

## COURSE STRUCTURE FOR B.Sc. ZOOLOGY MAJOR (With effect from the academic year 2020-2021 onwards)

Sem	Part	Sub Status	Subject Title	Course paper	Hrs/ Week	Credit
I	I	Language	Tamil/Other Language	1	6	4
	II	Language	Communicative English	1	6	4
	III	Core	Animal Diversity-I Invertebrata	1	4	4
	III	Add on Major (Mandatory)	Professional English for Life Sciences - I	1	4	4
	III	Major Practical – I	Animal Diversity-I Invertebrata	1	2	1
	III	Allied – I	Cell Biology, Genetics and Biotechnology / Industrial Fish and Fisheries- Biology of Fish	1	4	3
	III	Allied – I Practical – I	Cell Biology, Genetics and Biotechnology / Industrial Fish and Fisheries- Biology of Fish	1	2	1
	IV	Common	Environmental Studies	1	2	2
			Sub Total	8	30	23

Sem	Part	Sub Status	Subject Title	Course paper	Hrs/ Week	Credit
II	I	Language	Tamil/Other Language	1	6	4
	II	Language	English	1	6	4
	III	Core	Animal Diversity-II Chordata	1	4	4
	III	Add on Major (Mandatory)	Professional English for Life Sciences - II	1	4	4
	III	Major Practical – II	Animal Diversity-II Chordata	1	2	1
	III	Allied – I	Developmental Zoology, Ecology, Animal Physiology and Evolution / Industrial fish and fisheries- Capture fisheries	1	4	3
	III	Allied-I Practical – II	Developmental Zoology, Ecology, Animal Physiology and Evolution / Industrial fish and Fisheries- Capture Fisheries	1	2	1
	IV	Common	Value Based Education / சமூக ஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும் / Social Harmony	1	2	2
			Sub Total	8	30	23

**ANIMAL DIVERSITY - I - INVERTEBRATA**

**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) Gurgaon, Mumbai-400004.
2. Barrington, E.J.W., Invertebrate structure and function. Boston – Houghton. Mifflin 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<sup>th</sup> 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<sup>th</sup> 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 Grems Road, Thousand Lights, Chennai - 600006.

**ANIMAL DIVERSITY - I – INVERTEBRATA**

**MAJOR PRACTICAL - I**

**Animal Diversity I- Invertebrata**

**1. Dissections and Mountings:**

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

**2. Museum Specimens, Slides, Models and Charts:**

Paramecium- entire, binary fission, conjugation, Plasmodium, Marine sponge, Obelia colony, Medusae of Obelia, Madrepora, Ascaris male and female, Fasciola, Earthworm, Nereis, Chaetopterus, Leech, Honey Bee, Leptocorisa, Oryctes, Nauplius larva, Sepia, Octopus, Pinctada, Star fish, Bipinnaria larva, Sea cucumber.

**Cell Biology, Genetics and Biotechnology**

**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, Alkaptonuria 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 - 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.

## **REFERENCES**

1. The Biology of Fishes, Kyle, H. M., T.F.H. Publication, Hong kong 366 P.
2. The Life of Fishes, Marshall, 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

**CELL BIOLOGY, GENETICS AND BIOTECHNOLOGY**

1. Mounting of Giant Chromosome in Chironomous larva

(or)

Observation of Mitotic stages in onion root tip cells

2. Observation of simple Mendelian traits among the students

- **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, Lambda Phage, Recombinant DNA.

**INDUSTRIAL FISH AND FISHERIES - BIOLOGY OF FISH**

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.

**ANIMAL DIVERSITY –II: CHORDATA**

**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) Balanoglossus

**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:**

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 (11<sup>th</sup> 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 Industrial

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.

## SEMESTER II

MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc. Zoology) / Semester – I / Major Practical - II

### MAJOR PRACTICAL - II

#### Animal Diversity II – Chordata

#### 1. Dissections and Mountings:

- **Shark** – Placoid Scales.
- **Shark** – Digestive system (Demonstration only) – model / chart / CD – students have to draw the diagram and write detailed account of the digestive system in the observation note book.
- **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.
- **Rabbit / Rat**– Urinogenital system (Demonstration only) – model / chart / CD – students have to draw the diagram and write detailed account of the urinogenital system in the observation note book
- **Rabbit/Rat** – Heart (demonstration only) – model / chart / CD – students have to draw the diagram of external and internal structure and write detailed account of the heart in the observation note book

#### 2. Museum Specimens, Slides, Models and Charts

Amphioxus, Balanoglossus, Ascidian, Petromyzon, Narcine, Hippocampus, Sardinella, Anabas, Ichthyophis, Rhacophorus, Bufo, Ambystoma, Axolotl larva, Chelone mydas, Chameleon, Draco, Cobra, Dryophis, Sea snake, Pigeon, Kingfisher, Bat.

**DEVELOPMENTAL ZOOLOGY ECOLOGY  
, ANIMAL PHYSIOLOGY AND VOLUTION**

**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 - 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

## 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.

**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 samples and discuss the results
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:** Identification of any two plankton either fresh water or marine samples. Echinoids and Shark, Hermit crab and Sea anemone, Sacculina, Secchi disc.

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

**Evolution:** Ancon sheep.

**Allied Practical Examination at the end of each semester.**

**INDUSTRIAL FISH AND FISHERIES- CAPTURE FISHERIES**

**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.

**Allied Practical Examination at the end of each semester.**