

GOVERNMENT ARTS COLLEGE (AUTONOMOUS)

SALEM – 636007

NAAC Re-accredited with B Status

AFFILIATED TO PERIYAR UNIVERSITY



PG & RESEARCH DEPARTMENT OF ZOOLOGY

SYLLABUS FOR B.Sc., ZOOLOGY

CHOICE BASED CREDIT SYSTEM

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2021 -2022 ONWARDS)

DEPARTMENT OF ZOOLOGY

VISION

The Department of zoology is a nurturing field for students' holistic improvement and to inculcate the highest values of biological science including taxonomy, evolution, environment, developmental biology, and molecular science.

MISSION

- To motivate the students for their fruitful life.
- To develop the broad knowledge about the biology of animals.
- To impart entrepreneurial skills through application-oriented subjects.
- To provide the best education for students to achieve their goals.
- To promote research and learning.
- To create awareness about health-related problems by curriculum

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The Programme Educational Objectives for the Subject are as follows	
PEO1	Ensure acquiring the awareness on the basics of the zoology and to understand the different features and diversities in the animal kingdom - encouraging to provision the innovative solutions to make a global impact.
PEO2	Provides an expertise in the domain helpful for the higher education and research - with basic understanding of the subject, further education is made easier and skilful.
PEO3	Help gain a successful career in the different fields of biological sciences - up skilling and helping to analyse data scientifically and apply them for work-related research purposes.
PEO4	Enables the option to utilize the known knowledge for the human benefits and for society welfare - especially with the environmental sciences, anyone can understand socio-ecology.
PEO5	Help increase the entrepreneurial skills with bioethics in place and kick-start the professionalism aiding the industrial needs.

PROGRAMME SPECIFIC OUTCOMES (PSO)

The Programme Specific Outcomes for the Subject are as follows	
PSO1	Attain the basic knowledge of the Zoology concepts and principles, various studies related to the Zoology and other biological sciences.
PSO2	Demonstrate the procedural knowledge via various laboratory experiments and practical examination.
PSO3	Understand the underlying concepts involved and become more aware of the current environmental issues having global impact.
PSO4	Show the competence required for the non-major science subjects included and able to correlate the knowledge for various educational and industrial benefits.
PSO5	Participate in the science programmes and effectively be able to showcase the observational and appropriate skills required based on their understanding.

PROGRAMME OUTCOMES

The Programme Outcomes devised for the Subject of Zoology is as follows	
PO1	Demonstrate a fundamental understanding of the academic field of Zoology, its different learning areas and applications, and its link with related disciplinary areas/subjects; provides awareness on the divisions in Animal Kingdom, their distribution, relationship among them and with the environment.
PO2	Show Procedural knowledge in various professions related to the subject in different fields inclusive of research and development, teaching, government and public services with the help of practical tests in different branches; Use it to analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.
PO3	Exhibit Skills in areas related to their individual specialization like genetic engineering, in relation to current developments and related fields in the domain; helps to apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
PO4	Able to communicate the concepts, constructs and techniques involved in with ease and in a clear manner based on the animal evolution, animal behaviour, animal development and animal ecology topics.

PO5	Techniques and Methodologies discussed in the vital topics like Cell Biology, Genetics, Molecular Biology manifest the knowledge in research specific areas and studies by correlating the physiological processes of animals and relationship with cellular structure.
PO6	Understand the environmental conservation processes and its importance, pollution control, protection of endangered species, Wildlife Management, Climatic changes and Global Management are discussed as a paper to improvise the subject knowledge for identifying any problems related and in helping the impacted environment and biodiversity.
PO7	Helps advancement in job, trades, and employment with the help of knowledge about of Agro-based Small Scale industries like sericulture, fish farming, butterfly farming and vermicompost preparation and helps create various opportunities in the educational, research and developmental, social entrepreneurial sectors related to the same.
PO8	Should be able to create a contextual contents and examples in the real time world based on the applications and discussions carried out in all the subjects like combining clinical laboratory techniques studied as part of Medical Parasitology and behaviours of the microbes studied as part of the Microbiology.
P09	Improve the observational, computational, and analytical ethical skills required for the research and development fields discussed for evolving trends in Genetics, molecular biology, microbiology, cell biology, etc..
P10	Apply Zoology discipline helps in adding Benefit by provisioning in-depth information regarding the socio-economic, bio-economic and economical branches to use the underlying concepts and core knowledge in enabling the industrial, social and environment benefits; enhances the ethica skills to cater the professional and industrial needs.

COURSE STRUCTURE OF B.SC ZOOLOGY (STUDENTS ADMITTED FROM 2021-22)

Course Structure for UG Zoology - 2021-2022								
Sem.wis e paper	Part	Course Code	Course Name	Hours	Credits	Marks		Max
						IA	SE	
SEMESTER – I								
1	I	21FTL01	Foundation : Tamil -I	5	3	25	75	100
2	II	21FEL01	Communicative English-I	5	3	25	75	100
3	III	21UZL01	Core Course I: Invertebrata	5	5	25	75	100
4	III	21ABY01	Allied – I- Course I - Botany -I	5	4	25	75	100
5	IV	21AECC1	AECC –I: Value Based Education	2	2	25	75	100
6	IV	21UPE01	Professional English-I	2	2	50	-	50
7	III	21UZLP1	Core Practical - I: Invertebrata and Chordata	3	--	--	--	--
8	III	21ABYP1	Allied – I-Practical: Botany	3	--	--	--	--
TOTAL				30	19		-	550
SEMESTER – II								
1	I	21FTL02	Foundation : Tamil II	5	3	25	75	100
2	II	21FEL02	Communicative English-II	5	3	25	75	100
3	III	21UZL02	Core Course II: Chordata	5	5	25	75	100
4	III	21ABY02	Allied – I- Course II: Botany -II	5	4	25	75	100
5	III	21UZLP1	Core Practical- I: Invertebrata and Chordata	3	4	40	60	100
6	III	21ABYP1	Allied – I -Practical: Botany-I	3	3	40	60	100
7	IV	21AECC2	AECC-II: Environmental Studies	2	2	25	75	100
8	IV	21UPE02	Professional English-II	2	2	50	-	50
TOTAL				30	26		--	750
CUM-TOTAL					45	-	-	1300
SEMESTER – III								
1	I	21FTL03	Foundation Tamil - III	5	3	25	75	100
2	II	21FEL03	Foundation English – I	5	3	25	75	100
3	III	21UZL03	Core Course III: Cell Biology	5	5	25	75	100
4	III	21ACH01	Allied – II- Course I: Chemistry	5	4	25	75	100
5	IV	21UZLS1	Skill Enhancement Course I: Aquaculture	2	2	25	75	100
6	IV	21UZLN1	Non-Major Elective Course I: Nutrition and Dietetics	2	2	25	75	100
9	V	21EXAT1	Extension (Community Service)*: National Cadet Corps	(Self Study)	2	-	100	100
9		21EXAT2	Extension (Community Service)*: National Social Service					
9		21EXAT3	Extension (Community Awareness)*: Indian Heritage and Culture					
9		21 EXAT4	Extension (Community Awareness)*: Public Health and Personal Hygiene					
7	III	21UZLP2	Core Practical - II: Cell Biology & Genetics	3	-	-	-	-
8	III	21ACHP1	Allied – II -Practical: Chemistry	3		--	--	-
TOTAL				30	21	-	-	700
CUM-TOTAL					66	-	-	2000
SEMESTER – IV								
1	I	21FTL04	Foundation : Tamil IV	5	3	25	75	100
2	II	21FEL04	Foundation English – II	5	3	25	75	100
3	III	21UZL04	Core Course IV: Genetics	5	5	25	75	100
4	III	21ACH02	Allied – II-Course-II: Chemistry - II	5	4	25	75	100
5	IV	21UZLS2	Skill Enhancement Course II: Poultry Science	2	2	25	75	100

6	IV	21UZLN2	Non-Major Elective Course - II: Economic Zoology	2	2	25	75	100
7	III	21UZLP2	Core Practical –II: Cell Biology and Genetics	3	4	40	60	100
8	III	21ACHP1	Allied – II – Practical: Chemistry	3	3	40	60	100
9	IV	21AEEC1	Ability Enhancement Elective Course I: Gandhian Thoughts	(Self Study)	2		100	100
		21AEEC2	Ability Enhancement Elective Course II: Human Rights					
		21AEEC3	Ability Enhancement Elective Course III: Business Startup Fundamentals					
		21AEEC4	Ability Enhancement Elective Course IV: Professional Ethics & Cyber Netiquette					
			TOTAL	30	28	-	-	900
			CUM-TOTAL		94	-	-	2900
SEMESTER – V								
1	III	21UZL05	Core Course V: Developmental Biology	5	5	25	75	100
2	III	21UZL06	Core Course VI: Animal Physiology	5	5	25	75	100
3	III	21UZL07	Core Course VII: Immunology	5	5	25	75	100
4	III	21UZLM1	Major Based Elective I: Medical Laboratory Techniques	4	4	25	75	100
		21UZLM2	Major Based Elective II: Economic Entomology					
5	III	21UZLM3	Major Based Elective III: Biostatistics and computer applications	3	4	25	75	100
		21UZLM4	Major Based Elective IV: Biochemistry					
6	IV	21UZLS3	Skill Enhancement Course III: Vermitechnology	2	2	25	75	100
7	III	21UZLP3	Core Practical – III: Dev. Biology, Animal physiology, and Immunology	3	--	--	--	-
8	III	21UZLP4	Core Practical – IV: Environmental Biology, Evolution and Biotechnology	3	--	--	--	-
			TOTAL	30	25			600
			CUM-TOTAL		119			3500
SEMESTER – VI								
1	III	21UZL08	Core Course VIII: Environmental Biology	5	5	25	75	100
2	III	21UZL 09	Core Course IX: Evolution	5	5	25	75	100
3	III	21UZL10	Core Course X: Biotechnology	5	5	25	75	100
4	III	21UZLM5	Major Based Elective V: Microbiology	4	4	25	75	100
		21UZLM6	Major Based Elective VI: Ornamental fish culture					
5	III	21UZLPR	Project Work	3	4	25	75	100
		21UZLM7	Major Based Elective VII: Wildlife conservation and management					
6	IV	21UZLS4	Skill Enhancement Course IV: Sericulture	2	2	25	75	100
7	III	21UZLP3	Core Practical – III: Developmental Biology, Animal physiology and Immunology	3	4	40	60	100
8	III	21UZLP4	Core Practical – IV: Environmental Biology, Evolution and Biotechnology	3	4	40	60	100
			TOTAL	30	33	-	-	800
			CUM-TOTAL		152	-	-	4300

**CORE COURSE –I :
INVERTEBRATA**

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL01	Core Course - I:Invertebrata	60hours	5	-	5

Course Objectives:

- ❖ To know about amazing diversity of living forms from simple to complex one.
- ❖ To enlightens about how each group of organisms arose and having different structural organization in the environment with their special characteristics.
- ❖ To deals with the differences and similarities between various Invertebrates organisms based on their morphology and anatomy which led to their grouping into taxa and classes.
- ❖ To familiarized regarding disease causing parasites of various Phyla and prevention of such diseases in man and domestic animals.
- ❖ To understand the economic importance of Invertebrates belongs to various Phyla particularly Annelids, Arthropods and Molluscs.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand the general taxonomic rules on animal classification, the principles and methods of taxonomy and the general characters of phylum Protozoa and understand the protozoan's parasites of human.	Remember
CO2	Classify the phylum Porifera & Coelenterata using examples, Understand the canal system of sponges and Polymorphism in Coelenterates.	Understand
CO3	Phylum helminthes & Annelida with taxonomic keys, and a basic idea of metamerism in Annelids and parasitic adaptations of helminthes.	Apply
CO4	Understand the classification and characteristics of Phylum Arthropoda, mouth parts of insects, the classification and characteristics and economic importance of Phylum Molluscans.	Analyze
CO5	Classification and characteristics of Phylum Echinodermata & structures and water vascular system and larval forms of echinoderms	Apply

Unit - I**12 hours**

A brief introduction on Nomenclature – Modern classification of animal kingdom. Phylum: Protozoa – General characters and Classification up to class level. Type study: Paramecium Structure and Reproduction. General Topic – Protozoan parasites of Human.

Unit- II**12 hours**

Phylum: Porifera: General characters – Classification up to class level. Type Study: Sycon – Cellular structure and development. General Topic - Canal system in sponges. Phylum: Coelenterata – General characters–Classification up to class level. Type Study: Aurelia – Structure and life history.
General Topic – Polymorphism in Coelenterates.

Unit- III**12 hours**

Phylum: Platy helminthes – General characters, Classification up to class level. Type study: Tape worm - Structure , Reproduction and Development. General Topic: Parasitic adaptations of Helminthes
Phylum: Annelida – General Characters, classification up to class level. Type study: Nereis – External morphology and Reproduction
General Topic: Metamerism in Annelids.

Unit- IV**12 hours**

Phylum: Arthropoda – General characters, classification up to class level. Type study: Cockroach – External morphology, Digestive system and Nervoussystem. General Topic: Mouth parts of insects. Phylum: Mollusca - General characters, classification up to class level
Type Study: Unio (Lamellidens) – External morphology and digestive system.
General Topic: Economic Importance of Molluscans.

Unit - V**12 hours**

Phylum: Echinodermata - General characters, classification up to class level.
Type study: Asterias rubens (starfish) - External morphology, water vascular system in star fish.
General Topic: Larval forms of Echinoderms

Textbooks:

1. Agarwal, V.K. (2000) Invertebrate Zoology – S. Chand and Company Ltd., Publications.
2. Barnes R.D. (1987) Invertebrate Zoology – Saunders College Publications.
3. Barrington E.J.W., (1981) Invertebrate structure and function – ELBS, edition 1981.

4. EkambaranathaIyer (1993) Manual of Zoology – vol . I. Invertebrata, S. Viswanathan (Printers & Publisher) Chennai.
5. Kotpal, R.L. (2003) Modern Text book of Zoology – Invertebrates, Rostogi Publications.

Reference Books:

1. Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
2. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
3. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
4. Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
5. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
6. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
7. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.

Online Resources:

1. <http://www.yahoo.co.uk/science/biology/zoology>
2. <http://www.animaldiversity.com>
3. <http://www.librery.si.edu>
4. <http://www.electronic zoo>
5. <http://www Biology browser.com>
6. <http://www.enature.com>

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S				M	S	S	
CO2		S	S	M		M	M		S	
CO3		S		M		S		M	S	
CO4	S	S				L	L	M	S	
CO5	S	S	S	M	M	M				

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

CORE COURSE- II: CHORDATA

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL02	Core Course - II: Chordata	56 hours	4	-	5

Courseobjectives:

- ❖ To offers an insight into the systemic Zoology of Chordates and giving an account on their phylogeny.
- ❖ To explores Vertebrate morphology and functional anatomy to understanding major events in the evolution of various classes of Vertebrates.
- ❖ To understand the ecology, behavior and physiological adaptation of various Vertebrate groups in diverse habitats.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Identified the taxonomic status and evolutionary significance of entire Chordates. Gained basic knowledge of Pisces and their anatomical features.	Remember
CO2	Impaired the knowledge on ecological adaptations and some special features like parental care in Amphibians.	Understand
CO3	Know about the important group of Reptiles and their anatomical and physiological features and popularized with harmful and harmless eco-friendly Reptiles.	Apply
CO4	Make students to understand the basic information about Ornithology, Anatomical features, and special adaptations of Aves, which may useful for developed students' career as wildlife photographers.	Apply
CO5	Understand the basic information about mammals with special reference to its Anatomical features and significance o and maintenance of domestic Mammals.	Apply

Unit - I**12hours**

Prochordates: Introduction, General Characters with examples. Type study: Amphioxus - External Morphology, Digestive, Circulatory and Respiratory systems. Class: Pisces - General characters. Type study: Scoliodon – External Characters, Digestive, Respiratory, Circulatory systems, and Reproductive System.

General Topic: Accessory respiratory organs in fishes.

Unit- II**12hours**

Class: Amphibia: General Characters.Type Study: Frog - External Characters, Digestive, Respiratory, Structure of Heart and Reproductive systems.

General Topic: Parental care in Amphibians.

Unit - III**12hours**

Class: Reptilia: General Characters.Type Study: Calotes – External characters, Digestive, Circulatory and Reproductive System.

General Topic: Identification of poisonous and non-poisonous snakes

Unit- IV**12hours**

Class: Aves - General Characters.Type Study: Pigeon – External Characters, Digestive, Respiratory and Reproductive system, Structure of Brain.

General Topic: Flight adaptations in Birds.

Unit - V**12hours**

Class: Mammalia - General Characters.

Type Study: Rabbit - External Characters, Digestive, Respiratory, Circulatory, Excretory and Reproductive systems - Structure of Brain.

General Topic: Dentition in Mammals

Text books :

1. Jordan, E.L & Verma, P.S. (2000) Chordate Zoology, S. Chand & Co, New Delhi.
- 2.Kotpal, R. L.(2014).Modern Text Book Of Zoology-Vertebrates.4 th edition , Rastogi Publications,New Delhi.
- 3.Ekambaranatha Iyer (1993) Manual of Zoology Vol.II, Viswanathan (Printers & Publishers), Chennai.

Reference Books:

1. Young, J.Z. 1981 The Life of Vertebrates, III rd Ed Clarendon Press, Oxford.
2. William N McFarland, F and Harvey PoughTom.J.C and Heiser, J.B.1979. Vertebrate Life. Collier-Macmillan Publishers, London .
3. Waterman. A.J. 1971. Chordate Structure and Function. McMillan Co. London.
4. Jolie, M. 1968. Chordate Morphology. East West Press. Pvt, Ltd.
5. Romer, A.S. and Parson, T.S. 1978. Vertebrate Body. W.B. Saunders Co.,Philaelphia.

Web Resources :

1. <http://www.yahoo.co.uk/science/biology/zoology>
2. <http://www.animaldiversity.com>
3. <http://www.librery.si.edu>
4. <http://www.electronic zoo>
5. <http://www.biology browser.com>
6. <http://www.enature.com>

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S				M	S	S	
CO2		S	S	M		M	M		S	
CO3		S		M		S		M	S	
CO4	S	S				L	L	M	S	
CO5	S	S	S	M	M	M				

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

CORE PRACTICAL I – INVERTEBRATA & CHORDATA

Course Code	Course Name	Lecture(L)	Tutorial(T)	Practical(P)	Credit
21UZLP1	Core Practical I – Invertebrata & Chordata	-	-	24 hours	4

I. Major Practical

(Virtual Dissection shall be following for Scheduled animals)

1. Cockroach -Digestive system, Reproductive system, Nervous system
2. Prawn – Nervous system, Digestive system .
3. Digestive system of a fish .(Locally available)
4. Reproductive systems of a fish (Locally available)
5. Types of scales in fishes - Preserved specimens
6. Frog: Digestive and Circulatory system (Virtual dissection)

II. Minor Practical

1. Cockroach-Mouthparts
2. Earthworm body setae and pineal setae
3. Mounting of prawn appendages - Cephalothorax and abdominal Appendages
4. Mouth parts of honey bee , mosquito and housefly.
5. Air Bladder in fishes .(Locally available)
6. Fish – Placoid Scales Mounting.(Preserved specimens - Shark skin)

III. Spotters

a) Classify and Giving Reason of the following:

Amoeba, paramecium, Leucosolenia, Aurelia, Sea anemone, Liver fluke, Taenia solium, Ascaris, Male and Female, *Nereis*, Chaetopterus,, Leech, Scorpion, Millipede, Crab, Limulus, Pila, Sepia, Octopus, Asterias, Amphioxus, Balanoglossus, Ascidian Salpa, Scoliodon, Torpedo, Pristis, Rhinobatus, Trygon, Salmo, Clarius, Ophiocephalus, Anguilla, Anabas, Exocoetus, Hippocampus, Echenis, Tetrodon, Petromyzon, Ichthyophis, Bufo, Rachoporus, Hemidactylus, Draco, Chameleon, Varanus, Cobra, Viper, Enhydrina, Typhlops, Sea snake, Cobra, Krait, Viper, Wood pecker, Duck, Parrot, Loris, Mongoose and Pteropus.

b) Draw and Labelled Sketch of the following:

Ephyra larva, Fasciola T.S, Fish Scales - Placoid , Cycloid, Ctenoid , Ganoid. Quill feather, Pigeon-pectoral girdle, pelvic girdle.

c) Biological significance of the following:

Sponge - Gemmule, Physalia, Ephyra larva, Redia, Cercaria, Nauplius larva, Trocophore larva, Bipinnaria Larva, Ichthyophis, Ascidian Tadpole.

d) Relating structure and function of the following

Spicules - Sponges, Neries- parapodium, Taenia- Scolex, Prawn – Antennule, Pila-Radula , Starfish – Pedicellaria , Tube feet.

e) Comment on Skeletal structure / dentition of the following .

Synsacrum, Skull of Rabbit, and Man..

IV. Record

CORE COURSE - III: CELL BIOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL03	Core Course III: Cell Biology	56 Hours	4	-	5

Course Objectives:

- ❖ To understand the structure and function of the cell.
- ❖ Appreciate the interactions and coordination of cellular organelles in the cell.
- ❖ Acquire knowledge about functions and central dogma of the cell.
- ❖ Understanding molecular events of Cell division and cell cycle
- ❖ To understand Cancer development and control mechanisms.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Gain knowledge on cell structure and its functions	Apply
CO2	Analyse the functional role of various cellular organelles in the cell.	Analyse
CO3	Learn the integrated molecular events.	Understand
CO4	Hypothesize Chromosomes Structure and functions	Create
CO5	Understand the mechanisms of cell division and control of Cancer mechanisms.	Evaluate

Unit- I**12 hours**

Principle and working of Microscopes: Simple Microscope, compound microscope, Phase contrast Microscope, Electron microscope (EM) - Scanning EM (SEM) and Transmission EM (TEM). Basic micro techniques - Fixation, Embedding, Sectioning and staining.

Unit - II**12 hours**

Cell theory, structure - Prokaryotic and Eukaryotic cells. Plasma membrane – structure, models and Functions. Active, Passive transport and Facilitated transport. Cell - cell junctions - Tight junctions, Desmosomes, Gap junctions.

Unit- III**12 hours**

Structure and Functions of Cell organelles: Endoplasmic reticulum, Golgi complex, Lysosomes. Mitochondria, peroxisomes. Cytoskeleton - Microtubules, Microfilaments and Intermediate filaments.

Unit - IV**12 hours**

Structure and functions of Nucleus: Nuclear envelope, Nuclear pore complex. Nucleolus. Chromosomes – Fine Structure, types, and special types - Giant chromosomes (Polytene and Lamp brush chromosomes).

Unit - V**12 hours**

Cell division – Mitotic division, Mitotic apparatus. Meiotic division and its significance. Cell cycle and its regulation. Cancer – carcinogenic agents, symptoms, and treatment. Ageing and apoptosis.

Textbooks:

1. Verma P.S and Agarwal V.K. (2016). Cell Biology S. Chand and Company Pvt. Ltd. I Edition
2. Gupta PK (2009) Cell and Molecular Biology. Rastogi Publications, Meerut.

References Book :

1. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley and Sons Ltd. New York.
2. Powar C.B (1983). Cell Biology. Himalaya Publishing House, Bombay
3. De Robertis EDP and De Robertis EMF (2001) Cell and Molecular Biology. Lippincott Williams and Wilkins, USA.

Online Resources :

1. <https://online.une.edu/science-prerequisites/cell-biology/>
2. <https://di.uq.edu.au/community-and-alumni/sparq-ed/cell-and-molecular-biology-experiences/introduction-cell-biology>

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S		S		L			M		S
CO2	S	S	S	M	M	L		S		S
CO3	S	S	S		S			S		S
CO4	S	L	S		L		L	S	M	M
CO5	S		S	M	S	S	M	S	S	S

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

SKILL ENHANCEMENT COURSE -I: AQUACULTURE

CourseCode	CourseName	Lecture(L)	Tutorial(T)	Practical(P)	Credits
21UZLS1	Skill Enhancement Course -I: Aquaculture	28 hours	2Hours	-	2

Course Objectives:

- Creation of mass awareness, capacity building, exposure training and skill development of all learners.
- Conservation of native, endangered, and traditional species and developing breeding farms of commercially potential species on a large scale.
- Introduce and promote ornamental fisheries in the aquaculture sector.
- The most important objectives of aquaculture practices are resource conservation, food production and generation of economic wealth.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand the various types and methods of Aquaculture practices.	Understanding
CO2	Understand the modern techniques and methods of fishery industries.	Understanding
CO3	Create and construct fish ponds for aquaculture	Creating
CO4	Attained knowledge about important cultivable fin fishes	Applying
CO5	Understand the importance supplementary fish feeds and Artificial feed preparation	Understanding
CO6	Develop the skills about Aquarium construction and Ornamental fish culture	Applying
CO7	Provides knowledge of ornamental fish breeding Which is highly professional	Understanding

Unit - I: **6 hours**

Definition and scope. Aquaculture systems- Extensive, Semi-Intensive, Intensive, Super Intensive, Monoculture, Polyculture and Integrated culture. Methods of aquaculture- Rafts, Racks, Cages, Poles and Ropes.

Unit - II: **6 hours**

Nursery and rearing ponds preparation. Water quality management. Major species for freshwater aquaculture. Selection, transportation and acclimatization of fish seeds.

Unit - III: **6 hours**

Feed formulation -Supplementary feeds. Forms of feeds - Wet, Moist, Dry, Mash, Pelleted Feeds. Floating and Sinking pellets. Feed additives - Binders, Antioxidants, Enzymes, Pigments, Growth promoters, Feed stimulants. Live food organisms.

Unit - IV: **6 hours**

Construction of Home aquarium. Aquarium plants. Aquarium accessories and decorative. Rearing of ornamental fishes.

Unit - V: **6 hours**

Methods of fish breeding - Bundh breeding and Induced breeding of fishes. Hypophysation of fishes. Spawn rearing techniques. Pathogenicity of bacterial, viral and fungal infections of fin fishes.

Field visits: Visits to Fish farm & Submission of reports.

Text books :

1. Jhingran, V.G. Fish and Fisheries in India , Hindustan Publishing Corporation (India).
2. Arumugam.N. Aquaculture., Saras Publications, Nagercoil.
3. Hoff F.H. and Snell T. W. Plankton Culture Manual. Florida Aqua Farms, Inc.
4. Santhanam,N.Sukumaran, Pavanasam Natarajan. A Manual of Fresh-water Aquaculture., Oxford & IBH Publishing Company, 1987.
5. TVR Pillai., Aquaculture: Principles and Practices, Wiley-Blackwell; 2nd edition.

Reference Books:

1. The Biology of Fishes, Kyle, H. M., T.F.H. Publication, Hong kong .
2. The Life of Fishes, Marshall,N.B.1965,Weidenfeld & Nicolson, London.
3. The Marine and Freshwater Fishes of Ceylon,Munro I.S.R,1982.Soni Reprints Agency, New Delhi.
4. Talwar, P.K. and A.G.Jhingran, Inland Fishes of India and Adjacent Countries, Vol I & Vol II, 1991,Oxford & IBH Publishing Co Pvt Ltd., New Delhi .

5. Bal D.V and K.V Rao .,Marine Fisheries..Narendra Publishing House Delhi Rev.Ed.
6. V.G and K.L Sehgal Cold water fisheries of India. Inland fisheries society of India.
7. Srivastava U.K and Dharma Reddy Fisheries Development in India. Concept publishing Co., New Delhi.

Online Resources:

1. <http://www.aquacase.org>
2. <http://www.fishbase.org>
3. <http://www.thefishsite.com>
4. www.fao.org/fishery/species/search/en
5. http://ec.europa.eu/fisheries/cfp/aquaculture/index_en.htm

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	-	-	M	-	M	S	S
CO2	S	S	S	-	-	M	-	M	S	S
CO3	S	S	S	-	-	M	-	-	S	S
CO4	S	S	S	-	-	M	M	-	S	S
CO5	S	S	S		-	M	L	-	S	S
CO6	S	S	S	-	-	M	L	-	S	S
CO7	S	S	S	-	-	M	-	-	S	S

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

NON-MAJOR ELECTIVE COURSE I: NUTRITION & DIETETICS

Course Code	Course Name	Lecture(L)	Tutorial(T)	Practical(P)	Credit
21UZLN1	Non-Major Elective Course I: Nutrition And Dietetics	28 hours	2 hours	-	4

Course Objectives:

- ❖ To establishing standard body weight.
- ❖ To know the energy requirements.
- ❖ To determine the glycemic index and antioxidant value of foods.
- ❖ To find the bioavailability of nutrients.
- ❖ To determine the nutrient requirements of sports persons and of people who do physical activity at different levels.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Students will gain the knowledge regarding nutritional classification of food, method and media of cooking, nutritive value and processing, storage of plant-based foods.	Understand
CO2	Principles of nutrition Understand the functions and sources of nutrients, role of nutrients in maintenance of good health.	Understand
CO3	Human physiology Able to understand the physiological processes and functions as applicable to human nutrition	Remember
CO4	Animal food science Gain knowledge regarding nutritive value, classification, processing, preservation, and storage of animal foods. Also, students understand the medicinal value of Indian spices and condiments.	Apply
CO5	Human nutrition able to identify what foods are good sources for what nutrients.	Apply

Unit - I**6 hours**

Definition- Food, Nutrition and Nutrients, Food groups based on functions. Nutritive values. Balanced diets. Recommended dietary allowances (RDA).

Unit - II**6 hours**

Major Nutrients- Sources, functions, deficiency and excess of Carbohydrates, Protein and Lipids. Energy Balance - Total Energy Requirements.

Unit- III**6 hours**

Micronutrients - Vitamins-Types, Sources, Functions and deficiency symptom. Minerals - Dietary Sources and biological role of macro minerals (Calcium, Magnesium, Sodium, Chloride and Potassium) and micro minerals (Iodine, Iron, Copper, Zinc and Fluoride).

Unit - IV**6 hours**

Undernutrition - Undernutrition in Children, Malnutrition- Treatment and Prevention. Fast foods and its adverse effects. Paleo diets. Food preservatives and its effects on health.

Unit - V**6 hours**

Nutrition during pregnancy, lactation, and infancy. Obesity and underweight. Food allergens, Diet therapy, Food contaminations. Nutritionally relevant infections and infestations

Text books:

1. Srilakshmi.B Food Science,New Age International(P) Ltd. Publishers Sixth edition (2016).
2. ManayShakunthala and Shadaksharaswamy M. Food facts and Principles. New Age International(P) Ltd Publishers,Reprint(2005).

Reference Books:

1. Swaminathan M,Food Science and Experimental food,Baappo Publishers Company Ltd,1997. Optional nutrition,Bionutritionmalnutrition- under nutrition,over nutrition. Recommended Dietary Allowances (RDA) Factors affecting RDA, Indian Standards for Heights andWeights.
2. Usha Chandrasekar, Food Science in Indian Cookery,Phoenix Publishers House Private Limited,2002.

Online Resources:

1. www.nutriongate
2. www.nap.edu
3. www.eatright.org/cgi/search.cgi
4. www.who.org
5. www.ironoverload.org
6. www.who.int/home/search
7. www.sbaa.org/

MAPPING WITH PROGRAM OUTCOMES										
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L		L			S	M	S
CO2			S		M			S		
CO3			S					M		
CO4	S		M						L	

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

CORE COURSE IV : GENETICS

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL04	Core Course IV: Genetics	56 hours	4	-	5

Course Objectives:

- ❖ Understanding inheritance biology from Mendel's period to present.
- ❖ Understand and describe the central dogma of biology at the molecular level.
- ❖ Organizing ideas from genes to gene mapping.
- ❖ To enrich the knowledge about the scope and application of genetic knowledge.
- ❖ Obtain knowledge on Genomics, Proteomics and Drug discovery.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	To know the Structural and functional aspects of Genes and Chromosomes	Remember
CO2	Understand Mendelian Principles and dominance	Understand
CO3	To understand concepts behind genetic disorder, gene mutations and various causes associated with inborn errors of metabolism	Apply
CO4	Isolate and Identify the various syndromes and disorders affecting the Genes	Apply
CO5	Distinguishing the Twin characteristics and to know the chromosome mapping	Analyze

Unit- I

12 hours

Mendelian principles - Law of Dominance, segregation, independent assortment. Concept of gene and genome- Allele, multiple alleles, pseudoallele, complementation tests. Codominance, incomplete dominance.

Unit - II

12 hours

Linkage and crossing over. Sex determination, sex linked (Haemophilia and Colour blindness) and sex limited inheritance in man. Extra chromosomal inheritance –plasmogenes, maternal inheritance. DNA – structure and types of replications. Gene mapping: Linkage maps.

Unit - III**12 hours**

Polygenic inheritance in man (skin pigmentation), heritability and its measurements, QTL mapping. Mutation: Types (lethal, conditional, biochemical), causes and detection. Mutants - types (germinal and somatic mutants), Mutagenesis – Insertional and Site-directed mutagenesis.

Unit - IV**12 hours**

Chromosomal aberrations - Deletion, duplication, inversion, translocation, and its effects. Ploidy and its types. Syndromes – Down's syndrome, Turner's syndrome and Klinefelter's syndrome. Recombination - Homologous and non-homologous recombination. Transformation, Conjugation, Transduction in bacteria.

Unit - V**12 hours**

Twins – Identical, Non-Identical and Syamis. Eugenics – Positive and Negative, Euphenics, Euthenics. Human Karyotypes, Pedigree analysis. Genetic Counseling – Hereditary disorders. Human Genome Project and its applications. HapMap project.

Textbooks:

1. Verma P.S and V.K. Agarwal (2008). Genetics. S. Chand and Company Private. Ltd. New Delhi.
2. BernisAnanandharaj (2006). Genetics.Chrisolite Publications.

Reference Books:

1. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley and Sons Ltd. New York.
2. Snustad DP and simmons MJ (2011) Principles of Genetics.6th edition John Wiley and Sons.
3. Tamarin RH (2001) Principles of Genetics (2001) 7th edition, McGraw-Hill, New York.

Online Resources :

1. <https://www.coursera.org/learn/genetics-evolution>
2. <https://www.coursera.org/learn/genomics-research>
3. <https://www.genetics.org/>

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	S	L	S		M	L	S	S
CO2		S	S		S		M		S	
CO3		S			S			L	S	
CO4	L	S			M				S	S
CO5	L	S	S	S	M				M	S

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

SKILL ENHANCEMENT COURSE-II : POULTRY SCIENCE

CourseCode	CourseName	Lecture(L)	Tutorial(T)	Practical(P)	Credits
21UZLS2	Skill Enhancement Course -II: Poultry Science	28 hours	2 Hours	-	2

Course Objectives:

- To understand the basic aspects of housing, feeding, breeding and health care of poultry.
- To impart knowledge on processing and preservation of poultry eggs and meat.
- To impart knowledge on different systems of breeding, design and modern tools in poultry breeding.
- To gain knowledge about care and management of breeders, hatchery operation, health management.
- To study about common diseases and disorders of poultry, diagnosis, vaccination, prevention, control, and treatment.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand the production of poultry and its importance	Understanding
CO2	Understand the modern feeding techniques and methods.	Understanding
CO3	Create and construct poultry farms	Creating
CO4	Attain knowledge about the chick's maintenance	Applying
CO5	Understand the importance supplementary poultry feeds And artificial feed preparation	Understanding
CO6	Develop the skills about poultry diseases and its prevention	Applying
CO7	Provides knowledge of poultry byproducts which is Highly economical	Understanding

Unit – I

6 hours

Poultry species - Chicken breeds – Broiler (Cobb, Ross) Country Chicks, Hybrid - Quality of egg number, Egg weight, Growth rate, Livability, Fertility, Hatchability and Egg quality.

Unit - II

6 hours

Poultry Nutrition - Systems of feeding - dry mash, crumble and pellet feeding. Restricted and phase feeding programme for chicks, grower and layer. Feed types – LSC, LGC, Layer Finisher. PBS, BS, Broiler Finisher. Poultry feed composition.

Unit - III**6 hours**

Modern Hatchery - Lay out & Equipments. Design of poultry houses - Floor system and Cage house. Management of layers and breeders. Light management. Debeaking. Dubbing. Litter management.

Unit - IV:**6 hours**

Diseases of poultry – bacterial, viral, and parasitic diseases and treatment. Vaccination programmes. Deworming programmes. General farm sanitation (Spraying and Fumigation) hygiene.

Unit – V**6 hours**

Poultry by products - Structure, chemical composition and nutritive value of egg. Preparation of various egg products and their uses. Processing, packing, preservation and grading of poultry meat.

Assignment and Student Activity: Poultry Farm visit and Report Submission.

Textbooks

1. Hued L M. 2003. Modern Poultry Farming. Greenworld.
2. Powell-Owen W. 2008. Poultry Farming and Keeping. Daya Books.
3. Prashad .J. 2005. Poultry Production and Management.
4. Kalyani. Singh R .A. 1996. Poultry Production. 3rd .Ed. Kalyani publishers.
5. Crawford R D. 1990. Poultry Breeding and Genetics. Elsevier publishers.

Reference books

1. Pearson A M & Gillett T A. 1996. Processed Meats. 3rd Ed. Chapman & Hall.
2. Stadelman W & Cotterill O J. 2002. Eggs Science and Technology. 4th Ed.
3. Einsminger M E. 1992. Poultry Science. Poultry International Book Distributing Co.
4. MacO'North & Bell . D. 1990. Commercial Chicken Production Manual. 4th Ed. Avi Publ. Co. Inc., Westport, Connecticut.
5. Singh R A & Panda .B. 1992. Poultry Production. Kalyani Publishers.
6. Singh R P & Kumar. J. 1994. Biometrical Methods in Poultry Breeding. Kalyani Publishers

Online Resources

1. <http://www.csiro.au>
2. www.meatscience.org
3. www.ag.research.co.nz/mirinz
10. <http://www.avianresearch.co.uk>
11. <http://www.eatchicken.com>
12. <http://www.poultryscience.org>

4. www.poultryhelp.com

5. www.eggcom.com <http://www.dpichi>

6. [http://www.Midwest Poultry.com](http://www.MidwestPoultry.com)

7. <http://www.nebraskapoultry.org>

8. <http://www.ohiopoultry.org>

9. <http://www.americanpoultryassn.com>

13. [http://www.poultry egg.org](http://www.poultryegg.org).

14. [http://www.poultry researchbcentre.chtt](http://www.poultryresearchcentre.chtt)

15. [www.poultry science.uark.edu/poult](http://www.poultryscience.uark.edu/poult)

16. [http://www.avian research.co.ukhtt](http://www.avianresearch.co.ukhtt)

17. [http://www.eat chicken.comhttp://](http://www.eatchicken.comhttp://)

18. [http://www.poultry science.org](http://www.poultryscience.org).

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	-	-	M	S	M	S	S
CO2	S	S	S	L	L	M	S	L	M	S
CO3	S	S	S	-	-	-	-	S	S	S
CO4	S	S	M	-	-	-	-	M	M	M
CO5	S	S	S	-	L	-	-	-	M	S
CO6	S	S	M	-	-	-	M	-	S	S
CO7	S	S	S	-	-	-	L	-	S	S

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

NON-MAJOR ELECTIVE COURSE - II: ECONOMIC ZOOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLN2	Non-Major Elective Course - II: Economic Zoology	28 Hours	2 Hours	-	5

Course Objectives:

- ❖ This course helps in understanding the different types of animal culture and related benefits
- ❖ This course helps in understanding different species available with the different animals cultured.
- ❖ This course provides a beginner level of understanding of the methods involved in the different breeds of the animals
- ❖ This course discusses on the importance of the animals in relation to the economical significance for the humans.
- ❖ This course is unique in highlighting the commercial and industrial significance/value of animals.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand the culture techniques of fish.	Understand
CO2	Understand silkworms rearing.	Understand
CO3	Understand the Bee keeping equipment and apiary management.	Understand
CO4	Be aware of a broad array of career options and activities in human medicine.	Apply
CO5	Importance of Economic aspects in the different animal cultures.	Create

Unit -I**6 hours**

Vermitechnology – Scope and importance of vermiculture. Biology of earthworm (*Eudrillus*). Rearing of earthworms. Vermicompost preparation methods - Pit and Heap method. Methods of Harvesting (Manual & Mechanical). Economic Importance of vermicompost.

Unit -II**6 hours**

Sericulture: Silk – types (Eri, Muga, Tasar and Mulberry). Biology and life cycle of *Bombyx morisilkm*moth. Rearing of silkworm –rearing house and equipments. Silk Harvesting methods. Economic importance of silk.

Unit -III**6 hours**

Apiculture: Species of honeybees, Colonies of honey bees (Queen, Drone, Worker bees). Social behaviour of honey bees and Waggle dance. Newton's Bee hive. Extraction methods of honey - equipments. Nutritive and medicinal value of honey.

Unit -IV**6 hours**

Poultry Farming: Breeds - Types. Poultry house – layout and design, Poultry feeds. Poultry equipments. Poultry products – eggs and meat. Nutritive value of egg and poultry meat.

Unit -V**6 hours**

Dairy Management: Varieties of dairy animals (cattle and goat). Construction of cattle farms. Processing and packing of milk. Techniques of dairy management. Nutritive value of cow milk. Dairy by products and marketing.

Textbooks:

1. Shukla, G.S. and Upadhyaya, V.B. (1999-2000). Economic Zoology (Rastogi Publishers).
2. Narasimhanna, M. N. Manual of Silkworm Egg Production; CSB, Bangalore 1988.

Reference Books:

1. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
2. Sengupta, K. A Guide for Bivoltine Sericulture; Director, CSR & TI, Mysore 1989.
3. Krishnaswamy, S Improved Method of Rearing Young age silkworm; CSB, Bangalore, 1986.
4. Ranganathan L.S, Vermicomposting technology- soil health to human health.
5. Lee, Earthworm Ecology.
6. Stevenson, Biology of Earthworms.

Online Resources

1. <http://www.fishbase.org>
2. <http://www.thefishsite.com>
3. www.fao.org/fishery/species/search/en
4. www.poultryhelp.com
5. www.eggcom.com
6. <http://www.dpichi>
7. www.nebraskapoultry.org
8. <http://www.ohiopoultry.org>
9. www.MidwestPoultry.com
10. <http://www.amerpoultryassn.co>

MAPPING WITH PROGRAMME OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S		S		L			M		S
CO2	S	S	S	M	M	L		S		S
CO3	S	S	S		S			S		S
CO4	S	L	S		L		L	S	M	M
CO5	S		S	M	S	S	M	S	S	S

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

CORE PRACTICAL - II : CELL BIOLOGY & GENETICS

COURSE CODE	COURSE NAME	LECTURE(L)	TUTORIAL(T)	PRACTICAL(P)	CREDIT
21UZLP2	Core Practical II - Cell Biology & Genetics	-	-	24 Hours	4

I. Major Practical

1. Micrometry: (A) Camera Lucida (b) Stage Micrometer (C) Ocular Micrometer.
2. Squash preparation of different stages of meiosis in grasshopper - testis.
3. Mounting of polytene chromosome in chironomous larva.
4. Smear preparation of human blood for RBC using haemocytometer.
5. Smear preparation of human blood for WBC using haemocytometer
6. Blood Smear preparation and Differential count of WBC.
7. Blood Grouping ABO & Rh.

II. Minor Practical

1. Squash preparation of mitosis stage in Onion root tip.
2. Smear preparation of squamous epithelium of human buccal cavity.
3. Study of mutants in Drosophila.

III. Spotters

1. Ciliated, Columnar, Glandular, Squamous epithelium.
2. Nerve and Bone tissues.
3. Striated, Non striated and Cardiac muscles.
4. Recording of Mendelian traits in Man.
5. Male and female identification of Drosophila.
6. Human Karyotype – Normal – Male and Female.
7. Chromosomal abnormalities – Autosomal (Down's syndrome)
8. Sex chromosomal abnormalities

(a)Turner 's syndrome

(b)Kleinfelter's syndrome.

9. Pedigree analysis – Colour blindness, Polydactyly, Haemophilia.

10. Transformation, conjugation, transduction and sexduction.

11. Model preparation DNA and Transgenic animals.

IV. Record

CORE COURSE –V: DEVELOPMENTAL BIOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL05	Core Course –V Developmental Biology	56 Hours	4	-	5

Course Objectives:

- To make the students familiar with the basic facts and problems of the Science of Developmental biology.
- To expose the students to the recent concepts in Developmental Biology, including highlighting their important contribution to the stem cell field and clinical sciences.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Students endeavored to understand the ontogenetic development, physiological and biochemical nature of gamete.	Understand
CO2	To study the development of Vertebrate and human welfare.	Apply
CO3	Students who successfully complete the course will be able to: Name, describe and order the main stages of development common to most multicellular organisms	Remember
CO4	Identify the cellular behaviors that lead to morphological change during development.	Analyzing
CO5	Describe the main anatomical changes that occur during development.	Apply

Unit - I

12hours

Scope of Developmental Biology, Gametogenesis – Spermatogenesis and Oogenesis, Structure of Mammalian Sperm and Ovum. Fertilization –Types and process. Parthenogenesis – ArhenotokyandThelytoky.

Unit – II

12hours

Cleavage – Planes of Cleavage, Types of Cleavage. Morula, Blastula and Gastrulation in frog. Morphogenetic Movements - Epiboly ,Emboly, Mechanism of Morphogenetic Movements. Fate map – Frog.

Unit – III**12hours**

Organogenesis of Chick - development of central nervous system - Development of Brain, Spinal Cord, Eye, Development of chick - heart and kidney.

Unit – IV**12hours**

Development of fetal membranes in mammals – Amnion, Chorion, Yolk Sac and Allantois. Placentation in Mammals. Gradient Theory- Experimental evidence. Organizer – Speman’s Experiments. Nuclear Transplantation in Amphibia.

Unit – V**12hours**

Metamorphosis – Amphibian metamorphosis. Regeneration – Types of Regeneration, Mechanism of Regeneration, Regeneration of Frog limb. Birth Control, Infertility, Artificial Insemination, Test – Tube Baby. IVF, GIFT, Embryo Transplantation.

Text Books:

1. Verma.P.S and Agarwal, V.K- Chordate embryology

Reference Books:

1. Balainsky- Introduction to embryology
2. Bodmer – Modern embryology

Online resources:

- <https://embryology.med.unsw.edu.au/embryology/index.php/>
- http://dx.doi.org/10.1136/gut.47.suppl_4.iv12

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1			L	L			M	S		M
CO2	S	M					S	L		
CO3	S	L					L		S	
CO4	S					M	L			
CO5		S						M	S	

CORE COURSE – VI: ANIMAL PHYSIOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL06	Core Course – VI: Animal Physiology	56 Hours	4	-	5

Course Objectives:

- To give an insight about the cellular basis of physiological functions
- To familiarize about how the structure-functional relationships.
- To give students an insight about the molecular and cellular basis of physiological functions in animals

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Develop understanding for the fundamental concepts of physiology of digestion. Familiarize with the role of vitamins in health	Understand
CO2	Student should understand how blood circulates. Familiarize students with renal physiology	Analyzing
CO3	Familiarize students with physiology of muscle Student should understand the neuronal communication	Analyzing
CO4	Develop the fundamental concepts of physiology of Respiration	Analyzing
CO5	Develop basic understanding of endocrine system and its interactions with other systems	Understand

Unit - I**12hours**

Digestion – Process and mechanism. Absorption of carbohydrates, proteins and lipids. Hormonal control of digestion. Vitamins and minerals – functions and deficiency diseases.

Unit - II**12hours**

Respiration – types. Respiratory organ - Integument, gills & lungs. Respiratory organ of man. Mechanism of Respiration in man. Respiratory pigments in animals. Transport of O₂ and CO₂, Bohr's effect. Respiratory Quotient.

Unit - III**12hours**

Heart - types. Structure and functions of Mammalian heart. Heartbeat & pace maker – Cardiac cycle. ECG. Pulse and blood pressure. Blood- composition and functions, Mechanism of clotting. Structure of mammalian kidney. Nephron structure. mechanism of urine formation.

Unit - IV**12hours**

Types of muscles - Ultra structure of muscle, Muscle contraction. Neurons – structure and types. Nerve Impulse propagation. Synaptic transmission. Neuro transmitters and types. Reflex action.

Unit - V**12hours**

Structure and functions of testis and ovary. Hormonal control of esterase and menstrual cycle. Endocrine glands and its functions. Hormonal control of metamorphosis in Amphibians.

Textbooks:

1. Arumugam.N., Mariakuttikan. A,2019. Animal Physiology. Saras Publications, Nagercoil
2. Verma,P,S and Agarwal (2000).AnimalPhysiology. S Chand and Company Ltd, New Delhi

References books:

1. Guyton.A.C, and Hall.J.E, Text Book of Medical Physiology, 12th Edn.Saunders, Elsevier
2. Jain.A.K, 2017.Textbook of Physiology. Avichal Publishing Company.
3. Lehninger. A.L, Michael Cox, Nelson DL. 2017.Biochemistry, 7th Edn, Macmillan, New York.
4. Reddy PB. (2015). Text Book of Animal Physiology, IMRF Publishing house, Andhra Pradesh, India.
5. Best and Taylor. (1990). Physiological Basis of Medical Practice. Wilkins Co.
6. Ganong, W.F. (2003), Review of Medical Physiology, McGraw Hill, New Delhi.

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	S	L	L	M	L	M	S	L
CO2	S	M	M	M	L	S	M	M	L	L
CO3	S	M	S	M	M	M	L	M	S	M
CO4	M	M	S	S	M	L	L	S	L	M
CO5	L	S	M	S	M	S	L	M	S	S

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

CORE COURSE VII - IMMUNOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL07	Core Course-VII: Immunology	60	5	-	5

Course Objectives:

- Know to protect and safeguard ourselves from the hazardous.
- To know well about defence mechanism in the form of immune system.
- To know the invasion of pathogens and their toxic products.
- To study resistance that forms the basis of immune system.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Observed the inborn or acquired resistance of living organisms to infection of micro-organisms.	Remember
CO2	Classify the immunity, Understand the primary and secondary immune response.	Understand
CO3	Studied vaccine and medicine to refer the human beings	Apply
CO4	The classification and structure and functions of primary and secondary immune organs.	Analyzing
CO5	Classification and characteristics of autoimmune disease, Studied well biology that is concerned with immunity.	Apply

Unit – I

12hours

Scope of Immunology. Innate Immunity and Acquired Immunity- Active Immunity & Passive Immunity – Natural and Artificial. Lymphoidal organs. Primary lymphoid organs – Thymus, Bursa of Fabricius and Bone marrow. Secondary lymphoid organs – Lymph node, Spleen, MALT, Peyer's patches and Tonsils.

Unit – II

12hours

Cells involved in the Immune system – B and T -cells. Immunoglobulins – Basic structure, types and biological Properties of Immunoglobulins (IgG, IgA, IgM, IgD and IgE). Cell mediated Immunity- Cytokines and Lymphokines .

Unit – III**12hours**

Primary and Secondary Immune Response. Antigens and Haptens . Antigen – Antibody reactions – Salient Features ,Specificity , Binding Sites , Precipitation Agglutination of ag-ab Reaction. . Opsonization.

Unit – IV**12hours**

Complement –Classical and Alternative Pathway. Biological Functions of Complement. Complement Fixation. Major Histocompatibility Complex - Molecules and Functions of MHC. Hypersensitivity – Types

Unit – V**12hours**

Auto-immune Diseases- Addison’s Disease, Rheumatoid Arthritis. Classification of Autoimmune Diseases. Diagnosis of Auto immune Disease, Treatment of Autoimmune Disease. Vaccination, Tissue Typing, Organ Transplantation and Tissue Grafting.

Text Books:

- 1.Immunology–J.Kubey
- 2.Immunology –L.M.Roitt, J.Brestoff andD.K.Males.

Refernce Books:

- 1.Immuno-biology- Janeway CA and PaulTravers.
- 2.Monoclonal Antibodies: Principles and Practice- J.W.Goding.
- 3.Hybridoma Technology in the Biosciences and medicine- T.A.Springer.
- 4.Vaccines- New Approaches in immunization- F.Brown, R.M.Chanock, KALerner.

MAPPINGWITHPROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L				S		L	S		
CO2			S					M	S	L
CO3			S					S	L	M
CO4			S				L	S		M
CO5			S				S	M	L	

MAJOR BASED ELECTIVE – I: MEDICAL LABORATORY TECHNIQUES

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLM1	Major Based Elective – IMedical Laboratory Techniques	60 hours	5	-	4

Course Objectives:

- ❖ Explain the role of medical laboratory services
- ❖ State the laboratory rules, ethics, professional code of conduct and polices
- ❖ Describe and practice collection, handling of clinical specimens

Course outcomes:

On successful completion of the course, students will be able to		
CO1	Understanding the basic practices in laboratory	Understand
CO2	Student will be familiar in handling glasswares and safety requirements in the disposal of waste	Apply
CO3	Student will be able to collect clinical specimens and analyze it	Analyzing
CO4	Develop the fundamental skill to analyze urinary samples	Analyzing
CO5	Develop basic understanding of various methods to diagnose the diseases	Understand

Unit – I

12 hours

Functional components of clinical laboratory. Basic needs of clinical laboratory. Good Laboratory Practice (GLP). Safety Precautions and First Aid - treatment for Superficial Wounds, Burns, Chemical Poisoning, and Electric Shock.

Unit – II

12 hours

Cleaning, maintenance and Care of Glassware. Sterilization – Physical and Chemical Methods - Handling Pathogens - Specimen processing in the laboratory - Disposal of specimens and infected materials - Safety requirements of the laboratory.

Unit – III

12 hours

Hematology – Collection of Blood Sample, Smear Preparation, Blood Cells - enumeration of RBC and WBC, Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR), Platelet Count, Prothrombin time and Haemoglobin estimation.

Unit – IV**12 hours**

Urine Analysis – (Collection of urine, stool, semen, CSF, sputum samples) Routine examination and analysis for albumin, glucose, ketones, bile pigments. Analysis of stools – Concentration techniques -Sedimentation and Flotation methods. Pregnancy test.

Unit – V**12 hours**

Pathology- Tests for Viral Diseases- HIV, Bacterial Diseases-Tuberculosis, cholera, Protozoans -Amoebic Dysentery, Malaria, Helminths- Filariasis, Ascaris, Rheumatoid Arthritis ,Cancer, Alzheimer’s and Parkinson's Disease.

Textbooks:

1. Ramanik Sood. 2009 - Medical laboratory technology : methods and interpretations; 6th Edn., Jaypee Brothers Medical Publishers.

Reference books:

1. Barbara.H Estridge., Anna P Reynolds., Norma J Walters 2000. Basic medical laboratory techniques. Albany, N.Y., Delmar Publishers
2. Baker F.J. And Silverton R.E. 1998. Introduction to Medical Laboratory Technology. Hodder Arnold Publication.

MAPPINGWITHPROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	L	L	M	L	M	M	L
CO2	M	S	S	M	L	S	M	S	L	L
CO3	M	M	S	S	M	S	L	M	M	M
CO4	S	S	M	M	S	L	L	S	L	M
CO5	L	S	M	S	S	S	L	S	S	S

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

MAJOR BASED ELECTIVE – III : BIOSTATISTICS AND COMPUTER

APPLICATIONS

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLM3	Biostatistics and Computer Applications	40	5	-	4

On successful completion of the course, students will be able to		
CO1	Organize, manage and present data, Perform and interpret the statistical analyses with real molecular biology data	Remember
CO2	Understand the foundation on statistical methods to enable students to compute and interpret basic statistical parameters.	Understand
CO3	Apply Statistical data using MS-Excel.	Apply
CO4	Analyze statistical data graphically using frequency distributions and cumulative frequency distributions. Analyze statistical data using measures of central tendency, dispersion and location.	Analyzing
CO5	Apply to identify the type of statistical situation to which different distributions.	Apply

Unit- I

Introduction- Data, Collection of data and organisation. Classification and Tabulation of data. Types- primary and secondary. Diagrammatic representation - Bar diagram - Types, Pie diagram. Graphical representation of data- Frequency distribution- Histogram , Frequency polygon, Ogive curves.

Unit- II

Measure of central tendencies - Mean - Simple Arithmetic Mean, Median, Mode for individual, Discrete and continuous series . Measures of dispersion - Range, ,Quartile deviation, Mean deviation. Standard deviation, Standard error and Coefficient of variance.

Unit- III

Correlation- Types, Methods to study- Scatter, Graphic, Correlation co-efficient. Regression analysis. Chi-square test, Test of significance, statistical hypothesis, level of significance, Degree of freedom, Goodness of fit, Application of biostatistics in biology.

Unit- IV

Components of computer, computer organisation- Input , output, CPU- Processing and storage devices. Application of computer in biology.

Unit- V

Networking and internet: Introduction to networks, types of network, application of network, use of internet, WWW, concept of E-Mail.

Text Books:

1. Statistical methods for biologists. S.Palanichamy & M.Manoharan .,1990.Palani Paramount Publications. Tamilnadu.
2. Introduction of Biostatistics . Pranab kumar Banerjee , 2006. S. Chand & Company Ltd. New Delhi.

References:

- 1)Introduction of biostatistics& computer science-Y.I.Parakar & M.GDhanyagude NiraliPrakasahan publishers,pune
- 2)Biostatistics by K.S.Negi AITBS publications& distributors, New DelhiBishop O.N.statistics for Biology. Boston, Hollghtan, Mifflin.
- 3)Introduction to Biostatistics by pranabkumar, S.Chand company Ltd.NewDelhi.
- 4)Fundamental of Computers of Raja Kumar,V.,PHI.

SKILL ENHANCEMENT COURSE III VERMITECHNOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLS3	Vermitechnology	45 hours	3	-	2

Course Objectives:

1. To understand the basic knowledge on recycling of biodegradable waste of different kinds.
2. To create awareness among the students on vermicomposting practices.
3. To get knowledge and significance about sustainable agriculture, organic farming and waste management using vermi technology.
4. This course is structured for the benefit of the students having broad scope for employability..

Course Outcomes:

On successful completion of the course, students will be able to		
C01	Get the knowledge about the characteristics and role of earthworm in sustainable agriculture.	Remember
C02	Understand the importance of waste degradation by eco-friendly method.	Understand
C03	Apply the basic idea and methods of vermicomposting in agriculture and horticulture.	Apply
C04	Analyze the vermiculture products and their benefits in agriculture practice, economics of vermitechnology along with the practical difficulties	Analyzing
C05	How to maintain a small vermicompost bin as a simple method for converting the Kitchen waste and apply knowledge on commercialization of Vermiproducts.	Apply

Unit - I

8 hours

Concepts of vermiculture. Influence of soil organisms in vermitechnology - Litter degradation and decomposition. Problems in vermiculture and remedial solutions.

Unit – II

8 hours

Endemic and exotic species of earthworms. Ecological classification of earthworms- epigeic, anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in soil drilospheres and vermicasts.

Unit – III

8 hours

Vermicomposting materials, Vermicomposting methods- Small scale and large scale. Factors affecting vermicomposting - pH, moisture, temperature. Vermiculture unit - materials required and maintenance.

Unit – IV

8 hours

Harvesting of vermicompost - quality, properties and advantages over chemical fertilizers. Packaging and marketing- cost benefit analysis. Vermiwash and its applications.

Unit - V

8 hours

Pests, parasites and pathogens affecting earthworms. Uses of earthworms in food and medicine - ayurvedic and unani. Recycling of food wastes in vermitechnology, Bioremediation through vermitechnology.

Text Books:

1. Sultan Ahmed Ismail. The Earthworm, Others India Press, Mapura 403507, Goa, India. 2005.
2. Seethalakshmy. A Text book of Vermitechnology, Saras Publications. 3rd Edition, 2012.
3. Prakash Malhotra (2008). Economic Zoology, Adhyayna Publishers & Distributors, New Delhi.
4. Bhatnagar, R.K. and Palta, R.K., (1996). Vermiculture and Vermicomposting. Kalyani Publishers, New Delhi.
5. Arun K. Sharma. (2002). A hand book of Organic Farming, , Agrobios, Jodhpur, India The Earthworm book, S.A. Ismail. Other India press, Goa - 403 507, India (2005).
6. Gupta P.K. (2008). Vermicomposting for Sustainable Agriculture. Agrobios. India. UZO

Reference Books :

1. Edwards, C.A. and Loft, J.R. Biology of Earthworms, 3rd Edition, Chapman Publications. 1977.

2. NIIR Board, The complete Technology Book on Vermiculture and Vermicompost. 2006, New Delhi.
3. ArunK.Sharma, (2002). A Hand book of organic forming, Agrobios, Jothpur, India.
4. Edwards, C.A. and J.R. Lofty (1977) “Biology of Earthworms” Chapman and Hall Ltd., London

Online Resources:

- 1.<http://faunaofindia.nic.in/PDFVolumes/spb/022/index.pdf>
- 2.https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf.

MAPPING WITH PROGRAM OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	S	L	M	S	S
CO2	S	S	L	M	M	S	L	M	S	S
CO3	S	S	L	M	M	S	L	M	S	S
CO4	M	S	L	M	M	S	L	M	S	S
CO5	S	S	L	M	M	S	L	M	S	S

CORE COURSE VIII - ENVIRONMENTAL BIOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL08	Core Course VIII - Environmental biology	56 hours	4	-	5

Course Objectives:

- To know the temporal changes in the occurrence , abundance and activities of the organisms.
- To study the inter- relation between the organisms in populations and communities.
- To realize the potential of the natural resources and it's contributory functions.
- To create an awareness of environmental pollution issues.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand the. structural adaptation and functional adjustments of organisms.	Understand
CO2	Learns about the biological productivity of Nature and how this best serve mankind.	Remember
CO3	To observed conservation and management of natural resources and pollution.	Analyzing
CO4	Understand the reason of extinct animals, national park and wild life sanctuary.	Analyzing
CO5	classification and characteristics of pollution and its effects	Apply

Unit – I**12hours**

Scope of Ecology, Natural resources - Abiotic Factors (Temperature and Light), Biotic Factors – Animal Association – Symbiosis, Commensalism, Mutualism, Competition, Antagonism, Parasitism and Predation. Ecological Cycle.

Unit – II**12hours**

Ecosystem – Types , Dynamics of Ecosystem. Food Chain. Food web, Energy Flow, Ecological Pyramids- Pyramid of Numbers, Biomass and Energy. Ecotone ,Ecological succession – concept ,types & trends, climax and stability.

Unit – III**12hours**

Habitat Ecology –Classification – Fresh water Ecology – Lentic Habitat and Lotic Habitat. Marine Habitat – Pelagic Zone and Benthic Zone. Estuarine Habitat – Oligohaline, Mesohaline and Polyhaline. Terrestrial Habitat – Tundra biome, Forest biome and Grassland Biomes. Biome Types of India.

Unit – IV**12hours**

Population Ecology – Characteristics of Population – Population Density, Natality, Mortality, Age Distribution and Population Growth. Community Ecology, Ecological Indicators. Biodiversity – concepts and importance.

Unit – V**12hours**

Pollution sources, cause ,effects –Air, Water , Soil , Noise , thermal and radiation. Pollutants - types. Climate change – causes and effect. Threats to stratospheric ozone. Global warming. Acid rain. Climate convension.

Text Books:

1. Agarwal, K.C.,1989.Environmental Biology. Agro Botanical Publishers, India.
2. Gupta, P.K and Salunka, D.K. 1985. Modern toxicology. Vol I and II, Metropolitan, New Delhi.
3. LU, F.C. 1985. Basic Toxicology. Hemisphere Publication. Corporation, Washington, N.Y.London
4. Pal, B.P., 1982 Environmental Conservation and Development, Nataraj Publishers, Dehra Dun, India.

5. Sharma, P.D., 1995. Environmental Biology and Toxicology. Rastogi and Company, Meerut, India.
6. Sood, A. 1999. Toxicology. Sarup & Sons, New Delhi.
7. Trivedi P.R., & Gurdeepraj., 1992. Environmental Biology. Akashdeep Publishing House, New Delhi.

Reference Books:

1. Break Mely, W. 1980. Chemicals in the Environment. Marshal Dokker INC Newyork.
2. Butler, G.C. 1978. The Principles of Ecotoxicology Scope. 12, ICSO Scope John wiley and sons, Chicheater.
3. Pandey G.N. & G.C. Carney, 1989. Environmental Engineering. Tata McGrawHill Publishing Co., Ltd.
4. Subramanian, M.A, Toxicology: Principles and methods, MJP Publishers, Chennai.

Online resources:

http://dir.yahoo.com/science/ecology/aquatic_ecology/

http://dir.yahoo.com/science/ecology/population_ecology/

<http://www.okstate.edu/artsci/botany/bisc3034/lnotes/communit.htm>

<http://www.sosmath.com/diffeq/first/application/population/population.html>

http://dir.yahoo.com/Science/Ecology/Biogeochemical_Cycles/

http://dir.yahoo.com/Science/Earth_Sciences/Atmosphere/Ionosphere/

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	-	S	-	M	-	S	L	-	-	-
CO2	-	L	-	M	-	S	-	-	-	-
CO3	-	M	-	-	-	S	L	-	-	-
CO4	L	S	-	S	-	S	M	-	-	-
CO5	-	-	-	L	-	S	-	-	S	-

CORE COURSE IX – EVOLUTION

Course code	Course Name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL09	Core Course IX : Evolution	60 hours	5 hours	---	5

Learning Objectives:

- The course will give the student knowledge about evolutionary processes and skills in phylogenetic analysis
- To study molecular evolution.
- The subject of evolutionary biology is taught as the history of life
- To emphasize the historical nature of evolutionary biology and the evolutionary concepts.

Learning Outcomes:

On successful completion of the course, students will be able to		
CO1	Students learn how evolution is the central theoretical explanation for all of life, for all its diversity of form and function.	Understand
CO2	Students learn that evolution is a significant part of understanding who we are as humans.	Remember
CO3	Students learn practical skills like constructing phylogenetic trees	Analyzing
CO4	Describe evolutionary process at the molecular level	Analyzing
CO5	Apply molecular methods to study genetic variation within and between species	Apply

Unit- I**12 hours**

Origin of life - Special creation, Cosmozoic, Abiogenesis, Biogenesis. Biochemical origin of life. Chemical origin of life - Biomolecules, Opinion of Haldane and Oparin, Urey-Miller Hypothesis. Origin of Pro and Eukaryotic cell.

Unit- II**12 hours**

Evidences of evolution – Comparative anatomy- Homologous and Analogous organs. Vestigial organs. Embryological evidences. Paedogenesis. Fossils and fossilization - Dating of fossils - Extinctions. Living fossils. Geological time scale – Era, Period & Epoch.

Unit- III**12 hours**

Theories and concepts of evolution- Lamarckism and Neo-lamarckism, Darwinism and Neo-Darwinism, Germplasm theory, Mutation Theory, - Modern Synthetic theory. Genetic drift - Founder's principle. Polymorphism - Transient and stable.

Unit -IV**12 hours**

Isolation and Speciation- Isolating mechanisms - types. Species concepts - definition of species. Origin of species - Allopatric and Sympatric speciation. Mimicry & Colouration - Batesian and Mullerian. Adaptive Radiation – Origin & Variations.

Unit -V**12 hours**

Molecular evolution and Patterns of evolution – Phylogenetic trees - definition. Molecular clock. Micro and Macro evolution – definition. Patterns of evolution - Convergent, Divergent, Parallel & Co-evolution. Evolution of Man - Biological & Cultural.

Text Books :

1. N. Arumugam, Organic Evolution, Saras Publications, Taminadu.
2. M. P. Arora, Evolution, Himalaya Publishing House Pvt. Ltd. Publication.
3. Paul Amos *Moody*, Introduction to Evolution. Harper, New York, ed. 2'
4. Dobzhansky, The Genetics And The Origin of Species, Columbia Uty. Press.
5. Dodson., Evolution – Process and Product. Reinhold Publishing Corporation, New York.

Reference Books:

1. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition - New Haven, Yale University Press.
2. Colbert, E.H. 1969 - Evolution of vertebrates, Wiley, New York.
3. Mayr, Ernst, 1973 - Animal species and Evolution. The Belknap Press of Harvard University, Cambridge.
4. Dobzhansky, T. 1976 - Genetics and the origin of species. Oxford and TBH Publishing Co. New Delhi.

5. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
6. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
7. Life, Origin, Evolution and adaption (2002) - Sanjib Chattopadhyay. Books and Allied (p) Ltd.
8. Bishop, B. A., & Anderson, C. W. (1990). Students' conceptions of natural selection and its role in evolution. *Journal of Research in Science Teaching*, 27, 415-427.
9. Hafner, M.S. (1994). *Evolution laboratory: Laboratory exercises and discussions in evolutionary biology*. Baton Rouge, LA: Louisiana State University.
10. Hartl, D. L. (1988). *A primer of population genetics* (2nd edition). Sunderland, MA: Sinauer Associates.
11. Minkoff, E. C. (1983). *Evolutionary biology*. Reading, MA: Addison-Wesley Publishing Company.
12. Sober, E. (1994). *Conceptual issues in evolutionary biology*. Cambridge, MA: MIT Press.

Online Resources:

1. <https://doi.org/10.1108/07378830910988496>
2. <http://www.evolutionsociety.org/content/education/resources>
3. <http://www.evolutionkills.org>
4. <http://www.faculty.virginia.edu/evolutionlabs>
5. www.biologcorner.com
6. www.fscj.edu
7. www.askiitians.com
8. www.bioogia.buap.mx
9. www.coursehero.com

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	-	S	-	M	-	S	L	-	-	-
CO2	-	L	-	M	-	S	-	-	-	-
CO3	-	M	-	-	-	S	L	-	-	-
CO4	L	S	-	S	-	S	M	-	-	-
CO5	-	-	-	L	-	S	-	-	S	-

CORE COURSE X: BIOTECHNOLOGY

Course code	Course name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZL10	Core Course X: Biotechnology	60hours	5	-	5

Course objectives:

- ❖ Understand the basic concepts and principle of biotechnology.
- ❖ Acquire the basic concepts in genetic engineering.
- ❖ To gain knowledge on selection and application of genetic engineering tools.
- ❖ Acquaint with the knowledge genetic engineering tools.
- ❖ To understand the recent trends in Intellectual Property Right and Values.

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Understand of the theoretical knowledge of various fields in biotechnology	Understand
CO2	Acquire and analyze the knowledge of cloning.	Analyze
CO3	Gain knowledge of vectors, gene transfer techniques	Remember
CO4	Use of Separation techniques and PCR techniques	Apply
CO5	Acquire and apply the skill of modern Biotechnology.	Create

UNIT I

Scope and importance of Biotechnology. Cloning – Steps involved in gene cloning method. Restriction endonucleases, DNA ligases Vectors – plasmid, cosmids and YAC.

UNIT II

Isolation ,Purification and Separation of DNA.Selection and expression of cloned DNA. Construction of genomic and cDNA libraries. Screening of recombinant DNA

UNIT III

Fractionation techniques Ultracentrifuge, Chromatographic separation and Electrophoresis. Southern and Northern blotting. Hybridization techniques.Microinjection. Electroporation and PCR technique.

UNIT IV

Applications of biotechnology in agriculture,industry and medical field.Gene therapy, DNA finger printing.Cell based DNA Cloning. Gene knock out technique. Transgenic animals.

UNIT V

Biotechnology and future: stem cell culture, CRISPR technology. Vaccine designing. Organ Transplantation. Human Genome Project. IPR and ethical concerns, copyrights, Conditions for patenting.

Text books:

1. Elements in Biotechnology -Gupta, P.K. (1997). - Rastogi Publications, Meerut .
2. Sathyanarayana U (2005). Biotechnology. Books and Allied P. Ltd. Kolkata

Reference books:

1. Primrose S.B (2000). Modern Biotechnology. Blackwell Scientific Publications, Oxford, London.
2. T. A. Brown (2006). *Gene Cloning and DNA Analysis-An Introduction*. 5Ed. Wiley Blackwell Publishers.
3. K. Wilson and J. Walker.(2010).Principles and Techniques of Biochemistry and Molecular Biology, 7 Ed. Cambridge University Press.

Mapping with Program Outcomes										
COs	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L								
CO2			S				L			
CO3			L							M
CO4					S				S	
CO5						M		L	S	L

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

MAJOR BASED ELECTIVE – III: MICROBIOLOGY

Course code	Course Name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLM3	Major based elective – III: Microbiology	40 Hours	5 Hours	---	4

Course Objectives :

- Gain knowledge, development and scope of Microbiology
- Internalize the techniques used to observe microorganisms
- Understand the concept of asepsis and techniques used for the cultivation of microorganisms
- To understand about the concept of microbiology, classification of microorganisms, microbial culture, food spoilage and preservation methods
- Epidemiology of various disease and waste water treatment and pollution control.

Course Outcomes:

On successful completion of course, students will be able to		
CO1	Understand about scope and history of microbiology, media preparation, classification, staining, micrometry, reproduction in bacteria.	Understand
CO2	Cultivate and control of microorganism, isolation and identification of bacteria. Methods of sterilization and disinfection	Understand
CO3	Food preservation and prevention of food spoilage	Apply
CO4	Identify the Pathogenesis and diagnosis of bacterial disease and role of antibacterial, antifungal and antiviral drugs.	Analyze
CO5	Understand about environmental microbiology, sewage treatment, microbes in soil, heavy metals, fuel, types of bioleaching and microbial interactions.	Understand

Unit – I

8 hours

Introduction of microbiology Classification of microbes. Structure and functions of bacteria and virus. Staining techniques - Simple staining and differential staining. Micrometry.

Unit – II**8 hours**

Media preparation – solid and liquid media. Pure culture techniques – spread & pour plate method. Isolation and identification of bacteria in soil, water and air. Methods of sterilization and disinfection . Microbial control.

Unit – III**8 hours**

Sources , types and incidence of microorganism in vegetables, meats, poultry, sea food, milk and dairy products. Spoilage of food, fruits, vegetables, cereals, meat, poultry egg, sea food, caned products . Factors influencing spoilage.

Unit - IV**8 hours**

Morphology, pathogenesis and laboratory diagnosis of bacterial disease - Diphtheria, tuberculosis, Vibrio cholerae, Typhoid, Dysentery, and Gonorrhoea. Lab diagnosis of Viral disease - AIDS, Rabies, Chicken pox, Hepatitis B, Common cold and small pox.

Unit – V**8 hours**

Significant of environmental microbiology, sewage treatment- primary and secondary treatment, Role of microbes in Bio-remediation. Solid waste management. Bioleaching – direct and indirect leaching and microbial interactions.

Text Books:

- 1.A.Mani, A.M.Selvaraj, L.M.Narayanan and N.Aarumugam, 2015, Microbiology, SarasPublications.Nagercoil.
- 2.Pelczer Jr.J.J., Chan ., E.C.S. and Kvieg.R.,2003. Microbiology, McGraw Hill, New York.
- 3.Frazier, W.C. and Westhoff, D.C.,1995. Food microbiology (Fourth Edition), Tata MC Graw Hill Publication co. Ltd, New Delhi.

Reference Books:

- 1.Ananthanarayan, R., JayaramPanikar, C.K., 2004. Text Book of Microbiology. Orient Longman Limited, Chennai.
- 2.Prescott, L.M., Harley, J.P. and Klein. D.A., 2002. Microbiology, Fifth Edition, WCB McGraw Hill, USA.
- 3.Greenwood, D. Richard C.B. Salk, John F. Peutherer, 2003. Medical Microbiology (5th Edition), Churchill Livingstone, USA.
- 4.Tom Elliot, Hastings, M and Desselberger, U.1997. Lecture Notes on Medical Microbiology (3rd Edition), Black Well Science, UK.
- 5.Rheinheimer, G. 1980. Aquatic Microbiology. 2nd edition, Jhon Wiley & sons, New York.
- 6.Atlas, Ronald, M.Baratha, and Richard 1987. Microbiology Ecology. 2nd edition.Benjamin /

Cummings Publishing Co., California.

Online Resources:

1. www.pdfdrive.com
2. <https://bio.libretexts.org>
3. <http://www.wales.nhs.uk/sitesplus/888/agordogfen/149787>
4. <http://ecoursesonline.iasri.res.in/course/view.php?id=108>
5. <https://www.cliffsnotes.com/study-guides/biology/microbiology/microbial-cultivation-and-growth/microbial-cultivation>
6. <https://www.swayam.gov.in>

MAPPING WITH PROGRAM OUTCOMES										
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	L	L	S	L	S	S	S	S
CO2	S	S	M	L	S	L	S	M	L	M
CO3	M	S	L	L	S	L	M	M	S	L
CO4	M	S	L	L	S	L	S	S	S	M
CO5	S	S	L	L	M	L	M	M	M	S

**MAJOR BASED ELECTIVE COURSE –VII: WILD LIFE CONSERVATION &
MANAGEMENT**

Course code	Course Name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLM7	Major based elective VII: Wild Life Conservation and Management	40 hours	5 hours	---	4

Course Objectives:

- ❖ The course is framed to train the students to know about wildlife conservation and management
- ❖ Train the students to appear in forest department job opportunities.
- ❖ To give a foundation of various quantification methods used in wildlife science.
- ❖ To give an idea about various software and its usage in handling wildlife data.
- ❖ To give an insight to the advanced statistics and its application in wildlife.
- ❖ Give an insight to basics of life sciences
- ❖ Gain hands on experience in experimentation

Course Outcomes:

On successful completion of course, students will be able to		
CO1	Develop an understanding of how animals interact with each other and their natural environment	Understand
CO2	Develop the ability to work collaboratively on team-based projects	Apply
CO3	Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues	Remember
CO4	Demonstrate proficiency in the writing, speaking, and critical thinking skills needed to become a wildlife technician	Analyze
CO5	Develop an ability to analyze, present and interpret wildlife conservation management information	Create

Unit - I

8 hours

Scope and opportunities of Wildlife Sciences, Major forest types of India, Protected areas, Sanctuaries, National Parks, Tiger reserves, Biosphere Reserves and their role.

Unit - II

8 hours

History, Location, Habitats, Fauna and importance of Mudumalai Tiger Reserve, Sathyamangalam Tiger Reserve, KalakkadMundanthurai Tiger Reserve, Anamalai Tiger Reserve and Gulf of Mannar.

Unit - III

8 hours

Planning census – sample counts, Block counts, Roadside counts , Dung count, Pugmark & waterhole census. Identifying animals based on indirect signs. Capture & recapture techniques – tiger, co-predator monitoring census methods (WII) – usage of M-stripes.

Unit - IV

8 hours

Foraging behaviour - group foraging - Breeding seasons - factors - courtship and display, polyandry, polygamy - promiscuity - brood parasites –Aggression – Competition – Social spacing – Territory .Social behaviour of elephants and primates.

Unit - V

8 hours

IUCN (International Union for Conservation of Nature and Natural Resources) – CITES (The Convention on International Trade in Endangered Species of Wild Fauna and Flora) – Endangered Mammals of India & Conversation – Project Tiger & Project Elephant. Conservation of Indian rhinoceros and lion. Importance of Zoos in Conservation.

Text books:

- 1 Vivek Menon. Indian Mammals - A Field Guide. Hachette Book publishing India Pvt. Ltd.
- 2.Sale JB, Berkmuller K. Manual of wildlife techniques for India.
3. A.K.Agarwal. Animal Behaviour. Jain Publications Pvt. Ltd. New Delhi.
4. Rajesh Gopal. Wildlife Management Techniques. Oxford University Press. New Delhi.

Reference Books:

1. Ali S, Ripley SD. Handbook of the birds of India and Pakistan. Compact edition. Oxford University Press and BNHS, Mumbai. Ali, S. and SD Ripley.
2. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
3. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials and statutes. New Delhi: Oxford University Press.

Online Resources:

1. MacKenzie PRESENCE User Manual.
2. http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2012/PRES ENCE_Occupancy_Statistics%20_Soft ware_Manual_20121112.pdf.
3. https://en.wikipedia.org/wiki/Main_Page (for R, Mark & Capture)
4. <https://www.pdfdrive.com/zoology-books.html>

MAPING WITH PROGRAM OUTCOMES										
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	M	M	S	S
CO2	M	S	S	S	M	S	S	S	M	M
CO3	S	M	M	S	S	S	S	M	S	S
CO4	M	S	S	S	M	M	M	S	S	S
CO5	S	S	S	M	M	S	M	S	S	M

SKIL ENHANCED COURSE – IV: SERICULTURE

Course code	Course Name	Lecture (L)	Tutorial (T)	Practical (P)	Credit
21UZLS4	Skil Enhanced Course – IV Sericulture	30 Hours	2 Hours	--	2

Course Objectives:

- ❖ To acquire more knowledge about sericulture and entrepreneur opportunities in sericulture.
- ❖ To impart training in extension management and transfer of technology,
- ❖ Acquire knowledge and develop skill in silkworm rearing and support silkworm farming.

Course Outcomes:

On successful completion of course, students will be able to		
CO1	Acquire sound knowledge on different components of sericulture industry with Rearing house and equipments.	Understand
CO2	Understand about Mulberry cultivation, Different Mulberry varieties, organic and inorganic manure application.	Understand
CO3	Selection of seed cocoons, Preparation of egg layings, transportation with Hatching methods.	Apply
CO4	Acquire knowledge and develop skill in silkworm rearing techniques, Silkworm diseases, Spinning, mounting, Harvesting of cocoon and marketing.	Analyze
CO5	Understand about Reeling methods, Silk examination and grading of silk.	Understand

Unit –I**6 hours**

Sericulture - Introduction and scopes. Types of silkworms – Mulberry , Tasar , Muga & Eri . Morphology and life cycle of *Bombyx mori* silkworm .Structure of silk gland. Rearing house and equipments. Disinfection of Rearing house.

Unit-II**6 hours**

Mulberry cultivation of India – Selection of land and mulberry cultivation - Different methods of planting - Mulberry varieties – organic and inorganic manure application .Pruning - Harvesting and preservation of leaves.

Unit -III**6 hours**

Rearing techniques – Selection and preservation of seed cocoons- Preparation of layings (Egg sheets and Loose eggs) washing of silkworm eggs - Egg transportation and incubation – Hatching and methods of brushing. Chawki rearing (young age) and late age rearing.

Unit –IV**6 hours**

Mounting , Spinning, Harvesting and Storage of cocoons. Transportation and marketing. Reeling methods – Charka – Cottage basin. Re-reeling , Silk examination , cleaning , Lacing , Skeining - grading of silk.

Unit –V**6 hours**

By-products of silkworm. Silkworms as bioreactor. Silkworm diseases and its control measures – Pebrine, Flacherie, Muscardine ,Grasserie and Uzifly .

Text Books:

1. Ganga G. and Sulochana Chetiy, J. 2005. An Introduction to Sericulture 2nd Edition, Oxford and IBH Publishers & Co. New Delhi.
2. Johnson M, and kesary. M, 2015. Sericulture fifth edition, Marthandam.

Reference Books:

1. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
2. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR•& TI, Mysore.
3. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. • Ltd., Tokyo, Japan1972.
4. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
5. Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
6. A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR•& TI, Mysore 1989.
7. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, • Bangalore, 1986.

8. Hand Book of Sericulture Technologies - Dandin. S.B. Jayasural and Giridhar.K.
9. Rangaswamy .G ., (1987). Manual on sericulture FAO, Vol I-IV, Agriculture service bulletin ,CSB,Bangalore , India.
10. www. pdfdrive.com

MAPING WITH PROGRAM OUTCOMES										
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	L	L	L	S	M	L	S
CO2	S	L	L	M	L	M	S	L	L	S
CO3	S	M	L	L	L	L	S	M	L	M
CO4	M	L	L	L	L	L	S	M	L	M
CO5	M	M	L	L	M	L	S	M	L	S

SEMESTER VI - PRACTICAL III
ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY AND
IMMUNOLOGY
PAPER CODE: 21UZLP3

I. PRACTICALS

1. Amylase activity in relation to pH in human saliva.
2. Identification of Nitrogenous excretory products.
3. Test for urea and sugar in urine samples.
4. Temporary mounting of Chick embryo 24, 48 and 72 hrs.
5. Estimation of Haemoglobin (Hb) content.
6. Estimation of blood bleeding time and clotting time.
7. WIDAL Test -Demo

II. SPOTTERS

1. Sphygmomanometer
2. Kymograph
3. Stethoscope
4. Human heart (entire)
5. Eye
6. Ear
7. Kidney
8. Neuron synapse
9. Placenta - sheep
10. Chick –Egg stage
11. Frog - Blastula, 1
2. Frog - Gastrula
13. Sperm and Ovum
14. Frog- Tadpole
15. Metamorphosis - insect
16. Metamorphosis - Frog.
17. Incubator
18. Autoclave
19. Colony counter
20. Laminar air flow chamber

III. SUBMISSION OF RECORD

SEMESTER VI - PRACTICAL IV
ENVIRONMENTAL BIOLOGY, EVOLUTION AND
BIOTECHNOOLOGY - PAPER CODE: 21UZLP4

I. PRACTICALS

1. Estimation of dissolved oxygen content of water samples.
2. Estimation of dissolved CO₂ content of water samples.
3. Estimation of Salinity in water samples.
4. Estimation of Carbonates and Bicarbonates in water samples.
5. Construction of ecological pyramid of a pond.
6. Qualitative analysis of Marine water planktons.
7. Determination of pH in water samples.
8. Animal cell culture media preparation.a. Natural media, b. Artificial media.

II. SPOTTERS

- 1.Rain gauge
- 2.Hygrometer
- 3.Thermometer
- 4.Ecological pyramid
- 5.Barometer
- 6.Sacchi disk
- 7.Food chain in pond ecosystems
- 8.Analogous organs
- 9.Homologous organs
- 10.Vestigial organ
- 11.Connective link-Peripatus, Archaeopteryx
- 12.CO₂ Incubater
13. Fermenter
14. Roux bottle
15. Roller bottle
16. Cell lines
17. Genegun
18. Plasmids – pBR 322, PUC 8.
- 19.Retero Virus
20. Yeast artificial chromosome.

III. SUBMISSION OF RECORD

ALLIED ZOOLOGY - I

Course Code	Course Name	Lecture(L)	Tutorial(T)	Practical(P)	Credit
21AZL01	Allied Zoology- I	28 Hours	2 Hours	-	4

Course Objectives:

- ❖ To study individual organisms and their importance
- ❖ To study the structural and functional organization of the different organisms
- ❖ To understand the different morphologies of the organisms mentioned
- ❖ To know the economic importance of the various organisms

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Acquire knowledge about the biology of taxonomy categories	Understand
CO2	Knowledge about basic of parasitology, host-parasite interactions	Understand
CO3	Understand about the various lifecycles of individual organisms, their morphology and importance	Understand
CO4	Understand the classification, function of different biology of chordates	Understand

Unit - I **12hours**

Protozoa: General Characters. Type study: *Entamoeba histolytica*- External morphology, life cycle. Porifera: General Characters. Type study: *Leucosolenia* – External morphology – Reproduction. Coelenterata: General Character's. Type study: *Obelia* – External morphology (structure of the colony, polyp, medusa) – life history. General Topic: Pathogenic Protozoans.

Unit - II **12 hours**

Platyhelminthus: General characters. Type study: *Taenia solium*- External morphology – life history. Aschelminthes (Nematoda): External Characters. Type study: *Ascaris* - External morphology- Life cycle. Annelida: General Character's. Type study: Earthworm – external morphology – life cycle. General Topic: Parasitic adaptations of helminthes.

Unit - III **12 hours**

Arthropoda: General Characters Type study: *Penaeus*: External morphology. Mollusca: General Characters Type study: Fresh water mussel - External morphology - digestive system. Echinodermata: General Characters Type study–Starfish- ExternalMorphologyandWaternvascularsystem. General Topic: Economic importance of insects.

Unit - IV **12 hours**

Pisces: Type study – Shark- external morphology. Amphibia: Type study- Frog- external morphology- digestive system and respiratory system. Reptilia: Type study- Calotes - external morphology and digestive system. General topic: Identification of Poisonous and Non- Poisonous Snakes.

Unit- V **12 hours**

Aves: Type study: Pigeon - external morphology- digestive system and respiratory system. Mammalia- Type study: Rabbit - external morphology- digestive system and excretory system.
General topic: Dentition in Mammals.

Text book:

1. EkambaranathaIyer, M. &Ananthakrishnan, T.N. (1990). Outlines of Zoology (Viswanathan Publishers) Vol. I & II.

Reference Books:

1. Kotpal, R.L. (1997). Modern Text Book of Zoology Invertebrata. Rastogi Company, Meerut (U.P.),India.
2. Kotpal, R.L. (1997). Modern Text Book of Zoology -Vertebrata. Rastogi Company,

Course code	Course name	Lecture(L)	Tutorial(T)	Practical(P)	Credit

, India.

Online Resource:

1. <https://unl.libguides.com/c.php?g=51779&p=3148685>

MAPPING WITH PROGRAM OUTCOMES										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S		S		L			M		S
CO2	S	S	S	M	M	L		S		S
CO3	S	S	S		S			S		S
CO4	S	L	S		L		L	S	M	M
CO5	S		S	M	S	S	M	S	S	S

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

21AZL02	Allied Zoology – II	56	4	20	4
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Course Objectives:

- ❖ To understand the fundamentals of the Cell biology and give an insight on human
- ❖ To know about embryology concepts and importance with reference to various developmental aspects of frog.
- ❖ To create awareness about the various physiological aspects of Vertebrates including Human.
- ❖ To learn about fundamentals of ecosystem and Anthropogenic impacts on it.
- ❖ To get an overall information about evolution of various animal groups with reference to different theories

Course Outcomes:

On successful completion of the course, students will be able to		
CO1	Develop deeper understanding of what life is and how it functions at cellular level. Impaired the knowledge about classical and human genetics.	Understand
CO2	Familiarized with various aspects of animal developmental process including with man with special reference to Infertility and IVF techniques.	Apply
CO3	Popularized with various functional and physiological aspects of life, which may use full to apply the knowledge to lead a healthy lifestyle.	Apply
CO4	Developed a skill to observe various ecosystems, identify causes for pollution and adopt various methods for control it.	Apply
CO5	Identified the contribution of various evolutionists and observe the evolutionary trends in various animal groups.	Remember

Unit- I

12 hours

Cell Biology: Cell theory, Ultra Structure of Animal cell – Structure of Plasma membrane – Fluid mesoic models and function of Plasma Membrane - Mitochondria - Structure and functions. Genetics: Mendalin Laws of Inheritance – Blood groups of Man

Unit - II

12hours

Developmental Biology: Ultra structure of Mammalian Sperm, Types of Eggs - Fertilization and Cleavage. In vitro Fertilization (IVF) techniques in human

Unit- III**12 hours**

Physiology: Digestion and Excretion in man – Digestive glands, Digestive enzymes – Absorption of digested food materials - Male and Female sex hormones. Structure of heart in man.

Unit- IV**12hours**

Ecology: Abiotic and Biotic factors – Food chain and Food web in Pond Ecosystem. Animal Associations. Pollution - Air, Water and Noise – Causes, Ecological effects and Preventive measures.

Unit- V**12hours**

Evolution: Origin of life – Different concepts – Theories of Organic evolution - Lamarkism and Neo Lamarkism, Darwinism and Neo Darwinism

Text books:

1. Bernice Anantharaj - Allied Zoology – Tamil version

2. Verma, P.S. and V.K. Agrawal. Cellbiology, Genetics, Molecularbiology, Evolution and Ecology. S. Chand publishers, New Delhi.

3. Verma, P.S. B.S. Tyagi and V.K. Agarwal. Animal Physiology. S. CHAND Publishers, New Delhi

Reference books:

1. Berry, A.K. A Textbook of Animal Physiology. Emkay publications

2. Rastogi. S.C. Cellbiology. New Age International, Ltd Publishers.

3. Sharm. P.D. Ecology and Environment, Rastogi Publications.

ONLINE REFERENCES

1. <http://www.eol.org>

2. <http://www.animaldiversity.com>

3. <http://www.librery.si.edu>

4. <http://www.electroniczoo.com>

MAPPING OF THE PROGRAM OUTCOMES										
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S				M	S	S	
CO2		S	S	M		S	M		S	
CO3		S		M		L		M	S	

CO4	S	S				L	M	M	S	
CO5	S	S	S	S	M	L	-	-	-	

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

ALLIED ZOOLOGY PRACTICALS

Course Code	Course Name	Lecture(L)	Tutorial(T)	Practical(P)	Credit
21AZLP1	Allied Zoology Practical			24 Hours	3

Practicals

1. Cockroach: Digestive system
2. Prawn: Nervous system
3. Earthworm- Digestive system
4. ABO-Blood Grouping

5. Mouthpartsofcockroach
6. MouthpartsofMosquito
7. Mouth parts of Honey bee
8. Earthworm-Body setae
9. Shark – Placoid Scales

III. Spotters

Entamoeba, Plasmodium, Paramecium, Paramecium-Conjugation, Sycon, Obelageneria, Fasciolahepatica(Entire&Transversesection), Taeniasolium(Entire&Transversesection), Taenia- Scolex, Ascaris Male &Female, Neries(Entire&Transversesection), Prawn, Freshwatermussel, Star fish, Amphioxus, Shark(Entire and Placoidscale), Pigeon(Entire and quill feather), Rabbit, Section of Mammalian ovum, Section of Mammalian sperm, Frog –blastula, gastrula, human heart, Ecological pyramida, Vestigial organs. Naja naja, Viper, Russel.

IV. Record

THEORY QUESTION PAPER PATTERN

Time: 3 Hours

Max.Marks: 75

PART – A

15 x 1 = 15 Marks

Answer all Questions. Multiple Choice

- (a)
- (b)
- (c)
- (d)

PART – B

2 x 5 = 10 Marks

Answer Any Two Questions Out of Five

PART – C

5 x 10 =50 Marks

Answer All Questions.

Either (or) Type

Five Questions (One Question from each unit)

PRACTICAL QUESTION PAPER PATTERN

Time: 3 Hours

Max.Marks: 60

- | | | |
|------|--------------------|----------|
| I. | Major Practical | 25 Marks |
| II. | Minor Practical | 15 Marks |
| III. | Spotters (A. & B.) | 10 Marks |
| IV. | Record | 10 Marks |

