:///C:/Users/ACER/Downloads/invertebrates_3-4_unit_guide%20(1).pd	

COURSE OUTCOME (CO)		
K1	CO1	Describe common and distinctive features of invertebrate organisms including Protozoans, Porifera, coelenterates, Platyhelminthes, and Annelids.
K2	CO2	Explain Phylogenetic relationships between the phyla covered.
K2	CO3	Discuss important concepts in Invertebrate's organization including body symmetry, Body cavity and Segmentation.
K2	CO4	Describe important biological processes in Invertebrates.
K2	CO5	Gain Knowledge about locomotion, body support, Feeding and Digestion, Excretion and Osmoregulation, Respiration, Circulation, Sensory perception and Behavior Reproduction and development.

BLOOM'S MAPPING							
PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	S	H	M	L	L	H	S
CO2	S	M	L	L	L	M	L
CO3	S	H	L	L	L	H	H
CO4	S	S	H	L	L	M	H
CO5	S	M	L	L	L	H	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	4 Hrs/Week	SEMESTER	I
CREDITS	4	COURSE TITLE	CORE II: INVERTEBRATA - II
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To enable the students to understand the Classification of animals.➤ To acquire the knowledge about Invertebrates and their diversity.➤ To evaluate general characters of Arthropoda and Mollusca.➤ To know the economic importance of Invertebrates.			
UNIT	CONTENT		HRS
I	General Classification General characters and outline classification up to class level with examples – Arthropoda, Mollusca and Echinodermata.		15
II	Arthropoda Type study: <i>Penaeus</i> – External morphology, appendages, respiratory system, reproductive system and development. Affinities of Peripatus.		15
III	General Topics Mouth parts of Insects, Insect Metamorphosis, Economic Importance of Insects and Pest of Paddy, Cotton & Coconut, Productive insect – silk worm.		10
IV	Mollusca Type Study: <i>Pila globosa</i> – External characters, Body organization, Respiratory system, Sensory organs and Reproductive system General Topic: Pearl Culture and Pearl industry in India.		10
V	Echinodermata Type study; Starfish – External morphology, Pedicellaria, Water Vascular system, Reproductive system and Life cycle. General topic: Larval forms of Echinodermata.		10
TOTAL CONTACT HOURS			60

TEXTBOOKS	
1 N.C Nair, S.Leelavathy, N. Soundrapandian, T. Murugan. N. Arumugam (2012). A Textbook of Invertebrates. Saras Publication.	
REFERENCE BOOKS	
1. A Manual of Zoology, Volume I Invertebrata EkambaranathaAyyar. M and T.N. Ananthakrishnan, 2003, (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai. 2. Invertebrate, Phylum series, Kotpal, R L Rostagi Meerut (1990). 3. L.H.Hymen: The Invertebrates Vol I to VI. 4. R.D.Barnes: Invertebrate Zoology (Saunders). 5. Dhama and Dhama: Invertebrate Zoology. 6. E.J.W.Barrington: Invertebrata structure and functions (Borton Houghton) (Miffin & ELBS).	

COURSE OUTCOME (CO)		
K1	CO1	Understood the Classification and General characteristics Phylogeny of Invertebrates.
K2	CO2	To explain general characters of Arthropoda and Metamorphosis and Economic importance of Insects.
K3	CO3	To study the External as well as internal characters of Non-chordates.
K3	CO4	Described the general biology of few selected Non-chordates which are useful to mankind.
K3	CO5	Enriched knowledge on some importance of Mollusca and Echinodermata.
E REFERENCE 1. https://biologydictionary.net/invertebrate 2. http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf 3. file:///C:/Users/ACER/Downloads/invertebrates_3-4_unit_guide%20(1).pd		

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	H	M	L	L	H	S
CO2	S	H	M	L	L	M	S
CO3	S	H	M	L	L	S	H
CO4	S	H	M	L	L	M	H
CO5	H	M	L	S	S	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	3 Hrs/Week	SEMESTER	I	
CREDITS	3	COURSE TITLE	ANCILLARY ZOOLOGY I: INVERTEBRATA & CHORDATA	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To acquire knowledge about Invertebrates and Vertebrates.➤ To understand the morphological and physiological aspects of different animals.				
UNIT	CONTENT			HRS
I	Invertebrates :Introduction Principle of Animal taxonomy – outline classification of animal kingdom up to phylum level with example (flow chart only) Salient features of Invertebrates. Protozoa: <i>Entamoeba histolytica</i> - structure, Lifecycle, Pathology, Prevention and Treatment. Porifera: External morphology of <i>Olynthus</i> .			5
II	Coelenterata: Types of coral reefs. Platyhelminthes: <i>Fasciola hepatica</i> external morphology only. Aschelminthes: Parasitic adaptations in <i>Ascaris</i> . Annelida: <i>Earth worm</i> – External morphology and Digestive system and associated microbes in intestine. Arthropoda: <i>Cockroach</i> – External features, Digestive and Nervous system. Mollusca: <i>Pila</i> – External morphology only. Echinodermata : Starfish – External morphology.			10
III	Introduction to Chordates Classification of phylum chordate up to class level with example (flow chart only), Salient features of Prochordates and Vertebrates. Prochordata: External morphology of - <i>Amphioxus</i> , <i>Balanoglossus</i> . Pisces : Shark- External morphology only Amphibia : Frog - External morphology - Digestive system.			10
IV	Reptiles: <i>Calotes</i> - External morphology- Digestive system Aves : Pigeon- External morphology-Respiratory system Mammals : Rabbit- External morphology -Excretory system.			10
V	General topics Migration of Fishes - Identification of Poisonous and Non-Poisonous snakes- Dentition in Mammals.			10
TOTAL CONTACT HOURS				45

TEXTBOOKS

1. Arumugam N. (2018) Allied Zoology Part I & Part II – Saras Publications, 114/35 G, A.R.P Camp Road, Periyavillai, Kottar PO, Nagercoil – 629 002, Kanyakumari.
2. N.Arumugam (2010) A Text book of Chordates.
3. N.Arumugam (2012) A Text book of Invertebrates.

REFERENCE BOOKS

1. A Manual of Zoology, Volume I Invertebrata Ekambaranatha Ayyar. M and T.N. Ananthakrishnan, 2003, (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
2. Invertebrate, Phylum series, Kotpal, R L Rostagi Meerut (1990).

E REFERENCE

1. <https://biologydictionary.net/invertebrate>
2. [http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell. pdf](http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf)
3. file:///C:/Users/ACER/Downloads/invertebrates_3- 4_unit_guide%20(1).pdf

COURSE OUTCOME (CO)

K1	CO1	Identified the Invertebrates and Features of Protozoa and Porifera.
K2	CO2	External and Internal features of the organisms will be remembered.
K2	CO3	Identified the features and classify Vertebrates.
K2	CO4	Identify Prochordates, Pisces and Amphibians.
K2	CO5	Compare Poisonous and Non- poisonous Snakes and explain the adaptive features in Aves and Mammals.

BLOOM'S MAPPING

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	H	L	M	S	H	S
CO2	S	M	S	M	H	M	M
CO3	S	H	H	H	S	L	H
CO4	H	S	M	S	M	M	H
CO5	L	M	S	M	M	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	2 Hrs/Week	SEMESTER	I	
CREDITS	2	COURSE TITLE	SKILL BASED COURSE I: APICULTURE	
COURSE OBJECTIVE				
<div>➤ To understand the standard of Indian bee keeping and compare with the international standard.</div> <div>➤ To acquaint with the issues and challenges in primitive bee keeping.</div>				
UNIT	CONTENT			HRS
I	Scope of Apiculture. Honeybee – Classification, types of honeybees – <i>Apis dorsata</i> , <i>Apis cerana</i> , <i>Apis florea</i> , <i>Apis indica</i> and <i>Apis mellifera</i> . Biology of Honeybee - External structure and Life cycle.			6
II	<i>Apis indica</i> – Social life of Indian Honeybee. Foraging behavior of Bees, Queen rearing methods.			6
III	Choice of Bee in Apiculture – Desirable traits for Bee keeping, Poor choice, Good Choice and Best Choice.			6
IV	Principles of Bee keeping – Methods of bee keeping in India – Primitives hives – Wall type, Movable type, Bamboo Hive. Modern hives – Langstroth hive, Newton hive. Appliances used in Bee keeping.			6
V	Economic importance of Bee products – Chemical composition, Nutritive value and Medicinal uses of Honey, Bees Wax and Bee Venom.			6
TOTAL CONTACT HOURS				30

TEXTBOOKS	
1.Dr.N.Arumugam, Dr.S.Murugan, Dr.J.JohnsonRajeshwar and Dr.R.Ram Prabhu, (2005), Applied Zoology, Saras Publication, Nagerkovil.	
REFERENCE BOOKS	
1. Dhama.P.S&Dhama.J.K, (1976). Invertebrate Zoology, R.Chand& Co., Publishers, New Delhi	
2. EkambaranathAyyar. M. (1973). A manual of Zoology Vishwanathan Printers and Publishers Private Ltd., Chennai.	
E REFERENCE	
1. https://ag.tennessee.edu/EPP/Redbook/Apiculture%20(Beekeeping).pdf	
2. https://drive.google.com/file/d/1rpz8Qhqqy6UoOOVpLjIVDZP3ZXqjNBte/view	
3. http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/7420/1/	

COURSE OUTCOME (CO)		
K1	CO1	Gain knowledge about steps involved in Bee keeping.
K2	CO2	Comprehend innovative ideas to flourish economically.
K3	CO3	To produce value added products from the byproducts.
K4	CO4	To overcome the practical difficulties in apiculture.
K5	CO5	To learn techniques to commercialize the byproducts of Bee keeping

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	H	S	M	L
CO2	S	S	H	S	H	M	L
CO3	L	S	S	H	H	M	L
CO4	M	H	M	H	M	M	L
CO5	S	M	H	S	L	L	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	8 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	CORE III: CHORDATA
COURSE OBJECTIVE <ul style="list-style-type: none"> ➤ To gain knowledge about the classification and general characters of Vertebrates. ➤ To know the evolutionary significance of Prochordates. ➤ To understand the Structure and Function of various systems in animals. ➤ To acquire knowledge on Identifying the Poisonous and Non-poisonous snakes. ➤ To study the Adaptations of Birds and Mammals. ➤ To Analyze gradual Development of habit and habitats of various animals. 			
UNIT	CONTENT		HRS
I	Taxonomy and Prochordata Chordate's characteristics, Outline classification up to class level with examples. Type study: <i>Amphioxus</i> - External morphology, Digestive System and Excretory System only. General topics : Affinities of Hemichordate, Retrogressive Metamorphosis in <i>Ascidian</i> .		20
II	Pisces and Amphibians General characters, classification of Fishes and Amphibians up to class level with examples. Type study: Shark- External Morphology, Digestive System and Reproductive System only. General topics: Salient features of <i>Petromyzon</i> , Migration of fishes. General characters, classification of Amphibians up to class level with examples. Type Study: Frog-External Morphology, Circulatory system, Reproductive system and Development only. General Topic: Parental care in Amphibia.		25
III	Reptiles General characters, classification of Reptiles up to class with examples. Type study: <i>Calotes</i> - External Morphology, Digestive System and Urinogenital system only. General topics: Identification of Poisonous and Non-Poisonous Snakes, Poison Apparatus, Biting mechanism and First Aid. Origin of Reptiles and Golden age of Reptiles.		25
IV	Aves General characters, classification of Aves up to class with examples. Type study: <i>Pigeon</i> - External Morphology, Respiratory System, Flight Muscles, Synsacrum, Pectoral and Pelvic girdles only. General topics: <i>Archaeopteryx</i> and its evolutionary significance, Flight adaptation in birds, Migration of birds.		25

V	Mammals: General characters, Classification of Mammals up to class with examples. Type study: Rabbit- External Morphology, Digestive System, Circulatory system, Excretory system and Reproductive System only. General topics: Salient Features of Prototheria and Metatheria, Adaptation of Aquatic Mammals and Dentition in Mammals.	25
TOTAL CONTACT HOURS		120

TEXTBOOKS

1. A Textbook of Chordata – Arumugam. N *et al.*, 2017, Saras Publication, Kottar, Nagercoil.
2. Chordate Zoology – Jordan. E.L. and Verma. P.S., 2011, S. Chand and Company Ltd., Ram Nagar, New Delhi.

REFERENCE BOOKS

1. A Manual of Zoology, EkambaranathaAyyar. M and T.N. Ananthakrishnan, 2003 (Reprint), Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
2. Modern Textbook of Zoology vertebrates, Kotpal. R.L., 2009, Rastogi Publications, Meerut, India.
3. S.Viswanathan (Printers & Publishers) Rt.Ltd. Chennai 4.The Chordates, 2nd Edition, Cambridge University Press, New York.
4. Vertebrate Life, 9th Edition, Harvey Pough. F, Christine Janis, Heiser. J.B., 2013, Benjamin-Cummings Publishing House, San Francisco.
5. Comparative Vertebrate Zoology, Hyman. L.H., McGraw Hill Co., New York.
6. Life of Vertebrates, J.Z. Young.

E REFERENCE

1. <https://www.uou.ac.in/sites/default/files/slm/BSCZO-104.pdf>
2. http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d_17c945e461b45.pdf

COURSE OUTCOME (CO)

K1	CO1	Portray the origin and ancestry of Chordates and basic principles of Chordate classification.
K2	CO2	Gain knowledge on fundamental Chordate characters.
K3	CO3	Understand interrelationship of Pro-chordates with Invertebrates and Vertebrates
K4	CO4	Gain knowledge on Birds and their Migration.
K5	CO5	To understand the Economic importance of higher animals.

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	S	M	M	M	L	S	H
CO2	S	M	M	S	M	H	S
CO3	S	M	S	M	M	S	H
CO4	S	M	M	M	M	M	H
CO5	M	S	S	H	M	H	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	3 Hrs/Week	SEMESTER	II	
CREDITS	3	COURSE TITLE	ANCILLARY ZOOLOGY II: INTEGRATED ZOOLOGY	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To introduce the basics of combined Zoology.➤ To give the knowledge of Poultry farming and Vermicomposting.				
UNIT	CONTENT			HRS
I	Cell biology and Genetics Structure of Animal cell – Structure and function of Nucleus. Mendelian Law – Sex linked Inheritance in Man – Colorblindness and Hemophilia. Syndrome – Klinefelter syndrome. ABO Blood group and Rh factor. .			10
II	Animal physiology and Developmental biology Circulation – Structure and function of Human Heart. Excretion– Structure of kidney and Nephron. Respiration– Transport of Respiratory Gases. Structure of Human Egg & Sperm – Fertilization – Puberty – Menstrual Cycle – Pregnancy & Childbirth.			10
III	Microbiology and Immunology Introduction of microorganism– Protozoan disease –Malaria , Bacterial disease –Tuberculosis, Viral disease – Common cold. Types of Immunity – Innate & Acquired Immunity – Lymphoid Organs (Primary & Secondary).			10
IV	Biotechnology and Evolution Cloning – Dolly and Human cloning. IVF – Test tube baby. Origin of Life – Lamarckism – Darwinism			10
V	Applied zoology Introduction to Poultry farming – Construction of Poultry house – Rearing of Layers and Broilers. Preparation and methods of Vermicomposting – advantages of Vermicompost.			5
TOTAL CONTACT HOURS				45

TEXTBOOKS

A.Mariakuttikan & N. Arumugam – Animal Physiology.
 N. Arumugam- Cell biology.
 N.Arumugam – Embryology
 N.Arumugam – Organic Evolution.
 N.Arumugam – Applied Zoology – Vermiculture and Poultry farming
 L.M.Narayanan, Dulsy Fatima, N.Arumugam A.Thangamani – Microbiology and Immunology.
 N.Arumugam - Genetics
 V.Kumaresan, (2015) – Biotechnology – Saras publication.

REFERENCE BOOKS

.Mariakuttikan & N. Arumugam – Animal Physiology.
N. Arumugam- Cell biology.
N.Arumugam – Embryology

E REFERENCE

1. [https://mobot-biodiversityjc.weebly.com/uploads/1/8/6/0/18603232/the evolutionary biology of species by t g barracloUGH 2019.pdf](https://mobot-biodiversityjc.weebly.com/uploads/1/8/6/0/18603232/the_evolutionary_biology_of_species_by_t_g_barracloUGH_2019.pdf)
2. <http://bgc.org.in/pdf/study-material/developmental-biology-7th-edsf-gilbert.pdf>

COURSE OUTCOME (CO)

K1	CO1	Basic Human Physiology and Developmental biology.
K2	CO2	To study the Animal cell and fundamental concepts of Genetics.
K2	CO3	Compare the types of Immunity and diseases.
K2	CO4	Discuss about the Cloning and concept of Evolution.
K3	CO5	Utilize the knowledge gained in Poultry farming and Vermicomposting to become an Entrepreneur.

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	H	S	S	H
CO2	L	M	H	H	H	S	M
CO3	H	M	M	M	H	S	H
CO4	H	H	M	L	H	S	H
CO5	S	S	M	S	M	H	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	II
CREDITS	2	COURSE TITLE	SKILL BASED COURSE II: DIARY FARMING
COURSE OBJECTIVE			
UNIT	CONTENT		HRS
I	Dairy Farming Definition, Scope and Maintenance of Cattle, Techniques adapted in Cattle breeding- Outbreeding, Crossbreeding and Artificial insemination.		6
II	Dairy Breeds Important Cattle breeds and their characteristics-Milch breeds (Sindhi), Dual Purpose Breeds (Ongole), Draught Breeds (Kangayam) and Exotic Breeds (Jersey).		6
III	Dairy Feed Common Cattle feed and their Nutritive value, Balanced ratio for cattle. Milk Composition, Nutritive value and Pasteurization of Milk and Milk Products – Butter, Ghee and Cheese.		6
IV	Common Disease and Control Bacterial Diseases- Anthrax, Mastitis. Viral Diseases – Foot and Mouth Diseases. Non-Contagious Disease – Milk fever and Constipation.		6
V	Practical section Visit to Aavin Chilling Centre.		6
TOTAL CONTACT HOURS			30

TEXTBOOKS
REFERENCE BOOKS
1. Ibraheem Kutty and Sheeba Khamer, Milk Production and Processing. Daya Publishing House, Delhi, 2014
2. Banerjee G.C, A Text Book of Animal Husbandry, Oxford & IBH Publishing Co.Pvt., Ltd, New Delhi.

E REFERENCE
1. http://www.fao.org/3/y5169e/y5169e.pdf
2. http://dahd.nic.in/sites/default/files/Excerpts%20of%20Poultry%20Farmn%20Manual-ilovepdf-compressed.pdf

COURSE OUTCOME (CO)		
K1	CO1	To gain knowledge about Dairy farming and new techniques adapted for Cattle Breeding.
K2	CO2	To understand about various Dairy breeds and their importance
K3	CO3	To learn the techniques and apply for the preparation of Cattle feed and their nutritive values.
K4	CO4	To analyse the composition and Nutritive value of Milk and gain in-depth knowledge about Pasteurization of milk and Milk products.
K5	CO5	Have an enhanced knowledge about Bacterial and Viral disease in Dairy farms.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	H	S	M	S	L
CO2	S	H	M	S	H	H	M
CO3	S	S	S	M	S	H	L
CO4	S	M	S	M	S	H	M
CO5	H	M	L	H	L	M	H

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	3 Hrs/Week	SEMESTER	I & II
CREDITS	4	COURSE TITLE	CORE PRACTICAL I: INVERTEBRATA & CHORDATA
COURSE OBJECTIVE			
<div>➤ To identify and classify Museum specimens.</div> <div>➤ To study the salient features of these Museum Specimen.</div>			
CONTENT			HRS
Dissection Charts	Earthworm: Nervous system. Cockroach: Digestive system and Nervous system. Prawn appendages. Frog: Arterial system and Venous system (Chart only).		30
Mounting Charts	Earth worm – Body setae and Penial setae. <i>Cockroach</i> – Mouth parts, salivary apparatus. <i>Pila</i> -Radula. Shark –Placoid scales. Frog – Brain.		
Spotters	1. Protozoa- <i>Paramecium</i> -Entire, <i>Paramecium</i> Binary fission and Conjugation. 2. Porifera – Ascon sponge, Gemmules, Spicules. 3. Coelenterata – <i>Obelia</i> colony, Medusa of <i>Obelia</i> , <i>Physalia</i> and <i>Madrepora</i> . 4. Helminthes- <i>Liver fluke</i> , <i>Cercaria</i> larva, <i>Ascaris</i> (male and female). 5. Annelida – Earthworm and Trochophore larva. 6. Arthropoda – Prawn, Zoea larva and <i>Peripatus</i> . 7. Mollusca - <i>Pila</i> and <i>Octopus</i> . 8. Echinodermata – Star fish – Oral, Aboral View and Bipinnaria Larva. 9. Prochordata – <i>Amphioxus</i> , <i>Balanoglossus</i> and <i>Ascidian</i> . 10. Pisces –Shark and Hippocampus. 11. Amphibian – Frog and <i>Rhacophorus</i> . 12. Reptilia – <i>Calotes</i> , <i>Naja naja</i> and <i>Chameleon</i> . 13. Birds – Pigeon and <i>Archaeopteryx</i> 14. Mammalia – Bat and Rabbit.		45
			75

COURSE OUTCOME (CO)		
K1	CO1	Able to dissect and examine various Organ systems in situ.
K2	CO2	Preserving the Animals for examination.
K3	CO3	Acquire basic Skills in animal dissections.
K4	CO4	Be familiar with the External morphology of animals.
K5	CO5	To know their salient features by observing the animals.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	H	H	H	H	S
CO2	S	S	H	H	H	M	M
CO3	S	S	H	M	M	L	H
CO4	S	H	H	M	M	M	H
CO5	M	H	L	M	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	I & II
CREDITS	4	COURSE TITLE	ANCILLARY PRACTICAL I: INVERTEBRATA & CHORDATA AND INTEGRATED ZOOLOGY
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To virtually explore the morphology and anatomy of Vertebrates and Invertebrates➤ To understand the experimental concepts of Genetics, Cell biology, Animal physiology & Immunology.			
CONTENT			HRS
Anatomical Observation and comment on the following Systems (Models/Charts and Visual aids.)	Invertebrate- <i>Cockroach</i> <ul style="list-style-type: none">• External morphology (male & female)• Digestive system• Nervous system• Mouth parts• Salivary apparatus Chordate-Frog External morphology Arterial system and Venous system (Chart only).		30
Observation of the following Animals	<i>Paramecium, obelia, Fasciola hepatica, Ascaris, Earthworm, Starfish, Amphioxus, Ascidian, Balanoglossus, Shark, Calotes, Pigeon.</i>		30
Experiments	Preparation of Onion root tip and observe the Mitotic stages. Blood smear preparation. Detection of Protein, Lipid & Carbohydrate		
Spotters	Structure of Immunoglobulins, Blastula and Gastrula,		
			60

COURSE OUTCOME (CO)		
K3	CO1	To remember and distinguish animals with their Morphology and Anatomy.
K4	CO2	Experimental knowledge on Developmental aspects.
K5	CO3	To understand different types of Macroscopic concept.
K5	CO4	Identification of developmental stages of Frog.
K4	CO5	Understand the Evolutionary concept.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	L	S	M	H
CO2	H	S	S	M	H	S	M
CO3	S	H	M	M	H	M	H
CO4	M	L	S	M	S	H	L
CO5	S	M	H	S	M	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	6 Hrs/Week	SEMESTER	III
CREDITS	5	COURSE TITLE	CORE IV: CELL BIOLOGY
COURSE OBJECTIVE			
<ul style="list-style-type: none">➤ To understand the principles of different Microscopes.➤ To learn various cytological techniques to understand ultra-structure of Cellular organelles➤ To enhance the knowledge on Cell organelles and their role in metabolic activities.➤ To understand the cell division and Genetic makeup of the cell and its significance.➤ To know about Cancer and its types, causes and Diagnosis.			
UNIT	CONTENT		HRS
I	History of Cell biology History of Cell biology – History, Scope and Theories. Structure of Prokaryotes (<i>E. coli</i>) and Eukaryotes (Animal cell), difference between Prokaryotic and Eukaryotic cell. Plasma membrane – Models to explain the Structure, Specializations and Functions.		15
II	Microscopy and Cytological techniques Microscopy: Compound and Electron Microscopes – Transmission Electron Microscope and Scanning Electron Microscope (TEM and SEM). Cytological techniques – Microtome, Fixation and Staining.		15
III	Cell Organelles Cell organelles – Ultra structure and functions of Endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, Mitochondria, Nucleus and Nucleolus.		20
IV	Cell division and Cancer Chromosomes – Types, Structure, and functions. Special types of chromosomes – Polytene, Lampbrush and Super Numerary Chromosomes. Cell Division - Cell Cycle, Amitosis, Mitosis and Meiosis. Cancer - Types, Causes, Properties, Diagnosis and Treatment and Oncogenes. Senescence – Changes occurring during Aging and causes of Aging.		20
V	NUCLEIC ACIDS Nucleic acids – Structure of DNA (Watson & Crick Model), Replication of DNA - Semi Conservative Replication. RNA – Types (mRNA, rRNA, tRNA & ssRNA) and functions. Central Dogma of Protein Synthesis-Transcription and Translation.		20
TOTAL CONTACT HOURS			90

TEXTBOOKS

1. Text Book of Cellbiology, Arumugam, N.A. (2008 Edition) Saras Publication, Kottar, Nagarcoil.

REFERENCE BOOKS

1. Verma, P.S., and V.K.Agarwal, 1995, cell and Molecular Biology, 8th edition, S. Chand & Co., New Delhi – 110 055, 567.
2. De Roberties E.D.P and E.M.F.De Roberties. 2011. Cell and Molecular Biology. 8th edition. B.I. Publications Pvt. Ltd., India
3. Rastogi, S.C., 2010, Cell and Molecular Biology, Second Edition, New Age International (p) Ltd., New Delhi.
4. Power, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi.
5. Karp G. 2013. Cell and Molecular Biology Concepts and Experiments. John Wiley & Sons, Inc
6. Lodish et al.2008 Molecular Cell Biology.6th Ed., W.H. Freeman & Co.USA

E REFERENCE

1. http://compbio.case.edu/koyuturk/teaching/eecs600/slides/Molecular_and_Systems_Biology.pdf
2. <file:///C:/Users/ACER/Downloads/Full.pdf>

COURSE OUTCOME (CO)

K1	CO1	Understand different types of Microscopic techniques to identify Subcellular structures in a Cell.
K2	CO2	Learn various Cytological techniques to understand Ultra-structure of Cellular organelles.
K3	CO3	Be able to describe the structure and functions of Nucleus with reference to special chromosomes.
K4	CO4	Understand the Cell division and Genetic makeup of the cell and its significance.
K5	CO5	Know about Cancer and its types, Causes, Diagnosis and Treatment.

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	S	S	M	H	M	S	M
CO2	S	S	H	M	M	S	M
CO3	S	S	H	M	M	S	L
CO4	S	M	S	M	M	S	M
CO5	S	M	M	M	L	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	III
CREDITS	2	COURSE TITLE	Skill Based course III: Vermiculture
COURSE OBJECTIVE			
➤ To learn the Biology of Earthworm.			
➤ To study about Nutrient value of Compost.			
UNIT	CONTENT		HRS
I	Vermitechnology-Definition, History, Selection of Suitable Species, Basic characters of Suitable Species.		6
II	Systematic position of Earthworm – Habit and Habitat, Commercial varieties of Earthworm for Vermicomposting, Economic importance of Vermiculture, difference between compost and Vermicompost.		6
III	Life cycle of Earthworm, Diseases and Predators of Earthworm control measures, effect of Earthworm on the Physical features of Soil.		6
IV	Preparation of Vermibed, Maintenance of Composting Pit, Collection of Vermicompost, substrate for Vermicompost, Nutrient value of Vermicompost, Vermiwash and Marketing of Vermicompost.		6
V	Effect of Vermicompost on Plant growth, Soil microbes and Earthworm, Therapeutic values of Earthworm.		6
TOTAL CONTACT HOURS			30

TEXTBOOKS

1. Seethlakshmi. M. and Santhi. R. (2012) Vermitechnology, Saras publication, Nagercoil, Tamilnadu.
2. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N. (2018) A textbook of Invertebrates – Saras Publication, Nagercoil, Tamilnadu.

REFERENCE BOOKS

1. Arun.K. Sharma, (2004), Biofertilizers for sustainable Agriculture, Agro bios, Jodhpur
2. Gupta, P.K., (2004), Vermicomposting for sustainable Agriculture, Agro bios, Jodhpur.

E REFERENCE

1. https://clarkcountycomposts.org/images/class_3_-_red_worm_composting.pdf
2. <https://www.free-ebooks.net/academic-science/Handbook-of-Vermicomposting/pdf?dl&preview>
3. file:///C:/Users/ACER/Downloads/5c55d33672e19.pdf
4. <https://www.uvm.edu/sites/default/files/Extension-MasterGardener/compostingwithworms.pdf>
5. [https://ag.tennessee.edu/EPP/Redbook/Apiculture%20\(Beekeeping\).pdf](https://ag.tennessee.edu/EPP/Redbook/Apiculture%20(Beekeeping).pdf)
6. <https://drive.google.com/file/d/1rpz8Qhqyy6UoOOVpLjIVDZP3ZXqjNBte/view>

COURSE OUTCOME (CO)		
K1	CO1	To analyze the Role of Earthworm in Organic farming.
K2	CO2	Environmental protection through Solid Waste Management.
K3	CO3	Adopt new techniques in maintaining Soil Health.
K4	CO4	Deploy Vermitechnology for Sustainable agriculture
K5	CO5	To understand Primary, Secondary degradation and Vermibed preparation.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	H	S	L	M
CO2	H	H	M	H	H	L	H
CO3	S	S	H	M	L	M	H
CO4	S	M	S	M	M	M	S
CO5	S	L	M	H	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	2 Hrs/Week	SEMESTER	III	
CREDITS	2	COURSE TITLE	NON-MAJOR ELECTIVE I: SERICULTURE	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To enable the students to learn the basics of Silkworm Rearing techniques.➤ To understand the economic importance of Sericulture.				
UNIT	CONTENT			HRS
I	Introduction to Sericulture- History and present status of Sericulture Silkworm morphology and life cycle of Silkworm.			6
II	Grainage- Reproductive seeds & industrial seeds – Voltinism - Univoltine, Bivoltine, Multivoltine eggs.			6
III	Rearing- Rearing house, Rearing appliances, Types of Brushing and Bed cleaning. Rearing of Chawki worm, Rearing of Late age worms-Shelf rearing, Shoot rearing and Floor rearing and care during Moulting.			6
IV	Feeding and Optimum Environmental conditions during Rearing, Selection of ripe worms, Spinning, Mounting, Harvest, Storage and Transport of Cocoons, Uses of Silk.			6
V	Silkworm diseases. Flacherie, Muscardine,- Causative agent, Symptoms, Prevention and control measures.			6
TOTAL CONTACT HOURS				30

TEXTBOOKS
1. Comprehensive Sericulture, G.Ganga (2003) Volume - 1 & Volume - 2, Oxford & IBH Pub.,Co.,Pvt.,Ltd.,
REFERENCE BOOKS
1.S. Krishnaswamy <i>et al.</i> , (1972). Sericulture manual - 1(Mulberry Cultivation), manual - 2 (Silkworm rearing) & manual -2 (Silk reeling). Food and Agriculture Organisation of the United Nations, Rome.
2.Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers 4 - 2, Hiroo,SibuyaKu,Tokyo,Japan.
3.Sericulture in India,VenkataNarasaiah(2003), Ashish Publishing House, New Delhi.

E REFERENCE
1. http://www.survivorlibrary.com/library/silk_culture_a_manual_with_complete_instructions_1885.pdf
2. https://n-modell.hu/11kopjts/178679-introduction-to-sericulture-pdf

COURSE OUTCOME (CO)		
K1	CO1	Identify and know the importance of Silkworm
K2	CO2	Comprehend the methodologies involved in Silkworm rearing
K3	CO3	Execute self-employment in Sericulture
K4	CO4	Validate different Rearing techniques and it's by products
K3	CO5	Understand and control the diseases of Silkworm

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	H	H	H	H	M
CO2	S	H	M	M	M	M	S
CO3	S	H	M	M	L	H	L
CO4	S	H	M	M	L	H	L
CO5	S	H	M	L	M	S	H

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	5 Hrs/Week	SEMESTER	IV
CREDITS	4	COURSE TITLE	CORE V: GENETICS
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand Mendelian principle in Plant cross.➤ To know about Linkage and Crossing over.➤ To understand Mutation.➤ To study Human chromosomes and Syndromes.➤ To know about DNA and DNA repair.			
UNIT	CONTENT		HRS
I	Mendelian Principle Mendel and his experiments and the Laws of Inheritance: Monohybrid cross and Dihybrid cross in Pea, Law of Segregation, Law of Independent Assortment. Gene interactions: Epistasis: Plumage colour in Poultry. Multiple alleles: ABO Blood groups and Rh factor in Human beings, Blood transfusion. Multiple factors: Skin colour in Human beings.		10
II	Linkage and Crossing Over Coupling and Repulsion Hypothesis, Linkage in Drosophila, Linkage groups, Theories. Crossing over in Drosophila - Mechanism of Crossing over-Types of Crossing over, Theories and Cytological evidence. Sex linkage: Sex-linkage in Man (Hemophilia and Colour blindness).		15
III	Sex Determination Chromosomal theory of Sex Determination in Man. Chromosomal Aberrations: Numerical: Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy- Autopolyploidy and Allopolyploidy. Aneuploidy- Monosomy, Nullisomy and Trisomy. Structural - Deletions (Terminal, Insertion), Duplication (Tandem, Reverse tandem and Displaced), Translocation (Simple, Isochrome, Reciprocal, Displaced) and Inversions (Pericentric and Paracentric). Significance of chromosomal aberrations. Extra Chromosomal Inheritance: Kappa particles in Paramecium, Plastid inheritance in Mirabilis.		20
IV	Human Chromosomes Normal Human Karyotype, Inherited disorders: Allosomal (Klinefelter's syndrome and Turner's syndrome), Autosomal (Down syndrome). Mendelian Traits: Strait hair, Curly hair, Widow's peak, Dimpled Cheeks, Mid digital hair, Hitchhiker's thumb, Clasping of hands and Hypertrichosis. Pedigree studies: Symbols used in Pedigree analysis- Pedigree analysis of important Genetic disease. Eugenics: Positive and Negative.		20
V	Genetic code and DNA repair Introduction - SOS mechanism, Triple, Universal colinearity, Non Overlapping, Polarity, Initiation, Termination - Codons and Anticodons - Wobble hypothesis - DNA repair mechanism - Direct, Excision, Mismatch and Recombinational repair.		10
TOTAL CONTACT HOURS			75

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P.G Department of Zoology OBE syllabus 2022-23 onwards BOS dt 06.05.2022 Academic council 30.05.2022

TEXTBOOKS

1. R.P.Meyyan, (2013).Genetics, Saras Publications, Nagerkoil , VII Ed.

REFERENCE BOOKS

1. P.S.Verma and T.K. Agarwal., (2007) S.Chand &Co., New Delhi.
2. McKusick, V.A., (1968) Human Genetics, Prentice - Hall of India Private Limited, New Delhi.

E REFERENCE

1. <https://thunderbooks.files.wordpress.com/2009/05/introduction-to-biotechnology-and-genetic-engineering-infinity-2008.pdf>
2. <http://www.ifsc.usp.br/~ilanacamargo/FFI0740/2.pdf>
3. <https://ingeniumcanada.org/sites/default/files/2019-01/education-genetics-and-biotechnology-eak.pdf>

COURSE OUTCOME (CO)

K1	CO1	To understand Mendelian principle in Plant Cross.
K2	CO2	To know about Linkage and Crossing over.
K3	CO3	To understand Mutation.
K4	CO4	To study Human Chromosomes and Syndromes.
K3	CO5	To know about DNA and DNA repair.

BLOOM'S MAPPING

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

S-Strong; H-High; M-Medium; L-Low

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P.G Department of Zoology OBE syllabus 2022-23 onwards BOS dt 06.05.2022 Academic council 30.05.2022

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	4 Hrs/Week	SEMESTER	IV
CREDITS	4	COURSE TITLE	CORE VI: BIOSTATISTICS AND BIOINFORMATICS
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To study the fundamentals of Biostatistics and Bioinformatics.➤ To study the application of Biostatistics for testing Hypothesis.➤ To acquire the knowledge on biological databases.			
UNIT	CONTENT		HRS
I	Introduction to Biostatistics Introduction to Biostatistics, basic concepts of Biostatistics - Data, Sample, Variable. Collection of Data - Primary and Secondary data collection. Processing of Data-Classification and tabulation –Types of classification, Tabulation of data and Parts of a table.		10
II	Presentation of Data Diagrammatic presentation of Data - Rules for drawing a Diagram, Kinds of Diagrams. Graphic presentation of Data - Bar diagram, Pie diagram, Histogram and Frequency Curve.		10
III	Measures of Central Tendency Measures of Central tendency- Mean, Median and Mode. Measures of Dispersion: Range, Standard deviation, Standard error, Variance.		15
IV	Test of Significance Students’ ‘t’ test, Chi square test and goodness of fit and Correlation analysis.		10
V	Bioinformatics Aims, Tasks and Applications of Bioinformatics. Structural, functional, and comparative genomics, Genome Mapping, Human Genome Project. Internet and email. Nucleic Acid Sequencing Data bases – Gene Bank, EMBL, & NCBI, Protein Sequence Databases – TrEMBL, PiR& SWISSPROT. Sequence Alignment-Pair wise Alignment – FASTA and BLAST Multiple Alignment – CLUSTA and Phylogenetic analysis.		15
TOTAL CONTACT HOURS			60

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P.G Department of Zoology OBE syllabus 2022-23 onwards BOS dt 06.05.2022 Academic council 30.05.2022

TEXTBOOKS

1. Biostatistics- P.Ramakrishnan, 2015 Saras Publications.

REFERENCE BOOKS

1. Statistical methods, Gupta S.P, (2006) Sultan Chand & Sons Educational Publishers, New Delhi.
2. Fundamental of Biostatistics, Khan A.S, &Khanum A, (2004) Ukaas Publishers, Hyderabad.
3. Methods of Biostatistics, Baskararao T, (2001) PARAS Publications, Hyderabad.
4. Biostatistics and Computer application, Arumugam.N Saras Publications, Kottar, Nagarcoil 2010.
5. Statistical Methods for Biologists. S. Palanichamy, M. Manoharan. Publisher, Palani Paramount, 1990.
6. Introduction to bioinformatics -T.K.Attwood & D.J.Parry - Smith
7. Developing Bioinformatics & Computer Skills – Cynthia Gibas& Per Jamback.

E REFERENCE

1. http://www.aun.edu.eg/molecular_biology/Procedure%20Bioinformatics22.232015/Xiong%20%20Essential%20Bioinformatics%20send%20by%20Amira.pdf

COURSE OUTCOME (CO)

K1	CO1	Understand the basic concept and application of Biostatistics and Bioinformatics.
K2	CO2	Know about the methods of data collection and techniques of Sampling.
K3	CO3	Understand the process of Classification and Tabulation of Data.
K4	CO4	Know about the Diagrammatic and graphic presentation of data, measures of Central tendency and Dispersion.
K5	CO5	To communicate the results of Statistical analysis accurately and effectively.

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	L	M	M	H	S	S	H
CO2	M	M	H	H	S	H	M
CO3	M	M	H	S	S	M	S
CO4	M	H	H	S	S	M	L
CO5	H	S	L	M	H	S	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	IV
CREDITS	2	COURSE TITLE	Skill Based course: SERICULTURE
COURSE OBJECTIVE			
<div>➤ To enable the students to learn the basics of Silkworm Rearing Techniques.</div> <div>➤ To understand the economic importance of Sericulture.</div>			
UNIT	CONTENT		HRS
I	Introduction to Sericulture- History and present status of Sericulture Silkworm morphology, life cycle of Silkworm.		6
II	Grainage - Reproductive seeds & industrial seeds – Voltinism- Univoltine, Bivoltine, Multivoltine eggs.		6
III	Rearing- Rearing house, Rearing appliances, Types of Brushing and Bed cleaning. Rearing of Chawkiworm, Rearing of Late age worms - Shelf rearing, Shoot rearing and Floor rearing, care during Moulting.		6
IV	Feeding and Optimum Environmental conditions during rearing, Selection of ripe worms, spinning, mounting, harvest, storage and transport of Cocoons, Uses of Silk.		6
V	Silkworm diseases : Flacherie, Muscardine,- Causative agent, Symptoms, Prevention and control measures.		6
TOTAL CONTACT HOURS			30

TEXTBOOKS
1.Comprehensive Sericulture, G.Ganga (2003) Volume - 1 & Volume - 2, Oxford & IB Pub.,Co.,Pvt.,Ltd.,
REFERENCE BOOKS
1.S. Krishnaswamy et al.(1972).Sericulture manual - 1(Mulberry Cultivation), manual – 2 (Silkworm rearing) & manual -2 (Silk reeling).Food and Agriculture Organisation of the United Nations, Rome.
2.Text book of Tropical Sericulture (1975) Japan OverseasCorporation Volunteers 4 - Hiroo,SibuyaKu,ToKYO,Japan.
3.Sericulture in India,VenkataNarasaiah(2003), Ashish Publishing HouseNew Delhi.

E REFERENCE
1. http://www.survivorlibrary.com/library/silk_culture_a_manual_with_complete_instructions_1885.pdf
2. https://n-modell.hu/11kopjts/178679-introduction-to-sericulture-pdf

COURSE OUTCOME (CO)		
K1	CO1	Identify and know the importance of Silkworm
K2	CO2	Comprehend the methodologies involved in Silkworm Rearing
K3	CO3	Execute self-employment in Sericulture
K4	CO4	Validate different Rearing techniques and it's by products
K5	CO5	Understand and control the diseases of Silkworm

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	H	H	S	L	H
CO2	S	H	M	M	H	L	M
CO3	S	H	M	M	L	M	L
CO4	S	H	M	M	M	M	L
CO5	H	L	S	L	H	L	M

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	IV
CREDITS	4	COURSE TITLE	CORE PRACTICAL II: CELL BIOLOGY, GENETICS, BIOSTATISTICS AND BIOINFORMATICS
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To study about the cell and its division practically➤ To understand the genetics of Mendelian traits.➤ To learn biological databases.			
SUBJECT	CONTENT		HRS
CELL BIOLOGY	Experiment Identification of Mitotic stages in Onion root tip Preparation of Human Blood Smear Spotters / Models E.coli, Golgi bodies, Endoplasmic Reticulum, Nucleus, Mitochondria and Chromosome Giant chromosomes in Chironomus larvae Watson & Crick model of DNA - Model. DNA replication - Semi conservative Replication - Model.		
GENETICS	Mendal’s Law of Segregation with beads of two different colors. Observation of Simple Mendelian Traits Spotter Sex Linked Inheritance in Man - Colour Blindness and Hemophilia. Cytoplasmic Inheritance - Kappa particles in Paramecium and Shell coiling in Snail. Syndromes: Down’s Syndrome, Klinefelter’s Syndrome and Turner’s Syndrome		
BIostatISTICS AND BIOINFORMATICS	Internet Browsing – e-mail, Search engines. Biological Data Bases: Nucleic acid sequence Data Bases: NCBI, EMBL Protein sequence Data Bases: SWISS – PROT, Tr-EMBL. Sequence alignment: BLAST.		
TOTAL CONTACT HOURS			

COURSE OUTCOME (CO)		
K1	CO1	Understand the process of mitotic and meiotic cell division.
K2	CO2	Gain knowledge about cell and cell organelles
K3	CO3	To give an insight about biochemistry and cell organelles in research.
K4	CO4	To understand the Mendelian Laws through Experiments
K5	CO5	To acquaint with Biological Data Bases

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	H	M	L	M	M	L
CO2	H	S	L	M	S	L	H
CO3	S	L	M	L	M	M	L
CO4	M	L	S	M	M	H	L
CO5	S	H	M	L	M	M	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	6 Hrs/Week	SEMESTER	V
CREDITS	5	COURSE TITLE	CORE VII: BIOCHEMISTRY
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To know the structure and properties of Biomolecules.➤ To understand the role of Carbohydrates, Protein and Lipids.➤ To study the different Metabolic cycles.➤ To know the importance of Enzymes and Vitamins.➤ To understand the role of Nucleic acids.			
UNIT	CONTENT		HRS
I	Introduction to Biomolecules Biomolecules- Major characteristics of Biomolecules, Carbon as the main component of Biomolecule, Origin of life chemical composition of life, Elements of life, Atom and Chemical bonds – pH & buffer.		15
II	Carbohydrates Carbohydrates: Structure, Classification, Properties and Physiological significance Monosaccharides: Glucose, Fructose & Ribose Disaccharides: Sucrose, Lactose & Mannose, Polysaccharides: Homopolysaccharides – Starch & Glycogen Heteropolysaccharides - Neutral sugar Mucopolysaccharides- Hyaluronic acid & Heparin.		25
III	Aminoacids & Proteins Amino acids: Structure, Classification, Properties and Biological importance Proteins: Structure-Primary, Secondary, Tertiary and Quaternary.		15
IV	Lipids Lipids-Structure, Classification, Properties and Physiological significance Simple lipids-Triglyceride-Saturated, Unsaturated fatty acids, Essential and Non-essential fatty acids and Waxes. Compound lipids-Structure and Physiological significance Derived lipids - Structure and Physiological significance (Steroid, Cholesterol, Terpenes)		15
V	Metabolism and Enzymes Carbohydrate: Glycolysis Protein: Deamination, Transamination, and Decarboxylation, Lipid: β oxidation of Palmitic acid with its Energetics Enzymes: Classification, Properties and Physiological significance Mechanism of Enzymatic action.		20
TOTAL CONTACT HOURS			90

TEXTBOOKS

1. N. Arumugam *et al.*, Prescribed Text: of Biochemistry, Saras publications.
2. Ambika Shanmugam, 1998, Fundamentals of Biochemistry for Medical students, Published by the Author, Madras.
3. Satyanarayana, U. and Chakrapani, U. 2009. Biochemistry, Books and Allied Pvt. Ltd., Kolkata.
4. Deb-Biochemistry.

REFERENCE BOOKS

1. Harpers Illustrated Biochemistry, 30th Edition. The McGraw- Hill Education, 2011.
2. Nelson, D.L., Leininger, A.L. and Cox, M.M., Lininger Principles of Biochemistry, W.H. Freeman Co., 2012.
3. Deb, AC. Fundamental of Biochemistry, 10th Edition New Central Book Agency. Pvt.Ltd, Kolkata, 2011.
4. Lubertstryer - Biochemistry.
5. Bell, Davidson & Scarborough – Prescribed Text: of Physiology and biochemistry.
6. Jeyaraman, J.J., 1981. - Laboratory manual of Biochemistry.

E REFERENCE

1. http://swayam.gov.in/nd1.noc19_bt19/preview
2. http://www.swayam.gov.in/nd1_noc20_bt11/Preview 3. <http://ndl.iitkgp.ac.in/>

COURSE OUTCOME (CO)

K1	CO1	Gain basic knowledge on Biomolecules.
K2	CO2	Understand the classification and biological importance of Carbohydrate.
K3	CO3	Get thorough knowledge the importance of Amino acids & Protein.
K4	CO4	Know the classification, properties, and biological importance of Lipids.
K5	CO5	Understand the Metabolism & Enzymes.

BLOOM'S MAPPING

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

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	6 Hrs/Week	SEMESTER	V	
CREDITS	5	COURSE TITLE	CORE VIII: DEVELOPMENTAL BIOLOGY	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To acquaint to the different stages of Embryogenesis.➤ To study the process of Fertilization and Development.➤ Compare the process of Gastrulation and Organogenesis.➤ To understand the post Embryonic developmental events.➤ To study Embryonic adaptations, Human reproduction, and Reproductive technology in man.				
UNIT	CONTENT			HRS
I	Basic concept of Developmental biology Historical review of Embryology- Theories - Preformation, Epigenic, Von Beer’s and Bio genetic laws. Regulative and Gradient theories. Gametogenesis: Origin of Primordial germ cells – Spermatogenesis – Oogenesis – Structure of Mammalian Sperm and Ovum -Types of egg based on the amount and distribution of Yolk - presence and absence of shell - types of development. Ovulation and Insemination.			20
II	Fertilization and Cleavage Physical – Chemical – Cytological – Physiological changes. Theories of Activation –significance. Parthenogenesis -Natural and artificial. Cleavage: Planes and Patterns of Cleavage. Blastulation - types of Blastula.			15
III	Gastrulation and Organogenesis Gastrulation – Construction of Fat map-Morphogenetic movements - Gastrulation in frog. Organogenesis: Development of Eye and Heart in Frog. Morphogenetic fields and gradient.			20
IV	Embryonic and Post Embryonic Development Placentation in mammals – Classification and functions. Developmental signification of Fetal Membrane Chick. Regeneration in Planarians and Amphibians. Metamorphosis in Amphibians.			20
V	Applied Embryology Applied Embryology: Sexual cycle - Estrous cycle - Puberty – Menstrual cycle – Pregnancy and Child birth, Menopause – Birth defects. – Infertility – In vitro fertilization and Embryo transfer. Concept of Test tube baby and advantages.			15
TOTAL CONTACT HOURS				90

TEXTBOOKS
Dr.N. Arumugam, (2013), Developmental Zoology, Saras Publication, Nagercoil.
REFERENCE BOOKS
P.S.Verma and Agarwal, (1975),Chordate Embryology, X Ed.,S.Chand& Company Pvt Ltd. Ramnager, New Delhi.
Dr.R.C.Dalela and Verma, (1986-1987), A Text book of Chordate Embryology, VI Ed.,Jai Prakashnath& Co., Meerut city, India.

E REFERENCE

1. https://mobot-biodiversity.jc.weebly.com/uploads/1/8/6/0/18603232/the_evolutionary_biology_of_species_by_t_g_barracough_2019.pdf
2. <http://bgc.org.in/pdf/study-material/developmental-biology-7th-edsf-gilbert.pdf>

COURSE OUTCOME (CO)		
K1	CO1	Acquaint with the theories of Developmental Biology.
K2	CO2	Gain in-depth knowledge in the developmental stages of Embryogenesis.
K3	CO3	Comprehend the process of Gastrulation and Organogenesis.
K4	CO4	Have an enhanced knowledge and appreciation of life cycle transitions like Metamorphosis and Regeneration.
K5	CO5	Acquire better understanding of scientific reasoning exhibited in experimental life science.

BLOOM'S MAPPING							
PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	L	M	L	M	S
CO2	M	S	L	H	M	L	H
CO3	H	L	M	H	L	S	M
CO4	H	L	M	S	L	M	H
CO5	S	H	L	M	L	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	6 Hrs/Week	SEMESTER	V	
CREDITS	5	COURSE TITLE	CORE PRACTICAL III: BIOCHEMISTRY AND DEVELOPMENTAL BIOLOGY	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand the principles of biochemical reactions within our body.➤ To understand the significance of enzymes and hormones in metabolic pathways.➤ To learn the procedure for the chick blastoderm.				
Subject	CONTENT			HRS
BIOCHEMISTRY	Enzyme Activity: Effect of Temperature on Salivary Amylase activity Q ₁₀ analysis. Qualitative tests for Protein, Carbohydrate and Lipid. Chromatography – Paper Chromatography (Demonstration only). Principle & Applications – pH meter, Colorimeter and PAGE			30
DEVELOPMENTAL BIOLOGY	Experiment Temporary Mounting of Chick Blastoderm Observation and study of prepared Micro slide – Frog Two cell stage, four cell stage Blastula, Gastrula Observation of Chick Blastoderm 24 Hours, 48 Hours, 72 Hours and 96 Hours			30
TOTAL CONTACT HOURS				60

COURSE OUTCOME (CO)		
K3	CO1	The biochemical understanding through scientific enquiry.
K4	CO2	Students gain knowledge about various tools and techniques used in biological systems.
K5	CO3	Understand the nature of mechanical, physical, and biochemical functions of humans.
K5	CO4	To know the enzymes, and the cells of which they are composed.
K5	CO5	To identify the developmental stages of Frog and Chick

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	H	H	S	S	S
CO2	H	S	M	M	S	H	H
CO3	S	H	S	M	S	H	L
CO4	S	L	S	M	H	M	M
CO5	H	S	H	L	M	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	5 Hrs/Week	SEMESTER	V
CREDITS	4	COURSE TITLE	ELECTIVE I: IMMUNOLOGY
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand the basic principles and applications of Immunology.➤ To know the knowledge about various diseases.➤ To expose the students into the field of medicine with powerful preventive, therapeutic and diagnostic tools.			
UNIT	CONTENT		HRS
I	Introduction History and scope of Immunology – Types of Immunity – Innate and Acquired Immunity. Innate – Physical and Mechanical factors, Biochemical, Cellular, Genetic factors and other factors. Acquired Immunity – Active & Passive Immunity –Natural and Artificial Immunity.		15
II	Organs of immune system Primary Lymphoid organs- Thymus and Bone Marrow. Secondary Lymphoid organs- Spleen and Lymph node.		15
III	Cells of the Immune system – T-lymphocytes, B-lymphocytes, Null cells, Mononuclear phagocytes, Granulocytes, Neutrophils, Basophils, Eosinophil, Basophil Mast cells and Dendritic cells.		15
IV	Antigens and Antibodies Immunogens: Types of Antigens, General properties of Antigens, Adjuvants, Haptens, Epitopes and Paratopes. Immunoglobulins: Immunoglobulin basic structure, Types, Properties and Function. Hybridoma Technology: Production and Application of Monoclonal Antibodies.		15
V	Basic concepts of Immune system Major Histocompatibility Complex: Structure of MHC molecules and HLA system. Complement system: Classical and Alternate pathway. Vaccines: Designed Vaccine and whole organism. Hypersensitivity: Type I, II, III, IV & V. Transplantation Immunology – Graft Rejection. Autoimmune Disease – Haemolytic anaemia. Immunodeficiency disease – AIDS.		15
TOTAL CONTACT HOURS			75

TEXTBOOKS
1.Dr.N. Arumugam <i>et al.</i> , (2013) – Textbook of Immunology, Saras Publication.
REFERENCE BOOKS
1. Kuby1., (1992), Immunology, IV Ed.,- W.H.Freeman and company.
2. Evan M.Roitt., (1988), Essentials Immunology – VI Ed., ELBS imprint.

E REFERENCE

1. https://labscientists.files.wordpress.com/2017/12/microbiology_immunology-1.pdf
2. http://lib.rudn.ru/file/Immunology_Microbiology_Catalogue_eBook.pdf
3. <https://www.moscmm.org/pdf/Ananthanarayan%20microbio.pdf>
4. <https://alraziuni.edu.ye/book1/Laboratories/microbiology%20immunology.pdf>

COURSE OUTCOME (CO)

K1	CO1	To remember the structure and function of Immunological cells and organs.
K2	CO2	To understand the methods of Immunological interactions.
K3	CO3	To apply the knowledge of Antigens and Antibodies.
K4	CO4	Recognize the significance of Immune system in Transplantation of organs.
K5	CO5	Gain knowledge about Autoimmune and Immune Deficiency diseases.

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	H	H	S	L	H
CO2	S	H	M	M	H	L	M
CO3	S	H	M	M	L	M	L
CO4	S	H	M	M	M	M	L
CO5	H	L	S	L	H	L	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	5 Hrs/Week	SEMESTER	V
CREDITS	4	COURSE TITLE	ELECTIVE I: BIOPHYSICS AND INSTRUMENTATION
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To develop skill in understanding and handling Molecular Science and Instrumentation.➤ To make the students capable of understanding the under lying principles of various reaction and Biological interactions.➤ To understand the Principles and applications of various Laboratory instruments.			
UNIT	CONTENT		HRS
I	Bimolecular interactions Valence of carbon - Polar and Non-Polar molecules – Covalent, Ionic and Coordinate Bonds. Hydrogen Bonding - Weak interactions, Ester linkage, Electrostatic, Disulphide and Peptide bonds - Vander Waal’s forces.		15
II	Solutions Hydrophiles and Hydrophobes - Acid-Base Concept, Molarity, Molality and Normality, Ampholyte, pH and pKa value - Redox potential – Principles of Diffusion and Osmosis – Hypo, Hyper and Isotonic solutions.		15
III	Thermodynamics First and Second laws of Thermodynamics, Biological applications of Enthalpy, Free energy, Activation energy, Unavailable energy and Entropy.		15
IV	Signaling and kinetics Enzyme action: Michaelis - Menton Equation - Vmax - Km - Line Weaver Burk plot. Action Potential – Refractory period – Synaptic Potential. Radio-Labeling and Tracer techniques.		15
V	Instrumentation principles Principles and Applications of – Centrifugation – Electrophoresis - Spectrophotometer – ECG – interpretation of Electrocardiograph.		15
TOTAL CONTACT HOURS			75

TEXTBOOKS	
1 Arumugam N and Kumaresan V. (2017). Bio Physics and Bioinstrumentation, Saras Publication, Nagercoil, Tamilnadu. 2 Bajpai PK. (2008.) Biological Instrumentation and Methodology, S. Chand and Co. Ltd. New Delhi.	
REFERENCE BOOKS	
1. Arumugam N and Kumaresan V. (2015). Principles and Techniques in Biophysics, Saras Publication, Nagercoil, Tamilnadu. 2. Jain JL, Jain N and Jain S. (2009). Fundamentals of Biochemistry, S. Chand Publications, New Delhi. 3. Setlow RB and pollard EL. (1962). Molecular Biophysics, Pergamon Press. 4. Mohan P Arora (2015). Biophysics, Himalaya Publishing House, Nagpur. 5. Veerakumari L. (2010). Bioinstrumentation, MJP-Publishers, Chennai.	

E. REFERENCES

- 1.<https://www.mooc-list.com/course/understanding-research-methods-coursera>
- 2.https://swayam.gov.in/nd2_ugc19_ge04/preview

COURSE OUTCOME (CO)		
K2	CO1	Able to know the basics about the Molecular bonds and interactions
K2	CO2	The learner will be trained in preparing solutions and handling Instruments at basic level.
K3	CO3	The students will be capable of interpreting and understanding the basis of Bioenergetics in living system.
K4	CO4	Gain the knowledge in the area of Enzyme and its action.
K5	CO5	Understand and apply skills in Biological tools and techniques.

BLOOM'S MAPPING							
PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	M	M
CO2	S	S	S	M	S	S	M
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	5 Hrs/Week	SEMESTER	V
CREDITS	4	COURSE TITLE	ELECTIVE II: MICROBIOLOGY
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand the basics and applied aspects of Microbiology.➤ To acquaintance with the different applications of Microbial techniques.➤ To impart knowledge on medical and industrially important Microbes.			
UNIT	CONTENT		HRS
I	Introduction: History, Scope, and Applications of Microbiology Virus: Characteristics of Virus, classification of Virus, Structure, and Multiplication of Bacteriophage. Bacterial growth: Methods of Bacterial growth, Growth Rate and Growth Curve. Bacterial Culture: Culture medium-Types, Sterilization and Culture of <i>E.coli</i> .		15
II	Food and Dairy Microbiology Microorganism in Milk-Sources and types and Preservation of Milk. Dairy products-Starters and important Dairy products. Food microbiology-Spoilage of food in Toxification and Food Infection, Canned Food. Preservation: Objectives, Principals and Methods.		15
III	Agricultural & Environmental Microbiology Biofertilizer - Role of Microbes in Soil Formation, Fertility Crop production. Microorganism as Biofertilizers: Bacteria- <i>Rhizobium</i> , Algae : <i>Azoola</i> , Fungi: <i>VAM</i> Biopesticide – Bacterial: <i>Bacillus thrungiensis</i> , Fungal and Viral pesticide Sewage and sludge treatment- Primary, Secondary (aerobic and anaerobic) and Tertiary treatment.		15
IV	Industrial Microbiology Products of fermentation industry: Bioactive products, Enzymes, Aroma Compounds Antibiotics and Amino acids. Fermentation process – Stages, Types and methods of Fermentation. Industrial production and Application: Penicillin.		15
V	Medical Microbiology Causative organism, Transmission, and Preventive measures: Hepatitis-B, Rabies, Swine flu, Chikungunya and Covid-19 and its variants. Nosocomial and Zoonotic infections.		15
TOTAL CONTACT HOURS			75

TEXTBOOKS
1. N.Arumugam <i>et al.</i> , (2011), Microbiology, Saras Publication.
REFERENCE BOOKS
1. Dr.R.C.Dubey, Dr.D.K.Maheswari, (2010), A Textbook of Microbiology, S.Chand & CO Ramnager, New Delhi.
2.Samuel Baron, Medical microbiology, II Ed., Wesley publishing company, California.

E REFERENCE

1. http://herba.msu.ru/shipunov/school/biol_154/textbook/intro_botany.pdf
2. http://www.survivorlibrary.com/library/strasburgers_text_book_of_botany_1921.pdf
3. https://biolympiads.com/wp-content/uploads/2018/09/1-Botany_Basics.pdf

COURSE OUTCOME (CO)

K1	CO1	To keep in mind about the basic technologies applied in Microbiology.
K2	CO2	To understand the different Culture techniques.
K3	CO3	To apply the Microbial Culture techniques in Industrial and Agricultural aspects.
K4	CO4	To analyze the Applications of Microbiology.
K5	CO5	To evaluate the Microbial diseases.

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	L	M	M	H	S	S	H
CO2	M	M	H	H	S	H	M
CO3	M	M	H	S	S	M	S
CO4	M	H	H	S	S	M	L
CO5	H	S	L	M	H	S	L

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	5 Hrs/Week	SEMESTER	V
CREDITS	4	COURSE TITLE	ELECTIVE II: HUMAN GENETICS AND COUNSELING
COURSE OBJECTIVE <ul style="list-style-type: none">➤ The give an idea about various aspects of Human Genetics, Heredity and Genetic Disease and various methods of Prenatal Diagnosis.➤ To make the students aware of the Human Genome Project promises and achievements.➤ To make the students understand the central and unifying position of Genetics in biological services and to create awareness for a better community.			
UNIT	CONTENT		HRS
I	Chromosomes Human chromosome – International system of Nomenclature - Chromosome number, Idiogram, Banding methods (Q, C, G and R banding).		15
II	Inheritance Monogenic traits, Autosomal inheritance, Dominant, Recessive, Sex-influenced traits, Mitochondrial inheritance, MIM number, Consanguinity and its effects.		15
III	Pedigree Pedigree, Gathering family history, Pedigree symbols, Construction of Pedigrees, Presentation of Molecular Genetic Data in Pedigrees, - Complications to the basic Pedigree patterns.		15
IV	Syndromes Human Chromosomal disorders (Syndromes) Disorders of Chromosome structure and Disorders of Chromosome number-Trisomy 18, Cri-du chat syndrome, Prader-illi Syndrome, Cystic fibrosis, Muscular Dystrophy, Thalassemia and Major Fragile x Syndrome.		15
V	Metabolic Errors In-born errors of metabolism: Alkaptoneuria –Galactosemia - Gaucher’s disease - Glucose-6-phosphate dehydrogenase deficiency - Niemann Pick disease. Behavioural Genetics : Genes related to Behaviour - Genetic and Environmental Manipulations, Learning and Memory. Dementia – Schizophrenia - Childhood Personality Disorders - Antisocial Personality - Criminal behavior.		15
TOTAL CONTACT HOURS			75

TEXTBOOKS

1. Meyyan RP. (2014). Fundamentals of Genetics, Saras Publication, Nagercoil, Tamil Nadu.
2. Verma PS and Agarwal VK. (2010). Genetics, S. Chand Publishers, New Delhi.

REFERENCE BOOKS

1. Bhatnagar SM, Kothari Lopa ML. (1999). Essentials of Human Genetics, 4 th edition- (Reprint 2004) – Orient Longman (P) Ltd., India.
2. Gangane SD. (2017). Human Genetics, Publisher-Reed Elsevier India Pvt. Ltd, India.
- 3 Gardner EJ. (2015). Principles of genetics, 7 th edition, John Wiley Sons, Inc., London, UK.
- 4 Strickberger MW. (1976). Genetics, Published by Macmillian Publishing Co., Inc., NewYork.

E REFERENCE

1. <http://www.maths.lth.se/matstat/kurser/statgen/book/StatisticsInGenetics-20031125.pdf>
2. <http://www.bionica.info/biblioteca/AnonimoxxxIntroductionMolecularGenetics.pdf>

COURSE OUTCOME (CO)		
K2	CO1	The students will be able to get the knowledge of Physiology and Genetics of blood groups.
K2	CO2	Knowledge of research principles and methods applicable in the discipline of Genetic testing approach taken for specific Genetic disorders.
K3	CO3	Gain knowledge of the role of Genetics as the underlying cause of various disorders of the human body.
K3	CO4	The course will give an idea about Genes related to behavior and Behavioral disorders.
K4	CO5	To train the students to seek the possibilities of identifying Human genetics and counseling as a Profession.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	M	M
CO2	M	S	S	M	S	S	M
CO3	S	M	S	S	S	S	S
CO4	S	M	S	S	M	S	S
CO5	S	S	S	S	S	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	2 Hrs/Week	SEMESTER	V	
CREDITS	2	COURSE TITLE	SKILL BASED COURSE V : AQUACULTURE	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To understand the Importance and scope of Aquaculture.➤ To gain a knowledge in the culture of fishes and its economic importance.➤ To understand the preparation of Pond and methods of Fish culture.➤ To gain a knowledge in the culture of Prawn and Oyster.➤ To understand the method for culturing the Pearl and Seaweed.				
UNIT	CONTENT			HRS
I	Introduction to Aquaculture Scope of Aquaculture- Aquaculture in India –Freshwater Aquaculture –Coastal Aquaculture – Marine Aquaculture – Metahaline Aquaculture - Culture practices in India – World Fisheries – Types of Fisheries – Culture Practices in the World.			6
II	Culture of indian Major Carps Seed Collection – Culture Practices –Feeding – Pond Fertilization – Weed Control – Predator Control – Disease Control – Harvesting – Marketing – Preservation.			6
III	Culture of Marine Prawn and Oyster Culture Operations in Prawn – Seed Collection-Culture Methods – Harvesting – Preservation – Marketing. Biology of Edible Oyster – Cultivable Species – Framing Operations – Culture Methods – Harvesting – Cleaning –Preservation – Marketing.			6
IV	Pearl Industry and Seaweed culture Types of Pearls – Composition of Pearl – Pearl- producing Animals – Biology of Pearl Oysters - Pearl Formation – Culture of Pearls – Introduction of Seaweeds - Uses of Sea weeds – Capture and Culture Fisheries – Culture Methods – Pond Culture – Field Culture.			6
V	Fish pathology Fish diseases – Parasitic disease – Protozoan, Bacterial and Viral diseases.(Each One disease) Government participation in aquaculture – Entrepreneurship Development in Aquaculture.			6
TOTAL CONTACT HOURS				30

TEXTBOOKS	
1.Dr.N.Arumugam, Dr.S.Murugan, Dr.J.Johnson Rajeshwar and Dr.R.Ram Prabhu, (2005), Applied Zoology, Saras Publication, Nagerkovil. 2.N. Arumugam <i>et al.</i> , Economic Zoology, (2013) Saras Publications, Nagerkovil.	
REFERENCE BOOKS	
1.J.D.Jameson and R. Santhanam. (1996). Manual of Ornamental Fishes and Farming Technologies- Fisheries College & Research Institute TANVASU, Tuticorin-628008. 2.R.Santhakumar et al., (2007). Manual on freshwater Ornamental Fish Culture, Dept.of Fisheries extension, Fisheries College and Research Institute, TANVASU, Tuticorin- 628008. 3.V.K.Venkataramani et al., (2004). Biodiversity and stock assessment of Marine Ornamental fishes. Dept of Fisheries biology & Capture fisheries, Fisheries College & Research institute,TANVASU, Tuticorin-628008.	

E REFERENCE

1. <https://www.mooc-list.com/course/oceanography-key-better-understand-our-world-coursera>
2. <https://igor.crew.c-base.org/aquaculture.pdf>
3. <http://www.agrifs.ir/sites/default/files/AQUACULTURE.pdf>
4. <https://www.cabi.org/uploads/CABeBooks/CAB-eBooks-ColAquaculture-and-Fisheries.pdf>
5. https://www.blackwellpublishing.com/pdf/catalogue_2007_online_aquaculture.pdf

COURSE OUTCOME (CO)

K2	CO1	To study the Introductory of aspects of Aquaculture.
K3	CO2	Demonstrate the technical aspects of Aquaculture.
K3	CO3	To know the Pond preparation and production of Prawn and Oyster.
K2, K3	CO4	To know about the commercial importance of Pearl and Seaweed.
K2, K3	CO5	To elaborate the Diseases in Fishes and Entrepreneur development in Aquaculture.

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	S	M	H	H	M	M	S
CO2	S	S	H	S	H	M	L
CO3	M	S	S	H	H	M	H
CO4	S	H	S	H	S	H	M
CO5	S	L	H	S	L	H	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	6 Hrs/Week	SEMESTER	VI
CREDITS	5	COURSE TITLE	CORE IX: ANIMAL PHYSIOLOGY
COURSE OBJECTIVE ➤ To understand the mechanisms that work to keep the Human body alive and functioning. ➤ To comprehend the detailed concepts of Digestion, Respiration, Excretion the functioning of Nerves and Muscles. ➤ To gain knowledge of various metabolic and Physiological mechanisms of the human body. ➤ To understand Neurophysiology, Receptors and Hormones. ➤ To gain fundamental knowledge of Animal Physiology.			
UNIT	CONTENT		HRS
I	Food & Nutrition Food and Nutrition, Balanced diet, Malnutrition Nutrition: Types of Nutrition and types of Feeding Digestive system: Digestive gland - Digestive Enzymes and their Role in Digestion. Digestive system and process of Digestion with reference to Human. Absorption-Carbohydrate, Protein and Lipid.		20
II	Respiration and Circulation Respiration Histology of Trachea and Lungs, Mechanism of Respiration, Respiratory pigments, Transport of Respiratory gases, Control of Respiration and Respiratory disorders. Circulation Structure and function of Human Heart, Origin and conduction of Heartbeat, ECG, Cardiac cycle, Origin and conduction of Heart Beat .		15
III	Excretion and Nervous co-ordination Excretion Excretory organs and products. Structure of Kidney and its functional unit, Mechanism of urine formation and Hormonal control of Excretion. Nervous co-ordination Structure of Neuron-Types of Neurons, Origin of action potential and its propagation across the Myelinated and non-Myelinated nerve fiber. Synapse, Types of Synapses, Synaptic transmission and Neuromuscular junction.		20
IV	Muscle and Receptors Muscle: Ultra-Structure of Skeletal muscle, Chemical composition, Properties and mechanism of Muscle contraction, Molecular and Chemical basis of Muscle Contraction, characteristics of Muscle twitch, Motor unit, Summation and Tetanus. Receptors Photoreceptor and Mechanoreceptors.		20
V	Bioluminescence and Hormones Bioluminescence Introduction, Types, structure of Bioluminescent organs. Significance and control of Bioluminescence. Hormones Overview of Pituitary Gland – Hormonal Disorder		15
TOTAL CONTACT HOURS			90

TEXTBOOK

1. Animal Physiology – Arumugam *et al.*, Saras Publication 2021.

REFERENCE BOOKS

1. Animal Physiology- P. S Verma, B.S.Tyagi, V.K. Agarwal, II ed, 1978, S.Chand & Company Ltd. Ram Nagar, New Delhi – 110 055.
2. General comparative physiology by Hoar, S. William, 3rd ed, 1987, Prentice Hall of India Pvt. Ltd. New Delhi, 18 BN-0-87692-337-6.

E REFERENCE

1. <https://www.classcentral.com/course/swayam-animal-physiology-12894>
2. https://swayam.gov.in/nd1_noc20_bt42/preview
3. <https://www.classcentral.com/course/edx-respiration-in-the-human>

COURSE OUTCOME (CO)

K1	CO1	Know the importance of food and Nutrition and Digestion.
K2	CO2	Attain knowledge on respiratory organ and blood circulation systems.
K3	CO3	Comprehend the structure and function of excretory system.
K4	CO4	Interpret the association between the nerve coordination and muscle physiology and Receptors.
K5	CO5	Gain a deep knowledge on Bioluminescence and Hormones.

BLOOM'S MAPPING

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

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	6 Hrs/Week	SEMESTER	VI
CREDITS	5	COURSE TITLE	CORE X: BIOTECHNOLOGY
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To know about the tools and methods of Gene transfer.➤ To get an idea of Transgenic animals and their importance.➤ Assess the history, scope and basics of Plant Biotechnology and Transgenic Plants.➤ Analyze the various aspects of Environmental Biotechnology including Biodegradation, Bioremediation, and Biosensor.➤ To study about recent advancements in Biotechnology.			
UNIT	CONTENT		HRS
I	Recombinant DNA Technology Introduction – brief history – steps- in – rDNA technology. Molecular tools: Restriction Enzymes and DNA ligases. Gene cloning vectors: Plasmid, Bacteriophage, Cosmid, Shuttle vectors and Expression vectors. Molecular Biology techniques: Microinjection, Electroporation, Retroviral method and PCR. Blotting Techniques: Southern and Northern Blotting.		20
II	Animal Biotechnology Cell Culture Techniques – Primary and Secondary Culture. Cloning of animals: Methods and uses. Transgenic animals and its Applications – Transgenic Fish. Sheep as Bioreactor. Human Genome Project (basic knowledge only).		20
III	Plant Biotechnology Plant tissue culture: Applications of Plant Tissue Culture and Protoplast Culture: Protoplast Fusion methods and its importance. Transgenic plants and its application: Techniques of transformation – Agrobacterium mediated gene transfer (Ti plasmid), Electroporation and Biolistic. Bio pesticides – Bt Toxins – transgenic “Killer cotton”.		20
IV	Environmental and Industrial Biotechnology Biodegradation: Degradation of Xenobiotics super bug – construction of Super bug to control Oil Pollution. Bioremediation: Insitu Bioremediation, Composting, Land forming and Digestion. Bioleaching: Direct and Indirect Leaching. Biosensors: Principle and Application of Glucose Biosensor. Biochips – Principle and Uses.		15
V	APPLICATION OF R –DNA TECHNOLOGY IN HUMAN HEALTH Recombinant DNA proteins and uses Interferon, Interleukin, Tissue Plasminogen activator and factors VII. Recombinant vaccines: Hepatitis – B, Rabies and FMD vaccine. Commercial production of Penicillin. DNA Finger Printing and its use in Forensic Science – Bioweapons.		15
TOTAL CONTACT HOURS			90

TEXTBOOKS	
1. V. Kumaresan, (2015), Biotechnology – Saras Publication.	
REFERENCE BOOKS	
1. R.C Dubey, (1993), A Textbook of Biotechnology. III Ed., S.Chand & company Ltd.	
2. H.K.Das,(2004), Text book of Biotechnology . III Ed., Wiley India (P) Ltd.	
3. S.C.Rastogi, (2007), Biotechnology – Principles and Applications – I Ed., Narosa Publishing house.	

E REFERENCE

1. <https://thunderbooks.files.wordpress.com/2009/05/introduction-to-biotechnology-and-genetic-engineering-infinity-2008.pdf>
2. <http://www.ifsc.usp.br/~ilanacamargo/FFI0740/2.pdf>
3. <https://ingeniumcanada.org/sites/default/files/2019-01/educationgenetics-and-biotechnology>

COURSE OUTCOME (CO)

K1	CO1	Know about the tools and methods of Cloning by using Bio techniques.
K3, K6	CO2	Elucidate transgenic animals and their importance. Acquire knowledge on tissue culture.
K2	CO3	Explain the history, scope and basis of Microbial Biotechnology and Transgenic plants.
K4	CO4	Analyze the various aspects of Environmental Biotechnology including biodegradation, bioremediation, and biosensor.
K3, K6	CO5	Understand the production and application of r-DNA proteins.

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO							
CO1	H	M	L	M	L	M	S
CO2	M	S	L	H	M	L	H
CO3	H	L	M	H	L	S	M
CO4	H	L	M	S	L	M	H
CO5	S	H	L	M	L	M	S

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	6 Hrs/Week	SEMESTER	VI	
CREDITS	5	COURSE TITLE	CORE PRACTICAL IV: ANIMAL PHYSIOLOGY AND BIOTECHNOLOGY	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To study the physiological adaptations of organisms to physical and chemical factors such as temperature, pressure, saltwater balance etc.,➤ To familiarize with the recent biotechnological techniques.				
SUBJECT	CONTENT			HRS
ANIMAL PHYSIOLOGY	Estimation of Rate of Oxygen consumption in fish. Effect of Temperature on Ciliary activity of Fresh water mussel. (Procedure only) Effect of Temperature on heartbeat of freshwater mussel. (Procedure Only) Qualitative detection of Excretory products Ammonia, Urea and Uric acid Estimation of Hemoglobin by Sahli’s method.			30
BIOTECHNOLOGY	Isolation of DNA. Isolation of RNA. Agarose gel Electrophoresis. PAGE. PCR (Demonstration only). Transgenic Techniques-Micro injection and Electroporation (Demonstration only). Spotters rDNA, Ti Plasmid, Lambda phage, Restriction enzyme - EcoR1, Southern blotting, Northern blotting. pBR322.			30
TOTAL CONTACT HOURS				60

COURSE OUTCOME (CO)		
K3	CO1	Impart knowledge about various metabolic and Physiological mechanism of animals.
K4	CO2	Students gain fundamental knowledge of Physiological process like Thermoregulation and Excretion.
K4	CO3	To understand and gain knowledge about r-DNA.
K5	CO4	Apply their knowledge in the production and application of Human Health Care products.
K3	CO5	Impart knowledge about various Metabolic and Physiological mechanism of animals.

BLOOM'S MAPPING							
PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	H	L	S	H	M
CO2	M	S	H	M	H	L	S
CO3	H	M	M	S	L	S	H
CO4	M	S	S	H	M	H	S
CO5	S	M	H	L	S	H	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	5 Hrs/Week	SEMESTER	VI	
CREDITS	4	COURSE TITLE	ELECTIVE III-EVOLUTION	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To acquire an in-depth knowledge on the Diversity and relationships in Animal world.➤ To develop a holistic appreciation on the Phylogeny and adaptations in animals.				
UNIT	CONTENT			HRS
I	Introduction and Origin of Life Evolution Vs Creation, History of evolutionary idea, Theory of Preformation, Theory of Epigenesis, Baer’s law Origin of life: Introduction, Abiogenesis, Biogenesis, Cosmozoic theory, Theory of Eternity of present conditions, Theory of Catastrophism and Origin of Life and Organic Evolution.			15
II	Evidence and Theories of Evolution Evidence from Morphological & Comparative Anatomical and Physiological. Adaptive radiation -Parallel Evolution. Theories of Evolution: Lamarckism, Neo-Lamarckism, Darwinism and Neo-Darwinism Fossils: Types, Method of Fossilization-Methods of dating the Fossils, Geological time scale.			15
III	Speciation & Isolation Speciation - Types, Mechanism and Pattern of Speciation. Isolation – Geographical and Reproductive Isolation.			15
IV	The Cause of Evolution Genetic Drift-Founders Principle. Hardy-Weinberg Equilibrium. Natural selection: The general Selection model - Group selection.			15
V	Human Evolution Human evolution - Organic Evolution of Man - Cultural Evolution of Man- Milestones of Cultural Evolution.			15
TOTAL CONTACT HOURS				75

TEXTBOOK

1.Arumugam, N. (2019). Organic Evolution. 7thedition, Saras Publication, Kanyakumari.

REFERENCE BOOKS

- 1.Modern Experimental Zoology by Preeti Guptha and Mridula Chaturvedi. 2010.
- 2.Strickberger, Evolution, Jones and Barlett Publishers Inc., London, 2010.
- 3.Sanjib Chattopadhyay. (2008). Evolution. Adaptation and Ethology, second edition, Books & Allied Pvt. Ltd., Kolkata.

E REFERENCE

1. https://mobot-biodiversity.jc.weebly.com/uploads/1/8/6/0/18603232/the_evolutionary_biology_of_species_by_t_g_barracclough_2019.pdf
2. <http://bgc.org.in/pdf/study-material/developmental-biology-7th-ed> sf-gilbert.pdf
3. <https://www.blackwellpublishing.com/ridley/EVOC20.pdf>

COURSE OUTCOME (CO)

K2	CO1	Recall the basic concepts of Origin of Life on Earth.
K2	CO2	Relate the evidence of Evolution and the supporting theories.
K3	CO3	To know about the Species concept and Genetic Drift.
K1	CO4	know the causes for Evolution.
K3	CO5	Discuss the stages of Human Evolution.

BLOOM'S MAPPING

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

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY	
COURSE CODE		BATCH	2022-2025	
HOURS	5 Hrs/Week	SEMESTER	VI	
CREDITS	4	COURSE TITLE	ELECTIVE III: ANIMAL BEHAVIOUR	
COURSE OBJECTIVE <ul style="list-style-type: none">➤ To know about basic concepts of Animal behavior.➤ To understand the Pattern of behavior of animals.➤ To understand the importance of Society and Social insects.➤ To learn the Sexual behavior of animals.➤ To distinguish different type of Biological Rhythms.				
UNIT	CONTENT			HRS
I	Introduction to Ethology Origin and history of Ethology, Brief Profiles of Karl Von Frisch, Ivan, Pavlov, Kornrad Lorenz, Nilco Tinbergen, Proximate and ultimate causes of Behaviour. Methods and recording the Behaviours. Wildlife conservation approaches and limitations management of Rare and Endangered species. Control and management of over abundant Wildlife Population. Ecological Monitoring and Animal species and Restoration programmes.			15
II	Stereotyped Behaviors Stereotyped behaviors- Individual behaviour patterns. Instinct vs Learnt behavior Associative Learning, Classical and Operant conditioning Habituation, Imprinting. Wildlife Senses Technique - Objective Direct and Indirect methods with reference to Herpeto fauna, Birds and Mammal. Project Tiger and Project Elephant.			15
III	Social Behaviors Social Behaviors- Concepts & Society: Communication and the Senses Altruism: Insects Society with Honey Bee as example foraging in Honeybee and advantages of the Waggle dance.			15
IV	Sexual Behaviour Sexual behaviour- Asymmetry of sex, Sexual Dimorphism, Mate choice, Intra, Sexual selection, Inter- sexual selection, Sexual Conflict in Parental care.			15
V	Biological Rhythm Type and characters short- and long-term Rhythms: circadian rhythm, tidal rhythm lunar rhythms photoperiod and regulation seasonal reproduction in vertebrates. Animal behaviours – Aggressive behaviour, Altruism- Communication and Signaling, Mating behaviour, Social system of Mammals. Insect socio- biology the man behaviours and its Genitive Traits.			15
TOTAL CONTACT HOURS				75

TEXTBOOK

1. Dewsbur, D.A Comparative animal behavior. McGraw Hill Book Company. 2001.
2. Alcock, J. Animals Behaviour: An evolutionary approach. Sinauer Assoc., Sunderland, Mass. 2015.

REFERENCE BOOKS

1. Bradbury, J,W., and S.L Vehrencamp. Principles and animals communication sinauer Assoc., Sunderland, Mass, USA.1999.
2. Eibl –Eibesfeldt, I.Ethology: the biology of behavior. Holt, Rinehart & Mc Graw Hill 16. 1970 3.
- Drickamer, L.C. S.H. Vessey and E.M. Jakob Animals Behavior. Mc Graw Hill. 2002.

E REFERENCE

1. <http://www.jnkvv.org/PDF/13042020153242134201400.pdf>
2. [https://txmn.org/elcamino/files/2010/03/Ornithology-Basic Concepts.pdf](https://txmn.org/elcamino/files/2010/03/Ornithology-Basic%20Concepts.pdf)

COURSE OUTCOME (CO)		
K2	CO1	Understand different type of Animal behavior and its significance.
K2	CO2	Get an insight to the students about the stereotyped behaviors.
K2	CO3	Know the Social behavior.
K2	CO4	Understand the Sexual behavior.
K4	CO5	Understand the type and characters of short- and long-term rhythms: Circadian Rhythm.

BLOOM'S MAPPING							
PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	M	M
CO2	M	S	S	M	S	S	M
CO3	S	M	M	S	S	S	S
CO4	M	M	S	S	M	S	S
CO5	S	S	S	S	S	S	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	VI
CREDITS	2	COURSE TITLE	NON-MAJOR ELECTIVE II: ECONOMIC ZOOLOGY
COURSE OBJECTIVE ➤ This course is designed to make the students understand the technical and commercial aspects of rearing edible freshwater Fish, Shrimps, Cattle, Pig, Poultry and Earthworms.			
UNIT	CONTENT		HRS
I	Edible Freshwater Fish Culture Aquaculture – Salient features – types – Farming practices – Cultivable fishes – Major Carps - Pond preparation – Management. Composite Fish Culture.		6
II	Shrimp Farming Biology – Cultivable species – Methods of Culture – Pond site – Artificial breeding –Live feeds – Hatchery management.		6
III	Dairy Farming Breeds of Cow, Buffalo, Goat and Pig. Breed improvement – Cross – Breeds. Milch cattle – Reproduction. Dairy products – Milk processing – Piggery management and products.		6
IV	Poultry Farming Breeds – Layers – Broilers. Methods of Poultry Keeping – Food and Feeding – management and Egg Production. Diseases of Poultry – Ran khet and Coccidiosis.		6
V	Vermiculture Earthworm – varieties – Biology – optimal conditions for Culture – Culture practices – Vermicompost – Vermicast – Vermiwash.		6
TOTAL CONTACT HOURS			30

TEXTBOOK

1.Applied Zoology, N. Arumugam, T.Murugan, J.Johnson Rajeswar, R.Ram Prabhu, Saras publications.

REFERENCE BOOKS

- 1.Introduction to Economic Zoology – Sarkar, Kundu, Chaki, New Central Book Agency, 2014
2. A text book of Economic Zoology – Aluminul Islam, Dreamtch Press, 2020
- 3.A Handbook on Economic Zoology - Dr.Jawad Ahsan, Dr. Subhas Prasad, Global Net Publication,2020

E REFERENCE

- 1.http:// www.fao.org>docrep>pdf 2.http:// www.uaex.edu>special-programs>bee keeping

COURSE OUTCOME (CO)		
K1	CO1	Explain the Aquaculture practices.
K2	CO2	Outline Shrimp culture methods and Hatchery management.
K2	CO3	Apply the knowledge of Dairy and Pig farming.
K1	CO4	Analyze the methods of Poultry farming, Disease and control measures.
K4	CO5	Assess the methods and uses of Vermicomposting.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	L	H	H	S	L	L
CO2	H	L	S	L	H	M	L
CO3	S	L	M	S	S	H	L
CO4	H	S	M	S	H	M	M
CO5	H	M	M	S	S	H	M

S-Strong; H-High; M-Medium; L-Low

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	3 Hrs/Week	SEMESTER	VI
CREDITS	2	COURSE TITLE	SKILL BASED COURSE VI: PROJECT
COURSE OBJECTIVE <ul style="list-style-type: none"> ➤ To obtain research knowledge Biological field. ➤ To access the Microenvironment and Report preparation. 			

COURSE OUTCOME (CO)		
K3	CO1	Make Research proposal.
K4	CO2	Construct tool of Data collection.
K5	CO3	Learn fieldwork modalities.
K6	CO4	Understand the process of Data analysis.
K6	CO5	Writing Research report.

BLOOM'S MAPPING							
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	H	L	M	L	L
CO2	S	S	L	L	M	S	S
CO3	L	L	S	L	H	S	M
CO4	H	S	M	M	M	S	L
CO5	S	L	H	S	S	S	L

S-Strong; H-High; M-Medium; L-Low