MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Zoology

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Sem.	Pt.I/ II/III IV/V	Subject Status	Subject title	Course /paper	Contact Hrs./ Week	Credits
I	I	Language	Tamil/Other Language	1	6	4
	II	Language	English	1	6	4
	III	Core	Animal Diversity-I Invertebrata	1	4	4
	III	Core	Animal Diversity-II Chordata	1	4	4
	III	Major Practical-I	Animal Diversity-I Invertebrata & Animal Diversity-II Chordata	1	2	2
	III	Allied-I	Cell Biology, Genetics and Bio-Technology/Industrial Fish and Fisheries-Biology of Fish	1	4	3
	III	Allied Practical-I	Cell Biology, Genetics and Bio-Technology/Industrial Fish and Fisheries-Biology of Fish	1	2	2
	IV	Common	Environmental Studies	1	2	2
			Sub total	**8**	**30**	**25**
II	I	Language	Tamil/Other Language	1	6	4
	II	Language	English	1	6	4
	III	Core	Developmental Zoology	1	4	4
	III	Core	Ecology & Toxicology	1	4	4
	III	Major Practical-II	Developmental Zoology & Ecology & Toxicology	1	2	2
	III	Allied-II	Developmental Zoology, Ecology, Animal Physiology & Evolution/Industrial Fish and Fisheries-capture Fisheries	1	4	3
	III	Allied Practical-II	Developmental Zoology, Ecology, Animal Physiology & Evolution/Industrial Fish and Fisheries-capture Fisheries	1	2	2
	IV	Common	Value based education/Social harmony	1	2	2
			Sub total	**8**	**30**	**25**
III	I	Language	Tamil/Other Language	1	6	4
	II	Language	English	1	6	4
	III	Core	Cell and Molecular Biology	1	4	4
	III	Major Practical-III	Cell and Molecular Biology	1	2	2
	III	Allied-III	Cell Biology, Genetics and Bio-Technology	1	4	3
	III	Allied Practical-III	Cell Biology, Genetics and Bio-Technology	1	2	2
	IV	Skilled based-core	(Any one) 1.Home aquarium 2. Nutrition and Dietetics	1	4	4
	IV	Non-Major Elective	(Any one) 1.Bee Keeping 2. Clinical Biology	1	2	2
			Sub total	**8**	**30**	**25**

IV	I	Language	Tamil/Other Language	1	6	4
	II	Language	English	1	6	4
	III	Core	Genetics	1	4	4
	III	Major Practical-IV	Genetics	1	2	2
	III	Allied-IV	Developmental Zoology, Ecology, Animal Physiology and Evolution	1	4	3
	III	Allied Practical-IV	Developmental Zoology, Ecology, Animal Physiology and Evolution	1	2	2
	III	Skilled based	PD/Yoga	1	4	4
	IV	Non-Major Elective	(Any one) 1. Public Health and Hygiene 2. Community and Social preventive Medicine.	1	2	2
	V	Extension Activity	NCC/NSS/YRC/YW			1
			Sub total	**8**	**30**	**26**
V	III	Core	Animal Physiology	1	5	4
	III	Core	Animal Biotechnology	1	5	4
	III	Elective	(Any one) 1. Sericulture 2. Economic Entomology 3. Dairy farming	1	5	4
	III	Elective	(Any one) 1. Apiculture 2. Food and Food Processing Technology 3. Poultry Science	1	5	4
	III	Major Practical-V	Animal physiology and Biochemistry	1	3	2
	III	Major Practical-VI	Animal Biotechnology	1	3	2
	III	Major Practical-VII	Corresponding Electives	1	2	2
	IV	Skill based common	Computer	1	2	2
			Sub total	**8**	**30**	**24**
VI	III	Core	Evolution	1	6	4
	III	Core	Immunology and Microbiology	1	6	4
	III	Core	Biostatistics,Computer applications & Bioinformatics	1	5	4
	III	Major Practical-VIII	Evolution, Immunology and Microbiology	1	3	2
	III	Major Practical-IX	Biostatistics,Computer applications & Bioinformatics	1	3	2
	III	Major Practical-X	Corresponding Electives	1	2	2
	III	Project Group		1	5	4
			Sub total	**7**	**30**	**22**

Total number of hours: 180 Total number of Credits: 147

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc. Zoology) / Semester – I / Core-1

ANIMAL DIVERSITY - I - INVERTEBRATA

4 Hrs. /Week **4x15=60Hrs/Semester** **12Hrs/Unit** **4 Credits**

OBJECTIVE:

To elucidate the importance of taxonomy, to know the methods of nomenclature, to realize the differences between Protozoa and Metazoa and to study the structure, functional organization, adaptations and the economic importance of lower and higher Invertebrates.

UNIT I

Introduction to Principles of taxonomy – Binominal nomenclature.

Protozoa: General Characters and classification up to classes with the examples.

Type study:- *paramecium:* morphology – nutrition – Osmoregulation – Excretion – Reproduction(binary fission and conjugation)

General structure, life cycle, Pathogeny and Control Measures of the following: (a) *Entamoeba histolytica (b) plasmodium*

Porifera: General Characters and classification up to classes with the names of the examples.

Type study:- *Leucosolenia* – External morphology – Body wall – Reproduction. **General topic:** Canal system in sponges.

UNIT II

Coelenterata: General characters and classification up to classes with the names of the examples.

Type study:- Obelia – External Characters (structure of the colony) – life history.

General Topics: Corals, Coral reefs and their significance.

Platyhelminthus: General characters and classification up to classes with the names of the examples.

General topic: (i) External morphology and life cycle of fasciola hepatica.

(ii) Parasitic adaptations of platyhelminthes.

UNIT III

Aschelminthes (Nematoda): External morphology, life cycle, pathogeny, Parasitic adaptations and control measures of the following:

(a) Ascaris lumbricoides (Round worm)
(b) Dracunculus medinensis (Guinea worm)
(c) Wuchereria bancrofti (Filarial worm)

Annelida: General characters and classification up to classes with the names of the examples.

External characters

General topics: (i) Metamerism in Annelida.

(ii) Biological significance of Earthworm.

UNIT IV

Arthropoda: General Characters and classification up to class with the names of the examples.

Type study: Penaeus: External characters–Appendages–compound eye -Reproductive system and Life cycle.

General topics: (i) social life in insects – Honey Bees

(ii) Beneficial insects – Honey bee, Lac insects and silk moth

(iii) External Characters, economic importance and control measures of the pests of agricultural crops (Coconut – Paddy)

(a) Oryctes rhinoceros (b) Leptocorisa acuta

UNIT V

Mollusca: General characters and classification up to classes with the names of the examples.

Type study: Pila globosa: External characters – shell – mantle cavity – Anatomy of Digestive system and reproductive system.

General topics: (i) Pearl culture and Pearl Industry in India.

(ii) Cephalopods as advanced Molluscs.

Echinodermata: General characters and classification up to classes with the names of the example.

Type study : Star fish: External Characters – Water vascular system.

General topic:- Larval forms of Echinodermata and their Phylogenetic significance.

REFERENCE BOOKS: Animal Diversity – I : Invertebrata

1. Arora, M.P.Non – Chordates ,Himalaya Publishing House, Ramdoot, Dr.Bhalero Marg (Kelewadi) Gurgan, Mumbai-400004.
2. Barrington, E.J.W.,Invertebrate structure and function.Boston – Houghton. Miffin and ELBS, London.
3. Bhamrah,H.S.et.al. A text book of Invertebrates. Alilnol Publications Private Limited,4374/4B.Ansari Road, Dayaganj,New Delhi – 110002.
4. Brusca, Invertebrates, ANE Books, Avantika,Niwas,19 Doraiswamy Road, T.Nagar,Chennai-600 017.
5. Ekambaranatha Iyer,M.: A Manual of Zoology Part I. Invertebrata, S. Viswanathan (printers and Publishers)Pvt.Ltd,Chennai.
6. Jan,A. Pechenik, Biology of the Invertebrates, Tata McGraw-Hill Publishing Company Limited,No.444/1 Sri Ekambara Naicker Industrial state,Alalpakkam, Porur,Chennai-600 016.
7. Jordan,E.L.and P.S. Verma. Invertebrate Zoology (14^{th} Edition).S. Chand and Company Limited,7361 Ram Nagar,Qutab Road,New Delhi-110055.
8. Kotpal R.L. Modern Text Book of Zoology, INVERTEBRATES (9^{th} Edition). Rastogi Publications, Gangotri, Shivaji Road, Meerut-250 002.
9. Mahanta Rita and I.K. Bhattacharyya. Invertebrate Zoology. Kalyani Publishers, B1/1299, Rajaendar Nagpur, Ludhiana-141008.
10. Parker and Haswell. A text Book of Zoology, Invertebrates Volume I. AITBS Publishers and Distributors,J5/6 Krishna Nagar, Delhi-110051
11. Verma, A. Invertebrates: Protozoa to Echinodermata. Naros Publishing House Private Limited.35-36 Greams Road, Thousand Lights, Chennai - 600006.

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc. Zoology) / Semester – I / Core - 2

ANIMAL DIVERSITY –II: CHORDATA

4 Hrs/week **4x15=60 Hrs/Semester** **12 Hrs/Unit** **4 Credits**

OBJECTIVE: To exemplify the intermediary position of Prochordates between invertebrates and vertebrates, and to study the structure, functional organization, adaptations and the economic importance of lower and higher chordates

UNIT I: **Introduction to chordata**: General characters(Diagnostic characters and additional characters)and Classification up to classes with the name of the examples.

Prochordata: General characters and classification up to orders with the name of the examples.

Type study: Amphioxus-External features-Digestive and Excretory system

External features and biological significance of the following

(a) Ascidian (b) Balanoglossuss

Agnatha: Petromyzon- External morphology; Ammocoetes Larva

UNIT II: Pisces: General characters and classification up to sub-classes with the names of the examples

Type study: scoliodon (shark) -External characters- Placoid scales-Digestive system-Respiratory system-Receptor Organs- Urinogenital system.

General topics: (i) Accessory respiratory organs in fishes (ii) Migration of fishes

(iii) Parental care in fishes

UNIT III: Amphibia: General characters and classification up to orders with the name of the example.

External features and biological significance of the following Examples:

(a) Rhachophorus (b) Ambystoma (c) Axolotl Larva.

General topic: Parental care in Amphibia

Reptilia: General characters and classification up to orders with the name of the examples

External features and Biological significance of the following Examples:

(a) Chelone mydas (b) Chamaeleon (c) Draco (d) Cobra

General Topics: (i) Identification of poisonous and non-poisonous snakes of South India (ii) Poison apparatus- Biting mechanism- venom- First aid for snake bite-Antivenom.

UNIT IV: Aves:- General characters and classification up to subclasses with the names of the examples.

Type study: Columba livia (Pigeon)-External characters-Flight muscles-Digestive system-Respiratory system-Urinogenital system

General topics: (i) Migration of Birds (ii) Flight adaptations in Birds

UNIT V: Mammalia: General characters and classification up to subclasses with the names of the examples.

Type study: Rabbit –External morphology – Digestive system – Respiratory system- Heart-Structure of Brain- Reproductive system.

General topics:(i) Egg laying mammals (ii) Adaptations of aquatic mammals

(iii) Dentition in mammals

REFERENCE BOOKS: Animal Diversity II - Chordata

1.Alexander, R.M. The Chordates Cambridge University Press.

2.Bhamrah, H.S. et al. A text book of chordates.Anmol publication Limited, 4374/4B Ansari Road,Daryaganj, New Delhi 110002.

3.Ekambaranatha Ayyar,M. and T.N.Ananthakrishnan. A Manual of Zoology Vol.II(chordate).S.Viswanathan (Printers and Publishers)Pvt.Ltd.,Chennai.

4.Jordan E.L. and P.S Verma.Chordata Zoology (11th Edition).S.Chand and Company Limited, 7361 Ram Nager,Qutab Road,New Delhi-110 055.

5.Kardong, K. Vertebrates:Comparative Anatomy,Function,Evolution.Tata Mc Graw Hill publishing Company Limited,444/1.Sri Ekambara Naicker Industial estate,Alapakkam,Porur,Chennai-600 116.

6.Kotpal.R.L.Modem Text Book of Zoology-vertebrates.Rastogi Publications, Gangotri,Shivaji Road,Meerut-250 002.

7.Kulshrestha,S.K.Comparative Anatomy of Vertebrates,Anmol Publishers a.Private limited,4374/14B,Ansari Road,Daryaganj.New Delhi-110 002.

8.Mahanta Rita and I,K.Bhattacharyya.Vertebrate Zoology,Kalyani publishers,B-1/1299,Rajinder Nagar,Ludhiana-141008.

9.Nigam,H.C.Biology of Chrodates.Vishal Publishing Company,Books Market,Old Railway Road,Jalandhar-144008.

10.Pough,R.H., C.M.Janis and J.B. Heiser. Vertebrate life.Pearson Education (Singapore) Pvt.Limited;Indian Branch-482 FIE Patpaganj,Delhi-110092.

11.Prasad, S.N.and Kashyap Vasantika,P.Text Book of Vertebrate Zoology,New Age International publishers,4835/24 Ansari Road,Daryaganj,New Delhi-110002.

12.Young,J.L.Life of Vertebrates.Oxford at the clarendon press,London.

Paper 1.1. Animal diversity I- Invertebrata

1. **Dissection and mountings:**

   Cockroach- Nervous system, Digestive System, Trachea, Salivary apparatus.

2. **Museum specimens, slides , models and charts:**

   Paramecium entire, Obelia colony, Ascaris male and female, Earthworm, Honey Bee, Leptocorisa, Nauplius, larva, Sepia, Pinctada, Star fish.

Paper 1.2. Animal Diversity II – Chordata

1 **Dissection and Mountings :**

- Shark – Placoid Scales.
- Frog – Arterial system (Demonstration only) – model / chart / CD – students have to draw the diagram and write detailed account of the arterial system in the observation note book.
- Frog – Brain (demonstration only) – model / chart / CD – students have to draw the diagram of dorsal and ventral view and write detailed account of the brain in the observation note book.

2. **Museum Specimens, slides, models and charts**

Amphioxus, Balanoglossus, Ascidian, Petromyzon,Narcine,Hippocampus,Rhacophorus, Ambystoma, Chameleon, Cobra, Kingfisher, Bat.

Course – 1.1 Cell Biology, Genetics and Biotechnology

4 Hrs/Week **4x15=60 Hrs/Semester** **12 Hrs/Unit** **Credits – 4**

OBJECTIVE:

To elucidate the structure and functions of the cell organelles; to exemplify the concept of genetics, the principles of inheritance and the role of genes in determining characters; to understand the application of the innovative technology to manipulate living organisms or parts of organisms to make products useful to human.

CELL BIOLOGY

UNIT I Ultra structure and functions of (a) Plasma membrane (b) Mitochondria (c) Nucleus. Chromosomes – Structure, types and functions; Giant Chromosomes (Polytene and Lampbrush Chromosomes)

UNIT II DNA: Structure (Watson and Crick Model), Replication.

RNA: Different types – r RNA – mRNA – tRNA; Protein synthesis.

Cancer cells and carcinogenesis – Definition, Types, Causes, Properties, Diagnosis and Treatment.

GENETICS

UNIT III Simple Mendelian traits in man; Multiple alleles – ABO blood groups in man – problems.

Rh-factor in human – Erythroblastosis foetalis. Multiple gene inheritance.

UNIT IV Sex determination in man; Sex linked inheritance in man – Haemophilia, Colour blindness and Hypertrichosis.

Non disjunction and Syndromes in man – Klinefelter's syndrome, Turner's syndrome and Down's syndrome.

Inborn errors of metabolism in man – Phenylketonuria, Alkaptanuria and Albinism

BIOTECHNOLOGY

UNIT V Definition, scope and importance of Biotechnology, Basic concepts of genetic engineering.

Restriction and modification system – Cloning vectors – (Plasmids, pBR 322, Lambda phage)

Introduction of cloned genes into host cells – Transgenesis – Transgenic animals and its application.

INDUSTRIAL FISH AND FISHERIES

Paper – I: BIOLOGY OF FISH

OBJECTIVE:

To help the students taking Industrial Fish and Fisheries as a subject to have a through knowledge of the various aspects of the Biology of Fish

UNIT I

Introduction: Fish Biology – Definition and basic concepts of biosystematics. Importance of classification – Theories of biological classification. Variations in structure, Form, Skin, Coloration, Scales, Mouth, Jaws, Teeth, Fins, Spines and other structures used in taxonomic studies. Induced breeding techniques – Hatching methods – Seed and Brood transport.

UNIT II

Study of external morphology and internal organization of a typical elasmobranch and teleost. Alimentary Canal and Associated Structures – Gills – Swim Bladder – Accessory Respiratory organs – Lateral line system – Sound and Light producing organs. Morphological and anatomical characters of Prawn, Crab, Lobster, Bivalve, Gastropod and Cephalopod (one example each)

UNIT III

Natural food of fishes – Feeding habits in various groups of fresh water and marine fishes, Prawns, Crabs, Lobsters and Cephalopods. Qualitative and Quantitative estimation of food consumption based on experimental studies and stomach content analysis – Seasonal changes in food availability and food preference – Food and Feeding in relation to age – Food selectively – Feeding intensity. Nutrition of fishes and utilization of food, Feeding strategies and energies. Artificial feeding – Nutritional requirement.

UNIT IV

Growth of fish – Absolute, Relative, Isometric and Allometric growth. The Cube Law – Methods for determination of growth – Length frequency analysis – Analysis of growth checks on hard parts like Scales, Otolith and Vertebrae – Estimation of growth by direct methods – Marking and tagging of fish for growth studies – Aging of fish and shell-fish based on length data and growth checks – Length weight relationships, Ponderal index, Relative condition factor and Gonado – Stomach index.

UNIT V

Types of reproduction, Sex differences – Sexual maturity, Classification of maturity stages, Size at first maturity. Estimation of fecundity – Ova diameter frequency – Fecundity in relation to length, Weight, Age and food supply. Spawning habits – Factors affecting Spawning, Spawning seasons and frequency. Embryonic and early development – Types of egg and Larvae – Metamorphosis of larva – Larval life and feeding habits. Reproductive behaviour and parental care – Social behaviour – Aggregation and Shoaling. Migrations – Anadromous and Catadromous.

PRACTICALS

1. Methods for Collection, Handling, Identification and Preservation of fish for taxonomic purposes.
2. Study of external morphology of fish. Specific identification of important fresh water and marine fishes, prawns, crabs, Bivalves and Cephalopods of India.
3. Identification of scales of fishes – Placoid, Cycloid and Ctenoid scales.
4. Study of food and feeding habits of fishes – Plankton feeder, Herbivore feeder, Carnivore feeder, Omnivore feeder, Detritus feeder. Study of Structural Adaptations for Diet.
5. Qualitative and Quantitative methods for Stomach content analysis.
6. Estimation of Oxygen, Carbon dioxide, Salinity content in water samples.
7. Plankton analysis in the water samples – any two.
8. Identification of Anadromous and Catadromous fishes.

REFERENCES

1. The Biology of Fishes, Kyle, H. M., T.F.H. Publication, Hong kong 366 P.
2. The Life of Fishes, Marshell,N.B.1965,Weidenfeld & Nicolson, London 402 P.
3. The Marine and Freshwater Fishes of Ceylon,Munro I.S.R,1982.Soni Reprints Agency, New Delhi 351 P.
4. Inland Fishes of India and Adjacent Countries., Vol I & Vol II,Talwar, P.K. and A.G.Jhingran,1991,Oxford & IBH Publishing Co Pvt Ltd.,New Delhi 1958 P.
5. Fisheries Ecology, Pitcher, T.J. & P.J.E. Hart,1992,Room Helm,London 414 P.
6. Introduction to the Practice of Fisheries Science.Royce,W.F.1984,Academic Press 438 P.
7. Fisheries Science its methods and application,1993,Rounsfell,G.A. and W.H.Everheart, John William & Sons New York,444

ALLIED PRACTICALS FOR 1.1.

2 Hrs/week **2x15=30 Hrs/Semester** **Credits 2**

CELL BIOLOGY, GENETICS AND BIOTECHNOLOGY

Mounting of Giant Chromosome in Chironomous larva

Analysis of any two planktons (marine/fresh water)

Study of the following through Charts, Slides and Figures:

Mitochondria, Interphase Nucleus, DNA, tRNA, ABO Blood group.

Colour Blindness, Haemophilia, Klinefelter's syndrome, Down's syndrome.

pBR 322, Lanmbda Phage, Recombinant DNA.

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc. Zoology) / Semester – II / Core - 3

DEVELOPMENTAL ZOOLOGY

(4 Hrs /Week) 4x15=60 Hrs/Semester 12Hrs/Unit Credits 4

OBJECTIVE: To understand the sequential changes from cellular grade of organization to organ grade of organization in the development of multicellular organisms.

UNIT I

Definition and Scope of Developmental Zoology – Gametogenesis – Spermatogenesis – Oogenesis – Vitellogenesis – Structure of Sperm and Egg in Chick. Fertilization: Pre and Post fertilization events – significance; Parthenogenesis.

UNIT II

Cleavage in chick – Fate map of Chick – Gastrulation in Chick – Chick Embryo 48, 72 Hrs. Manipulations of reproduction in Human: Infertility (male and female) – IUI - Invitro fertilization –Artificial insemination - Test tube babies – Amniocentosis.

UNIT III

Organogenesis : Development of brain and heart in chick.

Organizer : Primary and secondary organizers.

Morphogentic fields and gradient hypothesis.

UNIT IV

Hormonal control of Amphibian metamorphosis.

Extra-embryonic membranes in chick – Development, Types and Physiology.

Placenta in Mammals – Types and Physiology.

UNIT V

Nuclear Transplantation in Acetabularia - Regeneration – Types – Regeneration in Amphibians – Regeneration in Planaria. Birth control : Contraceptive devices: Surgical method – Hormonal methods – Physical barriers – IUCD.

REFERENCE BOOKS: Developmental Zoology

1. Arora, M.P. Embryology. Himalayan Publishing House, Ramdoot, Dr. Bhalero Marg (Kelewadi) Girgaon, Mumbai – 400004.
2. Arumugam, N.Developmental Biology. Saras Publications, 114/35G, A.R.P camp Road, Nagercoil.
3. Balinsky, B.J.Introduction to Embryology, W.B.Saunders, Philadelphia,USA.
4. Berry,A.K. An Introduction to Embryology,EMKAY Publications,Post Box No.9410, B – 19 East Krishna Nagar,Swami Payanand Marg,Delhi – 110 051.
5. Beryl, N.J. Developmental Biology,Tata McGraw Hill Publishing Company Limited, 444/1 Sri Ekambara Naicker Industrial Estate, Alapakkam, Porur, Chennai -600 116.
6. Developmental Biology: R.M.Twyman.Bios scientific publishers, Ltd. New Delhi (2001).
7. Diwan, A.P. Mammalian Embryology, Anmol Publications Private Limited,4374/4B Ansari Road , Daryaganj, New Delhi-110 002.
8. Diwan,A.P.Avian Embryology, Anmol Publications Private Limited,4374/4B Ansari Road , Daryaganj, New Delhi-110 002.
9. Gilbert,Developmental Biology,ANE Books India, Avantika Niwas, 19,Doraiswamy Road,T.nager,Chennai-600 017.
10. Goel,S.C.Principles of Animal Developmental Biology,Himalaya Publishing House,Ramdoot,Dr.Bhalerao Marg (Kelewadi)Girgaon,Mumbai – 400 004.
11. Jain,P.C. Elements of Developmental Biology (Chordate Embryology).vishal Publishing Company,Books Market,Old Railway Road,Jalandhar – 144 008.
12. Jangir, O.P.Developmental Biology – A Manual.Agrobios (India),Behind Nasrani Cinema,Chopasani Road,Jodhpur – 342 002.
13. Nelson, E.Comparative Embryology of Vertebrates.Tata McGraw Hill Publishing Company Limited,No. 444/1 Sri Ekambara Naicker Industrial Estate, Alapakkam,Porur, Chennai – 600 116.
14. Ramesh Mathur and Meenakshi Metha. Embryology.Anmol Publications Private Limited,4374/4B,ansari road,Daryaganj,New Delhi – 110 002.
15. Rao, K.V. Developmental Biology. A Modern Synthesis.Oxford & IBH Publishing company Private Limited, S-155 Panchshila Park, New Delhi 110017.
16. Sastry.K.V. and Vineeta Shukal, Developmental Biology Rastogi Publications Gangotri, Shivaji Road, Meerut-250 002.
17. Slack,Essential Developmental biology. ANE Books India. Avantika Niwas, 19,Doraiswamy Road,T.Nager,Chennai-600 017.
18. Subramomam, T.Developmental Biology. Narosa Publishing House Private Limited, 35 – 36 Grams Road, Thousand Lights, Chennai – 600 006.
19. Verma.P.S. and V.K. Agarwal. Chordate Embryology (10^{th} Edition).S. Chand & Company Ltd.7361 Ram Nagar,Qutab Road,New Delhi – 110055.

ECOLOGY & TOXICOLOGY

(4 Hrs. / Week) **4x15=60Hrs/Semester** **12 Hrs/Unit** **Credits 4**

OBJECTIVE:

To study the interaction and interdependence among environmental factors and living organisms – To enumerate the ill-effects and the health hazards of toxic agents released to the environment – To discern the evolutionary significance of animals, theories origin of species and significance.

UNIT I

i. **Abiotic factors :** Biological Effect of temperature and light.
ii. **Biotic factors:** Producer, Consumers and Decomposers.
iii. **Ecosystem:** Pond,Forest

UNIT II

i. Food chain, Food web, Trophic levels, Energy flow, Ecological Pyramids
ii. Animal Relationships: Mutualism, Commensalism, Antagonism (Antibiosis, Parasitism, Predation and Competition)

UNIT III

Population Ecology: Definition – Density – Natality – Mortality – Age – Distribution – Age pyramids –Population growth – Population fluctuations – Regulation of Population density - Animal Dispersion.

Community Ecology: Definition - Community stratification-Periodicity – Community interdependence – Ecotone - Edge effect- Ecological niche- Concept of community –Ecological Succession.

Adaptation:

- Desert Adaptation
- Cave Adaptation

UNIT IV

Wild life Conservation: Definition- Endangered Species – Causes for Depletion, Necessity for conservation – Methods of conservation – Sanctuaries – National Parks.

Remote sensing: Its application in agriculture, Fisheries, Forest management and Flood Management.

Urbanization: Reasons for urbanization, Urban problems, Methods to control urban growth.

UNIT V

Introduction to Toxicology, Definition, Outline classification of Toxicant.

Toxic agents and mode of action of Pesticides, metals, solvents, carcinogens, poisons

Environmental toxicology and public health.

REFERENCE BOOKS: ECOLOGY

1. Agarwal, A.K. Ecology and Environmental Biology. Student Edition, Agrobios (India) Behind Nasrani Conema, Chopasani Road, Jodhpur -342 002.
2. Arora, M.P. Ecology. Himalaya Publishing House, Ramdoot, Dr.Bhalerao Marg, Girgaon, Mumbai- 400 004.
3. Clarke, G.L. Elements of Ecology, John Wiley & sons Inc. New York.
4. Junega, Kavita. Ecology. Anmol Publications Private Limited, 4371/4B Ansari Road, Daryagani, New Delhi – 110002.
5. Kotpal, R.L and N.P. Bali. Concepts of Ecology Vishal Publishing Company,Books Market, Old railway road, Jalandhar – 144 008.
6. Madhab, C.Dash. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Limited,No.444/1.Sri Ekambara Naicker Industrial Estate, Alapakkam, Porur, Chennai – 600 116.
7. Odum , E.P. Fundamentals of Ecology. International Student Edition, W.B. Saunders Company, Philadelphia, USA.
8. Purohit, S.S. A Text book of Environmental Science, Student Edition, Agrobios (India), Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342 002.
9. Singh, H.R. and Neeraj Kumar. Ecology and Environmental Science, Vishal Publishing Company, Books Market, Old Railway Road,Jalandhar – 140 008.
10. Singh, S.P.Animal Ecology,6th Edition, Rastogi Publications, Gangotri, Shivaji Road, Meerut – 250 002.
11. Verma, P.S. and Agawal 1986, Environmental Biology, S. Chand & Co Ltd.,

TOXICOLOGY:

1. Omkar. Concepts of Toxicology, Vishal Publishing Company, Books market, Old Railway Road,Jalandhur-144 008
2. Sharma, P.D.Toxicology .Rastogi Publications, Shivaji Road,Meerut-250 002.
3. Subramanian, M.A.Toxicology, Principles and Methods.MJP Publishers, Tamil Nadu Book House,47 Nallathambi Street,Triplicane,Chennai-600005.
4. Shukla, J.P. and S.P.Trivedi, Fundamentals of Toxicology, New Central Book Agency(P)Limited, 8/1 Chintamoni Das Lane,Kolkata-700 009.

SEMESTER II- 2HRS / WEEK **2X15=30 HRS / SEMESTER**

PAPER 2.1. DEVELOPMENTAL ZOOLOGY

I. Mounting and observation of live sperms of a vertebrate
II. Mounting and observation of egg of a frog.
III. Temporary mounting and observation of chick embryo – 24,48,72,96 Hrs.
IV. Museum specimens, slides, models and charts

Sperm of a vertebrate, chick embryo – 24,48,72,96 Hrs.

Condom, Mala – D, Placenta in mammals, Discoidal, Cotyledonary, Zonary placenta, Diffuse placenta.

PAPER 2.2 ECOLOGY AND TOXICOLOGY

Ecology

I. Plankton mounting-any two fresh water/marine
II. Museum specimens, slides, models and charts
Secchi disc, Mutualism (Hermit crab and sea anemone),commensalism (Echeneis and shark), Parasitism (Sacculina on crab),Cyclomolphosis (Daphnia)
Predation (Snake and Rat)
Effect of light Protective Colouration(Leaf insect)
Effect of light Colour changes (chamaeleon)
Pond Ecosystem (Chart)
Food Chain – Forest Ecosystem
Food Web – Grass land.

III Compulsory Study Tour

- A one day study tour is compulsory to visit an ecologically important place such as sea shore, sanctuary, forest area etc., to observe and study the animals in their natural habitat.
- The students should write an illustrated , study tour report and the same is to be submitted for evaluation at the time of practical examination (5 marks).

DEVELOPMENTAL ZOOLOGY, ECOLOGY, ANIMAL PHYSIOCOLY AND EVOLUTION

4 Hrs/Week 4x15=60 hrs/Semester 15 Hrs/Unit Credits-4

OBJECTIVES:

To understand the sequential changes from cellular grade of organization to organ grade of organization in the development of multicellular organisms. To study the interaction and the interdependence among environmental factors and living organisms; To understand the functional significance of various organs and organ systems of animals. To discern the evolutionary significance of the animals, origin of species, effects of mutation.

UNIT I

Early development in Man: Structure of sperm and ovum; Fertilization – Cleavage, Morula, Blastocyst, Implantation and gastrulation – Fate map. Placenta in mammals – types and functions. Test tube babies – Twins – Amniocentosis.

Nuclear Transplantation in Acetabularia.

UNIT II

Abiotic factors: Biological effects of Temperature and Light; Biotic factors: Symbiosis, Commensalism, Mutualism, Parasitism, Prey-predator

Relationship; Adaptations: Desert adaptations.

Community: Ecosystem – Structure and dynamics of a pond.

UNIT III

Nutrition: Food constituents – Carbohydrates, Proteins and Fats.

Digestion: Role of enzymes in carbohydrate, protein and fat digestion.

Absorption: Absorption of digested food.

Metabolism: Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Glycolysis. Respiration: Transport and exchange of oxygen and carbon dioxide. Haemoglobin.

UNIT IV

Excretion: Structure of Nephron – Urine formation – Dialysis Nervous Co-ordination: Structure and types of neurons – Nerve impulse, conduction of nerve impulse through neuron and synapse.

Reproduction: Structure of human testis and ovary, Graafian follicle, Menstrual cycle and its hormonal control.

UNIT V

Theories of Evolution: Darwinism, Mutation theory of De Vries.

Adaptive radiation in birds.

Mimicry and Colouration.

INDUSTRIAL FISH AND FISHERIES

PAPER - 2 CAPTURE FISHERIES

OBJECTIVE:

To highlight the recent trends and types of capture fisheries to students studying industrial fish and fisheries

UNIT I

Capture Fisheries – Inland Capture Fisheries – Scope and importance of Capture Fisheries in India and World. Present yield and Estimates of Potential. Inland capture fishery resources of Indian Fisheries of major and minor carps. Cat fishes and other groups. Problems and management.

UNIT II

Cold water fishery resources – Fisheries of trout, Mahaseer and other Cold water Species. Lacustrine fisheries – Species, Catch, Fishing gears, Potential and Problems of Development and management. Estuarine fisheries. Fisheries of Brackish water lakes and back waters – Problems and Management.

UNIT III

Salient features of cultivable species of fishes and shell fishes.Marine fishery resources of India – Fisheries of Sardine, Lesser Sardine, Anchovies, Other Clupeoids, Mackerel, Ribbon fishes, Tunnies, Carangids and Cephalopods.

UNIT IV

Mid water and Demersal fisheries – Fisheries of Elasmobranches, Bombay duck, Cat fishes, Silver Bellies, Sciaenids, Pomfrets,Thread fins,Thread fin breams and Perches,Flat fishes,Prawns lobsters,Crabs,Mussels Oysters and Clams,Culture of edible Oyster.

UNIT V

Biological aspect of fishery managements,Principles of Conservation,Development and Management Concept and practice.Population dynamics – Concept of recruitment and yield,problems of over fishing,MSY,MEY and OSY

PRACTICALS

1. Identification of commercial fresh water and marine prawns.
2. Visit to a Prawn farm.
3. Visit to a fish processing industry.
4. Visit to a Landing centers.
5. Raceway culture system.
6. Field visit to observe fishing and to collect field data regarding species composition,Craft, Gear and Field problems regarding riverine, esturine,reservoir and cold water fisheries.
7. Study of fishery development programmes.
8. Study of fishery management problem – Laws,Acts and Field problems.

REFERENCE BOOKS

1. Fish and Fisheries of India Jhingran V.G. 1982 Hindustan Publishing Corporation India Delhi Rev.Ed.
2. Prawns and Prawn fisheries of India Kurian C.V and V.C Sebastian 1982.Hindustan Publishing corporation (India) Delhi Rev.Ed.
3. Marine Fisheries.Bal D.V and K.V Rao 1990.Narendra Publishing House Delhi Rev.Ed.
4. Cold water fisheriesof India.Jhingran V.G and K.L Sehgal 1979.Barrackpore Inland fisheries soceity of India.
5. Fisheries Development in India.Srivastava U.K and Dharma Reddy 1983.Concept publishing co.,New Delhi.
6. Introduction to the practice of fishery science,Royce 1984 Academic press,London.
7. Fishery Science its methods and Applications,Rounsefell,G.A and W.H Everhart 1953 John.Wiley,New York.

2 Hrs/Week **2x15=30 Hrs/Semester** **Credits 2**

DEVELOPMENTAL ZOOLOGY, ECOLOGY, ANIMAL PHYSIOLOGY AND EVOLUTION.

1. Mounting and observation of live sperms of a vertebrate.
2. Estimation of dissolved oxygen in two water sample and discuss the result
3. Qualitative test for glucose, protein and lipid.
4. Effect of temperature on the opercular movement of fish; Calculation of Q_{10}.
5. Museum specimens, slides, models and charts:

   Developmental Zoology: Human sperm, Human ovum, Cleavage, Diffuse Placenta,Zonary Placenta,Discoidal placenta,Cotyledonary Placenta (any two)

   Ecology: Echeneis and Shark, Hermit crab and Sea anemone, Sacculina, Secchi disc.

   Animal Physiology: Intestinal villi, Nephron, Heart of mammal.

   Evolution: Ancon sheep.

   Allied Practical Examination I for course subjects 1.1 and 2.1 at the end of the Second Semester.