KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)

COIMBATORE-641 029

DEPARTMENT OF ZOOLOGY

(UG)

CURRICULUM AND SCHEME OF EXAMINATIONS
(CBCS)
(2020 - 2021)

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

VISION

Developing the total personality of each and every student in a holistic way by adhering to the principle of ***Swami Vivekananda*** and ***Mahatma Gandhi***

MISSION

- Imparting holistic and man-making education with emphasis on character, culture and value - moral and ethical.
- Designing the curriculum and offering courses that transform its students into value added skilled human resources.
- Constantly updating academic and management practices towards total quality management and promotion of quality in all spheres.
- Extending the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- Taking steps to make education affordable and accessible by extending scholarships to the meritorious and economically disadvantaged students.
- Moulding the teachers in such a way that they become the role models in promoting Higher Education

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE-29

DEPARTMENT OF ZOOLOGY

Vision

To make students understand the diversity, habitat and functioning of animals in order to conserve the environment and promoting the new biology and its cutting – edge - Technology

Mission

Broadcasting knowledge in Animal Sciences through innovative teaching and learning and also to make awareness about problems affecting animal and human health and world challenging environmental issues

UG PROGRAMME OUTCOMES (PO)

PO1.	Acquire knowledge and skill in the basic and systematic animal sciences
PO2.	Apply knowledge of structure of cell organelles and its function in controlling various cellular mechanisms
PO3.	Correlate the physiological process of animals and the interaction of various organ systems
PO4	Understand the environmental issues and its importance and Biodiversity.
PO5	Gain knowledge of agro based Small scale industries like sericulture, fish farming and Apiculture.
PO6	Understand Animal behavior and response of animals to different instincts
PO7	Understand the immune mechanisms in disease control, vaccination, process of immune interactions
PO8	Apply Recombinant DNA Technology, genetic manipulation for the industrial production of molecules.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1.	Understand the nature and basic concepts of Non-chordates, sericulture, physiology, ecology, Economic zoology, Biotechnology, Biostatistics, Bioinformatics and Biophysics and Genetics.
PSO2.	Analyze the relationship among animals, plants and microbes by morphological and molecular studies.
PSO3.	Understand the applications of Biological sciences in Aquaculture, Agriculture, Environment and medicine
PSO4.	Gain knowledge about the techniques in Biology, effective communication and skills of problem solving methods in Biology.
PSO5.	Contribute the knowledge for the society building.

UZO 1

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE – 641 029

Course Name: **B.Sc., ZOOLOGY**

Curriculum and Scheme of Examinations under CBCS

(Applicable to students Admitted from the Academic Year **2020– 2021**)
Scheme of Examinations (With 4 Sem Language Papers)

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam (hours)	Credits
					CIA	ESE	TOTAL		
SEMESTER - I									
I	I	20TML101	Language I@	6	25	75	100	3	3
	II	20ENG101	English –I	6	25	75	100	3	3
	III	20UZO101	Core Paper 1–Invertebrata	7	25	75	100	3	5
	III	20UZO1I1 20UBO1A1	Allied A Paper 1- Sericulture I / Botany I	5	20	55	75	3	4
			Core Practical. 1- Invertebrata and Chordata	2	-	-	-	-	-
			Allied Practical. 1. Sericulture	2	-	-	-	-	-
	IV	20EVS101	Environmental Studies**	2	-	50	50	3	2
			Total	**30**	**95**	**330**	**425**		**17**
SEMESTER - II									
II	I	20TML202	Language II@	6	25	75	100	3	3
	II	20ENG202	English –II	6	25	75	100	3	3
	III	20UZO202	Core Paper 2 –Chordata	7	25	75	100	3	5
	III	20UZO2I2 20UBO2A2	Allied A Paper 2- Sericulture II / Botany II	5	20	55	75	3	4
		20UZO2CL	Core Practical. 1- Invertebrata and Chordata	2	40	60	100	3	2
		20UZO2IL 20UBO2AL	Allied A Practical 1. Sericulture /Botany	2	20	30	50	3	2
	IV	20VED201	Value Education- Moral and Ethics **	2	-	50	50	3	2
			Total	**30**	155	**420**	**575**		**21**

SEMESTER - III									
III	I	20TML303	Language III@	6	25	75	100	3	3
	II	20ENG303	English –III	6	25	75	100	3	3
	III	20UZO303	Core Paper 3– Cell and Molecular Biology	5	25	75	100	3	5
	III	20UBC 3A3	Allied B paper 1- Biochemistry	5	20	55	75	3	4
			Core Practical 2- Cell Biology andPhysiology	2	-	-	-	-	-
			Allied BPractical 2. Biochemistry	2	-	-	-	-	-
	IV	20UGA3S1	Skill Based subject 1- General Awareness	2	25	75	100	3	3
	IV	20TBT301/ 20TAT301/ 20UHR3N1	Basic Tamil* / Advanced Tamil** (OR) Non-major elective- I**- Human rights	2	-	75	75	3	2
			Total	**30**	**120**	**430**	**550**		**20**
SEMESTER - IV									
IV	I	20TML404	Language IV@	6	25	75	100	3	3
	II	20ENG404	English –IV	6	25	75	100	3	3
	III	20UZO404	Core Paper 4– Physiology	5	25	75	100	3	5
	III	20UBC4A4	Allied B paper 2- Biochemistry	5	20	55	75	3	4
		20UZO4CM	Core Practical 2- Cell Biology and Physiology	2	40	60	100	3	2
		20UBC4AL	Allied B Practical-1. Biochemistry	2	20	30	50	3	2
	IV	20UZO4S2	Skill Based subject 2- Health education	2	25	75	100	3	3
	IV	20TBT402/ 20TAT402/ 20UWR4N2	Basic Tamil* / Advanced Tamil** (OR) Non-major elective- II**- Women's rights	2	-	75	75	3	2
			Total	**30**	**180**	**520**	**700**		**24**
SEMESTER - V									
v	III	20UZO505	Core Paper 5- Genetics	5	25	75	100	3	4
	III	20UZO506	Core Paper 6- Evolution	5	25	75	100	3	4
	III	20UZO507	Core Paper 7–Ecology	5	25	75	100	3	4
	III	20UZO508	Core Paper 8–Biostatistics and Bioinformatics	5	25	75	100	3	4

			Core Practical 3: Evolution, Microbiology and Immunology and Biotechnology	2	-	-	-	-	-
			Core Practical 4: Ecology, Developmental Biology and Animal Diversity	2	-	-	-	-	-
	III	20UZO5E1	Major Elective -1	4	25	75	100	3	5
	IV		EDC-Extra Departmental Course	2	25	75	100	3	3
		20UZO5IT	Internship Training ****						Grade
			Total	**30**	**150**	**450**	**600**		**24**
SEMESTER - VI									
VI	III	20 UZO609	Core Paper 9 –Microbiology and Immunology	4	25	75	100	3	4
	III	20 UZO610	Core Paper 10 – Biotechnology	5	25	75	100	3	4
	III	20 UZO611	Core Paper 11 – Developmental Biology	5	25	75	100	3	4
	III	20 UZO612	Core Paper 12 – Animal Diversity	4	25	75	100	3	4
		20UZO 6CN	Core Practical 3: Evolution, Microbiology and Immunology and Biotechnology	2	40	60	100	3	2
		20UZO 6CO	Core Practical 4: Ecology, Developmental Biology and Animal Diversity	2	40	60	100	3	2
	III	20UZO6E2	Major Elective 2	3	25	75	100	3	5
	III	20UZO6Z1	Project***	3	20	80	100	3	5
	IV	20UZO6S4	Skill Based subject-3 Commercial fish culture	2	25	75	100	3	3
	V		Extension Activities*	-	50	-	50	-	1
			Total	**30**	**300**	**650**	**950**		**34**
			Grand Total				**3800**		**140**

Note:

CBCS – Choice Based Credit System

CIA – Continuous Internal Assesment

ESE – End of Semester Examination

@ Hindi/Malayalam/ French/ Sanskrit – 12HIN/MLM/FRN/SAN101 - 404

***** - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

******- No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

*** Project Report – 60 marks; Viva voce – 20 marks; Internal – 20 marks

**** The students shall undergo an internship training / field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100marks alone with the internal viva voce by the respective faculty. According to their, the grades will be awarded as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
40-49	C
<40	U (Reappear)

Major Elective Papers

(2 papers are to be chosen from the following 6 papers)

1. Poultry science and management
2. Economic Zoology
3. Pests and their Management
4. Human genetics and Counselling
5. Commercial fish culture
6. Vermitechnology

Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

Sub code and Title of the Extra Departmental Course (EDC)

20UZO5X1 - Human Anatomy

Extension Activities :

NCC – National Cadet Corps
NSS – National Service Scheme
YRC – Youth Red Cross
PYE – Physical Education
ECC – Eco Club
RRC – Red Ribbon Club
WEC – Women Empowerment Cell

Note: In core/ allied subjects, no. of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below

Tally Table:

S.No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/ French/ Sanskrit	400	12
2.	II	English	400	12
3.	III	Core – Theory/Practical/Project	1700	65
		Allied	400	20
		Electives /	200	10
4.	IV	Basic Tamil / Advanced Tamil (OR) Non-major elective	150	4
		Skill Based subject	300	09
		Extra Departmental Course	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Extension Activities NCC/NSS/YRC/PYE/ECC/WEC/RRC	50	1
		Total	3800	140

- 25 % CIA is applicable to all theory subjects except JOC, COP and Diploma Courses, which are considered as extra credit courses.
- The student should complete a SWAYAM – MOOC before the completion of the 5^{th} semester and the course completed certificate should be submitted to the HOD. Two extra credits will be given to the candidates who have successfully completed.
- A field trip preferably relevant to the course should be undertaken every year

UZO 6

Components of Continuous Internal Assessment

Components		Marks	Total
Theory CIA 1	75	**75+75=150/10 15**	**25**
Assignment / Seminar		**5**	
Attendance		**5**	
Practical CIA Practical		**25**	**40**
Observation Notebook		**10**	
Attendance		**5**	
Project Review		**15**	**20**
Regularity		**5**	

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1- Remembering; K2-Understanding; K3- Appling K4- Analyzing; k5 – Evaluating

1. Theory Examination – Part I, II and III

(i) CIA I & II and ESE: 75 Marks

Knowledge level	Section	Marks	Description	Total
K1 – K2	A (Answer all)	10X1=10	MCQ	75
K2-K4	B (Either or Pattern)	5X5 = 25	Short Answer	
K2-K4	C (Either or Pattern)	5X8 = 40	Descriptive/ Detailed	

(ii) CIA I& II and ESE : 55 Marks

Knowledge level	Section	Marks	Description	Total
K1 – K2	A (Answer all)	10X1=10	MCQ	55
K2-K4	B (Either or Pattern)	5X3 = 15	Short Answer	
K2-K4	C (Either or Pattern)	5X6 = 30	Descriptive/ Detailed	

2. Practical Examination:

Knowledge level	Section	Marks	Total
K3 – K5	Experiments	50	60
	Record Work	10	

3. Project Viva-Voce :

Knowledge level	Section	Marks	Total
K3- K5	Project Report	60	80
	Viva-Voce	20	

Programme code:06	B.Sc., Zoology			
Course code: 20UZO101	Core Paper 1 –Invertebrata			
Batch 2020-2021	Semester 1	Hour/Week 7	Total hours 105	Credit 5

Course Objectives

1. To obtain the knowledge of the taxonomical and characteristics of non chordates
2. To understand the morphological and anatomical features of selected non chordates
3. To create awareness about the harmful parasites and their economic importance of non chordates

Course Outcomes

K1 - K4	CO1	Get knowledge about the systematic position of various organisms
	CO2	Understand the various structure and its function of the non Chordates
	CO3	Understand and apply the knowledge on the important parasites and their control measures
	CO4	Get the knowledge and analyze the economically important organisms

SYLLABUS

UNIT I

Methods of Classification of Non Chordata **21Hrs**

Phylum Protozoa: Classification and characters up to Classes with suitable examples.

Type study : *Paramecium caudatum*
General Topic : Parasiticprotozoa -*Plasmodium vivax, Leishmania donovani*

Phylum Porifera

Type study : *Leucosolenia*
General Topic : Canal system in sponges

UNIT I **21Hrs**

Phylum Coelenterata: Classification and characters up to Classes with suitable examples.

Type Study : *Obelia*
General Topic : Coral reefs

Phylum Aschelminthes : Classification and characters up to Classes with suitable examples.

Type Study : *Ascaris lumbricoides*

General topic : Diseases caused, Symptoms and Control measures of parasitic Worms- *Wuchereria bncrofti*, Pin worms

UNIT III **21Hrs**

Phylum Platyhelminthes

Type study : *Fasciola hepatica*

General topic : Parasitic adaptations

Phylum Annelida: Classification and characters up to Classes with suitable examples.

Type Study : *Hirudinaria granulosa*

General topics : Metamerism in Annelids,
Economic importance of earthworms, Modes of life in polycheates, life history of Nereis and Earthworm

UNIT IV **21Hrs**

Phylum Arthropoda: Classification and characters up to Classes with suitable examples.

Type study : *Penaeus indicus*

General topic : Economical importance of Arthropodes; Metamorphosis in insects*, Modification of mouth parts in insects, social behavior of Apis and Termites

UNIT V **21Hrs**

Phylum Mollusca: Classification and characters up to Classes with suitable examples.

Type study : *Pila globosa*

General topics : Torsion in Gastropods,
Economic importance of molluscs

Phylum Echinodermata: Classification and characters up to Classes with suitable examples.

Type study : *Asterias rubens*

General topic : Larval forms of Echinoderms

***Self study (Questions may be asked from these topic also)**

Teaching methods :Chalk and talk, Power Point Presentation, Seminar, Smart Class,Room, Quiz.

Text Books

1. KotpalR L., (2016 Edition) Modern Text Book of Zoology – Invertebrate, Rostagi publication Meerut.
2. Jordan, E. L & P. S. Verma, (2009)Fifteenth Edition, Invertebrate Zoology. S. Chand & Co.
3. EkambaranathaAyyar M and AnanthakrishnanT.N.Viswanathan S (1981).Manual of Zoology Vol.1&2 Printers & Publishers Pvt.Ltd, Chennai.

Reference Books

1. Anderson D.T (2006). Invertebrate Zoology Oxford University Press
2. Dhami.P.Sand J K Dhami (2009). Invertebrate Zoology , S. Chand& Co., New Delhi.
3. Ruppert, Edward E., Fox, Richard S. and Barnes, D Robert. (2009). Invertebrate Zoology : A functional Evolutionary Approach. 7th edition. Thomson Brooks / Cole.
4. Nair N.C,.Leelavathi S, Soundrapandian N,.Murugan T., N Arumugam (2013). A Text book of Invertebrates, Saras Publication.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	S	S	H	H
CO2	H	H	S	H	S
CO3	S	S	H	S	S
CO4	H	M	H	M	H

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

Programme code -06	B.Sc Zoology			
Course code 20UZO1I1	Allied A Paper -I Sericulture -I			
Batch 2020-2021	Semester 1	Hour/Week 5	Total hours 75	Credit 4

Course Objectives

1. To create a self employment opportunity among student
2. To equip the skills of rearing of silkworms
3. To create better breeding and grainage techniques

Course Outcomes

K1 - K4	COI	Get knowledge about the mulberry and non mulberry silkworms.
	CO2	Understand the various silkworm rearing techniques
	CO3	Apply knowledge on control measures of silkworm diseases
	CO4	Analyze silkworm breeding and grainage techniques

SYLLABUS

UNIT I **15Hrs**

Introduction

Bombyx mori : Systematics, lifecycle, Silk gland and silk formation, Origin and economic importance of sericulture industry, Role of Central silk board and CSRTI, Mulberry and non-mulberry (Tasar, Eri &Muga) silk producing species, their distribution and food plants (Primary, Secondary & Tertiary).

UNIT II **15Hrs**

Silkworm rearing

Selection, location and orientation of rearing houses*. Environmental conditions essential for rearing - temperature, humidity, ventilation and light - methods for providing optimum conditions, Different methods of rearing, quality of leaf required for different stages, Cleaning, spacing and frequency of feeding, Mounting of worms, Harvesting of cocoons.

UNIT III **15Hrs**

Silkworm pathology

Disinfection of rearing rooms and equipments - control and prevention of a. Flacherie b. Muscardine c. Grasserie and d. Pebrine, Insects injurious to silkworm larva, pupa and cocoons.

UNIT IV **15Hrs**

Silkworm Genetics

Genetic basis of variation in silkworm - multiple alleles in *Bombyx mori*, Sex-linked inheritance and mutation in *Bombyx mori*.

Breeding : Aims of silkworm breeding-Inbreeding and cross breeding - combining various qualities of races, maternal inheritance and its consideration in breeding.

UNIT V **15Hrs**

Grainage techniques

Grainage techniques: various grainage techniques - selection of seed cocoons -emergence of moths - preparation and treatment of layings - refrigeration of over -wintered eggs.

*** Self Study (Questions may be asked from these topics also)**

Teaching methods : Chalk and Talk, Power Point Presentation, Seminar, Smart Class Room, Quiz

Text Books

1. Madan Mohan Rao. M. (2019). An introduction to sericulture. Second Edition, B.S Publications, Hyderabad. ISBN No. 9789387593978.

2. Ganga &Sulochanachetty. G. (2018). Second Edition. An introduction to sericulture.. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. Ganga. G. (2017) Comprehensive sericulture –Vol.2. Silkworm rearing & Silk reeling, Oxford & IPH Publishing Co. Pvt. Ltd. New Delhi..

2. Johnson M, Kesari M (2019) Saras Publications, Fifth Edition, Bioscience Book Publisher.

3. Thammanna N. Sonwalkar (2001) Handbook of Silk Technology. New Age International (P) Limited, Publishers, New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	H	M	M
CO2	S	M	H	M	H
CO3	H	M	M	H	M
CO4	S	H	H	M	M

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

Programmecode : 06	For B.Sc., Botany, Chemistry and Biochemistry			
Course code 20UZO1A1	Allied A Paper I Invertebrata and Chordata			
Batch	Semester	Hour/Week	Total hours	Credit
2020-2021	1	5	75	4

Course Objectives

1. To learn about the taxonomy and characteristics of non chordate
2. To obtain the knowledge of morphology and anatomy of the animals
3. To understand the biological significance of non chordates and chordates

Course Outcomes

K1 - K4	COI	Get knowledge about the classification of various organisms
	CO2	Study and understand the various parasites and protozoan diseases
	CO3	Apply the knowledge on the developmental stages of different animals.
	CO4	Analyze the morphology and anatomy on chordates and its migration, parental care.

SYLLABUS

UNIT I **15Hrs**

Phylum Protozoa : *Paramecium caudatum*
General topic : Canal system in sponges, Coral reefs

UNIT II **15Hrs**

Phylum Platyhelminthes : *Fasciola hepatica*
General topic : Parasitc worm diseases

UNIT III **15Hrs**

Phylum Arthropoda : *Periplanata americana*
General topic : Metamerism in Annelids
Water vascular system in star fish

UNIT IV **15Hrs**

Phylum Chordata : *Rana hexadactyla* (Excluding endoskeleton)
General topic : parental care of fishes and amphibians

UNIT V

15Hrs

Phylum Chordata : *Oryctolagus cuniculus* (Excluding endoskeleton)

General topic : Migration of birds, Dentition in Rabbit*

***Self study (Questions may be asked from these topic also)**

Teaching Methods:

Chalk and Talk,PowerPoint presentation, Seminar, Smart class, Assignment, Discussion, Quiz.

Text Books

1. EkambaranathaAyyar M and.AnanthakrishnanT.N.Viswanathan S (1981).Manual of Zoology Vol.1 & 2 Printers & Publishers Pvt.Ltd, Chennai.

2. EkambaranathaAyyar M and.AnanthakrishnanT.N.Viswanathan S (2009). Manual of Zoology Vol.2 & Part 1 Printers & Publishers Pvt.Ltd, Chennai.

Reference Books

1. Jordan, E. L., P. S Verma,. (2009) 15th Edition, Invertebrate Zoology S. Chand & Co.

2. Kotpal R.L. Morden (2016 Edition) Text book of Zoology-Vertebrates. Rastogi Publication. Meerut.

3. Thangamani, L.M. Narayanan, S.Prasannakumar., N. Arumugam (2010) Chordate Zoology, Saras Publications.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	S	S	M
CO2	S	S	S	H	H
CO3	H	S	H	H	H
CO4	S	H	M	M	S

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

Programme code -06	B.Sc Zoology			
Course code 20EVS101	Environmental Studies			
Batch 2020-2021	Semester 1	Hour/Week 2	Total hours 30	Credit 2

Course Objectives

1. To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.
2. To shape students into good "ecocitizens", thereby catering to global environmental needs.

SYLLABUS

UNIT I Multidisciplinary Nature of Environment 6 Hrs

1.1 Definition : scope and importance
1.2 Need for public awareness*
1.3 Natural resources
1.3.1 Types of resources
Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

UNIT II Ecosystems 6 Hrs

2.1 Concept of an ecosystem
2.2 Structure and functions of an ecosystem
2.3 Producers, consumers and decomposers
2.4 Energy flow in the ecosystem
2.5 Ecological succession
2.6 Food chains, food web and ecological pyramids
2.7 Structure and function of the following ecosystem*
Forest Ecosystem – Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

UNIT III Biodiversity and Its Conservation 6 Hrs

3.1 Introduction – Definition – Genetic – Species and ecosystem diversity
3.2 Biogeographical classification of India
3.3 Value of biodiversity*
3.4 Biodiversity at global, national and local levels
3.5 India as a mega – diversity Nation
3.6 Hot spot of biodiversity

3.7 Threats to biodiversity
3.8 Endangered and endemic species of India
3.9 Conservation of Biodiversity *insitu* Conservation of Biodiversity – *exsitu* Conservation of Biodiversity

UNIT IV Environmental Pollution 6 Hrs

4.1 Definition
4.2 Causes, effects and control measures of: Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution.
4.3 Solid Waste Managements: causes, effects, control measures of urban and industrial wastes.
4.4 Role of individual in prevention of pollution*.
4.5 Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution.
4.6 Disaster Management – Flood, Drought, Earthquake, Tsunami, Cyclone and Landslide.

UNIT V Social Issues and The Environment 6 Hrs

5.1 Sustainable Development
5.2 Urban problems related to energy
5.3 Water Conservation : Rain Water Harvesting and Watershed Management
5.4 Resettlement and rehabilitation of people, its problems and concerns, case studies – Narmatha Valley Project.
5.5 Environmental ethics, issues and possible solutions.
5.6 Climatic change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl.
5.7 Consumerism and waste products
5.8 Environmental Protection Act
5.9 Air Pollution Act (Prevention and Control)
5.10 Water Pollution Act (Prevention and Control)
5.11 Wild Life Protection Act
5.12 Forest Conservation Act
5.13 Issues involved in enforcement of environmental legislation
5.14 Public awareness*
5.15 Human population and the environment
5.15.1 Population Growth and Distribution
5.15.2 Population Explosion – Family Welfare Programme*
5.15.3 Environment and Human Health
5.15.4 Human Rights*
5.15.5 Value Education*
5.15.6 HIV / AIDS*
5.15.7 Women and Child Welfare
5.15.8 Role of Information Technology in Environment and Human Health*.

Text Book

1. P.Arul, A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velacherry main road, Velacheery, Chennai – 42, First Edition, Nov. 2004.

Reference Books

1. PurohitShammiAgarwal, A text Book of Environmental Sciences, Publisher Mrs. SaraswatiProhit, Student Edition, Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering, Publisher S.K.Kataria& Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi – 110 006.
3. J.Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001.

*** Self Study (Questions may be asked from these portions also)**

Teaching methods : Over Head Projector, Power Point Presentation, Seminar, Smart Class Room , Quiz

---

Question Paper Pattern
(External only)

Duration: 3 hours TotalMarks : 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

Programme code:06	B.Sc. Zoology			
Course code: 20UZO202	Core Paper- 2- Chordata			
Batch 2020-2021	Semester II	Hour/Week 7	Total hours 105	Credit 5

Course Objectives

1. To obtain comprehensive knowledge on the taxonomy and characteristics of chordates
2. To understand the morphological and anatomical features of chordates
3. To study the general features ,distribution and economic importance of chordates

Course Outcomes

K1 - K4	COI	Get knowledge about the classification of various organisms
	CO2	Understand the various physiological systems of Chordate
	CO3	Apply the knowledge in the field of economically important organisms
	CO4	Analyze gradual development of habit and habitats of various animals.

SYLLABUS

UNIT I **21Hrs**

Outline classification of Chordate

Prochordata: Classification and characteristics up to Classes with suitable examples

Type study : *Branchiostoma*

General topic : Salient features and affinities of Prochordata.

Pisces: Classification and characteristics: (Chondrichthyes, Osteichthyes)

Type study : *Scoliodon sorrakowah*

General topics : Fishes available in Indian waters and their Economic importance.

UNIT II **21Hrs**

Amphibians: Classification and characteristics of Amphibian

Type study : *Rana hexadactyla*

General topic : Parental care, Origin of tetrapode, Paedomorphosis

UNIT III **21Hrs**

Reptilia: Classification and characteristics

Type study : *Calotes versicolor*

General topics : Poisonous and non-poisonous Snakes*, Poison apparatus and snake venom, Status of Sphenodon

UNIT IV **21 Hrs**

Aves: Classification and characteristics

Type study : *Columba livia*

General topic : Migration in Birds, Flight adaptation

UNIT V **21Hrs**

Mammals: Classification and characteristics

Type study : *Oryctolagus cuniculus*

General topics : Dentition in Mammals (Rabbit & Human) Ruminent stomach

***Self study (Questions may be asked from theses topic also)**

Teaching Methods:

Over head projector, Power Point presentation, Seminar, Smart class Room, Assignment, Discussion, Quiz.

Text Books

1. Jordan E.L, and P.S Verma (2013) Chordate Zoology S Chand & Company Ltd, New Delhi
2. Kotpal R.L., (2012) Morden Text book of Zoology-Vertebrates Rastogi Publication. Meerut.
3. Thangamani, A. Prasannakumar, S. Narayanan, L.M. and N Arumugam. 2009Chordates, Saras Publication
4. Ekambaranatha Ayyar M Ananthakrishnan T.N. and.Viswanathan S (1981).Manual of Zoology Vol.1&2 Printers & Publishers Pvt.Ltd, Chennai.

Reference Books:

1. Nigam. H.C. Zoology of Chordates. (1972) 5thEdn. S.Nagin& Co. Publishers, Delhi.

2. Jordan EL and P.S Verma (1965) Chordate Zoology & Elements of Physiology, Meerut.

3. Young J.Z. (1981) The life of the vertebrates. 3 rd Edition. Oxford University Press. Great Britan.

4. William N. McFarland et al (1980). Vertebrate Life, Macmillan Publishing Co., Inc., New York.

5. Talwar, P.K.,and A.G Jhingran (1991) Inland fishes.Vol.2. Oxford & 1BH publishing Co.Pvt.Ltd. New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	S	S	H	S
CO2	S	H	H	S	S
CO3	H	H	H	S	H
CO4	H	S	S	H	M

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

Programme code -06	B.Sc Zoology			
Course code 20UZO212	Allied A Paper 2. Sericulture-II			
Batch 2020-2021	Semester II	Hour/Week 5	Total hours 75	Credit 4

Course Objective

1. To study the mulberry cultivation and rearing of silkworm
2. To develop skills about the quality and processing of silk
3. To know the importance of reeling and byproducts of reeling for industrial development

Course Outcomes

K1 - K4	COI	Get knowledge about the moriculture
	CO2	Understand the cultivation of mulberry plants, pests, diseases and control measures of mulberry
	CO3	Apply knowledge on processing of cocoons and different methods of silk reeling
	CO4	Analyze the importance of sericulture in entrepreneurship development.

SYLLABUS

UNIT I **15Hrs**

Moriculture: Distribution of varieties of mulberry - Climatic and other conditions for its growth - selection of land for cultivation. Different methods of mulberry cultivation- sexual and vegetative methods - merits and demerits.

UNIT II **15Hrs**

Weeds and weeding - pruning methods - dormancy in mulberry* – manuring. Insects injurious to the mulberry gardens - bacterial and fungal diseases of mulberry.

UNIT III **15Hrs**

Silk reeling: Origin and importance of reeling industry. Selection of Raw material (cocoons). Importance of quality of cocoons - physical and commercial characteristics of cocoons - defective cocoons. Cocoons testing and classification- price fixation of raw materials.

UNIT IV **15Hrs**

Processing of raw materials: Stiffling and condition of cocoons - storage – sorting - riddling of cocoons. Boiling of cocoons - Different methods - Brushing of cocoons - Reeling techniques: Reeling equipments. Comparative study of various equipments - Charka, cottage basins, and multi end basins - automatic reeling machines.

UNIT V **15Hrs**

Importance of water in reeling. Raw silk examination - Lacing and skeining - Byproducts of reeling. Filature management: Layout of a filature - sections of a modern filature

*** Self Study (Questions may be asked from these topics also)**

Teaching Methods:

Over Head Projector, Power Point presentation, Seminar, Smart class Room, Assignment, Discussion, Quiz.

Text Books

1. Madan Mohan Rao M. (2019). An Introduction to Sericulture. Second Edition, B.S publications Hyderabad, ISBN No. 9789387593978.
2. Ganga and Sulochanachetty G. Second Edition (2018). An introduction to sericulture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. 1. Ganga G. (2017) Comprehensive Sericulture– Vol. 2 Silkworm Rearing & Silk Reeling Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

2. Johnson M, Kesari, M (2019) Saras publications, Fifth Edition, Biosciences Book Publisher.

4. Tribhuvan Singh and Pramod Kumar Singh (2013) Mulberry Crop Protection. Discovery Publishing House Pvt. Ltd., New Delhi.

5. Kamal Jaiswal, Sunil P. Trivedi, B.N. Pandey and R.K. Khatri , (2009) Moriculture.APH Publishing Corporation, Ansari Road, Daryakanj. New Delhi.

6. Thammanna N. Sonwalkar (2001) Handbook of Silk Technology. New Age International (P) Limited, Publishers, New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	H	M	M
CO2	S	M	H	M	H
CO3	H	M	M	H	M
CO4	S	H	H	M	M

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

Programme code:06	B.Sc. Zoology			
Course code: 20UZO2CL	Core Practical- I-Invertebrata and Chordata			
Batch 2020-2021	Semester I&II	Hour/Week 2	Total hours 60	Credit 2

Course Objective

1. To observe various non chordate specimens by using Microscope
2. To know the various systems(Digestive system, circulatory system and Reproductive system) of frog or rat by using virtual laboratory
3. To analyze the quality of excretory product of certain vertebrate
4. To inculcate the significance of various non chordates.

Course Outcomes

K3 – K5	COI	Apply knowledge to study various anatomical system by using virtual laboratory
	CO2	Analyze the excretory products of certain vertebrates
	CO3	Evaluate the biological significance and structure and functions of various animals.

SYLLABUS

Experiment I:

Microscope: Dissection and Compound observation of different parts. Explain structure and functions of each part with suitable diagrams.

Focus non-chordate specimen slides under compound microscope at 10X & 40X as the case may be and describe with suitable diagram.

Slides: Amoeba, Paramecium (WM), Ceratium, Foraminifera shell, Volvox, Cercaria larva, Nauplius lara, Zoea larva, Alima larva of squilla, and Bipinnaria larva.

Experiment II:

Virtual laboratory: Observation and description of various systems of cockroach, Frog, pila, Pig, Pigeon, Starfish displayed over computer.

Experiment III:

Qualitative analysis of excretory products of certain vertebrates.

Ammonia in water from aquarium - Urea in urine of a mammal - Uric acid in excreta of birds.

Experiment IV: Spotters.

Classify and giving reasons: Euglena, Sycon, Obelia colony, Ascaris, Earth worm, Leech, Sepia, Sea cucumber, Amphioxus, Shark, Teleost fish, Frog, Calotes, Pigeon and Rabbit.

Draw labeled sketches: T.S. of Ascaris (male and female), T.S. of Hydra,T.S. of Taenia solium proglottid, T.S. through an arm of Star fish and T.S. through pharynx of Amphioxus.

Relate structure and function: Gemmule, Nereis parapodium, Earthworm body setae, Trachea (WM) of Cockroach, Tube feet (WM) of star fish, Placiod Scales, Ctenoid scales, Cycloid scales, Carapace, quill feather, and hair of a mammal.

Write descriptive notes: Skeleton of frog : Skull, Vertebral column, Atlas, Typical vertebra, urostyle, pectoral girdle, pelvic girdle, fore limb skeleton and hind limb skeleton. Poisonous and non-poisonous snake (one each).

Biological significance: Paramecium conjugation, Opalina, Coral (any one), Peripatus (picture), Limulus, Balanoglossus, Ambystoma, Archeoptryx (picture) and fossil (any one).

MODEL QUESTION PATTERN FOR CORE PRACTICAL I

CIA PRACTICAL EXAM

Model Practical Exam	=	25 Marks
Observation Note	=	10 Marks
Attendance	=	5 Marks
Total	**=**	**40Marks**

PRACTICAL EXAM QUESTION PATTERN

Time 3 hours Max: 60 marks

Question I. Virtual Lab.

Identify and describe a system displayed over computer = 10 marks

Question II.

Focus a specimen slide under Compound Microscope at 10X/40X = 05 marks

Question III. Qualitative analysis either Ammonia/Urea/Uric acid = 10 marks

Question IV. Spotters Identify and comment on as directed (5x5) = 25 marks

Question V. Record = 10 marks

Programme code- 06	B.Sc Zoology			
Course code 20UZO2IL	Allied A Practical 1. Sericulture			
Batch 2020-2021	Semester I&II	Hour/Week 2	Total hours 60	Credit 2

Course Objectives

1. To inculcate the practical knowledge on moriculture and sericulture, mulberry propagation, pests and diseases and their control measures
2. To know the importance of silkworm rearing, pests and diseases of silkworms and their control measures
3. To analyze the quality of silk through experiments

Course Outcomes

K2 – K4	COI	Apply knowledge on moriculture and sericulture
	CO2	Observe the biology, rearing, pests and diseases of silkworm and their control measures
	CO3	Evaluate the quality of silk
	CO4	Train to become an Entrepreneur

SYLLABUS

I.Moriculture:

1. Mulberry garden preparation & Maintenance
2. Preparation of Mulberry cuttings.
3. Pests & diseases of Mulberry Plant.
4. Deficiency diseases of Mulberry plant

II. Silkworm rearing:

5. Silk worm: Life cycle.
6. Silkworm egg, larva, pupa and adult
7. Disease free laying.
8. Rearing appliances.
9. Pests and diseases of silkworms.
10. Uzi fly

III. Eggs & Cocoons:

11. Demonstration- silk gland Dissection
12. Treatment of eggs.
13. Cooking & Reeling.
14. Estimation of renditta
15. Estimation of denier.

16. Estimation of shell ratio.

IV. Field Visit/ Study Tour

MODEL QUESTION PAPER FOR ALLIED PRACTICAL I

PRACTICAL EXAM

Model Practical Exam	=	10Marks
Observation Note	=	5Marks
Attendance	=	5Marks
Total	**=**	**20 Marks**

END OF SEMESTER EXAMINATION

Time = 3 hrs **MaxMarks = 30**

I – Determine _____ of Cocoon characters.	10 Marks
II – Determine _____ of Cocoon characters	6 Marks
III – Spotters – Identify and comment on A,B & C (3x3)	9 Marks
IV - Submission of Record	5 Marks
Total	**30 Marks**

Programme code:06	For B.Sc., Botany, Chemistry and Biochemistry			
Course code: 20UZO2A2	Allied A Paper 2 Cell biology, Genetics, Embryology, Physiology, Ecology and Evolution			
Batch	Semester	Hour/Week	Total hours	Credit
2020-2021	II	5	75	4

Course Objective

1. To acquire the knowledge about the cytology and developmental biology of living animals
2. To understand the physiology and of digestion
3. To create the awareness about the environmental pollution and learn about the evolutionary modification.

Course Outcomes

K1 - K4	COI	Get knowledge about the cell organelles and its functions and Genetic disorders.
	CO2	Understand the embryology of frog
	CO3	Apply the knowledge in the field of nutrition in man and conservation of eco system
	CO4	Obtain knowledge of the evolutionary significance of animals

SYLLABUS

UNIT I **15Hrs**

Structure of an animal cell, structure and functions of Mitochondria, Golgi body, Centrosome, Lysosomes and Nucleus,.Mendel's laws of inheritence, Human genetic disorders-haemophilia and colour blindness.

UNIT II **15Hrs**

Types of eggs. Cleavage, blastulation and gastrulation in Frog

UNIT III **15Hrs**

Nutrition in man-Food constituents and enzymes, digestion and absorption.

UNIT IV **15Hrs**

Ecosystem and its components, food chain, energy flow, Pollution of water, air and noise.

UNIT V

15Hrs

Evidences of Evolution - morphological, anatomical, embryological and biochemical. Theories of evolution - Lamarkism, Darwinism and De Vries, Mutation theory*.

***Self study (Questions may be asked from this topic also)**

Teaching Methods:

Chalk and Talk,PowerPoint presentation,Seminar, Smart class Room,Assignment,Discussion, Quiz**.**

Text Books

1. Arumugam N.,R. Meyyan (2010) Cell Biology, Genetics and EvolutionSaras Publications, Tamilnadu.
2. Arumugam N. (2014) Concepts of Ecology (Low price Edition),Saras Publications, Tamilnadu.
3. Veer Bala Rastogi M., (2001) Organic evolution, KedarNath Ram Nath publishers,Meerut, New Delhi

Reference Books

1. Veer Bala Rastogi M.,and Jayaraj S., (2008) Physiology, Ecology and Evolution. Kedar Nath Ram Nath Publishers, Meerut, New Delhi.
2. Chattopadhyay S., (2002) Life: Origin Evolution and adaptationBook &Allied (P) Ltd,Kolkata.
3. Verma, P.S and V.K. Agarwal. (2002) Concepts of Ecology (Environmental Biology) First Edition. S. Chand & Company Ltd,New Delhi -110044.

MAPPING

PSO \ CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	S	H	M
CO2	S	H	S	H	S
CO3	H	S	H	S	M
CO4	S	S	H	M	S

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

Programme Code- 06		B.Sc. Zoology		
Course Code: 20UZO303		Core Paper 3 – Cell and Molecular biology		
Batch 2020-2021	Semester III	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To provide the fundamental knowledge on cell types and characters.

2. To enhance the knowledge on cell organelles and their role in metabolic activities.

3. To understand the cell division and genetic makeup of the cell and its significance.

Course Outcomes

K1 – K4	CO1	Understand the importance of microscopy and staining techniques.
	CO2	Apply knowledge on the metabolic machinery of the cells.
	CO3	Analyze the significance of normal and abnormal activities of cells.
	CO4	Get knowledge on protein synthesis and cancer biology.

SYLLABUS

UNIT-I Microscopy **15 Hrs**

Use of Microscopes in cytology, Compound and Electron Microscopes, Microtome-Stains and Fixatives-Nuclear and cytoplasmic stains and staining techniques. Introduction to cell and cell types. Structure of Prokaryotic and Eukaryotic cell.

UNIT – II Cell Organelles and Functions **15 Hrs**

Structure and functions of Plasma membrane, Lysosomes, Golgi bodies and Ribosomes.

UNIT – III Cell Organelles and Functions

15 Hrs

Structure and functions of Endoplasmic reticulum, Mitochondria and Nucleus.

UNIT-IV Chromosome structure and Function **15 Hrs**

Chromosome - types, structure, Polytene and Lampbrush chromosomes, Structure and functions of Centrosomes. Cell cycle, Mitosis and Meiosis, significance of crossing over spindle fibres

UNIT – V Structure and Functions of DNA and RNA 15 Hrs

Nucleic acids - Structure and functions of DNA and RNA, DNA replication - Protein synthesis - Cell aging and cancer.

Teaching Methods:

Chalk and Talk,Power Point Presentation, Seminar, Smart class Room, Assignment, Discussion, Quiz.

Text Books

1. Arumugam N., 6th edition, (2007). Cell Biology - - Saras Publications, Shanmugapuram, Kanyakumari.
2. Rastogi C., (2010). Cell & Molecular Biology S 3rd Edition, New Age International (P) Limited, Publishiers, New Delhi.
3. Verma P. S & V.K. Agarwal.(2009). Cell biology, Genetics, Molecular Biology, Evolution & ecology. S. Chand & Company LTD, Ram Nagar, New Delhi, India.

Reference Books

1. Eduardo D.P.DeRobertis and E.M.P.DeRobertis (2017). Cell and Molecular Biology 8th Edition, Wolters Kluwer publication, Wolters Kluwer, Alphen aan den Rijn, The Netherlands.
2. Gupta P. K. (2008). Cell and molecular biology, Rastogi publications, Shivaji Road, Meerut, India.
3. Power C.B. (2009).Cell Biology, Himalaya Publishing House, Mumbai.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	H
CO2	H	H	H	H	H
CO3	H	H	S	H	S
CO4	S	M	H	S	S

S – Strong H – High M – Medium L – Low

Programme code 06	B.Sc Zoology			
Course code 20UGA3S1	Skill Based Subject 1 – General Awareness			
Batch 2020 - 2021	Semester III	Hour/Week 2	Total hours 30	Credit 3

Objectives

1. To acquire knowledge in relation to various competitive examinations.
2. To create awareness about an online examination which is being followed in competitive examinations.

UNIT I **6 Hrs**

1. Tamil and other Literatures

Tamil, English, Christian and Muslim Literatures – Ancient Literature – Bakthi Literature – Epics – Medieval Literature – Modern Literature (Novel, Dramas, Short Stories, Modern Poetry).

2. Economics and Commerce

Basic Economics – Auditing – Management – Capital Market – Foreign Trade – Companies – Banking.

3. Social studies

Indian History – Inventions – Indian Poetry – Constitution - Judiciary – Languages – Literacy – Indian Geography – Lithosphere – Climate – Soil – Agriculture – Population.

UNIT II **6 Hrs**

4. Numerical Aptitude

Objective Arithmetic : Number systems – probability – HCF and LCM of numbers***** - decimal fractions – simplification – squareroots and cuberoots – average – percentage – profit and loss – ratio and proportion – time and work – simple interest – area, volume and surface area***.**

5. Verbal Aptitude

Spot the odd one out – correct form of verb – preposition – find out the rightly spelt word – choose the correct meaning of idioms – synonyms and antonyms.

6. Abstract Reasoning

Logic Reasoning : Logic – statement – arguments – statement assumptions – Statement course of action – theme detection – deriving conclusion from passages.

Non – verbal Reasoning: Series – analogy – classification – analytical reasoning – mirror images – water images – paper folding – paper cutting – rule detection – grouping of identical figures.

UNIT III **6 Hrs**

7. General Science and Technology

Science- Basic principles and concepts in Physics, Chemistry, Botany and Zoology.
Technology - Metallurgy, instrumentation, discoveries and inventions of techniques.

8. Computer Science

Historical evolution of computers – Computer applications – Data processing concepts – Computer codes and arithmetic – Hardware components – Data Structures.

9. Education

Development process of the learner – Principles of development (physical, social, emotional and intellectual) – Learning process – Teaching and teacher behaviour – Interaction analysis – Microteaching – Teacher as a leader – Motivation – Personality dimension – concept of mental health – Counselling.

UNIT IV **6 Hrs**

10. Library and Information Science

Library and Information Science – Basics, Computer, Library Network and others like Research, Reprography etc.

11. Sports and Games

Athletics – Track Events – Field Events – Games – Indoor Games – Outdoor Games – General knowledge – Sport and Olympics – First Aid.

12. Current Affairs

State, Central and International affairs: Budgets – Politics – Sports – Education – Commerce and Industry – Inventions – Science and Technology – Currency – Agriculture – Movies – Guinness records – Awards – IT Industry – Space Research – Defence etc.

UNIT V **6 Hrs**

13. National Cadet Corps (NCC)

Introduction to the Armed Forces (Army, Navy, Air Force) – Dril – Weapon Training – Map Reading – Civil Defense.

14. National Service Scheme (NSS)

History of NSS – History of Motto, Symbol, Badge – Aims and Objectives – Duties and Total Hours – Organisational and Administrational setup – History of voluntary organization – Regular activities – Special camp activities – Special programmes – awards – Important days.

15. Youth Red Cross (YRC)

History of International Red Cross – History of Indian Red Cross – History of Youth Red Cross – Main objectives of YRC – Emblem – Fundamental principles of Red Cross – Organizational Setup – Activities of Youth Red Cross – Role of different functionaries – Training programmes for YRC Program Officers – Training programme for YRC Volunteers – YRC Song – Working Hours – General orientation – Special orientation – Program skill learning.

*** Self Study (Questions may be asked from these topics also)**

Text Book

1. VBC 1 – General Awareness, Question Bank, Kongunadu Arts and Science College, Coimbatore – 29, 2006.

Question Paper Pattern

Max. Marks 100

End of Semester Examination (ESE)- On-Line Examination **75 Marks**

1. 150 questions are to be given. Each question carries ½ mark.
2. In each unit, 30 questions are to be given, covering all the 5 units.

Continuous Internal Assessment (CIA) (through On-Line) **25 Marks**

a) Two Exams. 15 Marks
b) Assignment** 5 Marks
c) Attendance 5 Marks

** Each student has to submit an assignment in the topic Current Affairs area.

20UZO404

ProgrammeCode : 06		B.Sc.**:** Zoology		
Course Code 20UZO404		Core Paper 4 –Physiology		
Batch 2020-2021	Semester IV	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To get knowledge about the nutrition and feeding mechanism
2. To understand the structure and functions of various organ systems in the animal
3. To distinguish the interrelationship within physiological systems

Course Outcomes

K1 – K4	CO1	Explain and recognize the physiological structure and functions of various organs
	CO2	Apply anatomical knowledge in predicting the physiological consequences
	CO3	Describes physiological activity of organ system
	CO4	Distinguishes the types and functions of endocrine glands

SYLLABUS

UNIT I **15Hrs**

Nutrition and Respiration

Nutrition: Types of nutrition, feeding mechanisms, Digestion - extra cellular and intracellular. Metabolism of carbohydrates, protein and fats. Vitamins and minerals.

Respiration : Types of respiration, respiratory pigments, transport of gases, Bohr's effect, chloride shift.

UNIT II **15Hrs**

Circulation and Excretion

Circulation :

Types of heart, neurogenic and myogenic hearts. Blood and its composition, blood clotting pacemaker. Lymphatic system and its functions.

Excretion :

Nitrogenous waste products - Ammonotelism, Ureotelism and Uricotelism. Mammalian nephron, urine formation, hormonal control of renal function.Osmoregulation in freshwater, marine and terrestrial animals.

UNIT III **15Hrs**

Nerve Physiology

Structure and properties of nerve cell, Types of neurons, myelinated and non-myelinated nerve neurons. Origin and conduction of nerve impulse - structure of synapse, mechanism of interneuronal transmission, neuromuscular junction, neurotransmitters and reflex action.

UNIT IV **15Hrs**

Muscle Physiology

Structure, types and properties of muscles, muscle proteins, types of muscle contraction-isotonic, isometric contractions, Sliding filament theory of muscle contraction - chemistry and mechanism of muscle contraction.

UNIT V **15Hrs**

Endocrinology

Structure and functions of endocrine glands in Human- Pineal, Pituitary, Thyroid, Parathyroid, Islets of Langerhans, Adrenals, Testis and Ovary.

Teaching Methods: Power point presentation, Seminar, Assignment, Discussion, Quiz

Text Books

1. Verma, P. S. and Agarwal, V. K. (2016). Animal Physiology S.Chand & Company Ltd., New Delhi.
2. Goyal, K. A. and Sastry, K.V. (2012). Animal Physiology - Rastogi Publications, Meerut, India.

3. Christopher, D. Moyer and Patricia M. Schulte. (2007). Principles of Animal Physiology. 2nd Edition. Pearson. Benjamin - Cummings Publishing Company.

Reference Books

1. William S. Hoar, 1983. General and Comparative Physiology. Prentice Hall; 3rd Revised edition
2. Guyton and Hall, 2016. Text book of Medical Physiology- Elsevier Health – INR; second edition
3. David W Bishop & Prosser C Lodd. 2018 Edn., Comparative Animal Physiology, Franklin Classics Trade Press United States.
4. John E. Hall, Mario Vaz., Tony Raj & KurpadAnura2016.Guyton & Hall Textbook of Medical Physiology, 2n South Asia Edition, Elsevier India

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	S	S	S	S
CO2	M	H	H	S	H
CO3	H	S	S	H	S
CO4	H	H	H	S	S

S – Strong H – High M – Medium L – Low

Programme code :06		B.Sc. Zoology		
Course Code 20UZO4S2		Skill Based Subject 2- Health Education		
Batch	Semester	Hours / Week	Total Hours	Credits
2020-2021	IV	2	30	3

Course Objectives

1. To inculcate knowledge on health education and life styles
2. To create awareness about the importance of environment for healthy life
3. To educate the students in relation to health education programmes of Public importance.

Course Outcomes (CO)

K1– K4	CO1	Get knowledge about the concept of health
	CO2	Understand the role of Nutrition in Man
	CO3	Study various environmental pollution and diseases and their impacts on Man
	CO4	Create awareness on prevention and control ofdiseases

SYLLABUS

UNIT I **6Hrs**

Concept of health

Determinants of health- Indicators of Health- Personal hygiene- Public health- Concepts of disease- Agent - Host and Environment,Dynamics of diseasetransmission - Sources and routes of transmission- First Aid.

UNIT II **6Hrs**

Nutrition and health

Proteins, Carbohydrates, Fat, Trace elements- Food hygiene- Energy requirements - balanced diet – Malnutrition*.

UNIT III **6Hrs**

Environment and health

Air, Water,Soil pollutions and their effects on health.

UNIT IV **6Hrs**

Communicable diseases

Viral and bacterial disease (Acquired immune deficiency syndrome (AIDS), Mumps, Tuberculosis, Typhoid)

Non communicable diseases

Diabetes, Cancer, Heart and Kidney problems.

Vector- borne diseases

Dengue, Malaria

UNIT V **6Hrs**

Health care of the community

Health care services and Health programmes in India

*** Self-study (Questions may be asked from these topics also)**

Teaching Methods: Over Head Projector, Power point presentation, Seminar, Assignment, Discussion, Quiz. e-content.

Text Books

1. Murgesh,N. (2008). Health Education and Community Pharmacy. Sathya Publishers, Madurai.
2. Srilakshmi, B. (2011). Human Nutrition Dietetics –New Age International Publishers,6th edition

Reference Books

1. Robert, (2001).Hand book of Pollution, control processes. Noyesjaico publishing house, Mumbai.
2. Jill Varnes and Stephen, D.C. (2000). Health. Bud Getchell, Rurtypipin. Health and Company, Massachusetts.
3. A text book of Health Education, Health Care System and First Aid. (2019). Samiksha Publication .ISBN9789937710.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	S	M	H	M
CO2	S	M	H	S	H
CO3	M	H	S	H	S
CO4	S	S	H	M	H

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

Programmecode : 06		B.Sc.Zoology		
Course Code 20UZO4CM		Core Practical II – Cell and Molecular Biology and Physiology		
Batch 2020-2021	Semester IV	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To impart the practical knowledge on hematological studies

2. To understand mitotic and meiotic cell divisions

3. To know the principles of biomedical instrumentation and osmoregulation

Course Outcomes (CO)

K2 – K5	CO1	Understand the significance of osmoregulation
	CO2	Apply basic principles of hematological and cell studies
	CO3	Analyse the principles and uses of bioinstrumentation in medical laboratory
	CO4	Evaluate the importance of blood cell counts

Teaching Methods: Demonstration, Charts, Models.

SYLLABUS

1.Total RBC count in human blood.

2. Total WBC count in human blood.

3. Preparation of haemin crystal in human blood.

4. Preparation of blood smears (human) and observation on types of leucocytes.

5. Estimation of O_2 consumption in fish

6. Salivary amylase activity in human saliva.

7. Estimation of haemoglobin in human blood.

8. Blood grouping A, B, AB and O with Rh factor.

Cell Biology:

1. Squash preparation of onion root tip to observe mitotic stages.
2. Preparation of Buccal smear (human) to observe Barr body.

Spotters:

1. Stages of mitosis.
2. Stages of meiosis.
3. Haemocytometer.
4. Haemoglobinometer.
5. Anti-A & B serum.
6. DNA model.
7. Sphygmomanometer.
8. Glucometer.
9. Columnar epithelium
10. Ciliated epithelium.
11. Cardiac muscle TS.
12. Bone tissue TS.
13. Simple squamous epithelium.
14. Nervous tissue.
15. Frog – Blood smear .

MODEL QUESTION PAPER FOR CORE PRACTICAL II

CIA PRACTICAL EXAM

Model Practical Exam	=	25 Marks
Observation Note	=	10 Marks
Attendance	=	5 Marks
Total	**=**	**40Marks**

END OF SEMESTER EXAMINATION

Time-3Hours **MaxMarks-60**

Q I: Major Experiment	-	20Marks
Q II : Minor Experiment	-	15 Marks
Q III : Spotters 3x5	-	15 Marks
Q IV : Record	-	10 Marks
Total	**-**	**60 Marks**

Programme code - 06	B.Sc Zoology			
Course code 20UWR4N2	Non- Major Elective - II "Women's Rights"			
Batch 2020 - 2021	Semester IV	Hour/Week 2	Total hours 30	Credit 2

Objectives

1. To impart specific and up-to-date information about national and international laws related to the welfare of women.
2. To create awareness about crimes against women, legal rights of women in the country and access to justice.

UNIT I Laws, Legal Systems and Change 6 Hrs

Definition - Constitutional law, CEDAW and International Human Rights – Laws and Norms – Laws and Social Context – Constitutional and Legal Framework.

UNIT II Politics of Land and Gender in India 6 Hrs

Introduction – Faces of Poverty – Land as Productive Resources – Locating Identities – Women's Claims to Land – Right to Property - Case Studies.

UNIT III Women's Rights: Access to Justice 6 Hrs

Introduction – Criminal Law – Crime Against Women – Domestic Violence – Dowry Related Harassment* and Dowry Deaths* – Molestation – Sexual Abuse and Rape – Loopholes in Practice – Law Enforcement Agency.

UNIT IV Women's Rights 6 Hrs

Violence Against Women – Domestic Violence - The Protection of Women from Domestic Violence Act, 2005 - The Marriage Validation Act, 1982 - The Hindu Widow Re-marriage Act, 1856 - The Dowry Prohibition Act, 1961

UNIT V Special Women Welfare Laws 6 Hrs

Sexual Harassment at Work Places – Rape and Indecent Representation – The Indecent Representation (Prohibition) Act, 1986 - Immoral Trafficking – The Immoral Traffic (Prevention) Act, 1956 - Acts Enacted for Women Development and Empowerment - Role of Rape Crisis Centers.

*** Self-study (Questions may be asked from these topics also)**

Teaching Methods: Over Head Projector, Power Point Presentation, Seminar, Assignment, Discussion, Quiz.

Prescribed Book

Women's Rights Compiled by Kongunadu Arts and Science College, Coimbatore-29.

Reference Books

1. NityaRao "Good Women do not Inherit Land" Social Science Press and Orient Blackswan 2008
2. International Solidarity Network "Knowing Our Rights" An imprint of Kali for Women 2006
3. P.D. Kaushik "Women Rights" Bookwell Publication 2007
4. Aruna Goal "Violence Protective Measures for Women Development and Empowerment" Deep and Deep Publications Pvt. 2004
5. Monica Chawla "Gender Justice" Deep and Deep Publications Pvt. Ltd.2006
6. Preeti Mishra "Domestic Violence Against Women" Deep and Deep Publications Pvt. 2007
7. Clair M. Renzetti, Jeffrey L. Edleson, Raquel Kennedy Bergen, Source Book on "Violence Against Women" Sage Publications 2001.

NON-MAJOR ELECTIVES I & II

(2012 - 2013 onwards)

QUESTION PAPER PATTERN

Duration: 3 Hours Max. Marks: 75

Answer ALL Questions

SECTION A (5 x 5 = 25 marks)

Short answers, either or type, one question from each unit.

SECTION B (5 x 10 = 50 marks)

Essay type questions, either or type, one question from each unit.

UZO 45

Programme Code : 06	B.Sc Zoology		
	Non- Major Elective – III Consumer Affairs		
Batch 2020-21	Hours/Week 2	Total Hours 30	Credits 2

Course Objectives

1. To familiarize the students with their rights and responsibilities as a consumer.
2. To understand the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.
3. To have a handle the business firms' interface with consumers and the consumer related regulatory and business environment.

UNIT I **15 Hours**

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

UNIT II **15 Hours**

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District

Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III **15 Hours**

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT IV **15 Hours**

Role of Industry Regulators in Consumer Protection

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman
iii. Telecommunication: TRAI
iv. Food Products: FSSAI
v. Electricity Supply: Electricity Regulatory Commission
vi. Real Estate Regulatory Authority

UNIT V **15 Hours**

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings. Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview.

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

Suggested Readings

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :- www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook, www.bis.org
10. The Consumer Protection Act, 1986 and its later versions.

Programmecode : 06	B.Sc Zoology			
Course code 20UZO505	Core Paper - 5- Genetics			
Batch 2020-2021	Semester V	Hour/Week 5	Total hours 75	Credit 4

Course Objectives

1. To make the students to develop a comprehensive knowledge of pioneers and their contributions to genetics
2. To make the students understand various principles of heredity.
3. To create the knowledge about the application of genetic principles in different populations.

Course Outcomes

K1 – K4	COI	Get knowledge about the Mendelian principles in dominance and Co- dominance.
	CO2	Understand the genetic linkage, crossing over and sex- linked inheritance in animals
	CO3	Analyze the Genetic disorders in Man
	CO4	Evaluate the need of genetic counseling and its significance.

SYLLABUS

UNIT-I **15Hrs**

Mendelian principles: Mendel's monohybrid and dihybrid experiments. Interactions of genes: Incomplete dominance, co-dominance, complementarygenes, supplementary genes and duplicate genes. Multiple alleles with examples: Drosophila, coat colour in rabbit. Human blood group inheritance: ABO, Rh factor.

UNIT-II Linkage and Crossing over 15Hrs

Chromosome theory of Linkage, kinds of linkage, types of Crossing over, , kinds of Crossing over, theories about the mechanism of Crossing over, cytological detection of Crossing over, significance of Crossing over. Sex determination in Man and *Drosophila melanogaster*.

UNIT-IIIHuman Cyto-Genetics 15Hrs

Modern concept of gene, split gene, Fine structure of gene (cistron, muton and recon). Human karyotype, Banding techniques, use of Human cyto-genetics in medical science, Gene mutation, mutagenesis and chromosomal aberration.Detection of mutation by CLB Method. Mutagens:Physical and chemical.

UNIT-IV Genetic Disorders 15Hrs

Sex linkage in Man; Colour blindness, Haemophilia.Gene - protein relationship with reference to sickle cell anemia. Genetic disorders in Man: Klinefelter's syndrome, Down syndrome and Turner's syndrome. Biochemical Genetics: phenylketonuria, albinism, alkaptonuria

UNIT-V Population Genetics 15Hrs

Polymorphism - phenotypic & genotypic polymorphisms, transient polymorphism, balanced polymorphisms. Hardy-Weinberg Law. Inbreeding & out breeding - inbreeding co-efficient, genotype frequencies under inbreeding, uses & effects of inbreeding in farm animals, genetic consequences of inbreeding, reasons for inbreeding. Eugenics and Genetic counseling*.

*** Self-study (Questions may be asked from these topics also)**

Teaching Methods: Power Point Presentation, Seminar, Assignment, Discussion, Quiz, E-content.

Text Books

1. Veer Bala Rastogi (2010). A text book of Genetics. KedarnathRamnath, New Delhi.
2. Verma, P.S and Agarwal V.K. (2007).Genetics. S.Chand and Company Pvt. Ltd, New Delhi.
3. Genes - VIII (2003) by Lewin B Oxford University Pres

Reference Books

1. Sinnot, E.W. Dunn. L.C. Dobzhausky (2004).Principle of Genetics. McGraw Hill Book Company, New York
2. Robert .H . Lewin(2002), Principles of Genetics. Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
3. Peter Snustad.D and Michael J. Simmons(2011).Principles of Genetics. Wiley Publishers.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	S	S	M	H
CO2	M	H	M	S	M
CO3	S	H	M	H	S
CO4	H	S	H	H	H

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

Programme code : 06	B.Sc. Zoology			
Course code 20UZO506	Core Paper -6- Evolution			
Batch 2020 - 2021	Semester V	Hour/Week 5	Total hours 75	Credit 5

Course Objectives

1. Obtain the knowledge of animal behavior
2. Understand the concept of biological clock and circadian rhythm
3. Students can learn the processes of origin of life

Course Outcomes

K1 - K4	COI	Get knowledge about the chronology of animals
	CO2	Understand the modern synthetic theory of evolution
	CO3	Apply the reproductive behavior of animals
	CO4	Analyze the significance of geological time scale

Teaching Methods: Over Head Projector, Powerpoint presentation ,Seminar, Smart class, Assignment, Discussion, Quiz.

SYLLABUS

UNIT -I **15Hrs**

Introduction, Historical aspects of Evolutionary Concept , Origin of life , Zoological time Scale*****. Living Fossils

UNIT-II **15Hrs**

Evidences of Evolution - morphological, anatomical, embryological and biochemical. Theories of evolution - Lamarkism, Darwinism and De Vries, Mutation theory.

UNIT-III **15Hrs**

Theories of Evolution- Lamarckism Neolamarckism –Darwinism –NeoDarwinism/ Modern concept of natural selection –Species Concept –Orgin of species and Isolating Mechanisms.

UNIT-IV **15Hrs**

Convergent and parallel evolution, Micro and macro evolution , Adaptive radiation , Mimicry and colouration .Phylogenetic Trees of Invertebrates and Vertebrates .

UNIT- V **15Hrs**

Evolution Horse, Evolution Elephant, Evolution Man and Animal Distributions.

*** denotes Self study**

Teaching Methods: Over Head Projector, Power point presentation, Seminar, Assignment, Discussion, Quiz.

Text books

1. Gopalakrishnan.T.S ITTA Sambasiviah , A.P Kamalakara Rao ,(1970) Principles of Organic Evolution Pearl Publications, Madras-40.

2. Veer Bala Rastogi (2016). Organic Evolution –.Kedarnath Ramnath Publishers. Publisher: Medtech.

3. Arumugan N. (2017), Organic Evolution –Saras Publication

Reference Books

1. Minkoff .E.C (1983).Evolutionary Biology ,Addition Wesley Publisheres.
2. Dobzhansky (1977). Evolution –W.H Freeman and Co San Francis CO.
3. Gupta P.K (1988) Cytology ,Genetics & Evolution (5 th Edition) Rastogi Publications Shivaji road Meerut. -250002,India.

MAPPING

PSO / CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	H	H
CO2	H	S	H	H	H
CO3	S	H	H	H	H
CO4	H	H	H	S	H

S – Strong H – High M – Medium L – Low

Programme Code : 06	B.Sc, Zoology			
Course code 20UZO507	Core Paper - 7 – Ecology			
Batch	Semester	Hour/Week	Total hours	Credit
2020-2021	**V**	**5**	75	4

Course Objectives

1. To know the fundamental principles that govern the functioning of the environment.
2. To understand the concept of ecosystem and balance of nature.
3. To assess the relationship between environment and organisms.

Course Outcomes

K1 - K4	COI	Get knowledge about the ecological studies and their significance
	CO2	Understand the interlink between living and nonliving resources for an ecosystem management
	CO3	Acquire knowledge on Community and Habitat ecology at different geographical regions to enhance species specific management
	CO4	Analyze the ecological significance and their management

SYLLABUS

UNIT I **15Hrs**

Introduction to environment

Abiotic factors of the environment - Temperature, Light, Oxygen, Carbondioxide, Radiation and biological rhythm. Biotic factors of the environment: Commensalism, Symbiosis, and mutualism, Parasitism.

UNIT II **15Hrs**

Ecosystem

Components of an Ecosystem, pond as an example of Ecosystem - Food chain- Food web- Ecological pyramid and energy flow.

UNIT III **15Hrs**

Biogeochemical cycle

Water, Nitrogen, Phosphorus*, Oxygen, Carbondioxide and Sulfur .

Population ecology

Density- Natality- Mortality- Age distribution-Population growth and Dispersal.

UNIT IV **(15Hrs)**

Community ecology

Characters- Structure- Dominance- Stratification- Periodicity- Ecotone- Edge effect-Ecological niches and Ecological succession.

UNIT V **(15Hrs)**

Habitat ecology

Zonation-Characters-Flora and Fauna and their adaptation of aquatic habitats - fresh water, estuary and marine.

Terrestrial habitat

Physico-chemical characteristics - Forests, tundra, grasslands and deserts.

*** Denotes Self study**

Teaching Methods: Over Head Projector, Power point presentation, Seminar, Assignment, Discussion, Quiz.

Teaching Methods: Power point presentation/ Seminar/ Discussion/ Quiz

Text Books

1. Jeyaraj M. S. and Veerbala Rastogi. (2013). Animal ecology and Distribution of Animals, KedarnathRamnath publishers, Meerut, Delhi.
2. Arumugam, N. (2010). Concepts of Ecology by, Saras publications, Tamil Nadu.
3. Odum, E.P. (1969). Fundamentals of Ecology. W.B. Saunders publications, London.

Reference Books

1. Verma P. S. and V. K. Agarwal (1999). Environmental Biology. S. Chand & co, New Delhi
2. Sharma, P. D. (2000). Ecology and Environment - RostogiPublications, Meerut, India.

3. Agarwal, K. C. 1987. Environmental Biology - Agro Botanical Publisher, India.
4. Agarwal, V. K. and Usha Gupta. (2002). Ecology and Ethology - S.chand and Company Ramnagar, New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	M	H	S	H	M
CO2	S	M	H	S	H
CO3	H	S	H	S	H
CO4	H	H	M	M	H

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

Programme Code:06		B.Sc. Zoology		
Course Code 20UZO508		Core Paper- 8 – Biostatistics and Bioinformatics		
Batch 2020-2021	Semester V	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To provide the fundamental knowledge on statistics in biology.
2. To enhance the knowledge on statistical use, interpret results using descriptive statistical methods and analysis of significance level.
3. To learn the biological databases and apply bioinformatics tools.

Course Outcomes

K1 – K4	CO1	Get awareness in the data collection, analysis and interpretation of results.
	CO2	Understand the significance of biostatistics on biological sciences and also applied in research work.
	CO3	Apply fundamental knowledge on principle's and applications of instruments and its usage in projects.
	CO4	Analyze the role of computer applications and bioinformatics tools in biological data interpretation.

UNIT I **15 Hrs**

Data Collection- Classification - Primary and secondary data, Tabulations, Diagrammatic representation of data- Bar diagram, Pie diagram, Graphical presentation of data - Histogram, Frequency polygon, Frequency curve, Ogive, Pictograph.

UNIT II **15 Hrs**

Measures of Central Tendency - arithmetic mean, median and mode. Merits and demerits. Measures of dispersion - Standard deviation, standard error and Student's t- test.

UNIT III

ANOVA - one way and two way and Statistical package, Chi square test.

UNIT IV **15 Hrs**

Definition to Bioinformatics, Scope and Application of Bioinformatics, Systems Biology, Human genome project.

UNIT V **15 Hrs**

Introduction to database, DNA, Protein, Nucleic acid sequence database,Genbank, EMBL, UCSC, Swiss-port, PDB, Multiple sequence alignmentClustal W, FASTA,BLAST, PHYLIP

Teaching Methods: Power Point Presentation, Seminar, Assignment, Discussion, Quiz.

Text Books

1. Gurumani, N. 2015. An Introduction to Biostatistics. 2nd Edition,MJP Publisher, Chennai
2. Gupta S.P. 2006. Statistical methods. Sultan Chand and sons- 23, Educational publishers, Daryagans, New Delhi- 110002.
3. Attwood. T., 2007. Introduction to Bioinformatics. Pearson Education; 1st Edition
4. Rastogi, S. C., Parag Rastogi, Namita Mendiratta. 2008. Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery 3rdEdition, PHI Learning Pvt. Ltd., .

Reference Books

1. Jerrold H. Zar., 2010. Biostatistical Analysis. Prentice Hall Publication, 5th Edition.
2. Pillai, R.S.N. and Bhagavathi, V. (2001). Statistics, S.Chand and Co., New Delhi-5.
3. Prasad.S.(2004). Elements of Biostatistics Rastogi Publications, Meeruit, India.
4. Rajaram V. (2006).Fundamentals of computers, 4th edition. Prenlice Hall of India, Private Ltd- New Delhi- 110001.
5. Bioinformatics for beginners. (2014). SupratimChoudhuri, Tokyo Academic Press.

UZO 59

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	H
CO2	H	H	H	H	H
CO3	H	H	S	H	S
CO4	S	M	H	S	S

S – Strong **H** – High **M** – Medium **L** – Low

UZO 60 20UZO5EI

Programme code: 06	B.Sc. Zoology		
	Major Elective Paper 3 – Economic Zoology		
Batch 2020-2021	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To get knowledge about sustainable agriculture, organic farming and waste management by using Vermitechnology.
2. To understand the rearing and harvesting techniques in sericulture, apiculture and lac culture.
3. To inculcate knowledge on Aquaculture, Poultry and Animal husbandry aspects.

Course Outcomes

K1 – K4	CO1	Get knowledge about the characteristics and role of earthworm in sustainable agriculture.
	CO2	Understand the problems in Sericulture, apiculture and lac culture.
	CO3	Apply the knowledge on disease management in the field of poultry and animal husbandry.
	CO4	Analyze the economic importance of Apiculture, Lac culture, Poultry and aquaculture.

SYLLABUS

Unit I: Vermiculture **12 Hours**

Vermiculture –Classification of earth worms, Vermicomposting and their advantages, role of earthworms in sustainable agriculture and organic farming, Miscellaneous uses of earthworms (Poultry, Fisheries and Medicine).

Unit II: Sericulture **12 Hours**

Types of silkworms - Life cycle - Rearing methods - Harvesting –Diseases of Silkworm- Problems in sericulture- Economic importance of Sericulture- Marketing of Cocoons- Role of women in Sericulture.

Unit III: Apiculture and Lac culture **12 Hours**

Types of honey bees- Diseases and pests of bees and Lac insects -Harvesting and processing of honey and Lac -Marketing of honey and Lac -economic importance of apiculture and Lac culture.

Unit IV: Fisheries and Aquaculture **12 Hours**

Fishery resources in India, Economically important aquatic floral and faunal resources, value added fish and fishery products, opportunities in seafood exports, Importance of fisheries (capture, culture and ornamental) sector in Indian economy, Fisheries national income in India-Fisheries an alternative livelihood in India.

Unit V: Poultry farming **12 Hours**

Types of birds for poultry - Diseases and pests of bird – Lighting- Egg and meat production -poultry feed - Economic importance of poultry keeping.

Animal husbandry

Types of animals for animal husbandry - Diseases and pests of animals - milk and meat production and processing - Economic importance of animal husbandry*

***Self study (Questions may be asked from these topic also)**

Teaching methods

Over Head Projector/ Power Point presentation/ Seminar/ Assignment/Quiz

Text Books

1. Shukla, G.S and V.B. Upadhyay.(2016). Economic Zoology, 4 th Reprint (5th Edition). Rastogi Publication, Meerut.
2. Ayyappan, S, Jena,J.K, Gopalakrishnan, Aand A. K. Pandey. (2011). Handbook of fisheries and aquaculture. Indian Council of Agricultural Research. Directorate of Information and Publications on Agriculture, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi, India.
3. G.Ganga,J. Sulochana Chetty.(2017). Introduction to Sericulture, Oxford &Ibh Publishing Co Pvt Ltd.

Reference Books

1. NPCS Board of Consultants and Engineers. (2004). The Complete Technology book on Vermiculture and Vermicompost. Asia pacific Business Press. Inc. ISBN : 9788178331362.
2. ManjuYadav. (2003). Economic Zoology, Discovery Publishing House, New Delhi.
3. LokeshwarR. (2002). Hand Book of Animal Husbandry, ICAR, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	H	S
CO2	H	S	M	M	H
CO3	H	H	S	S	H
CO4	M	H	S	H	M

S – Strong **H** – High **M** – Medium **L** – Low

Programme code - 06	For All UG Programmes			
Course code - 20UZO5X1	Human Anatomy (EDC)			
Batch	Semester	Hour/week	Total hours	Credit
2020-2021	5	2	30	3

Course objectives:

1. To make the students to learn about the human body from cellular to system level.
2. To set a strong base for the biology related courses for other major students.
3. To motivate the students to pursue healthcare / bioinspired courses related higher studies and research.

Course outcomes:

Knowledge Level	Course Outcomes	
K1 – K4	CO1	Learn the different organ system of the human body
	CO2	Equipe the knowledge with structure of different organ system of the human
	CO3	Apply the knowledge gained on anatomy of human organ system in the healthcare
	CO4	Analysing the role of each organ system for the healthy life.

SYLLABUS

Unit 1: Integumentary, Skeletal and Muscular system 6 Hrs

Anatomy of generalized cell, Structure of the basic tissues - Epithelial tissue, skin, connective tissue, muscle tissue - Axial muscles, nervous tissue, structure and classification of bones.

Unit II: Digestive system 6 Hrs

Structure of Alimentary canal – Buccal cavity, oesophagus, pharynx, stomach, small intestine, microvilli, large intestine, rectum, structure of teeth and salivary glands. Accessory organs -liver and pancreas.

Unit III: Circulatory and Respiratory system 6Hrs

Circulatory system: Anatomy of heart, chamber, valves and associated vessels, contractile cells, composition of blood, differences in arteries, veins and capillaries. Structure of lymphoid organs.

Respiratory system: Anatomy of respiratory system – Nasal cavity, pharynx, larynx, trachea, pleura, Lungs - location, lobes and surfaces.

Unit IV: Nervous system and Sensory organs 6 Hrs

Nervous system: The anatomical and functional classification of nervous system, neurons, four major regions of brain, protection of the Central nervous system, cranial reflexes, comparison of the peripheral and autonomic nervous systems.

Sensory organs: Anatomy of the eyes and ear.

Unit V: Urinogenital Systems 6 Hrs

Excretory system: Anatomy of kidney – ultra structure of glomerulus - Ureter, urinary bladder and urethra.

Reproductive Systems: Male reproductive system – structure of testis and duct system, Prostate gland. Female reproductive system - Structure of ovaries and duct system. Structure of ovary, uterus, mammary gland and vestibular glands.

Text Books:

1. Vander, J, James H. Sherman, Dorothy Vander Lucianao. (2000). Human Physiology: The Mechanism of Body Function, McGraw Hill International publication.

2. Frederic, H. Martini, Judi L Nath, Edwin F. (2018). Bartholomew “Fundamentals of Anatomy and Physiology” Pearson Education.

3. Elaine N. Mariesh, Suzanne M Keller. (2018).“Essentials of Human Anatomy and Physiology” Pearson Education.

Reference Books:

1. Faller, A., Schuenke, M. (2004). The Human Body: An introduction to structure and function, Thieme, Stuttgart.

2. Gerard J. Tortora and Bryan Derikson. (2011). Principles of Anatomy and Physiology, 13th Edition, John Wiley and Sons, Inc publication.

3. Chaurasia's B.D. (2019) Human Anatomy, 8th Edition, CBS publisher.

MAPPING

PSO / CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	H	S
CO2	S	M	H	S	H
CO3	S	H	H	H	M
CO4	H	S	M	S	H

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

Programme Code: 06		B.Sc. Zoology		
Course Code 20UZO609		Core Paper 9 – Microbiology and Immunology		
Batch	Semester	Hours / Week	Total Hours	Credits
2020-2021	VI	4	60	4

Course Objectives

1. To update basic knowledge on microorganisms.

2. To understand the economic importance of microbes in relation to agriculture, industry and medicine.

3. To analyze and inculcate the fundamental knowledge on immune system and immunological responses to antigens.

Course Outcomes

K1 – K4	CO1	Make awareness about the morphology, taxonomy and culture methods of microbes.
	CO2	Uptain knowledge on microbes of biosphere.
	CO3	Understand the microbial diseases, causative organisms and their control measures.
	CO4	Study the immune systems and immune responses.

SYLLABUS

UNIT I **12 Hrs**

General bacteriology - Bacterial morphology, Structure, Identification and staining - Culture methods - Bacterial taxonomy.

UNIT II **12 Hrs**

Morphology and chemical properties and classification of virus-ultra structure of a bacterio phage - Lytic and lysogenic cycle of bacteriophage - (In Medicine, Industry, Agriculture), Microbiology of water, soil and air, Quantification of microbes.

UNIT III **12 Hrs**

Microbial Disease of Man

Causative organisms: Basic structure, Toxicity, symptoms and preventive measures; Protozoan diseases*, Typhoid, Diphtheria, Whooping cough, Pneumonia, Poliomyelitis, AIDS.

UNIT IV **12 Hrs**

Cells and Organs of Immune System cells of the Immune system

Cells of lymphoid and myeloid lineage. Primary lymphoid organs (thymus, bone marrow) Secondary lymphoid organs (lymph node, spleen, mucosal associated lymphoid tissue)

Types of immunity: Innate immunity and acquired immunity.

UNIT V **12 Hrs**

Antigen and antibody, structure, functions and interactions. Immune Response: Primary and secondary, cell mediated and humoral immunity, Vaccination preparation types. Complements-types, Salient features and functions.

*** Denotes Self study**

Teaching Methods : Power point presentation/Seminar/ Assignment /Discussion/Quiz

Text Books

1. Pelczar J. (1993).Microbiology-MichaelMC Grand Hillpublications,Chennai.
2. Dulsy Fatima &Arumugam.N(2000). Immunology- Saras Publication, Nagercoil.
3. Power C.B.and Daginawala.H.F (1984). Microbiology- Himalaya Publishing houses Bombay.
4. Duby. J (1999). Immunology – - W.G. Freeman & Co, New York.

Reference Books

1. Prescott, Joanme M Willey, Linda M. Sherwood, Christoper J. (2011) Microbiology, 8th edition. Mcgrraw Hill international edition.
2. Brock. Madigon, Martinko, Parker (1997). Biology of Microorganisms, 8th edition, Prestice Hall International INC.
3. Roger. Y.Stanier (1992). General Microbiology- Macmillan Publications, London.
4. Casida. L.E (2007). Industrial Microbiology Newage International (P) limited, New Delhi.
5. Satish Gupte, Jaypeebrothers (2006). The short text books of Medical Microbiology Medical Publishers (P) Ltd - Culcutta.

6. Tizard. I. R. (1995). Immunology: Introduction, 4th Edition. Saunders College Publishing, Philadelphia

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	H
CO2	H	H	H	H	H
CO3	H	H	S	H	S
CO4	S	M	H	S	S

S – Strong H – High M – Medium L – Low

Programme Code : 06		B.Sc., Zoology		
Course Code 20UZO610		Core Paper 10 – Biotechnology		
Batch	Semester	Hours / Week	Total Hours	Credits
2020-2021	VI	5	75	4

Course Objectives

1. To get knowledge about application oriented aspects

2. To provide a platform to learn the deliberate use of living organisms for human welfare

3. To study the importance of Industrial Biotechnology

Course Outcomes

K1 – K5	CO1	Understand the Basics of Genetic Engineering
	CO2	Understand the techniques of cloning
	CO3	Get knowledge on Gene transfer tehcniques
	CO4	Apply the knowledge gained on Industry

SYLLABUS

Unit-I: Tools of Genetic Engineering **15 hours**

Basic principles - mechanism of natural gene transfer by Agrobacterium, generation of foreign DNA molecules, restriction enzymes, ligase, linkers, adapters, enzymes used in genetic engineering, cloning vectors and their properties, cosmids.

Unit-II : DNA Cloning and Sequencing **15 hour**

Cloning strategies - cloning with single strand DNA vectors, cDNA cloning and gene libraries, recombinant selection and screening methods, shuttle vectors, DNA sequencing strategies - Sanger's and Maxam - Gilbert's methods, applications of PCR, Southern, Northern and Western blotting.

Unit-III : Gene Transfer and Applications **15 hours**

Techniques of tissue culture-culturing explants and haploids, protoplasts fusion and embryoids, methods of gene transfer to animals, gene knockouts and transgenic animals, animal pharming and xenogarfting, biodegradation, bioleaching.

Unit-IV: Industrial Biotechnology and Gene therapy 15 hours

Applications of biotechnology-industrial biotechnology-fermentors, principle, types product recovery and purification of ethanol, enzyme biotechnology-production and uses of industrially important enzymes such as protease, waste treatment, bioenergy and biogas production. Gene therapy (somatic)-the principle and approaches.

UNIT-V: BIOSAFETY AND BIOETHICS 15 hours

Biotechnology - potential hazards, biological weapons, human genome research - the objectives and approaches, genomics and genome prospecting - the controversies, issues of biotechnology-social and scientific, technology protecting systems and the terminator, IPR, its concepts and conditions -patenting of genes, cells and life forms, evaluation of life patenting.

Teaching Methods: Over head projector, Power Point Presentation, Seminar, Assignment, Discussion and Quiz.

Text books

1. Kumaresan, V. (2009), Biotechnology. Saras Publications, Kanyakumari.
2. Glick, J. and Jack J. Pasternak, (2010),Molecular Biotechnology-Bernard American Society for Microbiology, 4th edition, Canada.
3. Satyanarayana, U. (2008).Biotechnology –Books and Allied Ltd.

Reference Books

1. Genes - VIII (2003) by Lewin B Oxford University Press.
2. Sadasivam, S. (2004).Biochemical methods - New Age International Publications.
3. Jogdand, S. N. (2005).Advances in Biotechnology -Fifth revised edition Published by Himalaya publishing house.
4. Brown, T. A. (2001). Gene cloning and DNA analysis - Fourth edition Blackwell Publishing.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	H	S	S	M
CO2	S	M	H	M	H
CO3	M	S	M	H	S
CO4	S	H	H	M	M

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

Programme Code : 06		B.Sc. Zoology		
Course Code 20UZO611		Core Paper- 11 – Developmental Biology		
Batch	Semester	Hours / Week	Total Hours	Credits
2020-2021	VI	5	75	4

Course Objectives

1. To get knowledge about theories of development and gametogenesis
2. To study the process of fertilization and cleavage of animals
3. To understand the embryonic developmental stages and extra embryonic nutrition of animals

Course Outcomes

K1 - K4	COI	Study the laws and theories of development and gametogenesis.
	CO2	Understand the process and different methods of fertilization.
	CO3	Apply the knowledge on various developmental stages of animals.
	CO4	Analyze the importance and knowledge on embryonic nutrition.

SYLLABUS

UNIT-I Theories of Development **15Hrs**

Theory of Preformation, Theory of Epigenesis, Theory of Pangenesis, Von Baer's law, Biogenetic law, Germplasm theory, Mosaic theory, Regulative theory, Gradient theory and Theory of Organizer.

Gametogenesis - Spermatogenesis, Oogenesis,

UNIT II Fertilization **15Hrs**

Sexual cycles, Theories of fertilization, physico-chemical aspects of fertilization,Birth control, Types of egg, polarity – Symmetry

Cleavage

Planes of cleavage - Patterns of cleavage - Laws of cleavage. Patterns of cleavage as illustrated in Amphioxus, Frog, chick and pig.

UNIT IIIBlastulation **15Hrs**

Blastulation, - Types of blastula, Fate maps

Gastrulation

Morphogenetic movements - Gastrulation in Frog and Chick.

UNIT IV Organogenesis in frog **15Hrs**

Development of Brain, Eye, Ear, Heart, Hormonal control*.

Embryonic Nutrition

Extra embryonic membranes in chick and Pig. Placentation in mammals.

UNIT V Experimental Embryology **15Hrs**

Gradient theory and Spemann, s experiments on organizer.

Clinical embryology

In Vitro fertilization (IVF), Artificial insemination and Embryo transfer, Cryopreservation,

Stem cells - Definition and basic aspects.

*** Self-study (Questions may be asked from these topics also)**

Teaching Methods:

Chalk and Talk, Power Point Presentation, Seminar, Assignment, Discussion, Quiz.

Text Books

1. Sastry. K.V and V. Shukla.(2018).Developmental Biology, Second Revised Edition, Rastogi Publications, Meerut, U.P.
2. VermaP.S. V.K. Agarwal(2012). Chordate Embryology. S. Chand Company Ltd., New Delhi.
3. Subramanian. M.A (2012). Developmental Biology. MJP Publishers, Chennai.

Reference Books

1. Michael J. F.Barresi and Scott. F. Gilbert(2019).12th Edition, Developmental Biology. Sinauer Associates Inc.
2. Balansky B.I and B.C. Fabian(2012). 5th Edition, An Introduction to Embryology.Cengage learning India.
3. Beril D.B. (2002). Developmental Biology.Naeosa publishing house Pvt Ltd, New Delhi.
4. Carlson B.M .(2007). Foundation of Embryology. Tata Mc Graw Hill, New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	S	S	H	H
CO2	S	H	M	S	M
CO3	H	M	S	S	H
CO4	M	H	H	H	S

S – Strong **H** – High **M** – Medium **L** – Low

Programme Code : 06		B.Sc, Zoology		
Course Code 20UZO612		Core Paper 12 – Animal Diversity		
Batch	Semester	Hours / Week	Total Hours	Credits
2020 - 2021	VI	4	60	4

Course Objectives

1. To understand the present status of Fauna.
2. To create awareness on conservation of endangered species.
3. To understand the comparison of ancient and recent information about the biodiversity.

Course Outcome

K1	CO1	Get knowledge about the endangered and extinct species.
K2	CO2	Compare the ancient and recent information about biodiversity
K3	CO3	Apply the knowledge in Inventorying new species and find out the species extinction rate.
K4	CO4	Analyze the significance various ecosystem and conservation of biodiversity

SYLLABUS

UNIT I **12Hrs**

Biodiversity – Concept and Definition, Latitude and longitude diversity, Types of biodiversity – Problems inventorying species – Biodiversity Hot spots – Western Ghats. IUCN Threatened categories – Selected endangered animals of India.

UNIT II **12Hrs**

People's participation and moments in Biodiversity conservation – Causes of decline of biodiversity – Sustainable Development – Biogeographical Regions. Sacred groves, Stalavrikshas.Biopiracy. and Biodiversity laws.

UNIT III **12Hrs**

Processes responsible for species richness and extinction – Metapopulation concept – Current and future species extinction rates, Biodiversity Measurement. Ecosystem Diversity: Wetland ecosystem – Marine ecosystem – Estuarine ecosystem – Mangrove ecosystem, Ecology of Coral reefs.

UNIT IV **12Hrs**

Biodiversity Act. Conservation of Biodiversity: Invitro conservation – DNA barcoding – Test tube gene bank – Field gene bank — Future strategy for the conservation of Biodiversity, Animal Ethics

UNIT V **12Hrs**

Introduction to the study of Animal Behaviour – Branches of Ethology – Concepts of Ethology, Methods of Studing Behaviour . Mammalian Nervous system and Behaviour (With special Reference to Hypothalamus*).Hormones and Behaviour .Biological Clocks.

*** Self-study (Questions may be asked from these topics also)**

Teaching Methods: Over Head Projector, Power Point Presentation, Seminar, Assignment, Discussion Quiz.

Text books

1. Reena Mathur (2014) Animal Behaviour Rastogi Publications.Meerut.

2 Mohan .P (1995) Animal Behaviour Arrora Himalaya Publishing house .Mumbai

3. Gundevia H.S and Hare Govind Singh. (2009) Animal Behaviour- S.Chand limited

4.Krishnamoorthy. K. (2003). An advanced text book of biodiversity, Principles and practice., Oxford and IBH publication company Pvt. Ltd, New Delhi.

5.Kumar U. and Mahendrajeet Asija (2005). Biodiversity principles and conservation, Student edition, Jodhpur. India.

.

Reference Books

1.Ramamurthy Rallapalli and Geetha Bali, (2002). Biodiversity. APH Publishing Corporation, New Delhi.

2.Pullaiah, T . (2006). Biodiversity in India. Regency publication, New Delhi.

3. John Alcoc (2013), 10 th Edition, Animal Behaviour An Evloutionary Approach Sinauer associates.

4. Agarwal V.K, (2013) Animal Behaviour (Ethology).S. chand publishers

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	H	H	H
CO2	H	H	S	H	H
CO3	S	S	M	M	S
CO4	H	H	M	M	H

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

ProgrammeCode : 06		B.Sc., Zoology		
Course Code 20UZO6CN		Core practical 3. Evolution, Genetics, Microbiology and Immunology and Biotechnology		
Batch 2020-2021	Semester VI	Hours / Week 2	Total Hours 60	Credits 2

Course Objectives

1. To know the application of various techniques in genetic engineering
2. To Understand the Immunotechniques
3. To Understand the evolution of animals

Course Outcomes

K2 – K5	CO1	Understand more knowledge in the operations of advanced Biotechnological equipments
	CO2	Apply the products obtained through microorganisms
	CO3	Analyze practical information in animal cell culture and plant cell culture
	CO4	Evaluate the values of biofertilizers and biopesticides for the healthy society

SYLLABUS

1. Introduction of Microbiology, Laboratory Safety, Use of Equipment; Sterilization Techniques;
2. Sterilization techniques – dry heat, wet heat, chemical sterilization
3. Culture Media-Types and Use; Preparation of Nutrient broth and agar
4. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
5. Gram staining, Microscopy methods in the study of microorganisms – Working and care of Microscope
6. Isolation of pure cultures from soil, air and water samples
7. Antibiotic Sensitivity tests-disc method

8. Protein precipitation
9. Quality of milk
10. Isolation of DNA from goat liver
11. Estimation of protein of fish tissues
12. Estimation of carbohydrate from fish tissues
13. Gel electrophoresis
14. Agglutination test
15. Immunoelectrophoresis (DEMO)
16. Karyotyping

Spotters

I Evolutionary Significance

1.Vulture
2.Turtle andtartoroise (chelonmydas,Startoroise)
3.Fish (latimeria)
4. Reptiles (Sphenodon, Archaeopteryx)
5.Mollusca (Nautileus)

II Microbiology and Biotechnology

1. Electrophoretic instruments
2. Vaccine (viral)
3. Antibiotic (penicillin)
5. Plant saplings produced through plant tissue culture
6. Spirulina (SCP)
7. Biopesticides (Neem, Pongamia)
8. Biofertilizer (Azolla)
9. Mushrooms
10. Nitrogen fixing plant
11. Vermicompost
13. Cell culture media
14. Insulin (commercial)

MODEL QUESTION PAPER FOR CORE PRACTICAL IV

CIA PRACTICAL EXAM

Model Practical Exam = 25 Marks
Observation Note = 10 Marks
Attendance = 5 Marks
Total = 40Marks

END OF SEMESTER EXAMINATION

Time-3Hours **MaxMarks-60**

Q I: Major Experiment - 20Marks
Q II : Minor Experiment - 15 Marks

Q III :Spotters 3x5 - 15 Marks
Q IV :Record - 10 Marks
Total - 60 Marks

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	H	S	S	M	M
CO2	S	H	M	S	S
CO3	S	M	S	H	M
CO4	M	H	H	S	S

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

Programme Code :06	B.Sc, Zoology			
Course code 20UZO6CO	Core Practical 4. Ecology, Developmental Biology and Animal Diversity			
Batch	Semester	Hour/Week	Total hours	Credit
2020 -2021	VI	2	60	2

Course Outcomes

K2 – K5	COI	Get practical knowledge about the species identification, diversity and their ecological significance
	CO2	Understand about the species diversity and water pollution due to anthropogenic activity
	CO3	Apply practical knowledge on plankton analysis, sericulture, vermiculture, and pest management.
	CO4	Analyze about practical and filed knowledge in relation to environment management

SYLLABUS

I. Analysis of water – Pond and Sewage.

1. Estimation of dissolved oxygen
2. Salinity
3. pH
4. Carbonates and bicarbonates
5. Carbondioxide

II. Qualitative analysis of plankton (any five) & mounting.

III. Study of intertidal rocky, sandy and muddy shore fauna (any three examples) with their specific adaptations.

Developmental Biology

Frog embryology slides: Stages of cleavage – 2 cell stage, 4 cell stage, 8 cell stage, Blastula and Gastrula.

1. Chick embryology - Stages of development 24hr, 48hr, 72hr & 96hr.
2. Placenta of Pig, Sheep and Man.

Field Study

1. Visit to coastal area to study the intertidal fauna

Sericulture

1. Study of life history of *Bombyxmori* using live specimens.
2. Practical knowledge of methods of Silkworm rearing. Visit to Silkworm rearing center.
3. Assessment of cocoon characters- Shell ratio, Denier and Renditta.

Vermiculture

1. Rearing of earthworm.

Pests and Their Control

Spotters: Identify and comment on

1. Coconut pest
2. Brinjal pest
3. Mosquitoes (Adults of Culex and Aedes)
4. House fly
5. Bed bug
6. Head louse

Teaching methods :

Over Head Projector/ Power Point presentation/ Seminar/ Assignment/Quiz

UZO 81 20UZO6CO

MODEL QUESTION PAPER FOR CORE PRACTICAL III

Model Practical Exam	=	25 Marks
Observation Note	=	10 Marks
Attendance	=	5 Marks
Total	**=**	**40 Marks**

END OF SEMESTER EXAMINATION

Time- 3 Hours **Max Marks-60**

Q I : Major Experiment	-	20 Marks
Q II : Minor Experiment	-	15 Marks
Q III :Spotters 3x5	-	15 Marks
Q IV : Record	-	10 Marks
Total	**-**	**60 Marks**

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	M	S	M	H	S
CO2	H	S	S	M	H
CO3	H	H	H	H	H
CO4	S	M	H	S	H

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

MAJOR ELECTIVE PAPERS

1. Wild life Ecology and Management
2. Poultry science and management
3. Economic Zoology
4. Pests and their Management
5. Vermitechnology
6. Human genetics and Counselling

UZO 83

Programme Code: 06	B.Sc. Zoology		
	Major Elective 1 - Wild Life Ecology and Management		
Batch 2020 -2021	Hours / Week 3	Total Hours 45	Credits 5

Course Objectives

1. To understand and appreciate biodiversity and the Act to protect the wild species.
2. To learn different techniques to study wild life and develop knowledge of the benefits of ecosystem.
3. To get knowledge the about various methods to conserve biodiversity**.**

Course Outcomes

K1 - K4	COI	Explain the various components of an ecosystem
	CO2	Describe the wildlife management in India and National Parks and Sanctuaries.
	CO3	Analyze the Biodiversity hot spots, Endangered species and their Protection
	CO4	Evaluate the Wild life management Techniques and animal plant interaction.

SYLLABUS

UNIT I **9Hrs**

Ecosystem aquatic ecosystem- Pond, terrestrial ecosystem- forest trophic relations in ecosystems, food chain, food web, ecological pyramids. Biotic community and ecological niche.

UNIT II **9Hrs**

Wild life of India – Ecological sub regions of India. Endangered flora and fauna. Wild life management in India - Indian board for wild life. National parks and sanctuaries.

UNIT III **9Hrs**

Biodiversity

Biodiversity-kinds of biodiversity; Biogeography-continental shift, zoogeography, biodiversity hot spots*, endemicity; Endangered species

UNIT IV **9Hrs**

Field Sampling Techniques

Population estimation-concept, line transect, quadrate sampling; Basic methods in behavioral and food habit studies; Wildlife management techniques.

UNIT V **9Hrs**

Ecosystem Services

Animal plant interactions-pollinators, seed dispersal, biological pest control, vector; Wildlife products - food, medicine, Germplasm, domestication; Ecological balance - prey predator relationships.

***Self study (Questions may be asked from these topic also)**

Teaching methods :

Over Head Projector/ Power Point presentation/ Seminar/ Assignment/Quiz

Text Book:

1. Sharma P.D. (2009).Ecology and Environment. /10th Ed. Rastrogi publications. Meerut.
2. Hoselli BB (2008). Concepts in Wild Life Management Daya publishing house New Delhi 110002.

Text books

1. Aaradhana Salpekar(2013) Introduction to wildlife (Refrence, Hardcover, Aaradhana Salpekar), Published by Jnanada Prakashan, **ISBN-13:** 978-8171393985.
2. Mohan .P (1995) Animal Behaviour Arrora Himalaya Publishing house .Mumbai
3. Gundevia H.S and Hare Govind Singh. (2009) Animal Behaviour- S.Chand limited
4. Krishnamoorthy. K. (2003). An advanced text book of biodiversity, Principles and practice., Oxford and IBH publication company Pvt. Ltd, New Delhi.

5. Kumar U. and Mahendrajeet Asija (2005). Biodiversity principles and conservation, Student edition, Jodhpur. India.

Reference Books

1. Cody, M.L.and J.M Diamond (1975). Ecology and evolution of communities..Harvard University Press. Cambridge.
2. Giles.H. (1984).Wildlife Management Techniques. Natraj Publishers, Dehra Dun.
3. Gopal, R. (1992). Fundamentals of Wildlife Management.. Justice Home. Allahabad.
4. Agarwal V.K.and Usha Gupta. (2004). A biology of numbers and difference. Blackwell Science, Oxford. Ecology1st Ed. S.Chand and Company Ltd.New Delhi.
5. Asthana D.K. and Meerut Asthana. (2006). Environmental Studies. (Reprint 2007). S. Chand and company Ltd. New Delhi.
6. Madhab Chandra Desh and Sathya Prakash Desh. (2009). Fundamentals of Ecology. 3rd Ed. Tata McGraw Hill Education Pvt.Ltd. New Delhi

UZO 86

Programme code: 06	B.Sc Zoology		
	Major Elective Paper 2 –Poultry Science and Management		
Batch	Hour/Week	Total hours	Credit
2020-21	3	45	5

Course Objectives

1. To develop knowledge on the history and the role of poultry in rural development and its structure.
2. To learn the methods of rearing, breeding and production of poultry.
3. To get the knowledge about the preparation of feed, antibiotics, vaccines and marketing.

Course Outcomes

K1 – K4	COI	Get knowledge about the importance of poultry farming
	CO2	Understand the types of poultry breeding
	CO3	Apply the knowledge in types of incubators for poultry breeding
	CO4	Evaluate the importance of poultry marketing

SYLLABUS

UNIT I **9Hrs**

History and importance of Poultry farming, Role of the Poultry in rural development, employment potential, ***** Economics and contribution to national productivity, Egg production, manure as by-product. Physiology of poultry birds with reference to digestive and reproductive system.

UNIT II **9Hrs**

Breeds of poultry birds and scientific methods of breeding Hybrid and cross breed. Indian and exotic selecting chicks and parents for production factors in selection, Hatching, selecting eggs for hatching, Maintenance of temperature and humidity sterilization of room during hatching, separation and selling.

UNIT III **9Hrs**

Poultry house and equipment, space requirement, types of house, number of birds, equipments for feeding, protection from enemies and adverse conditions.

UNIT IV **9Hrs**

Nutrition of Poultry birds, requirement according to age feed formulation, classification of feed stuffs. Milling by products, availability of raw materials and their cost, food grinders and mixtures, use of antibiotics.

UNIT V **9Hrs**

Brooding and rearing, sexing, vaccination, natural and artificial breeding, types of brooding, temp. requirement culling. Debreaking of poultry, characters of good layers and broilers, rearing of chicks.

*** Denotes Self study (Questions may be asked in the topics)**

Teaching Methods:

Over Head Projector, Power Point Presentation, Seminar, Smart class, Assignment, Discussion, Quiz.

Text Books

1. Keith Wilson (2007). A Hand book of poultry practice. 2nd Ed. Agrobios (India), Jodhpur.
2. Norris Elye. (2005). The poultry science L.C.R. Biotech books.Delhi.35.

Reference Books

1. Manju Yadav (2003) .Economic Zoology: Discovery publishing house. New Delhi
2 Pande B. V.R.Reddy, V.R.Sadagopen and A.K.Shrinivasan. (1984) reprinted (1997), Feeding of Poultry. Indian council of Agricultural research. Power Printers New Delhi.
3 Venkatakrishnan, R. (1995). Poultry farm. 1st Ed. Balaji publications. Madras.
4 Sharma R.D. (1997). Hand book of Animal Husbandry Indian Council of Agricultural Research. 2nd Ed. (reprint) published by Director Directorate of Publications and information on Agriculture. New Delhi.

UZO 88

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	M	S	H
CO2	M	S	H	M	S
CO3	H	M	S	H	M
CO4	H	S	H	S	M

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

UZO 89

Programme code: 06	B.Sc. Zoology		
	Major Elective Paper 3 – Economic Zoology		
Batch 2020-2021	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

4. To get knowledge about sustainable agriculture, organic farming and waste management by using Vermitechnology.
5. To understand the rearing and harvesting techniques in sericulture, apiculture and lac culture.
6. To inculcate knowledge on Aquaculture, Poultry and Animal husbandry aspects.

Course Outcomes

K1 – K4	CO1	Get knowledge about the characteristics and role of earthworm in sustainable agriculture.
	CO2	Understand the problems in Sericulture, apiculture and lac culture.
	CO3	Apply the knowledge on disease management in the field of poultry and animal husbandry.
	CO4	Analyze the economic importance of Apiculture, Lac culture, Poultry and aquaculture.

SYLLABUS

Unit I:Vermiculture **12 Hours**

Vermiculture - Selection of suitable species based on their characteristics, Vermicomposting and their advantages, role of earthworms in sustainable agriculture and organic farming, Miscellaneous uses of earthworms (Poultry, Fisheries and Medicine).

Unit II:Sericulture **12 Hours**

Types of silkworms - Life cycle - Rearing methods - Harvesting - Processing of Silk - Marketing of Cocoons - Economic importance of sericulture - Problems in sericulture.

Unit III:Apiculture and Lac culture **12 Hours**

Types of honey bees- Diseases and pests of bees and lac insects -Harvesting and processing of honey and lac -Marketing of honey and lac -economic importance of apiculture and lac culture - Problems in apiculture and lac culture.

Unit IV: Fisheries and Aquaculture **12 Hours**

Fishery resources in India, Economically important aquatic floral and faunal resources, Value added fish and fishery products, opportunities in seafood exports, Importance of fisheries (capture, culture and ornamental) sector in Indian economy, Fisheries an alternative livelihood in India.

Unit V: Poultry farming **12 Hours**

Types of birds for poultry - Diseases and pests of bird - Egg and meat production -poultry feed - Economic importance of poultry keeping.

Animal husbandry

Types of animals for animal husbandry - Disease and pests of animals - Milk and meat production and Processing - Economic importance of animal husbandry*

***Self study (Questions may be asked from these topic also)**

Teaching methods

Over Head Projector/ Power Point presentation/ Seminar/ Assignment/Quiz

Text Books

1. Shukla, G.S and V.B. Upadhyay.(2016). Economic Zoology, 4 th Reprint (5th Edition). Rastogi Publication, Meerut.
2. Ayyappan, S, Jena,J.K, Gopalakrishnan, Aand A. K. Pandey. (2011). Handbook of fisheries and aquaculture. Indian Council of Agricultural Research. Directorate of Information and Publications on Agriculture, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi, India.
3. B. Vasantharaj David and Ramamurthy V. V. (2016). Elements of Economic Entomology. 8th Edition. Brillion publishing.

Reference Books

4. NPCS Board of Consultants and Engineers. (2004). The Complete Technology book on Vermiculture and Vermicompost. Asia pacific Business Press. Inc. ISBN:9788178331362.
5. Fenemore P.G. A. Prakash. (2002) Applied Entomology, New age international (P) publishers, New delhi.
6. ManjuYadav. (2003) Economic Zoology, Discovery Publishing House, New Delhi.
7. LokeshwarR. (2002) Hand Book of Animal Husbandry, ICAR, New Delhi

8. Vinitha Jaiswal, Kamal Kumar Jaiswal. (2014). Economic zoology. Prentice Hall of India.
9. Ashok K Rathoure , Nuzneen Z Deshmukh, Dinesh Kumar, Rachno Goswami. Applied and Economic Zoology. Astral Publication.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	H	S
CO2	H	S	M	M	H
CO3	H	H	S	S	H
CO4	M	H	S	H	M

S – Strong **H** – High **M** – Medium **L** – Low

Programme code - 06	B.Sc Zoology		
	Major Elective 4- Pests and Their management		
Batch 2020-2021	Hour/Week 3	Total hours 45	Credit 5

Course Objectives

1. To acquire information on insect pests and non- insect pests in agricultural crops
2. To get knowledge on biology and nature of damage caused by insect pests and non insect pests in various crops
3. To learn knowledge about the insect vector of human and their control measures

Course Outcomes

K1 - K4	COI	Get knowledge about the importance of insect pests of agricultural crops and plant diseases transmitted by insect pests.
	CO2	Understand the biology and nature of damage caused by insect pests and non insect pests in various crops
	CO3	Study the insect pests of stored grains
	CO4	Apply knowledge on the importance of vectors on human health and their control measures

SYLLABUS

UNIT I **9Hrs**

Insects of agricultural importance - types of damage on crops - insects in relation to plant diseases.

UNIT II **9Hrs**

Biology, nature of damage on crops and control measures of one major pest of each of the following crops: paddy, sugarcane, cotton and coconut.

UNIT III **9Hrs**

Biology, nature of damage on crops and control measures of plant nematodes, mites, crabs, snails, birds and rats.

UNIT IV **9Hrs**

Insect pests of stored produces- rice weevil *(Sitophilus oryzae),* Red flour beetle *(Tribolium castaneum)* and Pulse beetle *(Callosbruchus chinensis).*

UZO 93 20UZO6E2

UNIT V **9Hrs**

Insects in relation to public health*- biology, role of insect vectors of human and control measures of mosquitoes, house flies, bed bug and head louse.

***Denotes self study**

Teaching methods :

Over Head Projector/ Power Point presentation/ Seminar/ Assignment/Quiz

Text Books

1. Vasantharaj David. B and T. Kumarasami (1982). Elements of Economic Entomology, Popular Book depot, Madras-15.
2. Tembhare D.B. - Modern Entomology- (2000) Himalaya Publishing House- Delhi.
3. Anantha Krishnan TN (2007). General and Applied Entomology. Tata Mc Gran Hill Pub. Co.Ltd.

Reference Books

1. Nayar K.K & T.N. Anathakrishnan and B.V. David. (1983) General and applied Entomology, Tata McGraw Hill publishing Co. Ltd., New Delhi.pp. 589
2. Fenemore P.G., Prakash (2002). A.Applied Entomology – 2002. New age International (P) publishers- New Delhi.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	S	H	M	S
CO2	H	M	S	S	H
CO3	H	S	M	H	M
CO4	S	H	S	S	S

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

UZO 94

Programme code: 06	B.Sc., Zoology		
	Major Elective Paper 6 –- Human Genetics and Counselling		
Batch	Hour/Week	Total hours	Credit
2020-2021	3	45	5

Course Objectives

1. To understand knowledge on the blood types, transfusion and diseases.
2. To know about the applications of aminocentesis, dermatoglyphics and Population genetics.
3. To learn the applications of Genetic engineering and Genetic counseling

Course Outcomes

K1 – K4	COI	Explain the Physiology and genetics of blood groups.
	CO2	Describe the various syndromes and Population genetics.
	CO3	Analyses the application of genetic engineering in man.
	CO4	Evaluate the genetic counselling and pedigree chart.

SYLLABUS

UNIT I **9Hrs**

Blood groups (major types) Blood transfusion, Erythroblastosisfoetalis. Physiology and genetic of blood groups.

UNIT II **9Hrs**

Aminocentesis, Dermatoglyphics: Terminology, methods of observation and printing, dermatoglyphic features of syndrome.

UNIT III **9Hrs**

Population genetics, Hardy-Weinberg principle and its application in human population.

UNIT IV **9Hrs**

Genetic engineering and its applications in human being, Cancer***** , AIDS.

UZO 99

UNIT V **9Hrs**

Genetic counseling, definition, aims, procedure in genetic counseling and its limitation. Pedigree chart and its uses.

*** Denotes Self study**

Teaching Methods:

Over Head Projector, Power Point presentation, Seminar, Smart class, Assignment, Discussion, Quiz.

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	M	S	H
CO2	M	S	H	M	S
CO3	H	M	S	H	M
CO4	H	S	H	S	M

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

Programme Code :06	B.Sc, Zoology			
Course code 20UZO6Z1	Project Work and Viva - Voce			
Batch	Semester	Hour/Week	Total hours	Credit
2020-2021	VI	3	45	5

Course Objectives

1. To acquire the basic knowledge about research and carryout research problems in zoology.
2. To explore the ability to plan carryout innovative project in group
3. To improve the knowledge on various research methods in zoology

Course Outcomes

K2 – K4	COI	Use foundational practical knowledge to carry out research in the specified area.
	CO2	Analyze the results and to collect the basic information in zoology.
	CO3	Evaluate the research findings and present them in written and oral.
	CO4	Implement the research findings for the upliftment of mankind

Guidelines to the Distribution of Marks:

IA	Project Review	15	**20**
	Regularity	5	
ESE	Project Report Present	60	**80**
	Viva – Voce	20	
Grand Total		**100**	

Teaching Methods: Over Head Projector, Power Point Presentation, Seminar, Assignment, Quiz

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	M	S	M	H	S
CO2	S	S	S	S	H
CO3	H	H	H	H	S
CO4	S	S	H	S	H

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

Programme Code : 06	B.Sc, Zoology			
Course code 20UZO6S4	Skill Based Subject 3 Commercial Fish Culture			
Batch	Semester	Hour/Week	Total hours	Credit
2020-2021		**2**	30	3

Course Objectives

1. To develop knowledge in characteristics, structure and resources of fisheries.
2. To increase the fishery sector performance by production, culture practices and farm management.
3. To improve the trade and its contribution to the nation economy.

Course Outcomes

K1 - K4	COI	Get knowledge about the commercial production of fishes in India
	CO2	Understand the practices of fish culture and its management to produce quality fish for human consumption
	CO3	Apply practical knowledge into fish production and marketing to become successful entrepreneur
	CO4	Analyze students acquired technical knowledge which is helpful to begin an entrepreneurship in the field of Fisheries

UNIT I Introduction 6Hrs

Fishery resources of India. Major reservoir, lakes and their fisheries. Fisheries- status - exploitation and prospects. Marine, Brackishwater, Freshwater and Cold water fisheries of India.

UNIT II Biology of fishes 6Hrs

Study of food and feeding habits of commercially important fishes. Reproductive biology – maturity stages, gonadosomatic index, pondoral index, fecundity, sex ratio and spawning. Eggs and larval stages and developmental biology of finfishes and shell fishes.

UNIT III Culture practices 6Hrs

Commercially important fishes breading and seed productions techniques*. Traditional (pokkali, bheries, gazanis, khazans), semi-intensive, intensive and super-intensive culture systems.

UNIT IV Soil and Water Chemistry 6Hrs

Water culture, Water quality parameters for Fishculture – Temperature, Turbidity, determination of pH, Electrical conductivity and salinity. Dissolved Oxygen, Carbon dioxide, Total alkalinity, Total hardness, Ammonium and Nitrite. Soil preparation and quality management for Fishculture.

UNIT IV Fish Nutrition and Feed Technology 6Hrs

Nutritional requirements of cultivable fish and shellfish. Feed formulation and manufacturing. Feed evaluation - feed conversion ratio (FCR), feed efficiency ratio (FER). Feeding devices and methods. Factors affecting digestibility. Nutritional deficiency diseases.

UNIT V Entrepreneurship Development 6Hrs

Government schemes and subsidies for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to fisheries sector. Contract farming and joint ventures, public-private partnerships. Fish processing and export.

***Self study (Questions may be asked from theses topic also)**

Teaching Methods Power point presentation/ Seminar / Discussion / Quiz

Text books

1. Srivasta C.B.L (2002). A text book of fishery science and Indian fisheries, kitab Mahal, Allahabad.
2. Santhanam, R. (1990). Fisheries Science, Daya publishing House, New Delhi.
3. Ayyappan, S. J. K. Jena, A. Gopalakrishnan, A. K. Pandey (2011). Handbook of fisheries and aquaculture. Indian Council of Agricultural Research. Directorate of Information and Publications on Agriculture, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi, India.

Reference books

1. James PM. (1983). Handbook of Mariculture. Vol. I. Crustacean Aquaculture. CRC Press.
2. Leung P, Lee CS and O'Bryen JP. (Eds.). (2007). Species and System Selection for Sustainable Aquaculture. Blackwell Publ.
3. Boyd, C. E. and Tucker, C. S. (1992). Water Quality and Pond Soil Analyses for Aquaculture, Alabama Agricultural Experimental Station, Auburn University.
4. De Silva SS & Anderson TA. (1995). Fish Nutrition in Aquaculture. Chapman & Hall Aquaculture Series.

5. Lavens P & Sorgeloos P. (1996). Manual on the Production and Use of Live Food for Aquaculture. FAO Fisheries Tech. Paper 361, FAO.
6. Shankar KM & Mohan CV. (2002). Fish and Shellfish Health Management. UNESCO Publ.
7. Wedmeyer G, Meyer FP & Smith L. (1999). Environmental Stress and Fish Diseases. Narendra Publ. House. New Delhi.
8. Jhingran VG. (1991). Fish and Fisheries of India. Hindustan Publ.
9. Landau M. (1992). Introduction to Aquaculture. John Wiley & Sons.
10. Mcvey JP. (1983). Handbook of Mariculture. CRC Press.
11. Reddy PVGK, Ayyappan S, Thampy DM & Krishna G. (2005). Text book of Fish Genetics and Biotechnology. ICAR. New Delhi
12. Pillay TVR & Kutty MN. (2005). Aquaculture: Principles and Practices. 2nd Ed. Blackwell.
13. Pandey N & Davendra SM. (2008). Integrated Fish Farming. Daya Publ. House. New Delhi

MAPPING

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
CO1	S	H	H	H	H
CO2	H	M	M	M	S
CO3	M	H	S	H	H
CO4	H	M	H	M	S

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