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

DEPARTMENT OF ZOOLOGY

(UG)

CURRICULUM AND SCHEME OF EXAMINATIONS
(CBCS)
(2019 - 2020)

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

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)
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DEPARTMENT OF ZOOLOGY

VISION

Empowering the Students to face the challenges in a holistic way

MISSION

To produce well disciplined, socially committed morally and educationally intellectuals through quality education and Research

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.	Correlates 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.	Understood the nature and basic concepts of Non-chordates, sericulture, physiology, ecology, Economic zoology, Biotechnology, Biostatistics, Bioinformatics and Biophysics and Genetics.
PSO2.	Analyzed the relationship among animals, plants and microbes by morphological and molecular studies.
PSO3.	Understood the applications of Biological sciences in Aquaculture, Agriculture, Environment and medicine
PSO4.	Gained knowledge about the techniques in Biology, effective communication and skills of problem solving methods in Biology.
PSO5.	Contributed 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 **2019 – 2020**)
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	19TML101	Language I@	6	25	75	100	3	3
	II	19ENG101	English –I	6	25	75	100	3	3
	III	19UZO101	Core Paper 1–Invertebrata	7	25	75	100	3	5
	III	19UZO1I1 19UBO1A1	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	19EVS101	Environmental Studies**	2	-	50	50	3	2
			Total	**30**			**425**		**17**
SEMESTER - II									
II	I	19TML202	Language II@	6	25	75	100	3	3
	II	19ENG202	English –II	6	25	75	100	3	3
	III	19UZO202	Core Paper 2 –Chordata	7	25	75	100	3	5
	III	19UZO2I2 19UBO2A2	Allied A Paper 2- Sericulture II / Botany II	5	20	55	75	3	4
		19UZO2CL	Core Practical. 1- Invertebrata and Chordata	2	40	60	100	3	2
		19UZO2IL 19UBO2AL	Allied A Practical 1. Sericulture /Botany	2	20	30	50	3	2
	IV	19VED201	Value Education- Moral and Ethics **	2	-	50	50	3	2
			Total	**30**			**575**		**21**

SEMESTER - III									
III	I	19TML303	Language III@	6	25	75	100	3	3
	II	19ENG303	English –III	6	25	75	100	3	3
	III	19UZO303	Core Paper 3– Cell and Molecular Biology	5	25	75	100	3	5
	III	19UBC 3A3	Allied B paper 1- Biochemistry	5	20	55	75	3	4
			Core Practical 2- Cell Biology and Physiology	2	-	-	-	-	-
			Allied B Practical 2. Biochemistry	2	-	-	-	-	-
	IV	19UGA3S1	Skill Based subject 1- General Awareness	2	25	75	100	3	3
	IV	19TBT301/ 19TAT301/ 19UHR3N1	Basic Tamil* / Advanced Tamil** (OR) Non-major elective- I**- Human rights	2	-	75	75	3	2
			Total	**30**			**550**		**20**
SEMESTER - IV									
IV	I	19TML404	Language IV@	6	25	75	100	3	3
	II	19ENG404	English –IV	6	25	75	100	3	3
	III	19UZO404	Core Paper 4– Physiology	5	25	75	100	3	5
	III	19UBC4A4	Allied B paper 2- Biochemistry	5	20	55	75	3	4
		19UZO4CM	Core Practical 2- Cell Biology and Physiology	2	40	60	100	3	2
		19UBC4AL	Allied B Practical-1. Biochemistry	2	20	30	50	3	2
	IV	19UZO4S2	Skill Based subject 2- Health education	2	25	75	100	3	3
	IV	19TBT402/ 19TAT402/ 19UWR4N2	Basic Tamil* / Advanced Tamil** (OR) Non-major elective- II**- Women's rights	2	-	75	75	3	2
			Total	**30**			**700**		**24**
SEMESTER - V									
v	III	19UZO505	Core Paper 5- Genetics	5	25	75	100	3	4
	III	19UZO506	Core Paper 6- Evolution	5	25	75	100	3	4
	III	19UZO507	Core Paper 7–Ecology	5	25	75	100	3	4
	III	19UZO508	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	19UZO5E1	Major Elective -1	4	25	75	100	3	5
	IV	19UBC/UBT/ UBO – 5X1	EDC-Extra Departmental Course	2	25	75	100	3	3
		19UZO5IT	Internship						Grade
			Total	**30**			**600**		**24**
SEMESTER - VI									
VI	III	19UZO609	Core Paper 9 –Microbiology and Immunology	4	25	75	100	3	4
	III	19 UZO610	Core Paper 10 – Biotechnology	5	25	75	100	3	4
	III	19UZO611	Core Paper 11 – Developmental Biology	5	25	75	100	3	4
	III	19 UZO612	Core Paper 12 – Biodiversity and Animal behaviour	4	25	75	100	3	4
		19UZO 6CN	Core Practical 3: Evolution, Microbiology and Immunology and Biotechnology	2	40	60	100	3	2
		19UZO 6CO	Core Practical 4: Ecology, Developmental Biology and Biodiversity and Animal behaviour	2	40	60	100	3	2
	III	19UZO6E2	Major Elective 2	3	25	75	100	3	5
	III	19UZO6Z1	Project	3	20	80	100	3	5
	IV	19UZO6S4	Skill Based subject-3 Commercial fish culture	2	25	75	100	3	3
	V	$$	Extension Activities*	-	50	-	50	-	1
			Total	**30**			**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. 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

Non-Major Elective Papers

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

Extra Departmental Course (EDC)

1. Ornamental Fishery Technology

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	400	12
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Extension Activities NCC/NSS/YRC/PYE	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 are advised to complete a SWAYAM – MOOC before the complection of the 5th semester and the course completed certificate should be submitted to the HOD. Two credits will be given to the candidates who have successfully completed.
- A field trip preferably relevant to the course should be undertaken every year

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 Q 1 to 10	A (Answer all)	10X1=10	MCQ	75
K2 Q 11 to 15	B (Either or Pattern)	5X5 = 25	Short Answer	
K3 & K4 Q 16 to 20	C (Either or Pattern)	5X8 = 40	Descriptive/ Detailed	

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

Knowledge level	Section	Marks	Description	Total
K1 Q 1 to 10	A (Answer all)	10X1=10	MCQ	55
K2 Q 11 to 15	B (Either or Pattern)	5X3 = 15	Short Answer	
K3 & K4 Q 16 to 20	C (Either or Pattern)	5X6 = 30	Descriptive/ Detailed	

2. Practical Examination:

Knowledge level	Section	Marks	Total
K3	Experiments Record Work	50	60
K4		10	
K5			

3. Project Viva-Voce :

Knowledge level	Section	Marks	Total
K3	Project Report Viva-Voce	60	80
K4		20	
K5			

Programme code:06	B.Sc., Zoology			
Course code: 19UZO101	Core Paper 1 –Invertebrata			
Batch 2019-2020	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	COI	Get knowledge about the systematic position of various organisms
K2	CO2	Understand the various structure and its function of the non chordates
K3	CO3	Get the knowledge about the economically important organisms
K4	CO4	Analyze and understand the important parasites and their control measures

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 : Parasitic protozoa-*Plasmodium vivax, Leishmania donovani*

Phylum Porifera

Type study : *Leucosolenia*

General Topic : Canal system in sponges

UNIT II **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 bancrofti, Pin worms

UNIT III **21Hrs**

Phylum Platy helminthes

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 theses topic also)**

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

Text Books

1. Kotpal R L., (2015) Modern Text Book of Zoology – Invertebrate, Rostagi publication Meerut.
2. Jordan, E. L & P. S. Verma, (2000) Invertebrate Zoology. S. Chand & Co.
3. Nair N.C,.Leelavathi S, Soundrapandian N,.Murugan T., N Arumugam (2013) A Text book of Invertebrates , Saras Publication.
4. Ekambaranatha Ayyar M and.Ananthakrishnan T.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.S and 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.

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 19UZO1I1	Allied A Paper -I Sericulture -I			
Batch 2019-2020	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	COI	Get knowledge about the mulberry and non mulberry silkworms.
K2	CO2	Understand the various silkworm rearing techniques
K3	CO3	Apply knowledge on control measures of silkworm diseases
K4	CO4	Analyze silkworm breeding and grainage techniques

SYLLABUS

UNIT I **15Hrs**

Introduction

Bombyx mori : Systematics, General organisation, lifecycle, Silk gland and silk formation. Origin and economic importance of sericulture industry. 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: 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 : Over Head Projector, Power Point Presentation, Seminar, Smart Class Room, Quiz

Text Book

1. Madan Mohan Rao. M. (2008) A text book of sericulture B.S publications,Hyderabad.

2. Ganga &Sulochanachetty .G. (2006) An introduction to sericulture.. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. Ullal .S.R and M.N Narasimhanna(1977) Hand book of Practical Sericulture Published by Shri .A.R S. Gopalachar Secretary ,Central silk board ,.Meghdoot,Bombay.

2.Rangaswami.G and S. Manjeet. Jolly.(1988) Sericulture Manual –I , Mulberry Cultivation Published by Mohan Primlani for Oxford & IBH publishing CO. Pvt.Ltd. 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 19EVS101	Environmental Studies			
Batch 2019-2020	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

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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: 19UZO202	Core Paper- 2- Chordata			
Batch 2019-2020	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	COI	Get knowledge about the classification of various organisms
K2	CO2	Understand the various physiological systems of Chordate
K3	CO3	Apply the knowledge in the field of economically important organisms
K4	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 19UZO212	Allied A Paper 2. Sericulture-II			
Batch 2019-2020	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	COI	Get knowledge about the moriculture
K2	CO2	Understand the cultivation of mulberry, pests, diseases and control measures
K3	CO3	Apply knowledge on processing of cocoons and different methods of silk reeling
K4	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 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, 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. (2008) A text book of sericulture. B.S publications Hyderabad.
2. Ganga and Sulochanachetty G. (2006). An introduction to sericulture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. Ganga G. (2003) Comprehensive Sericulture– Vol. 2 Silkworm Rearing & Silk Reeling Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Rangaswami, G.and . Manjeet S. Jolly(1998), Mulberry Cultivation, Sericulture Manual-I FAO, UN IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Kamal Jaiswal, Sunil P. Trivedi, B.N. Pandey and R.K. Khatri , (2009) Moriculture..APH Publishing Corporation, Ansari Road, Daryakanj. 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: 19UZO2CL	Core Practical- I-Invertebrata and Chordata			
Batch 2019-2020	Semester I&II	Hour/Week 4	Total hours 120	Credit 5

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	COI	Apply knowledge to study various anatomical system by using virtual laboratory
K4	CO2	Analyze the excretory products of certain vertebrates
K5	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 19UZO2IL	Allied A Practical 1. Sericulture			
Batch 2019-2020	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

K1	COI	Apply knowledge on moriculture and sericulture
K2	CO2	Observe the biology, rearing, pests and diseases of silkworm and their control measures
K3	CO3	Evaluate the quality of silk

SYLLABUS

I. Moriculture:

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

II. Silkworm rearing:

4. Silk worm: Life cycle.
5. Rearing house
6. Rearing equipments.
7. Pests and diseases of silkworms.

III. Eggs & Cocoons:

8. Treatment of eggs.
9. Cooking & Reeling.
10. Estimation of renditta
11. Estimation of denier.
12. 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	B.Sc Zoology			
Course code 19VED201	Value Education – Moral and Ethics			
Batch 2019-2020	Semester II	Hour/Week 2	Total hours 30	Credit 2

Objectives:

- To impart the value education in every walk of life.
- To make them understand the relationship between Moral and Ethics.
- To impart the right attitude by practicing self introspection.
- To make them realize about their hidden power within them.
- To develop a knowledge for the steps of upliftment.
- To know about their goal of life.
- To make them understand the importance of yoga and meditation.
- To realize what is the real peace.
- To understand what are the ways to contribute peace to the whole world.
- To goad youth to reach excellence and reap success.

UNIT I **6hrs**

Introduction – Meaning of Moral and Ethics – Ethics and Culture – Aim of Education.

UNIT II **6hrs**

Swami Vivekananda – A Biography.

UNIT III **6hrs**

The Parliament of Religions – Teachings of Swami Vivekananda.

UNIT IV **6hrs**

Steps for Human Excellence.

UNIT V **6hrs**

Yoga and Meditation.

Text Book

1. Value Base Education – Moral and Ethics – Published by Kongunadu Arts and Science College (Autonomous), First Edition, 2015.

Reference Book

1. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication, 2000.

QUESTION PAPER PATTERN

(External only)

Duration: 3 hours Total Marks: 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: 19UZO303		Core Paper 3 – Cell and Molecular biology		
Batch 2019-2020	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	CO1	Understand the importance of microscopy and staining techniques.
K2	CO2	Apply knowledge on the metabolic machinery of the cells.
K3	CO3	Analyze the significance of normal and abnormal activities of cells.
K4	CO4	Get knowledge on protein synthesis and cancer biology.

SYLLABUS

UNIT-I **15Hrs**

Microscopy: Compound and Electron Microscopes, Microtome-Stains and Fixatives-Nuclear and cytoplasmic stains and staining techniques. Introduction to cell and cell types. Structure of Prokaryotes and Eukaryotes.

UNIT – II **15Hrs**

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

UNIT – III **15Hrs**

Structure, function and origin of Endoplasmic reticulum, Mitochondria and Nucleus.

UNIT-IV **15Hrs**

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

UNIT – V **15Hrs**

Nucleic acids - Structure of DNA and RNA, DNA replication - Protein synthesis - Cell aging and Types and propertics of cancer cells

Teaching Methods:

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

Text Books

1. Verma P.S.and V.K.Agarval, (1999). Text book of Cytology- S.Chand & Company (Pvt.) Ltd, New Delhi.
2. Arumugam N., 6th edition, (2007). Cell Biology - - Saras Publications, Shanmugapuram, Kanyakumari.
3. Ambrose E. J. and Dorothy. M. Easty (1970). Cell Biology, Second Edition, The English language book society & Nelson, Great Britain at the Camelot Press Ltd, Southampton.
4. Power C.B. (2009).Cell Biology, Himalaya Publishing House, Mumbai.

Reference Books

1. Gupta P. K., (2008). Cell and molecular biology, Rastogi publications, Shivaji Road, Meerut, India.
2. Gerald Karp, (1996). Cell and molecular biology, concepts & experiments: John Wiley & Sons, INC, New York.
3. Geoffrey M. Cooper and Robert E . Hausman. (2009). The Cell – A Molecular Approach, 5th edition. ASM PRESS, Washington, DC.
4. Lodish, Berk, Matsudaira, Kaiser, Scott, Zipursky Darnell. (2003). Molecular cell biology. 5th edition. W. H. Freeman & Company, 41, Madison Avenue, New York, England.
5. Verma P. S & V.K. Agarwal.(2009). Cell biology, Genetics, Molecular Biology, Evolution & ecology. S. Chand & Company LTD, Ram Nagar, New Delhi, India.
6. Rastogi C., (2010). Cell & Molecular Biology S 3rd Edition, New Age International (P) Limited, Publishiers, New Delhi.

7. Stephen L. Wolfe (1999). Introduction to Cell Biology, Wadsworth Publishing Company, Belmont, California, A Division of Wadsworth, Inc.
8. White M.J.D. (1973). Animal cytology & Evolution, Vikas Publishing House Pvt Ltd. New Delhi.
9. Singh S. P. and B. S. Tomas. (2012). Cell biology –, Rastogi Publications, Meerut - 02, India.

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 19UGA3S1	Skill Based Subject 1 – General Awareness			
Batch 2019-2020	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.

Programme code 06		B.Sc Zoology		
Course code 19UHR3N1		Non- Major Elective - I "Human Rights"		
Batch 2019-2020	Semester III	Hour/Week 2	Total hours 30	Credit 2

Objectives

1. To impart knowledge of human values, ethics and human rights to the students.
2. To reinforce positive personality traits and enhance physical, mental, social ethical and spiritual well-being of the students.

UNIT I Concept of Human Values, Value Education towards Personal Development 6 Hrs

Aim of education and value education; Evolution of value-oriented education; Concept of human values; types of values; Components of value education.

Personal Development:

Self-analysis and introspection; sensitization towards gender equality, physically-challenged, intellectually-challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.

Character Formation towards Positive Personality:

Truthfulness, Constructivity, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific vision**.**

UNIT II Value Education towards National and Global Development

National and International Values 6 Hrs

Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity.

Social Values - Pity and probity, self-control, universal brotherhood.

Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith.

Religious Values - Tolerance, wisdom, character*.

Aesthetic Values - Love and appreciation of literature and fine arts and respect for the same.

National Integration and international understanding.

UNIT III Impact of Global Development on Ethics and Values 6 Hrs

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise.

Modern challenges of adolescent emotions and behaviour; sex and spirituality: comparison and competition; positive and negative thoughts.

Adolescent emotions, arrogance, anger, sexual instability, selfishness, defiance.

UNIT IV Therapeutic Measures 6 Hrs

Control of the mind through

a. Simplified physical exercise

b. Meditation – objectives, types, effect on body, mind and soul

c. Yoga – objectives, types, Asanas

d. Activities:*

(i) Moralisation of Desires

(ii) Neutralisation of Anger

(iii) Eradication of Worries

(iv) Benefits of Blessings

UNIT V Human Rights 6 Hrs

1. Concept of Human Rights – Indian and International Perspectives
    a. Evolution of Human Rights
    b. Definitions under Indian and International documents
2. Broad classification of Human Rights and Relevant Constitutional Provisions.
    a. Right to Life, Liberty and Dignity
    b. Right to Equality
    c. Right against Exploitation
    d. Cultural and Educational Rights

e. Economic Rights

f. Political Rights

g. Social Rights

h. Rights to Information

3. Human Rights of Women and Children

    a. Social Practice and Constitutional Safeguards

        (i) Female Foeticide and Infanticide

        (ii) Physical assault and harassment

        (iii) Domestic violence

        (iv) Conditions of working women

4. Institutions for Implementation

    a. Human Rights Commission

    b. Judiciary

5. Violations and Redressal

    a. Violation by State

    b. Violation by Individuals

    c. Nuclear weapons and terrorism

    d. Safeguards

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

Prescribed Book : Human Rights, Compiled by Bharathiar University, Coimbatore - 46

Programme Code : 06		B.Sc.**:** Zoology		
Course Code 19UZO404		Core Paper 4 –Physiology		
Batch 2019-2020	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	CO1	Explain and recognize the physiological structure and functions of various organs
K2	CO2	Apply anatomical knowledge in predicting the physiological consequences
K3	CO3	Describes physiological activity of organ system
K4	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, fats and protein. 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, pacemaker, neurogenic and myogenic hearts. Blood and its composition, blood clotting*. Lymphatic system and its functions.

Excretion :

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

Types of nerves, myelinated and non-myelinated nerve fibres, synapse. Origin and conduction of nerve impulse; interneuronal transmission, neuromuscular junction, neurotransmitters and reflex action.

UNIT IV **15Hrs**

Muscle Physiology

Structure and properties of muscles, muscle proteins, isotonic, isometric contractions - chemistry of muscle contraction - Physiology of muscle contraction, theories of muscle contraction.

UNIT V **15Hrs**

Endocrinology

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

*** 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. Verma, P. S. and Agarwal, V. K. (2009). Animal Physiology S.Chand & Company Ltd., New Delhi.
2. Goyal, K. A. and Sastry, K.V. (2012). Animal Physiology - Rastogi Publications, Meerut, India.
3. Guyton and Hall, (2016). Text book of Medical Physiology- Elsevier Health – INR; second edition

Reference Books

1. Hoar, W.S., (1975) General and comparative Physiology, Prentice - Hall of India, Pvt., New Delhi.
2. Prosser, CL. and Brown Fo. (1961). Comparative Animal Physiology Second Edition. WB Saunders Co Philadelphia, Toppa Co Tokyo, Japan.
3. Best, CH and Taylor, NB. (1985). Physiology basis of medical practice. The Wilkins Company Baltimore.
4. Bentley, PJ. (1998). Comparative vertebrate endocrinology Cambridge University Press UK (S. Chand & Co.)
5. Gorbman, A and Bern, HAA. (1983). Text book of comparative endocrinology wiley western Pvt. Ltd., USA.
6. Schmit - Nelson.K.(1997) Animal Physiology Adaptation and environment, Cambridge Univ. Press.
7. Christopher, D. Moyer and Patricia M. Schulte. (2007). Principles of Animal Physiology. 2nd Edition. Pearson. Benjamin - Cummings Publishing Company.

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 19UZO4CM		Core Practical II –Cell Biology and Physiology		
Batch 2019-2020	Semester IV	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To impart the practical knowledge on haematological studies

2. To understand mitotic and meiotic cell divisions

3. To know the principles of biomedical instrumentation and osmoregulation

Course Outcomes (CO)

K2	CO1	Understand the significance of osmoregulation
K3	CO2	Apply basic principles of haematological and cell studies
K4	CO3	Analyse the principles and uses of bioinstrumentation in medical laboratory
K5	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 O2 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 19UZO4S2		Skill Based Subject 2- Health Education		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2020	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	CO1	Get knowledge about the concept of health
K2	CO2	Understand the role of Nutrition in Man
K3	CO3	Study various environmental pollution and diseases and their impacts on Man
K4	CO4	Create awareness on prevention and control of diseases

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 disease transmission - Sources and routes of transmission.

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 attack, Kidney problems.

Vector- borne diseases

Dengue

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.

Text Books

1. Murgesh. N. (2008). Health Education and Community Pharmacy. Sathya Publishers, Madurai.
2. Paramjit Rana, (2002). Total Health- English Edition, Mumbai
3. 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. Harnold Shyrlock and Hubert. O. Swartout, P. (1998). You and your health, Pacafic press publishing association- London.
3. Jill Varnes and Stephen. D.C. (2000). Health. Bud Getchell, Rurtypipin. Health and Company, Massachusetts.

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

Programme code - 06	B.Sc Zoology			
Course code 19UWR4N2	Non- Major Elective - II "Women's Rights"			
Batch 2019-2020	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 46

Programme Code : 06	B.Sc Zoology		
	Non- Major Elective – III Consumer Affairs		
Batch 2019-2020	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.

Programme code : 06	B.Sc Zoology			
Course code 19UZO505	Core Paper - 5- Genetics			
Batch 2019-2020	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	COI	Get knowledge about the Mendelian principles in dominance and Co- dominance.
K2	CO2	Understand the genetic linkage, crossing over and sex- linked inheritance in animals
K3	CO3	Analyze the Genetic disorders in Man
K4	CO4	Evaluate the need of genetic counseling and its significance.

SYLLABUS

UNIT-I **15Hrs**

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

UNIT-II **15Hrs**

Linkage in Drosophila. Crossing over: kinds of crossing over, crossing over in Drosophila, Cytological basis of crossing over - Stern's Experiment, Sex determination in Man, Drosophila, Birds and Honey bees, Sex- linked inheritance in Drosophila.

UNIT-III **15Hrs**

Morden concept of gene, split gene, Fine structure of gene (cistron, muton and recon). Gene mutation, mutagenesis and chromosomal aberration. Detection of mutation by CLB Method. Mutagens: Physical and chemical.

UNIT-IV **15Hrs**

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

UNIT-V **15Hrs**

Inbreeding, outbreeding and hybrid vigour. Population genetics: Hardy - Weinberg law. Eugenics and Genetic counseling. Human Genome Project *.

*** 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. Veer Bala Rastogi(2010). A text book of Genetic. Kadarnath Ramnath, New Delhi.
2. Verma, P.S and Agarwal V.K. (2007). Genetics. S. Chand and Company Pvt. Ltd, New Delhi.
3. Gardner E.J. (1991). Principles of Genetics. Wiley Eastern Pvt. Ltd., New Delhi.

Reference Books

1. Sinnot, E.W. Dunn. L.C. Dobzhausky(2004). Principle of Genetics. McGraw Hill Book Company, New York
2. Winchester A.M.(1967). Genetics. Oxfrord IBH, Madras
3. Singleton, W.R. (1963). Elementary Genetics. Van Nostrand Company, New York
4. Robert .H . Lewin (2002), Principles of Genetics. Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
5. 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 19UZO506	Core Paper -6- Evolution			
Batch 2019-2020	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	COI	Get knowledge about the chronology of animals
K2	CO2	Understand the modern synthetic theory of evolution
K3	CO3	Apply the reproductive behavior of animals
K4	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 19UZO507	Core Paper - 7 – Ecology			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	**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	COI	Get knowledge about the ecological studies and their significance
K2	CO2	Understand the interlink between living and nonliving resources for an ecosystem management
K3	CO3	Acquire knowledge on Community and Habitat ecology at different geographical regions to enhance species specific management
K4	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 19UZO508		Core Paper- 8 – Biostatistics and Bioinformatics		
Batch 2019-2020	Semester V	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To provide the fundamental knowledge on instruments, statistical methods and applications.
2. To enhance the knowledge on statistical use and interpret results using descriptive statistical methods.
3. To analyze the level of significance accurately and effectively using proper statistical methods.
4. To learn the applications of computer and its usage in Bioinformatics.

Course Outcomes

K1	CO1	Get awareness in the data collection, analysis and interpretation of results.
K2	CO2	Understand the significance of biostatistics on biological sciences and also applied in research work.
K3	CO3	Apply fundamental knowledge on principle's and applications of instruments and its usage in projects.
K4	CO4	Analyze the role of computer applications and bioinformatics tools in biological data interpretation.

UNIT I **15 Hrs**

Data Collection- Sources of data collection, Classification and 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

one way and two way ANOVA and Statistical package

15 Hrs

UNIT IV **15 Hrs**

Introduction to Bioinformatics, Scope and Application of Bioinformatics, Information technology, Systems Biology, Introduction to genomics and proteomics databases

UNIT V **15 Hrs**

Nucleic acid sequence database Genbank, EMBL, UCSC, Protein sequence databases, Swiss-port, PDB, BLAST, PSI-BLAST, Clustal W, FASTA.

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

Text Books

1. Palanisamy, S. and Manoharan, M. (1992). Biostatistics for biologist, Paramount Publications, Palani.
2. Ramakrishnan, P. (2009). Biostatistics, Saras publications, Nagercoil- 629002.
3. Pradeep, K. Sinha and Pritisinha.(1995). Computer Fundamentals, Concepts Systems and Applications. BPB Publications- New Delhi.

4. Supratim Choudhuri, (2014). Bioinformatics for Beginners., Academic Press.

Reference Books

1. Gupta S.P. (2006). Statistical methods. Sultan Chand and sons- 23, , Educational publishers, Daryagans, New Delhi- 110002.
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. Parameshwaran, R.(1997). Computer applications in Business. S. Chand and Co., New Delhi.
6. Bioinformatics for beginners. (2014). Supratim Choudhuri, Tokyo Academic Press.

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 19UZO609		Core Paper 9 – Microbiology and Immunology		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2020	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	CO1	Make awareness about the morphology, taxonomy and culture methods of microbes.
K2	CO2	Uptain knowledge on microbes of biosphere.
K3	CO3	Understand the microbial diseases, causative organisms and their control measures.
K4	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 19UZO610		Core Paper 10 – Biotechnology		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2020	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 Environmental Biotechnology

Course Outcomes

K1	CO1	Understand the fermentation technology for production of alcohols, enzymes
K2	CO2	Understand the role of microbes, Biofertilizers and Biopesticides in increasing the crop yield
K3	CO3	Get knowledge on application of Biotechnology on human and animal health care
K4	CO4	Apply Bioremediation technique for the protection of environment

SYLLABUS

UNIT – I Molecular Tools of Genetic Engineering 15Hrs

Biotechnology definition, Scope of Biotechnology – Enzymes : Exonuclease, Restriction endonuclease, Reserve transcriptase, Ligase, Alkaline phosphatase, Polymerase. Cloning Vectors: Bacterial vectors – Plasmid (pBR322), Bacteriophage (λ phage), Yeast vector- Yac vector- Yec vector: Shuttle vector.

Unit - II : Techniques in Genetic Engineering 15Hrs

Probes – Construction and Labeling (Radioactive- Random primed method, Non-radioactive- Biotinylation method). Blotting Technique – Southern Blotting.

Unit – III: DNA Sequencing Technique 15Hrs

Sangar and Coulson method, DNA Microarray, Introduction of recombinant DNA (Transformation, Transduction, Electroporation). Selection of r DNA (Direct selection, Immunochemical method- RIA, Colony hybridization).

Unit- IV: Cell culture methods 15Hrs

Animal cell culture, Cell culture – Steps involved in the cell culture technique.Organ culture – Methods and Application. Animal cloning – Nuclear Transfer Method – Cloning in Sheep (DOLLY). Medical biotechnology – Production of Hepatitis B vaccine, Monoclonal Antibodies, Human insulin

Unit –V: Applied Biotechnology 15Hrs

Agricultural Biotechnology –* Production of Bio-fertilizer (Rhizobium), Bio-insecticide (*Bacillus thuringiensis*). Industrial biotechnology – Production of Antibiotic (Penicillin), Alcohol (Ethanol). Food biotechnology – Production of SCP (Spirulina), Mushroom (White button). Environmental biotechnology – Biodegradation , Super Bug.

*** Denotes Self study**

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

Text books

1. Kumaresan, V. (2009), Biotechnology. Saras Publications, Kanyakumari.
2. Dubey, R.C. (2012), A text books of Biotechnology - S. Chand and Company, New Delhi.
3. Glick, J. and Jack J. Pasternak, (2010), Molecular Biotechnology-Bernard American Society for Microbiology, 4th edition, Canada.
4. Singh, B. D. (2015). Biotechnology –Kalyani Publishers.
5. Satyanarayana, U. (2008). Biotechnology –Books and Allied Ltd.

Reference Books

1. John Tooke and Tkurtl, (1983). Recombinant DNA - A short course James D Watson, Scientific American Book.

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.
5. Mohan. P. Arora. (2003). Biotechnology - First Edition, Published by Himalaya Publishing House. Edited by Chander Kanta.
6. Benjamin, (1987). Molecular Biology of the Gene– Cummings Pub.co; Subsequent edition.

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 19UZO611		Core Paper- 11 – Developmental Biology		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2020	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	COI	Study the laws and theories of development and gametogenesis.
K2	CO2	Understand the process and different methods of fertilization.
K3	CO3	Apply the knowledge on various developmental stages of animals.
K4	CO4	Analyze the importance and knowledge on embryonic nutrition.

SYLLABUS

UNIT-I Theories of Development

15Hrs

Theories of Preformation, Epigenesis, Pangenesis, Bear's law, Biogenetic law, Germplasm theory, Mosaic theory, Regulative theory, Gradient theory and Theory of Organizer

Gametogenesis - Spermatogenesis, Oogenesis,

UNIT II Fertilization **15Hrs**

Theories of fertilization, physico - chemical aspects of fertilization. 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 III Blastulation 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 Organizer 15Hrs

Gradient theory and theory of organizer, Gradients Spemann' s experiments on organizer.

Experimental Embryology

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

*** 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. Arumugam. N. (2010). A text book of Embryology . Saras Publications, New Delhi.

2. Verma P.S. V.K. Agarwal (2012). Chordate Embryology. S. Chand Company Ltd., New Delhi.

Reference Books

1. Scott. F. Gilbert. (2010). Developmental Biology. Sinauee Associates Inc.

2. Balanisky. (2008). An Introduction to Embryology. B.I. Saunder's Company, Pub. Philadelphia.

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 19UZO612		Core Paper 12 – Biodiversity and Animal behaviour		
Batch	Semester	Hours / Week	Total Hours	Credits
2019-2020	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

Programme Code : 06		B.Sc., Zoology		
Course Code 19UZO6CN		Core practical 3. Evolution, Microbiology and Immunology and Biotechnology		
Batch 2019-2020	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 gene sequencing in Eukaryotes
3. To develop the strategies for the biodiversity conservation

Course Outcomes

K2	CO1	Understand more knowledge in the operations of advanced Biotechnological equipments
K3	CO2	Apply the products obtained through microorganisms
K4	CO3	Analyze practical information in animal cell culture and plant cell culture
K5	CO4	Evaluate the values of biofertilizers and biopesticides for the healthy society

SYLLABUS

1. Sterilization Techniques.
2. Media preparation in animal.
3. Distribution of microbes in air and water media.
4. Determination of Microbiological quality of milk by MBR Test.
5. Hanging drop culture of cells.
6. Isolation of DNA from a animal tissue sample.
7. Isolation of protein by precipitation method.
8. Determination of protein content in fish tissue sample.

9. Determination of Carbohydrate from a animal sample.
10. Determination of phosphatase activity in fish tissue sample
11. Gel electrophoresis (Demonstration only).

Spotters

I Evolutionary Significance

1.Vulture
2.Turtle and tartoroise (chelon mydas,Startoroise)
3.Fish (latimeria)
4. Reptiles (Sphenodon, Archaeopteryx)
5.Mollusca (Nautileus)

II Microbiology and Biotechnology

1. Electrophoretic instruments
2. Vaccine (viral)
3. Antibiotic (penicillin)
4. Laminar air flow chamber
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
12. Autoclave
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 19UZO6CO	Core Practical 4. Ecology, Developmental Biology and Biodiversity and Animal behaviour			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	VI	2	60	2

Course Outcomes

K2	COI	Get practical knowledge about the species identification, diversity and their ecological significance
K3	CO2	Understand about the species diversity and water pollution due to anthropogenic activity
K4	CO3	Apply practical knowledge on plankton analysis, sericulture, vermiculture, and pest management.
K5	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

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

Programme Code :06	B.Sc, Zoology			
Course code 19UZO6Z1	Project Work and Viva - Voce			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	VI	2	30	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	COI	Use foundational practical knowledge to carry out research in the specified area.
K3	CO2	Analyze the results and to collect the basic information in zoology.
K4	CO3	Evaluate the research findings and present them in written and oral.
K5	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 19UZO6S4	Skill Based Subject 3 Commercial Fish Culture			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020		**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	COI	Get knowledge about the commercial production of fishes in India
K2	CO2	Understand the practices of fish culture and its management to produce quality fish for human consumption
K3	CO3	Apply practical knowledge into fish production and marketing to become successful entrepreneur
K4	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

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 84

Programme Code: 06	B.Sc. Zoology		
	Major Elective 1 - Wild Life Ecology and Management		
Batch 2019-2020	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	COI	Explain the various components of an ecosystem
K2	CO2	Describe the wildlife management in India and National Parks and Sanctuaries.
K3	CO3	Analyze the Biodiversity hot spots, Endangered species and their Protection
K4	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 87

Programme code: 06	B.Sc Zoology		
	Major Elective Paper 2 –Poultry Science and Management		
Batch	Hour/Week	Total hours	Credit
2019-2020	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	COI	Get knowledge about the importance of poultry farming
K2	CO2	Understand the types of poultry breeding
K3	CO3	Apply the knowledge in types of incubators for poultry breeding
K4	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 89

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 90

Programme code: 06	B.Sc. Zoology		
	Major Elective Paper 3 – Economic Zoology		
Batch 2019-2020	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To get knowledge about sustainable agriculture, organic farming and waste management 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	CO1	Get knowledge about the characteristics and role of earthworm in sustainable agriculture.
K2	CO2	Understand the problems in sericulture, apiculture and lac culture.
K3	CO3	Apply the knowledge on disease management in the field of poultry and animal husbandry.
K4	CO4	Analyze the economic importance of fisheries 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 national income 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

2. Shukla, G.S and V.B. Upadhyay (2008) Economic Zoology, 4 th ed. Rastogi Publication, Meerut
3. Bhatnagar, R.K and Paltra, R. K. (1996), Vermiculture and Vermicomposting, Kalyani Publishers, New Delhi.
4. Madan Mohan Rao M.. (1998). A Text Book of Sericulture, B.S. Publications, Hyderabad.
5. Pradip V.Jabde (1993) Text book of Applied Zoology, Discovery publishing house, New Delhi
6. 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.

Reference Books

1. Nayar K.K and T.N. Anathakrishnan and B.V. David.(1983) General and applied Entomology, Tata McGraw Hill publishing Co. Ltd., New Delhi.
2. Fenemore P.G. A. Prakash. (2002) Applied Entomology, New age international (P) publishers, New delhi.
3. ManjuYadav. (2003) Economic Zoology, Discovery Publishing House, New Delhi.
4. Fred V.Theobald. (1989) Economic Zoology, Print well Publisher. Jaipur. India.
5. Cunningham S, Dunn M.R and D.Whitmarsh. (1985) Fisheries Economics. St. Martin's Press.
6. Shang YC. (1981) Aquaculture Economics. Westview Press.
7. 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

UZO 93

Programme code - 06	B.Sc Zoology		
	Major Elective 4- Pests and Their management		
Batch 2019-2020	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	COI	Get knowledge about the importance of insect pests of agricultural crops and plant diseases transmitted by insect pests.
K2	CO2	Understand the biology and nature of damage caused by insect pests and non insect pests in various crops
K3	CO3	Study the insect pests of stored grains
K4	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).*

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 95

Programme Code: 06	B.Sc. Zoology		
	Major Elective Paper 5- Vermitechnology		
Batch 2019-2020	Hours / Week 3	Total Hours 45	Credits 5

Course Objectives

1. To aware the significance of sustainable agriculture and organic farming.
2. To inoculate basic knowledge on recycling of biodegradable waste of different kinds.
3. 2. To understand the value of Vermitechnology and its significance.

Course Outcomes

K1	CO1	Get knowledge on the significance of earthworms.
K2	CO2	Understand the importance of waste degradation by eco-friendly method.
K3	CO3	Apply the significance of Vermicomposting methods.
K4	CO4	Apply knowledge on commercialization of Vermiproducts.

SYLLABUS

UNIT I **9Hrs**

Distribution- Different types of earthworms. General body structure- External characters- Body Setae- Food and feeding habits, digestive system - Gut microflora and their importance* - Reproductive system cocoon formation.

UNIT II **9Hrs**

Role of earthworms in sustainable agriculture - organic farming - Earthworm activities - soil fertility and texture - soil aeration.

UNIT III **9Hrs**

Advantages of Vermiculture – Vermicast - Decomposition of bio - degradable Wastes and vermicomposing - Selection of suitable species - Basic characteristics of suitable species - Description of suitable species - Maintenance of Base culture.

UNIT IV **9Hrs**

Vermicomposting - Advantages of vermicomposting - small scale and large scale vermi composing. Type of Vermicomposting - requirements for Vermicomposting - maintenance of vermicomposting.

UNIT V **9Hrs**

Recycling of different wastes by vermicomposting - Organic wastes - Solid wastes - Municipal wastes - Animal Dung - Agricultural wastes. Application of Vermicompost - In horticulture and agriculture.

***Denotes self study**

Teaching methods :

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

Text Books

1. Bhatnagar, R.K. and Palta, R.K., (1996). Vermiculture and Vermicomposting. Kalyani Publishers, New Delhi.
2. Arun K. Sharma. (2002). A hand book of Organic Farming, , Agrobios, Jodhpur, India The Earthworm book, S.A. Ismail. Other India press, Goa - 403 507, India (2005).
3. Gupta P.K. (2008). Vermicomposting for Sustainable Agriculture. Agrobios. India.

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Reference Books

1. ArunK.Sharma, (2002). A Hand book of organic forming, Agrobios, Jothpur, India.
2. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
3. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use",Academic Press, Sydney.
4. Satchel, J.E. (1983). "Earthworm Ecology", Chapman Hall, London

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 98

Programme code: 06	B.Sc., Zoology		
	Major Elective Paper 6 –- Human Genetics and Counselling		
Batch	Hour/Week	Total hours	Credit
2019-2020	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	COI	Explain the Physiology and genetics of blood groups.
K2	CO2	Describe the various syndromes and Population genetics.
K3	CO3	Analyses the application of genetic engineering in man.
K4	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.

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	(For B.Sc Botany, Biochemistry and Biotechnology)			
Course code 19UZO5X1	Ornamental Fishery Technology (EDC)			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	5	2	30	3

Course Objective

1. To study ornamental fishes in world wide
2. To study the techniques of ornamental fish culture for employment opportunities
3. To know about the viable marketing strategies in India and international level

Course Outcomes

K1	COI	Get field knowledge for design and construction of aquarium.
K2	CO2	Understand the formulation of feed and nutrition management for betterment of ornamental fish culture
K3	CO3	Apply knowledge on health management for successful production of aquarium fishes.
K4	CO4	Analyze the breeding and culture techniques for the trading.

SYLLABUS

Unit I: Introduction **6Hrs**

Introduction to aquaculture, ornamental fishes and aquarium accessories. World aquarium trade and present status. Opportunities and its challenges

Unit II: Aquarium and accessories **6Hrs**

Setting up of aquarium – Tank shape and size, Tank fabrication, Type of filters, Aerators and other accessories

Unit III: Freshwater Ornamental Fishes **6Hrs**

Aquarium plants, Aquaponics*, Brood stock and seed productions practices- goldfish, live bearers, gouramies, barbs and tetras, angel, and Molly fishes.

Unit IV: Marine Ornamental Fishes 6Hrs

Diversity of marine ornamental fishes. Breeding and seed production of ornamental fishes. Quarantine measures. Reef aquarium. Method of collection and transportation of live fish. Applications of anesthetics and packing.

Unit V: Aquarium Management 6Hrs

Feed Management, Water quality management, Bio security measures- Sanitation and disinfection and Health Management.

*** denotes Self study**

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

Text Books

1. Ayyappan S., Jena, J. K. Gopalakrishnan, A. Pandey. A. K. (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.

2. Dholakia, Anshuman D. (2016). Ornamental Fish Culture and Aquarium Management. Daya Publishing House, New Delhi.

3. Goldstein, R. J. (1971). Diseases of aquarium fishes. T.F.H. Publications. 126 pp

Reference books

1. Kapoor D. and Abidi. R. (2004). Lucrative Alien Ornamental fish species for Aquarium Trade of India. Published by National Bureau of Fish Genetic Resources. Lucknow, India.

2. Fung, J.(2003). Tank bred watchman gobies: essential every reef aquarium. Tropical Fish Hobbyist LI (5):98-104.

3. Murthi.V.S. (2002). Marine ornamental Fishes of Lakshadweep CMFRI, Special publication 72

4. Beyers, C.J. de B. and Wilke, C.G. (1990). A device for maintaining constant consentration of dissolved oxygen and temperature in a closed aquarium system. Special report No. 5. S.F.R.I. iv, 9 pp.

5. De Graaf, F. (1991). Marine aquarium guide. T.F.H. Publications, Inc. 282 pp

MAPPING

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
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	For B.Sc Botany, Chemistry and Biochemistry			
Course code 19UZO1A1	Allied A Paper I Invertebrata and chordata			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	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	COI	Get knowledge about the classification of various organisms
K2	CO2	Understand the developmental stages of different animals
K3	CO3	Study the parasites and control measures
K4	CO4	Study the morphology and anatomy on chordates

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 and protozoan 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 theses topic also)**

Teaching Methods:

Over head projector, PowerPoint presentation, Seminar, Smart class, Assignment, Discussion, Quiz.

Text Books

1. Nair N.C,.Leelavathi S, N Soundrapandian, Murugn T., N Arumugam N (2013) A text book of Invertebrates Saras Publication

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

3. Ekambaranatha Ayyar M and.Ananthakrishnan T.N.Viswanathan S (1981).Manual of Zoology Vol.1&2 Printers & Publishers Pvt.Ltd, Chennai

Reference Books

1. Jordan, E. L., P. S Verma,. (2000) Invertebrate Zoology S. Chand & Co

2. Kotpal R.L. Morden (2012) Text book of Zoology-Vertebrates. Rastogi Publication. Meerut.

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	For B.Sc Botany, Chemistry and Biochemistry			
Course code: 19UZO2A2	Allied A Paper 2 Cell biology, Genetics, Embryology, Physiology, Ecology and Evolution			
Batch	Semester	Hour/Week	Total hours	Credit
2019-2020	II	4	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	COI	Get knowledge about the cell and its functions
K2	CO2	Understand the embryology of frog
K3	CO3	Apply the knowledge in the field of nutrition in man and conservation of eco system
K4	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.

UNITV **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 theses topic also)**

Teaching Methods:

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

Text Books

1. Arumugam N., R. Meyyan (2010) Cell Biology, Genetics and Evolution Saras Publications, Tamilnadu
2. Veer Bala Rastogi M., (2001) Organic evolution Kedar Nath 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 adaptation Book &Allied (P) Ltd, Kolkata.

Teaching methods :

Over Head Projector/ PowerPoint presentation / Smart Class Room/ Seminar/ Quiz

MAPPING

CO \ PSO	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	For B.Sc Botany, Chemistry and Biochemistry			
Course code 19UZO2AL	Allied –A- Practical I Zoology			
Batch 2019-2020	Semester I&II	Hour/Week 2	Total hours 60	Credit 2

Course Objectives

1. To observe the various anatomical systems of animals using virtual laboratory
2. To educate the students about the cell division and genetic disorders.
3. To know the developmental stages of frog and Plankton analysis

Course Outcomes

K3	COI	Apply knowledge on identifying non-chordate and chordate
K4	CO2	Analyze the biology and economic importance of non-chordate and chordates
K5	CO3	Evaluate the biological significance of animals

SYLLABUS

Experiment I:

Virtual laboratory: Observation of various systems of any one cockroach, Frog, pila, Pig, Pigeon, Starfish displayed over computer. (Digestive system, Arterial system, Venous system, Reproductive system - male & female) over computer.

Experiment II: Spotters

Animals: Paramecium conjugation, Sycon, Obelia colony, Liver fuke, Earth worm, Prawn, Pila, Star fish, Amphioxus, Shark, Toad, Chameleon, Horn Bill and Bat.

Cell Biology: Columnar epithelium & Bone tissue T.S.

Cell division: Stages of Mitosis: Interphase, Prophase, Metaphase, Anaphase and Telophase.

Genetic Syndromes : Downs, Klinefelter and Turner's (Picture).

Adaptive radiation: Fore limb Skeleton of vertebrates (Picture).

Embryology: Frog : ovum (picture), spermatozoa (Picture), 2 cell stage, 4 cell stage, 8 cell stage: Blastula (VS), Gastrula VS and Tadpole (4mmWM).

Experiment III:

Ecology: Observation of Plankton (any five).

Reference Books:

1. Verma P.S., 1983. A Manual of Practical Zoology by Invertebrate. 5th Edition. S.Chand & Company Limited, New Delhi.
2.. Sinha J., A.K.Chatterjee and P.Chattopadhyay, 2011. Advanced Practical Zoology. 2nd Edition. Books and Allied (P) Ltd, Kolkatta.

QUESTION PATTERN

CIA Practical Examination

Model Practical Examination	10 marks
Observation Note	05 marks
Attendance	05 marks
Total	20 marks

End of Semester Examination

Time 3 hours Max 30 marks

Question I. Virtual laboratory (one of the systems – identification & notes)	7 marks
Question II. Spotters – Identify and Comment on (5x3)	15 marks
Question III. Observe any one plankton from the given sample	03 marks
Question IV. Record	05 marks
Total	**30 marks**

MAPPING

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

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

Diploma Courses

1. Diploma in Apiculture
2. Ornamental Fish Production and Trade

UZO109

Diploma in Apiculture

1. Condition For Regulations

A candidate who have passed the Higher Secondary Examination (Academic Stream) conducted by the government of Tamilnadu or an examination as equivalent to 10, +2 course including CBSE, which have been recognized by the Bharathiar University or any other University accepted by the syndicate as equivalent there to subject to such conditions as may be prescribed therefore shall be permitted to appear and qualify for Diploma in Apiculture examination of this University after a course of study of a semester.

2. Duration of The Course

The course of the Diploma in Apiculture shall consist of a semester.

3. Course of Study

The course of study shall comprise instruction in books prescribed from time to time.

Paper 1: Basics of beekeeping

Paper 2: Beekeeping techniques

Paper 3 : Practical beekeeping -Lab

4. Examinations

The examinations shall be three hours duration to each paper at the end of the year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

5. Medium of Instruction

English shall be the medium of instruction

6. Scheme of Examinations

The scheme of the Examinations shall be follows:

Subject Code	Title of the Paper	Instruction hours/week	Exam. Marks			Duration of Exam (hours)	Credits
			CIA	ESE	TOTAL		
19UDZA101	Core Paper 1.Basics of beekeeping	2	25	75	100	3	2
19UDZA202	Core Paper 2. Beekeeping techniques	2	25	75	100	3	2
19UDZA2CL	Core Practical 1. Beekeeping	2	25	75	100	3	2
	Total	**6**			**300**		**6**

7. Passing Minimum

A candidate shall be declared to have passed examinations in theory of study only is he/she scores not less than 40 marks out of 100 in the University examinations.

8. Classification of Success Ful Candidates

The candidate who secures not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in FIRST CLASS. All other successful candidates shall be declared to have passed in SECOND CLASS. Candidates who obtain 75% in FIRST CLASS WITH DISTINCTION provided they pass all the examinations prescribed for the course in the first appearance.

Programme code : 06	Core Paper 1.Basics of beekeeping			
Course code 19UDZA101				
Batch 2019-2020	Semester	Hours/Week 2	Total hours 30	Credit 2

Course Objectives

1. To identify the different species of honey bees
2. To understand the structure and function of a honey bee hive.
3. To understand the basic biology of honey bees
4. To identify the pest and diseases of honey bees

Course Outcomes

K1	COI	Get knowledge and explain the honey bee species and role in agriculture
K2	CO2	Describe biology and structural adaptations of honey bees
K3	CO3	Develop knowledge about honey bee pest and diseses and their control measure.
K4	CO4	Educate the students for the role of honey bees in pollination

Teaching methods : Power point presentation, Seminar, Charts, Models, Assignment, Interaction, Quiz

SYLLABUS

UNIT 1 History and development of apiculture in India 6Hrs

History of bee keeping: definition, beekeeping in India, in worldwide. Traditional bee keeping, modern beekeeping, urban beekeeping. Importance of beekeeping.

Unit II Honey bee species 6Hrs

Identification of honey bee species and their races – rock bees, little bees, Indian bee, European bees and Stingless bees. Basic concepts of morphology of Honey bees : External organs and Internal organs.

Unit III-Biology of honey bees 6Hrs

Colony life and social organization: honey bee castes, structural adaptations of honey bees. Communication in honey bees –dance languages. Swarming and absconding.

UNIT 1V Honeybee Enemies and their management 6Hrs

Bee enemies: an introduction, bee enemies – Wax Moth, Ants, Wasps, Reptiles, diagnosis and identification. Mites infesting on honey bee colonies: *Varroa destructor* and tracheal mites (*Acarapis woodi*) - control measures of bee mites.

UNIT V Bee diseases and their control 6Hrs

Bacterial disease - American Foulbrood, European Foulbrood. Viral disease - Deformed Wing Virus, Sacbrood Virus, Black Queen Cell Virus, Kashmir Bee Virus, Acute Bee Paralysis Virus. Fungal disease - Chalkbrood, Stonebrood. Protozoan disease - *Nosema cerana*. Control measures of bacterial, viral, fungal and protozoan diseases.

Text books

1. David B. Vasantharaj (2016). Elements of Economic Entomology (8th Edition) Brillion Publishing, p 400.
2. Pradip V Jabde (1993). Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture, Agricultural Pests and their Controls. Discovery Publishing House, New Delhi, p 502.
3. Dewey M. Caron (2013). Honey Bee Biology and Beekeeping, Wicwas Press, Kalamazoo, MI 49001,p 368.

References books

1. VIjayakumar K.and R.Jeyaraaj (2017). Beekeeping and management techniques (Tamil), Kongunadu Arts and Science College, Coimbatore, p 145.
2. Ted Hooper (2010). Guide to Bees and Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books, Oxford.p 276.
3. Eva Crane (1999). The World History of Beekeeping and Honey Hunting. Routledge, Taylor and Francis group, New York, p-675.
4. Ghosh G.K. (1994). Beekeeping in India, APH Publishing, p194.

MAPPING

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

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

Programme code : 06	Core Paper 2. Beekeeping techniques			
Course code 19UDZA202				
Batch	Semester	Hours/Week	Total hours	Credit
2019-2020		2	30	2

Course Objectives

1. To develop skills about beekeeping management techniques.
2. To educate the students for the importance of beekeeping and honey processing in relation with entrepreneurship development
3. To aware the role of honey bees in pollination
4. To educate the students for value added products in honey

Course Outcomes

K1	COI	Get knowledge about basic beekeeping techniques
K2	CO2	Describe parts of bee hive and beekeeping equipments
K3	CO3	Develop knowledge about honey harvest and honey processing methods.
K4	CO4	Educate the students for value added products in honey and role of honey bees in pollination

Teaching methods:

Power point presentation, Seminar, Charts, Models, Assignment, Interaction, Quiz

SYLLABUS

UNIT I Bee botany **6Hrs**

Bee pasturage and pollination: Types of bee pasturage- honey pollen plants for bees, Palynological analysis, preparation of bee floral calendars and installing bee pasturage sources.

UNIT II Bee hive management **6Hrs**

Bee Hive: Traditional and modern beehives and beekeeping equipment, Parts of bee hive, basic requirements for beekeeping.

The Apiary: Some common practices in apiary management. Care during breeding season - supering, swarm control, dividing an established colony and transportation of hives (Migratory beekeeping).

UNIT III Management practices and colony manipulation **6Hrs**

General apiary management practices**:** uniting bee colonies and artificial feeding. Seasonal management of honey bees: honey flow season management, summer management and winter management. Bee hive products - harvesting and extraction methods**.**

UNIT IV Queen rearing 6Hrs

Queen rearing and colony multiplication: Raising honey bee queens, developmental stages of queen bee, requirements for rearing good queens, methods of rearing queens.

Unit V Properties of honey and its application 6Hrs

Honey - nutrients and composition of honey. Value added honey products. Properties of honey products. Types of value added honey products.

Text books

1. David B. Vasantharaj (2016). Elements of Economic Entomology (8th Edition) Brillion Publishing, p 400.
2. Pradip V Jabde, (1993). Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture, Agricultural Pests and their Controls. Discovery Publishing House, New Delhi, p 502.

References:

1. Alison Benjamin, Brian McCallum (2008). Keeping Bees and Making Honey. David & Charles, Newton Abbot, p 128.
2. Kim Pezza (2013). Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.5, p 144.
3. Conner L.J. Kim R. and Muir R. (2009). Queen Rearing Essentials, Wicwas Press, p 346.
4. Kim Flottum (2014). The Backyard Beekeeper: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden. Quarry Books, p 208.

MAPPING

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

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

UZO 115

CIA Examination Question Paper Pattern

Examination	15
Assignment	05
Attendance	05
Total	25

End Semester Examinations Question Paper Pattern

(For the students admitted from 2018 onwards)

Diploma in Apiculture

Time : 3 hours Max: 75 marks

Section A 10X1=10

Objective type questions

Section B 5X5=25

Answer all the questions (Either or type questions)

Section C 5X8=40

Answer all the questions (Either or type questions)

Programme code 06	Core Practical-1. Beekeeping			
Course code 19UDZA2CL				
Batch	Semester	Hours/Week	Total hours	Credit
2019-2020		2	30	2

Course Objectives

1. To identify the honey bee species, races and castes
2. To understand the behavior and physiology of honey bees
3. To know the importance of honey bees and hive products
4. To develop knowledge about value added products in honey

Course outcomes

K1	COI	Spply knowledge in identifying honey bee species, races and castes
K2	CO2	Analyze the behavior, importance and physiology of honey bees
K3	CO3	Field visit to study the apiary management techniques and honey harvesting methods
K4	CO4	Demonstrate the students for value added products in honey

Teaching methods :

Power point presentation, Seminar, Charts, Models, Assignment, Interaction, Quiz

SYLLABUS

1. Identification of different bee species and castes.

2. Hive inspection.

3. Dividing, uniting bee colonies and supering.

4. Supplementary feeding and honey extraction.

5. Swarm management.

6. Identification and management of bee enemies and diseases

7. Honey extraction, processing and bottling.

8. Bee pollen extraction.

9. Value added honey product preparation.

Text Books

David Cramp (2012). The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London, p 160.

David Cramp (2009). A Practical Manual of Beekeeping: How to Keep Bees and Develop Your Full Potential as an Apiarist. Spring Hill, London, p 304.

CIA Practical Examination

Model Practical Examination	10 marks
Observation Note	05 marks
Attendance	02 marks
Total	**20 marks**

End of Semester Examination

Time 4 Hours Max.marks – 60

1	Major Question	10 Marks
2	Minor Question	06 Marks
3	Spotters 3X3	09 Marks
4	Record submission	05 Marks
	Total	**30 Marks**

UZO 118

KONGUNADU ARTS AND SCIENCE COLLEGE
(*AUTONOMOUS*)
Affiliated to Bharathiar University
COIMBATORE-641029
CAREER ORIENTED PROGRAMMES SPONSORED BY UGC AT THE
FIRST DEGREE LEVEL
Course duration – One year
DEPARTMENT OF ZOOLOGY
DIPLOMA COURSE IN
ORNAMENTAL FISH PRODUCTION AND TRADE

1. **Regulations**

   A candidate who have passed the Higher Secondary Examination (Academic Stream) conducted by the government of Tamil Nadu or an examination as equivalent to 10 + 2 course including CBSE, which have been recognized by the Bharathiar University or any other University accepted by the syndicate as equivalent there to subject to such conditions as may be prescribed therefore shall be permitted to appear and qualify for Diploma in Ornamental fish production and Trade examination of this University after a course of study of a academic year.

2. **Duration Of The Course**

   The course of the Diploma in Ornamental fish production and Trade shall consist of a academic year.

3. **Course of Study**

   The course of study shall comprise instruction in books prescribed from time to time
   Paper 1 : Aquarium design, fabrications, and entrepreneurship development
   Paper 2 : Aquarium - Best Management Practices (BMP)
   Paper 3 : Aquarium (plants, fishes) production and Trade
   Paper 4 : Practical- 1-Lab
   Paper 5 : Project- 1

4. **Examinations**

   The examinations shall be two hours duration to each paper at the end of the semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

5. **Medium of Instruction**

   English shall be the medium of instruction

UZO119

DIPLOMA COURSE IN

ORNAMENTAL FISH PRODUCTION AND TRADE

The scheme of the Examinations shall be follows

Semester	Subject code	Title of the paper	Lecture hours	Marks			Duration of Exam (hours)	Credit point
				CIA	ESE	Total		
I	19UDZB101	Paper 1 Aquarium design, fabrications, and entrepreneurship development	75	25	75	100	3	5
	19UDZB102	Paper 2. Aquarium - Best Management Practices (BMP)	75	25	75	100	3	5
II	19UDZB103	Paper 3. Aquarium (plants, fishes) production and Trade	75	25	75	100	3	5
	19UDZB2CL	Paper 4- Practical	60	40	60	100	4	5
	19UDZB3Z1	Paper 5 Project Report and Viva-voce	60	20	(60 +20)	100		5
		Total	**345**	**500**				**25**

CIA- Continuous Internal Assessment

ESE-End of Semester Examination

1. PASSING MINIMUM

   A candidate shall be declared to have passed examinations in theory of study only is he/she scores not less than 40 marks out of 100 in the University examinations.

2. CLASSIFICATION OF SUCCESSFUL CANDIDATES

   The candidate who secures not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in FIRST CLASS. All other successful candidates shall be declared to have passed in SECOND CLASS. Candidates who obtain 75% in FIRST CLASS WITH DISTINCTION provided they pass all the examinations prescribed for the course in the first appearance.

   Objectives of the course :

1) To teach techniques of construction of aquarium and its maintenance.

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2) To give students knowledge about various techniques of ornamental fish breeding, rearing, feed preparation and its marketing to make them self sustainable after course.
3)To teach students about fish food production and health related problems with ornamental fish.
4)To inculcate importance of ornamental fish production in relation with trade for entrepreneurship development.

I - SEMESTER

PAPER 1 – Aquarium design, fabrications, and entrepreneurship development

TotalCredits:5 Total Hours: 75

Objectives

1) To inculcate importance of ornamental fish production in relation with trade for entrepreneurship development.
2) To give students knowledge about various techniques of Design, fabrication and filtration for aquarium maintenance
3) To teach techniques to understand about aquarium setting and accessories involved for construction of aquarium and its maintenance.

Course Outcomes

K1	COI	Get knowledge about the commercial ornamental fish production of in India
K2	CO2	Understand the practices of ornamental fish culture and its management to export worldwide
K3	CO3	Apply practical knowledge into fish production and marketing to become successful entrepreneur
K4	CO4	Analyze students acquired technical knowledge which is helpful to begin an entrepreneurship in the field of ornamental Fisheries

SYLLABUS

Unit- I : Introduction

Basics of aquaculture and aquaponics and scope. Ornamental fisheries new dimensions in aquaculture entrepreneurship and Trade. World trade of ornamental fish and export potential.

Basic knowledge and profile of some selected exotic and indigenous fishes. Major countries involved in ornamental fish buying and Status of ornamental fish farming in India.

Unit- II: Fabrication and setting up of aquariums

Design and construction of public fresh water and marine aquaria and oceanarium. Different types of fish tanks, Materials required for construction of tanks, Construction of all glass aquarium glass tank, Method of construction of all glass tanks (flow chart), Steps involved in setting up of aquarium

Unit- III : Aeration and filtration

Aerator, Power air-pump, Spray bar, Filters, Canister filter (external or internal type) Page, Trickle filter, Submersible power filter (box filter / corner filter), Submersible air-lifting filter (inside filter / corner filter), Biofilters in aquarium.

Unit- IV: Aquarium accessories and equipments

Aquarium accessories for small scale units, Equipments and accessories needed for small scale recreational ornamental fish culture unit, Aquarium accessories and equipments for large scale units, Equipment and accessories needed by large scale ornamental fish production unit, Pumps and pipe lines, Equipment and accessories for large scale ornamental fish seed production, Food/feed production units.

UNIT- V: Entrepreneurship Development

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

Text Books

1. Ayyappan S., Jena, J. K. Gopalakrishnan, A. Pandey. A. K. (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.

2. Dholakia, Anshuman D. (2016). Ornamental Fish Culture and Aquarium Management. Daya Publishing House, New Delhi.

3. Petrovicky, I., (1993). Tropical Aquarium Fishes. Chancellor press, London. p.258.

Reference Books

1. Dey, V.K., (1993) Ornamental fishes. Marine Products Export Development Authority, Kochi. pp.7-10.

2. FAO, (2007). Fishery statistics, Aquaculture production, 2005. Food and Agriculture Organization of the United Nations, Rome.

3. Shinji Mekino (1972). Home Aquarium, Aquatic Gems – Tropical Fish. Ward Lock Limited, London. p.97.

4. Wainwright, N. (1969). Coldwater Aquarium. Frederick Warne & Co ltd. England. p.75.

Mapping

CO \ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 4
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

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PAPER 2 – Aquarium - Best Management Practices (BMP)

TotalCredits:5 **Total Hours: 75**

Objectives

1. To impart knowledge about the various management practices for successful production of ornamental fishes
2. To teach students about culture of livefeeds, techniques involved to manufacture artificial feed and health management for ornamental fishes.
3. To understand the cost effective ornamental fish production by adoption of Best Management Practices (BMP)

Course Outcomes

K1	COI	Get field knowledge for design and construction of aquarium.
K2	CO2	Understand the formulation of feed and nutrition management for betterment of ornamental fish culture
K3	CO3	Apply knowledge on health management for successful production of aquarium fishes.
K4	CO4	Analyze the breeding and culture techniques for the trading.

Unit- I Aquarium fish management

Cleaning and disinfection of the aquarium, Commercially important marine and freshwater ornamental fishes- Quality assessment, Handling of live fishes, fish acclimation, Stress management, Grading and stocking ratio, Photoperiod, Brood stock management, larval, fry and juvenile management. Reef aquarium management.

Unit- II- Water management

Water quality parameters – Temperature, Salinity, Turbidity, determination of pH, Electrical conductivity, Dissolved Oxygen, Carbon dioxide, Total alkalinity, Total hardness, Ammonia, Nitrite and Heavy metals. Water culture, Re-circulation, Exchange and sanitation.

UNIT-III: Feed and feeding management

Live food organisms and its nutritional value, Proximate composition of live and artificial feeds, Feeding frequency, Collection and culture of Infusoria, Collection and culture of Artemia sp. Culture of daphnia, Culture of tubifex, Culture of blood worms, Mosquito larvae, Rotifers, Copepods. Preparation of artificial feed, Formulated feeds, Types of feeds, feed for formulation, Manufacturing, Feeding devices and methods and Feed additives

UNIT- IV: Health management

Biosecurity measures, Diseases of ornamental fishes- Bacterial diseases, Protozoan diseases, Fungal diseases, Parasitic diseases, Pathogenecity, Host, Pathogen and environment interactions. Disease diagnostics techniques. Drugs, Chemicals, Antibiotic, Probiotics and their mode of action. Quarantine and health certification for ornamental fishes.

UNIT- V: Transport and packaging

Method of collection and transportation of live fish, Transportation of ornamental fish, Fish packaging system, Steps to be taken while transporting fish, Application of anaesthetics, Conditioning of fish for packaging, Record keeping.

Text Books

1. Ayyappan S., Jena, J. K. Gopalakrishnan, A. Pandey. A. K. (2011). Handbook ofisheries 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.

2. Dholakia, Anshuman D. (2016). Ornamental Fish Culture and Aquarium Management. Daya Publishing House, New Delhi.

3. Goldstein, R. J. (1971). Diseases of aquarium fishes. T.F.H. Publications. 126 pp

Reference Books

1. Bhat, B.V., 2008. Export oriented aquaculture in India: An overview. Fishing Chimes, 27 (10/11): 51-58.

2. Boyd, C.E., 1992. Water quality management for pond fish culture. Elsevier science publishers, Netherland. p.317

3. Lochmann, R.T. and Phillips, H., 1994. Dietry protein requirement of golden shiners (Notemigonus crysoleucas) and goldfish (Carassius auratus) in aquaria. Aquaculture, 128:277-285.

MAPPING

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

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

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PAPER 3 – Aquarium (plants, fishes) production and Trade

TotalCredits:5 **Total Hours: 75**

Objectives

1.To impart knowledge on ornamental fish production and trade for develop entrepreneurship for uplift livelihood

2. To inculcate technical knowledge on ornamental fish production and its marketing to make them self sustainable after course.

3. To provide self employment opportunities and knowledge for students.

Course Outcomes

K1	COI	Get knowledge about the production of ornamental plants and fish species
K2	CO2	Understand the ornamental fish breading and rearing techniques to generate self employment
K3	CO3	Apply knowledge into the ornamental fishculture field to avoid production risks and enhance production level
K4	CO4	Analyze technical knowledge useful for consultancy, marketing and entrepreneurship development in the field of ornamental fishculture

Unit- I: Aquarium plants and its propagation techniques

Introduction to Aquarium plants and their export potential. Profiles of some selected aquarium plants. Morphology, multiplication of aquarium plants – different methods. Indigenous ornamental plants of Western Ghats. Aquarium plant propagation. Management of ornamental aquatic plants and its trading.

Aquarium- Pond maintenance

Unit- II: Biology

Fish biology- Gonad maturation, spawning, fertilization. Techniques in genetic improvement of ornamental fishes, Selective breeding, Selection, Crossbreeding, Hormonal induction of sex reversal

Unit- III: Breeding of live bearers and egg layers

Breeding of ornamental fish with reference to live bearer species- Breeding of Guppies, Mollies, Swardtail fish and Platy fish. Introduction hatchery management system for live bearers. Nursery management of live bearers. Rearing of live bearers

Breeding of ornamental fish with reference to selected egg layer species- Introduction to Breeding of Angel fish, Zebra fish and Neon tetra. Introduction hatchery management system for egg layers. Nursery management of egg layers. Special emphasis on Breeding of Gold fish.

Unit- IV : Setting up of spawning tank

Conditioning of parent fish, Spawning tank, Egg-scatterers, Egg-depositors

Egg-burriers, Mouth-brooders, Nest-builders, Breeding of fighter fish, Stimulating spawning, Water conditions, Food, The rearing tank, Raising the fry

Unit- V : Ornamental fish trade, its regulations and wildlife act

Ornamental fish trade

Production, marketing and Economic viability, Supply situation, Demand situation, US market, Japaneese market, Western Europe market, Indian scenario

Trade regulations and wildlife act

Trade regulations and wildlife act in relation to ornamental fishes, Definitions under the act, Prohibition of hunting, Trade or commerce in wild animals, animal articles and trophies,

Reporting of possession of government property, Certificate of ownership, Regulation for transfer of animal, Features of schedule I of wild life act.

Text books

1. Aexlrod, H.R. and Schultz, P.L., 1983. Hand Book of Tropical Aquarium Fishes. T.F.H. Publications, Hongkong. p.28-30.

2. Ahilan. B, Felix. N and Jameson, J.D., 2009. Goldfish. Daya Publishing House, New Delhi. p.87.

3. Handbook of Fish Biology and Fisheries Edited By J.B. Hart & John Reynold.

Reference Books

1. Hervey, G.F. and Hems, J., 1968. The Goldfish. Faber and Faber Limited, Great Britain. Pp.265

2. Joseph Smart . 2001. Goldfish varieties and genetics. Fishing News Books. USA p 216.

3. Purdom, C.M., 1993. Genetics and Fish Breeding. Chapman and hall London. p.277.

4. Dey, V.K., 2008. Global Trade in Ornamental Fish: Trends, Prospects and Issues. Abstract, International seminar on Ornamental fish breeding, farming and trade, Cochin, India. pp.2.

5. Ramachandran, A., 1999. International Trade in Ornamental Fish. 12th Indian Seafood Trade Fair, Souvenir. Seafood Exporters Association, India. pp.24-29.

6. Singh, T. and Dey, V.K., 2003. Ornamental fish trade runs into billions, Info fish Int., 5:54-60.

4. Text Book of Fish Biology and Indian Fisheries By Dr. R. P. Parihar, Central Pub. House
5. Fisheries Biology, Assessment and Management By Michael King – Fishing News Publishers (1995).

6. Thomas, K., 2008. Status of Ornamental fish trade in India with special reference to investment and trade opportunities. Abstract, International seminar on ornamental fish breeding, farming and trade, Cochin, India. pp.7.

MAPPING

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

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

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PAPER 4 – Practical- 1

TotalCredits:5 **Total Hours: 60**

- Identification of common ornamental fishes and plants.
- Aquarium accessories and equipments.
- Fabrication of all-glass aquarium.
- Setting-up and maintenance.
- Water quality parameters
- Fish Biology
- Fabrication of filters
- Conditioning and packing of ornamental fishes.
- Preparation of feed.
- Setting-up of breeding tank for live bearers, barbs, goldfish, tetras, cichlids, gouramis, fighters and catfishes.
- Identification of ornamental fish diseases and prophylactic measures.

Suggested Field Visits

Field visits are to be organised to facilitate students to have firsthand experience and exposure to technology / production / functioning of an organisation / unit or witness a relevant activity.
Each student must make at least 02 (Two) such visits to the units/markets/public aquarium out of 2 to 3 such visits organised by the college.

i) Visit to one of the units with one or multiple activities such as.

- Ornamental fish farm / Nursery/ Hatchery.

ii) Visit any production units such as

- Ornamental fish Food industry

iii) Govt. Offices such as

- National and state fishery Departments.

iv) Visit to National Laboratories, National Research Labs & Training Institutes such as

(Field visit is desirable to know the organization; however guest lecturers could also be helpful in understanding functioning).

Reference Books

1. Archana Sinha, Prem shankar Pandey and Surya Kumar Prabhakar (2008). Training Manual on Culture and Breeding of Ornamental Fish. Central Institute of Fisheries Education, Kolkatta centre.

2. Fish Biology By C.B.C. Srivastava – Narendra Pub. House.

3. Santhanam. R, Sukumaran. N and Natarajan.P., 1990. A manual of freshwater aquaculture. Oxford & IBH Publishing Co Pvt. Ltd., New Delhi. p.102-120.

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PAPER 5 – Project- 1

TotalCredits:5 **Total Hours: 60**

Suggested Topics For Individual Project

1. Setting and Maintenance of fresh water aquarium.
2. Setting and Maintenance of marine aquarium.
3. Breeding of various aquarium fishes.
4. Preparation of aquarium fish feed.
5. Breeding of aquarium fishes.
6. Rearing of aquarium fishes.
7. Propagation of aquatic plants.
8. Feasibility report of the maintenance of aquarium fishes in high profile residences.
9. Probability report of maintenance of a culture of Chaetoceros & Artemia by the fish farmers.
10. Project report for the establishment of small / medium / large ornamental fish farming unit
11. Feasibility report of various packaging materials in freezing / canning industry.
12. Feasibility report for establishing an aquarium shop.
13. Feasibility report for establishing a fish feed industry.
14. Setting up of marine aquarium with various accessories and its costing.
15. Finding herbal medicines for ornamental fish diseases
16. Propagation of aquarium plants and tissue culturing methods

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KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

Affiliated to Bharathiyar University

COIMBATORE-641029

END SEMESTER EXAMINATIONS QUESTION PAPER PATTERN

(For the students admitted from 2005 onwards)

COP- ORNAMENTAL FISH PRODUCTION AND TRADE (Diploma course)

Time : 3 hours Max: 75 marks

Section A 10*1=10

Objective type questions

Answer all the questions

Two questions from each unit should be taken

All question carry equal marks

Section B 5*5=25

Answer all the questions

Either or type questions

Two questions from each unit should be taken

All questions carry equal marks

Section C 5*8=40

Answer all the questions

Either or type questions

Two questions from each unit should be taken

All questions carry equal marks