

CHOICE BASED CREDIT SYSTEM (CBCS) IN ZOOLOGY**Total credit = 74****Credit (Core 48 + Elective 18 (Department) + Foundation 4+ Elective 4 (Other Departments))**
Foundation Credit 4 = 4 Compulsory (Computer Application)**Core Courses**

<i>Semester - I</i>		
Course Code	Course Name	Credit
ZL701C	Animal Diversity (Non Chordates and Chordates)	4
ZL702C	Developmental Biology and Endocrinology	4
ZL704C	Laboratory Exercise	4
ZL705C	Biochemistry and Molecular Biology	4
<i>Semester - II</i>		
ZL802C	Cell Biology and Genetics	4
ZL804C	Laboratory Exercise	4
ZL806C	Histology & Histochemistry	2
ZL807C	Environmental Biology and Animal Behaviour	4
<i>Semester - III</i>		
ZL902C	Parasitology and Immunology	2
ZL903C	Project	4
ZL906C	Animal Physiology	4
<i>Semester - IV</i>		
ZL1001C	Biosystematics & Evolution	2
ZL1003C	Project	4
ZL1008C	Economic Zoology	2
Total Credit		48

Elective Courses

<i>Semester II</i>		
ZL805E	Tools and Techniques in Biology	2
<i>Semester III</i>		
ZL904E	Aquatic Environmental Science	2
ZL905E1/ ZL905E2/ ZL905E3/ ZL905E5	Advanced Animal Ecology Fisheries Comparative Endocrinology Advanced Biochemistry	4
<i>Semester IV</i>		
ZL1004E	Aquaculture	2
ZL1005E	Insect Taxonomy	2
ZL1006E	Soil Zoology	2
ZL1007E1/ ZL1007E2/ ZL1007E4/ ZL1007E5	Biodiversity Fish Technology Mammalian Reproductive Physiology Advanced Cell Biology	4
Total Credit		18
Compulsory Foundation (Computer Application)		4
ST704E	Elective Other Department (Statistics)	4
Total Course Credit		74

Paper: ZL704C Laboratory Exercises**(Credit – 4)**

Sl. No.	Topics	Classes
1.	Slide preparation of mouth parts of different insects	2
2.	Drawing of development of schizocoelic and enterocoelic body cavities	2
3.	Drawing of cleavage pattern in protostomes and deuterostomes	2
4.	Identification of bones in birds (Pigeon) and mammals (Cavia/Ratus)	2
5.	Mounting, drawing & labeling of different types of scales, feathers in birds	2
6.	Slide identification: T.S. of skin (amphibian and mammalian), T.S. of lung (bird and mammal), T.S. of kidney (fish, bird, mammal), T.S. of intestine (amphibian and mammal)	4
7	Development of Chick embryo at different incubation period – studies with permanent slides	2
8	Development of neural fold, notochord and somites in Chick embryo	2
9	Development of fore brain, mid brain and hind brain in chick embryo	2
10	Stages of development of heart in chick embryo	2
11	Study of endocrine gland with permanent slides	2
12	Double stain (H-E) preparation of permanent slides of endocrine glands	3
13	Estimation of protein by Folin's reagent	3
14	Estimation of glucose by Anthrone reagent	3
15	Enzyme assay: effect of time and temperature, effect of substrate	3
16	Protein isolation and polyacrylamide gel electrophoresis	3
17	DNA isolation and agarose gel electrophoresis	3
18	Determination of casein content in milk	2
19	Determination of ascorbic acid in lemon and tomato	2
20	Determination of glucose absorption by intestine of chick	2
	Class Tests	6
	Total (Each class of 3 hours)	54 54x3=162

Paper: ZL804C Laboratory Exercises

Credit 4

Sl. No.	Topics	Classes
1.	Processing of mammalian glandular tissues and their double staining (Eosin & Hematoxylin)	02
2.	Preparation and staining of skeletal muscle of mammals	02
3.	Staining and identification of blood cells	02
4.	Identification of histological slides based on syllabus	02
5.	Metaphase chromosome preparation from rat bone marrow cells	04
6.	Polytene chromosome preparation from <i>Drosophila/Chironomus</i> salivary glands	03
7.	Staining of mitochondria	02
8.	Nucleocytoplasmic index	02
9.	Fluorescence staining	02
10.	Study of meiosis from grasshopper testis	04
11.	Immunofluorescent staining of actin fibres	02
12.	Analysis of Human Pedigree and construction of Pedigree Chart	02
13.	Determination of dissolve oxygen in water	02
14.	Determination of free carbon dioxide in water	02
15.	Analysis of Turbidity and Transparency of supplied sample	02
16.	Analysis of Carbonates and Bicarbonates of supplied sample	04
17.	Chromatographic separation of amino acids	04
18.	Tissue preparation for analysis of proteins, enzymes, nucleic acids using tools like centrifuge and spectrophotometer	05
	Class Tests	06
	Total (Each class of 3 hours)	54 (55x3=165)

Paper: ZL805E

Tools and Techniques in Biology

Credit 2

Sl. No.	Topics	Classes (hrs)
1.	Microscopy: Basics of bright field, dark field, phase contrast, fluorescence, confocal microscopy; transmission and scanning electron microscopy	3
2.	Centrifugation: Principle and uses of centrifuges (tissue processing and separation of various sub-cellular organelles)	3
3.	Spectrophotometry: Types and function of spectrophotometers; Beer-Lambert Law, molar extinction coefficient, absorption spectrum	3
4.	Electrophoresis: Principles, agarose and polyacrylamide gels, isoelectric focusing, two dimensional electrophoresis	3
5.	Chromatography: Principle and types, absorption, partition, gel filtration, ion-exchange, affinity, elementary concepts of HPLC	5
6.	Blotting techniques: Southern, Northern and Western blotting, microarray, DNA foot printing, EMSA	4
7.	Recombinant DNA techniques: Restriction endonucleases, cloning vectors, gene cloning, polymerase chain reaction, DNA sequencing	5
8.	Production of transgenic animals and application	2
	Class Tests	2
	Class Discussion	2
	Total	32

Paper: ZL903C

Project

Credit – 4

1. Course work

Sl. No.	Topics	Credit
1.	Course work	1
2.	Literature review and formulation of objectives	1
3.	Laboratory/ Field work	1
4.	Dissertation submission and power point presentation	1

Paper: ZL904E

Aquatic Environmental Science

Credit – 2

Sl. No.	Topics	Classes (hrs)
1.	Definition and scope of aquatic environmental biology, structure and function of aquatic ecosystem, wetland, pond, lake, river etc.	2
2.	Water and Light : scatter and diffusion, effects of UV radiation on aquatic fauna	2
3.	Thermal stratification and thermocline formation in lake, , flow of heat	2
4.	Contribution of atmospheric gases to aquatic ecosystem; Importance of wetlands as carbon sequester	1
5.	Gaseous biogeochemical cycle: Carbon and Oxygen cycle - diurnal and seasonal changes; Nitrogen cycle - forms of nitrogen, nitrogen fixation, dissolved organic nitrogen, eutrophication and control	3
6.	Sedimentary biogeochemical cycle: Phosphorus cycle, recycling of phosphorus, eutrophication and control	2
7.	Concept of meteorological data, climate change, causes and effects on biota, algae as carbon sequester, management	2
8.	Lentic and lotic resources- their conservation and sustainable development, basic characteristics of lentic and lotic environment, role of inorganic carbon and organic carbon (CO ₂ , CO ₃ , HCO ₃ , H ₂ CO ₃) and organic carbon	2
9.	Pesticides in freshwater: Origin, fate and effects on biota	3
10.	Marine ecosystem, its chemical characters and faunal distribution	2
11.	Estuarine ecosystem, its chemical characters and impact on faunal distribution	2
12.	Principles of analytical methods, Titrimetry, Gravimetry, Colorimetry and Spectrophotometry	2
13.	Hydrologic cycle, global water balance, ice sheets and fluctuations of sea levels, origin and composition of seawater, factors influencing the surface water, resources of oceans, ocean pollution, human use of surface and ground waters, groundwater pollution and control measures	3
	Class Tests	2
	Class Discussion	2
	Total	32

Paper: ZL905E2

Fisheries

(Credits – 4)

First Half		Credit -2
Sl. No.	Topics	Classes (hrs)
1.	Fisheries-definition, types, fishes, classification	1
2.	Diversity of freshwater and marine water fish fauna	3
3.	Riverine environment, characters of stream, physico-chemical and biological characters	4
4.	River pollution, Chemical characters of polluted river, biological indicators of India	3
5.	Dams and their effects on fish migration	3
6.	Fisheries of important reservoirs and lakes	4
7.	Estuarine and coastal fisheries	3
8.	Management of stocking ponds – Indian major carps (IMC), definition, characterization, wild resources, control of weeds, insects and predatory fishes, pond, fertilization, stocking, supplementary feeding, disease control	3
9.	Responsible fisheries - laws and regulations for conservation	1
10.	Endangered, near threatened, vulnerable and rare fish species and conservation strategies	3
	Class Tests	2
	Class Discussion	2
Second Half		Credit 2
1.	Hatcheries- types, characteristics, water quality	1
2.	Nursery, rearing, pre-stocking and post-stocking systems management	4
3.	Lay-out criteria of different nature of fish pond ecosystem	3
4.	Monoculture, principles, basic steps of field studies - merit and demerit	3
5.	Polyculture, principles, practices, merit of polyculture	3
6.	Integrated fish farming- concept, types, Paddy cum fish culture, Duck cum fish culture, sewage fed fisheries, scope and limitations	4
7.	Culture of herbivore fishes – role of <i>Ctenopharyngodon</i> , <i>Hypophthalmichthys</i> for biological control of weeds and microalgae, low carbon foot print fish	4
8.	Sustainable fish culture	2
9.	Monosex culture of Tilapia	2
10.	Shrimp farming	2
	Class Tests	2
	Class Discussion	2
Total		64

Paper: ZL1003C

Project work

Credit 4

Sl. No.	Topics	Credits
1.	Course work	1
2.	Literature review and formulation of objectives	1
3.	Laboratory/ Field work	1
4.	Dissertation submission and power point presentation	1

Paper: ZL1004E

Aquaculture

Credit 2

Sl. No.	Topics	Classes (hrs)
1.	Aquaculture definition, principle and scope, types, aquatic adaptation of fish, advantages of aquafarming, cultural diversity, biological pathway, socioeconomic importance	3
2.	Selection of sites for aquaculture, land based farm, open water farm etc, water quality and quantity management	2
3.	Biological characteristics of aquaculture species, common species and their importance	2
4.	Design and construction of aqua farms, fundamental concept, economic criteria	2
5.	Nutrition and feeds, food and feeding habits of cultivable species, HUFA, PUFA, nutritional importance and human health	2
6.	Economic viability, data requirements, cost-benefit analysis of aquaculture	2
7.	Aquaculture practices, husbandry procedures, carp	2
8.	Ornamental fish, diversity, culture and importance	2
9.	Management of stocking pond - optimal conditions of water quality criteria, management	2
10.	Culture of air breathing fishes-concept, principles and practices	2
11.	Culture of endangered species- <i>Ompok</i>	2
12.	Fin fish and shell fish- major cultivable species of shrimps, reproduction and larval rearing	2
13.	Fish health and disease treatment, husbandry procedures-cleaning, feeding, effluent treatment and management	2
	Class Tests	2
	Class Discussion	2
	Total	31

Paper: ZL1006E

Soil Zoology

Credit 2

Sl. No.	Topics	Classes (hrs)
1	Soil components and types; soil profile; physical and chemical properties of soil; macro and micro nutrients in soil and their importance to the soil organisms; physico-chemical changes in soil following application of organic manure/ vermicompost	3
2	Soil micro, meso- and macro- fauna - their spatial and vertical distribution and importance in soil ecosystem	3
3	Soil inhabiting nematodes, their general characters; life cycle of a plant parasitic nematode (<i>Meloidogyne incognita</i>); beneficial and harmful role of soil inhabiting nematodes	8
4	Earthworm and termites as soil-ecosystem engineers; their ecological categories, soil turnover, formation of biogenic structures (casts, galleries)	4
5	Reproductive biology of Earthworms; hermaphroditism, conjugation, cocoon production and biology of cocoon	4
6	Termite colonies; feeding habits and digestive processes in termites	2
7	Adaptive strategies in soil invertebrates	3
8	Class tests	2
9	Class discussion	2
	Total	31

Paper: ZL1007E2

Fish Technology

Credit 4

First Half		Credit -2
Sl. No.	Topics	Classes (hrs)
1.	Brood stock management, selection criteria, feeding	2
2.	Reproduction and genetic selection	3
3.	Basic water quality characters of nursery and rearing ponds	3
4.	Acclimatization, concept, basic importance, pathway for acclimatization technology	3
5.	Concept of captive breeding, steps for captive breeding technology, factors stimulating and suppressing, gonadotropin, <i>ex-situ</i> conservation of endangered fish	4
6.	Cryopreservation of gametes, significance, cryo-protectants, steps for cryopreservation, merit and limitations	3
7.	Sex control, sex reversal, sterilization, Hybridization, interspecific, intergeneric, significance	3
8.	Triploid fish, characterization of the species, artificial technology for development of triploid fish	4
9.	Transgenic fishes, gynogenesis, androgenesis, scope and limitations	3
	Class Tests	2
	Class Discussion	2
Second Half		Credit 2
1.	Fish pathology, fungus infection, bacterial diseases, protozoan diseases, control measure	4
2.	Harvesting and post harvesting technologies, by products of fish industry and their economic importance	3
3.	Transportation of live fish and seed, merits and limitations	3
4.	Freshwater prawn culture technology, breeding characteristics, juvenile prawn migration, culture practices	3
5.	Scope for Hilsa breeding and development	3
6.	Low carbon foot print fish culture- silver carp, grass carp, common carp etc.	3
7.	Induced spawning, brood stock, management, environmental control of spawning	3
8.	Trout, Salmon, stripping, fertilization and hatching,	2
9.	Raceway culture technology, water quality characteristics, significance	2
10.	Cage culture and Pen culture technology, species specification, steps of culture, scope	2
	Class Tests	2
	Class Discussion	2
	Total	64

Paper: ZL1008C

Economic Zoology

Credit 2

Sl. No.	Topics	Classes (hrs)
1.	Concept of pest, Pest management, Integrated pest management. Insect pests of paddy and vegetables, pesticides and their modes of actions.	6
2.	Sericulture: types of silkworm and silk, composition of silk, rearing of silk moth, extraction of silk, diseases of silk worm, scope of sericulture industry and recent approaches to improvement in quality of silk.	6
3.	Fish culture: Economic importance, edible fresh water fishes, indigenous and exotic fishes, culture practices, conservation, by products of fish industry, management	4
4.	Prawn fishery: Characterization of prawn and shrimp; fresh water prawn culture and its prospects in India	5
5.	Vermiculture and vermicomposting: selection of earthworm, principle, method and applications	5
	Class Tests	2
	Class Discussion	2
	Total	30