Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Under Choice Based Credit System (CBCS)

(2021-2022)

SYLLABUS

For

M. Sc. Fisheries

(Semester Pattern)

M. Sc. Sem. I to II

Academic flexibility with credit system to be implemented

From

2021 onwards

1. Name of the programme :- M. Sc. Fisheries (Freshwater aquaculture management)

2. Preamble:

Commencing as a purely traditional activity, fisheries have now transformed in to a commercial enterprise. The share of fisheries sector in the total GDP (at current prices) increased from 0.40% in 1950-51 to 1.03% in 2017-18, recording an increase of 157%. The sector contributed Rs. 1,75,573 crore to the GDP (at current prices) during FY 2017–18 (Ministry of Statistics and Programme Implementation, 2020). The sector has been showing a steady growth in the total Gross Value Added and accounts for about 6.58 per cent share of Agricultural GDP

According to the national Fisheries policy 2020 ,the total fisheries potential of India has been estimated at 22.31 million metric tons (in 2018), of this, the marine fisheries potential stands at an estimated 5.31 million metric tons and the inland fisheries potential has been estimated at 17 million metric tons. In the recent years, the fish production in India has registered an average annual growth rate of more than 7%. The fish production in the country has shown continuous and sustained increments since independence. The total fish production in the country rose from 0.752 million metric tons in 1950-51 to 13.42 million 3 metric tons (provisional) during FY 2018-19. Of this, the marine fisheries contributed 3.71 million metric tons and the inland fisheries contributed 9.71 million metric tons. During FY 2018-19, 71% of marine fisheries potential has been harnessed and the inland fisheries potential harnessed during the same period stands at 58%.

There are many freshwater water bodies such as parts of Rivers, Streams, Lakes, Reservoirs and ponds constructed in the agricultural fields which are not fully utilized. There is scope for increasing the use and improving the current culture of fishes practiced in the State and in the District Satara. The syllabus of the proposed programme will provide many trained personnel who would fulfill the needs of the society and improve the fisheries activities.

Objectives: To mold a generation of youth which can apply the subject knowledge in their life and careers and groom the career of many others. To inculcate scientific attitude enriched with a multidisciplinary perspective in the students. To update the

students with the needs of the industry and society. To develop a generation which feels responsible towards the society and the nation.

Outcomes After completing the M. Sc. Programme, the students will: have mastered the basics and applied aspects of the subject. The Masters produced will be in a position to apply their knowledge in their professional, social and personal life. The students passing out will be competent to pursue research or a career in the subject. They will develop sensitivity for social issues and become productive citizens of the nation.

3. Introduction: Semester Credit System

Total marks 2400 96 credits.	**Semester I- 600 marks 24 credits**	**4 Theory courses 2 Practical courses**
	Semester II- 600 marks 24 credits	**4 Theory courses 2 Practical courses**
	Semester III- 600 marks 24 credits	**4 Theory courses 2 Practical courses**
	Semester IV- 600 marks 24 credits	**4 Theory courses 2 Practical courses**

1. **Eligibility:**
   Graduate in Zoology, Zoology Fisheries, Fisheries as Specialization at last year at UG level and B. F. Sc. or any other equivalent course approved by other universities. Students with Fisheries as Subsidiary at B. Sc. II and Zoology or Equivalent subject at Graduation level.
2. **Examination:**
   As per the structure approved and communicated by CoE.

A. Pattern of Examination

External Examinations 60% weight age

Internal Examinations 40% Weight age

B. Standard of Passing

40% marks required separately in External as well as Internal Examinations.

C. ATKT Rules

As per the guidelines of instructions from the examination cell.

D. Award of Class

As per guidelines of the Examination cell.

E. External Students

This facility is not available for the course applied.

F. Setting of Question paper / Pattern of Question paper

G. Verification / Revaluation

As per the guidelines of the Examination cell.

6. Structure of the Course (Credit Based Semester System)

Semester I

Subject Code	Subject	Credits	Marks
MFT 101	BIODIVERSITY AND BIOSYSTEMATICS	4	100
MFT 102	ECOLOGY AND ENVIRONMENTAL POLLUTION	4	100
MFT 103	FISH CELL AND MOLECULAR BIOLOGY	4	100
MFT 104	SUSTAINABLE AQUACULTURE	4	100
MFP 105	Practical based on paper – LSFT 101 & LSFT 102	4	100
MFP 106	Practical based on paper – LSFT 103 & LSFT 104	4	100

Semester II

Subject Code	Subject	Credits	Marks
MFT 201	PHYSIOLOGICAL CHEMISTRY	4	100
MFT 202	QUANTITATIVE BIOLOGY AND TOOLS AND TECHNIUQES	4	100
MFT 203	AQUACULTURE BIOTECHNOLOGY	4	100
MFT 204	APPLIED GENETICS IN AQUACULTURE	4	100
MFP 205	Practical Based on 201 and 202	4	100
MFTP 206	Practical Based on 203 and 204	4	100

M.Sc. Fisheries

Academic Flexibility, Credit System

M. Sc. I – Sem. I

MFT 101 – Biosystematics and Biodiversity

Credit: (Theory – 04, Practical-04) Theory Lectures: 60

Unit I - Taxonomy

Introduction to taxonomy, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.

Modern Trends in Taxonomy: Morphological approach, immature stages and Embryological approach, Ecological, behavioral and Cytological approach.

Methodologies in systematics: Molecular markers for detection/evaluation of polymorphism, RFLP, RAPDetc.

Learning outcome –

1) Student will be able to define taxonomy, and various tasks of taxonomists.

2) They will be able to learn recent trends and approaches intaxonomy.

3) Students will know the use of molecular markers in systematics.

4) They will be able to demonstrate the ability to identify organisms to taxonomicgroup.

Unit II - Concept of species:

Introduction, Typological, Biological, Nominalistic, Evolutionary and recognition species concept with conclusions, taxonomic identification.

Zoological nomenclature: Origin of the code, international code of Zoological nomenclatures rules of nomenclature.Species and their number, polytypic species, Subspecies, other intraspecific group, superspecies.

Learning outcome –

1) Students will be able to define species.

2) They can summarize the different concept of species for taxonomic identification of the species.

3) They can classify the species based on the zoological nomenclature system by using the rules

included in it

Unit III

Biodiversity Science: Evolution of biodiversity, Factors promoting high diversity, Endemism and

Hotspots, Measures of Bio-diversity, Values of Biodiversity, Uses and Importance of Biodiversity.

Evaluation of priorities for conservation of habitats and species:

Selection criteria for protection of species–species quality, Hotspots, Conservation indices.

Learning outcome –

1) The students will be able to define biodiversity and study factors promotingand affecting

biodiversity.

2) They can understand the concepts of hotspot diversity and roles to conservethatdiversity.

Unit IV

Biodiversity Conservation:

Loss of biodiversity, listing of threatened biodiversity, Threats to biodiversity, Role of NGOs,

Colleges and Universities.

IUCN Guidelines for Red List categories and criteria (version 7.0), Red List of Indian Flora

And Fauna.

Learning outcome -

1) Students will be able to determine the importance of conservation of biodiversity.

2) They will know the roles played by NGOs, and different communities in conserving the biodiversity.

3) They can learn to categorize the Red data list of IUCN.

Recommended Books -

Alston, R.E. and B.L. Turner (1963): Biochemical systematics Prentices Hall Inc. Englewood Cliffs, N.J. 404 pp.

Avise, J.C. (1974): Systematic value of Electrophoretic data. Syst. Zool. 23 (4): 465 – 481.

Benazzi, M. (1973): Cytotaxonomy and evolution, General remarks vertebrate evolution. Ed. A.B. Chiarelli and Campus Academic Press, London and N.Y. pp.1-3.

Blomback, B and M. Blomback (1968): Primary structure of animal proteins as a guide in taxonomic studies. In chemitaxonomy and serotaxonomy (ed.) Hawkerspp. 3 – 20.Camp, W.H. (1951): Biosystematics Britania 7: 113 – 127.

CHamberlin, W.J. (1952): Entomological Nomenclature and Literature 3rdedition Dubuvuelowa William C. Brown Co.

Cole, A.J. (1969): Numerical taxonomy proceedings of the colliquiinnumericaltaxonomy held in the University of St. Andrews Sept. 1968. AcademicPress,N.Y 324 pp.

Hennig, W. (1966): Phylogenetic systematics Univ. Illinois Press III, 263 pp.Heywood, V.H. (1973): Taxonomy and Ecology Systematics Associationspecial Vol. 5 Academic Press, London, and New York 370 pp.

Huxley, J.S. (ed.) The New Systematics Oxford Uiv. Press London 538 pp.

Jeffrey, C. (1977): Biological nomenclature Indian Ed. Oxford and IBH Pub.Co. New Delhi 72 pp.

Mayr, E. (1969): Principles of systematics Zoology Mc. Graw Hill N.Y. 428 pp.

Mayr, E. and E.G. Linsley and R.L. Usinger (1953): Methods and Principles ofsystematic Zoology, Mc Graw Hill N.Y. 328 pp.

Oman, P.W. and A.D. Cushmann (1948): Collection and Preservation of insects U.S. Dept. of Agric.

Misc. Pub. 601: 1 – 42.

Pankhurst, R.J. (1978): Biological identification Edwards Arnold Ltd. London, 104 pp.

Pankhurst, R.J. (1984): Online identification programme version 4. Britishmuseum (Natural History) London.

Strickland, H.E. (1842): Rules of Zoological nomenclature Report of the 12th meeting ofBritish Association held at Manchester in 1842 Brit. Assoc. Adv. Sci. Rept. 1842: 7 – 18.

Ernst Mayr (1969): Principles of Systematics Zoology TMH Ed. Tata McGraw HillPublishing company Ltd. Bombay NewDelhi.

Primack,R.B.(1950):Aprimerofconservationbiology3rdeditionSinuerAssociates Inc.Publishers Sunderland MassachuttsUSA.

Ray Samitan Ray A.K. (2006): Biodiversity and Biotechnology New Central BookAgency (P) Ltd.

Wilson, E.O.: Biodiversity.

Knudsen, J.W.: Biological techniques collecting preserving and illustrating plant andanimals.

Black Welder, R.E. and Blair W.F. Guide to the Taxonomic literature of vertebrates.Alexander, R.M. The Chrodate.

Waterman, A.J. Chordate An advance Text book on Biodiversity- K. V. Krishnamurthy Biodiversity and

Biotechnology- Ray and Ray Biodiversity – Mandal and Nandi -Perspective in environmental tudiesKaushik and Kaushik Biodiversity- K. C. Agarwal

Theory and practice of animal taxonomy- V. C. Kapoor

M.Sc. Fisheries

Academic Flexibility, Credit System

M. Sc. I – Sem. I

MFT 102 - Ecology and Environmental Pollution

Credit: (Theory – 04 Practical-04)Theory Lectures:60

Unit I

1. Habitat and Niche:Concept and types of habitat, Ecological niche, Nichewidthand overlap.

2. Species interaction: Types of interactions, interspecificcompetition,Symbiosis.

3. Community ecology: Types and nature of communities, Structure ofcommunity, Community

dominance, edge andecotones.

Learning outcomes –

1) Students will be able to describe behavioral and physiological mechanisms by whichorganisms

interact with other organisms and with their physicalenvironment.

2) They can explain the biotic and abiotic factors that influence the dynamics ofpopulations.

3) They can summarize the local and geographical distribution and abundance of organisms

(habitat niche, community,bio-geography)

Unit II

1. Ecological Succession: Types and Patterns of succession, Climax.

2. Ecosystem: Structure and Functions of ecosystem, Primary production.

3. Environmental Impact Assessment: Definition and scope, characteristics, objectives,

components, methodology, procedure for obtaining EI Aclearance, preparation of EIA document.

4. Biogeochemical Cycles

Learning outcomes -

1) Explain the importance of biodiversity to ecosystems.

2) They can describe What is ecological succession.

3) They can also describe how the pioneer organism changes the environment.

4) Describe how the biogeochemistry, energy flow, or biodiversity of ecosystems responds to

climate change or another disturbance.

Unit III

Concept, Scope and Definitions of Environmental Pollution

- Types of pollutants- based on physical properties, forms, causes of environmental pollution, pollution in

relation to public health (Air, water, pesticide and radiation pollution).

Air pollution -Definition, sources, principle air pollutants, effects of air pollutants. Smog -

Classical smog and industrial pollution, photochemical smog and vehicular emission. Prevention

and control of air pollutants.

Environmental Legislation: Central and state boards for the prevention and control of environmental

pollution, powers and functions of pollution control boards, penalties and procedure, duties and

responsibilities of citizens for environmental protection, Wildlife Protection Act 1972.

Learning outcomes –

1) Students will be able to explain the causes of environmental pollution and preventive

and control measures to eradicate pollution.

2) They will understand the role and sources of pollutants

3) They will get knowledge about the environmental protection laws and the legal standards to

protect it.

Unit IV

Water pollution- Definition, Sources of water pollution, Types of water pollutants and their effects,

BOD, COD water pollution control, Sewage treatment.

Soil pollution- Sources, effects of soil pollutants and remedial measures.

Radioactive pollution - Types, sources and effects of radiation.

Agricultural pollution- Farm animal waste, Soil erosion plants residues, agrochemical-fertilizers and

pesticides.

Learning outcomes

1) Students will get to know about the sources of pollution and their pollutantsalong with their

control measures.

2) They will also be able to get awareness regarding diseases withpollution.

Suggested Readings:

1. Fundamentals of Ecology- Dash and Dash.

2. Basic Ecology- Odum E. P

3. Fundamentals of Ecology- Odum E.P

4. Modern concepts of ecology- K. D.Kumar.

5. Concepts of Ecology- H. D. Kumar.

6. Ecology - P. D.Sharma.

7. Environmental pollution Half, Rinehart and Winston, New York (1977)-LaurentHodges.

8. PandeyKamleshwar.,ShuklarJ.P.andTrivediS.P.(2005):FundamentalofToxicology.New

Central book agency PVT. LTD.Kolkata.

M.Sc. Fisheries

Academic Flexibility, Credit System

M. Sc. I – Sem. I

MFT 103 –Fish Cell and Molecular Biology

Credit: (Theory – 04 Practical-04)Theory Lectures:60

Unit I - Membrane Structure and Function

1.Structure of model membrane, lipid bilayer and membrane protein diffusion,

2. Osmosis, ion channels, active transport, membrane pump

3. Cell-cell adherence, Gap junction, ECM, Integrin.

Learning outcome –

1)The students will be able to understand the role of membranes to protect the cell.

2)They will be able to explain the models of membrane structure and diffusionof molecules passing through it.

3)They will know the importance of cell to cell communication.

Unit II - Secretary Pathway:

1. ER-structure (SER, RER), transport.

2. Ribosomes, polysomes, free ribosomes, membrane associated ribosomes and secretary pathway.

3. Vesicles involved in intracellular transport.

Learning outcome–

1) Student will be able to explain detailed Location, structure, function and transport in Endoplasmic Reticulum.

2) They will know the pattern of secretion of protein and its intracellular transport through vesicles.

3)They will understand the role of ribosomes in protein synthesis.

Unit III- Cellular respiration & degradation:

1. Peroxisomes – structure and functions.

2. Endosomes – late and early – structure, formation, assembly &components.

3. Lysosomes – structure &polymorphism.

4. Proteasomes – types structures, assembly &functions.

5. Mitochondria -structure, assemblycomponents.

6. Role of cyt.p.450 in detoxification (XenobioticTransformation)

Learning outcome1) Students will be able to explore the structure and function of cell organelles.

2) They will be aware about cellular activities like respiration and degradation in cell.

3) They will know the process of detoxification occurring in the body.

Unit IV- Nuclear Components:

1. Nucleus – EM.Structure.

2. Nuclear envelope – structure &function.

3. Chromosomes – Packaging of genome, genetic mapsand nucleolus.

4. Heterochromatin.

Cell cycle division and signal transduction:

1. Cell cycle – cyclins&cyclin dependent kinases & checkpoints.

2. Cytoskeleton & intracellular movement – microtubule,MTOC.

3. Micro filaments &intermediatefilaments.

4. Signal transductionpathway.

Learning outcome –

1) Student will be able to get the clear idea about the electron microscopic structure of

Nucleus and various components related to it.

2) They can explain the pattern of packaging of chromosomes in nucleus.

3) Students can know the importance of cell cycle and its role during cancer.

4) They will be provided understanding of cellular signalling in the body.

Reference Book:

1. Molecular biology of the Cell –Bruce Albert Pub. By Garland Pub. Inc.NewYork&London.

2. Molecular Cell biology – LodishBerk, Matsudaira, Kaiser, Krleger(2004) pub. By W,.H. Freeman & Company, NewYork.

3. Molecular cell biology – Gerald carp (2005) pu. By John Wiley&Sons.

4. Avers C.J. (1986)/ latest edition) Molecular Cell Biology, Addison-Westey, Reading inMassachusettes.

5. Baserga, R (1985)/ latest edition) The Biology of CellReproduction. Harward University Press Cambridge,Massachuselts.

6. Beck, F. and J.B. Lloyd (eds) (1974) The Cell in Medical Science,AcademicPress,London.

7. Callan, H.G (1986)/ latest edition) Lampbrush Chromosomes Springer – verlagNewYork.

8. Chambliss, G(ed)(1980)/latest edition) Ribosanes – Structure, Function& Genetics University of Park Press,Baltimore.

9. Edmunds, L.N. 1984 / latest edition- Cell Cycle Clock, Marcel Dekker, NewYork.

10. Edmunds, L.N. 1987/ latest edition. Cellular & Molecular Basis ofBiological Clocks Springer – VerlagBerlin.

11. Gomperts, B.D.(latest edition) PlusmaMembrance Academic press,

NewYork.

12. Henning, W (ed) 1987/ latest edition Structure &Functionof Eukaryotic Chromosanes Springer – Verlag,Berlin.

13. Moens, P.B. (ed) 1987/ latest edition Meiosis Academic Press,Orlands, Florida, USA.

14. Nomura, M.A./Tissiers&P. Lengyel (eds). 1974 Latest edition –Ribosomes Cold Spring Harber Laboratory Press, New York.

15. Tzagtoloff. A 1982/ latest edition Mitochondria Plenum Press, NewYork.

16. E. Munn 1982/ latest edition, Mitochondria: Structure, assembly &function.

17. Whaley – The Golgi apparatus 1976/ latest edition. The Frontiers inCell Biology series AcademicPress.

18. HoltgmanEThe frontiers in Cell Biology series AcademicPress.

19. Petty H.R 1993. Molecular Biology of MembrancePlenum.

20. YeagleP.L. 1993. The Membranes of Cells 2nd ed.AcademicPress.

21. Berger E.G. et.al. 1998. Reviews of Golgi ComlplexTrends CellBiologyVol. 8No.1.

22. Rapoport, T.A. etal. 1996. Protein Transport across the eukaryotic ER&Bucteria inner membranceAnnu. Rev. Biochem.65:271-303.

M.Sc. Fisheries
Academic Flexibility, Credit System
M. Sc. I – Sem. I
MFT 104– SUSTAINABLE AQUACULTURE

Credit: (Theory – 04 Practical-04)Theory Lectures:60

UNIT I

Present scenario and problems: Trends in global and Indian aquaculture; different farming systems; intensive systems and constraints - environmental degradation and disease outbreaks.

Unit II A Sustainability and development: Systems approach and its application in aquaculture with special reference to resource-poor systems; Role of aquatic resources in food and nutrition; Aquatic resource and livelihood systems.

B Socio-economic issues: Conflicts over water and land use; conflicts of interest between aqua farmers and fishermen; resistance from local public; anti-dumping duties.

UNIT III

Strategies for sustainability: Sustainability concept; food security; biosecurity; organic farming; integrated farming; responsible aquaculture; rotational aquaculture; bioremediation; role of biotechnology, traceability. Application of renewable energy in aquaculture - solar energy, wind, and tidal energy, Seed certification, Sustainable use of antibiotics.

UNIT IV

Economic viability: export vs. domestic marketing, value addition.

Guiding principles to sustainable aquaculture development: Coastal Aquaculture Guidelines Source Book, FAO Code of Conduct for Responsible Fisheries; Holmenskollen Guidelines for Sustainable Aquaculture.

M.Sc. Fisheries
Academic Flexibility, Credit System
M.Sc.-I, Sem.-I
MFP 105

(Practical based on paper – MFT 101& MFT 102)

Learning Objectives:

Students will able to1. Understand all aspects of invertebrate animals.

2. To study the Chordate phylum, systematic and biodiversity.

3. To identify and classify the animals by the identification key.

4. Able to understand the methods and procedure of animal collection and their preservation.

5. Able to understand the different parameters of aquatic habitat.

1. Study of museum specimens and slides invertebrate's phyla (one representative from each class) for biosystematics &biodiversity.

2. Study of museum specimens of chordates phylum (one representative from each class) for Biosystematics and biodiversity.

3) Identification of insects/ molluscs with the help of keys up to orders. 4). Identification of insects/ molluscs with the help of keys up to families.

6. Identification of animals with the help of keys up to families (fish/amphibian with the help of preserved specimens / models /pictures).

7. Methods of collection and preservation of animals.

8. Visit to ZSI/fields.

9. Study of inter relationships parasitism, symbiosis, commensalisms(2-3 examples From each).

10. Study of endangered species. (Models, pictures, charts.).

11. Study of adaptations in animals from Pisces, amphibian, reptilian, birds& mammals

(2-3 examples from each).

12. Visits to sanctuaries and National parks to study wild lifemanagement.

13. Study biodiversity of platue by Quadrate& transect method, Shannon indexand Simpsons index

14. Detection of heavy metal by Atomic absorptionSpectrophotometer

15. Use of software for identification of plants &animals.

16. Assessing existing data base onwww.

17. Harnessing information through Internet regardingBiodiversity.

18. Preparation of culture media isolation of DNA from plants &animals.

19. Study of microbes isolation, culture and staining from soil &water.

20.Identification of planktons from different watersamples

21. Determination of DO, CO2 Hardness, Chloride, Alkalinity of freshwaterand sewage water.(Physicochemicalparametres)

22. Determination of COD of sewagewater.

23. Determination of BOD of sewagewater.

24. Estimation of inorganic phosphate and nitrate from watersample.

26. Qualitative and quantitative estimation of Zooplanktons.

26. Detection of heavy metal from the watersample.

27. Practicals set on the network – internet, protein information, Genome& Chromosome database set byteacher.

28. Any other experiment set by the concernedteacher

Course Outcomes: After completion, students are able to

1. Understand the classification of non chordates and chordates.

2. Understand the Identification of animals with the help of keys up to families.

3. Able to study endangered species, adaptations and their interrelationships.

4. Able to study the parameters of different water samples.

Suggested Readings:

1. Alston, R.E. and B.L. Turner (1963): Biochemical systematics Prentices Hall Inc. Englewood Cliffs,

N.J. 404 pp.

2. Avise, J.C. (1974): Systematic value of Electrophoretic data. Syst. Zool. 23 (4): 465 – 481.

3. Benazzi, M. (1973): Cytotaxonomy and evolution, General remarks vertebrate evolution. Ed. A.B.

Chiarelli and Campus Academic Press, London and N.Y. pp. 1-3.

4. Blomback, B and M. Blomback (1968): Primary structure of animal proteins as a guide in taxonomicstudies. In chemitaxonomy and serotaxonomy (ed.) Hawkers pp. 3 – 20.

5. Camp, W.H. (1951): Biosystematics Britania 7: 113 – 127.

6. Ernst Mayr (1969): Principles of Systematics Zoology TMH Ed. Tata McGraw Hill Publishing

company Ltd. Bombay NewDelhi.

7. Primack,R.B.(1950):AprimerofconservationbiologY3rdeditionSinuerAssociates Inc. Publishers

Sunderland Massachutts USA.

8. Ray Samitan Ray A.K. (2006): Biodiversity and Biotechnology New Central Book Agency (P) Ltd.

9. Theory and practice of animal taxonomy- V. C. Kapoor

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Academic Flexibility, Credit System
M.Sc.-I Sem.-I
MFP 106

(Practical based on paper – MFT 103 & MFT 104)

Practical

- Demonstration of extracellular material a. Collagen, b.Elastin
- Demonstration of Glycosaminoglycans in the extracellular materialusing b. AB-1 c. AB-2.5 d. PAS e. AF +AB 2.5 (SialicAcid) f. $MgCl_2$ influence on alcinopoilia.
- Study of cellOrganelles. g. Nucleus demonstration by i) Basic Dyes : TB, HE, Methyleneblue. ii) Feulgen reaction Effect oftemperature
- Lysosome demonstration (Acid phosphatase and any othermethod)
- Golgi bodies demonstration (CajalMethod) 6. Effect of tonicity of solutions on plasma membrane –Isotonic, Hypotonic, Hypertonic b) Fragility test of RBC & Osmotic Resistance.

Practical

- Visit to conventional aquafarm to see the management of used water;
- Setting model for sustainable aquaculture (organic farm, integrated farm);
- Applications of remote sensing and GIS (geographical information system);
- Economic evaluation of aquaculture practices.

M.Sc. Fisheries

Academic Flexibility, Credit System

M.Sc.-I Sem.-II

MFT 201: Physiological Chemistry

Credit: (Theory – 04 Practical - 04) Theory Lectures: 60

Learning Objectives:

Students will able to1. Understand biochemistry of carbohydrates, protein and lipid.

2. To introduce structure, function and organization of various bio-molecules present in the living

cell.

3. Students know the structure and properties of macromolecules that act together to maintain and

perpetuate the living systems.

4. Understand the structure and function of nucleic acid.

Unit I

Principles of Biological chemistry:

Principles of biophysical chemistry (pH, buffer, reaction kinetics dissociation and association constants) Physical constants,

Structure of atoms, molecules and chemical bonds, Vander Waal's electrostatic, Hydrogen bonding and hydrophobic interactions. Thermodynamics, Concept of free energy, Enthalpy, Entropy,

Water: Structure and physicochemical properties, Energy rich bonds.

Basics of solution preparation: Molarity, Molality, Normality, W/V, % solution, ppm, Stock dilution

Unit II

Carbohydrates –

Structure, classification and function, Carbohydrate metabolism: Glycolysis, TCA cycle, Electron

transfer and ATP generation, Bioenergetics of ATP cycle, glycogenesis, glycogenolysis,

gluconeogenesis and Pentose phosphate pathway

Unit III

Proteins – structure, classification and function, Biosynthesis and Oxidation of amino acids.

Primary structure of proteins and nucleic acids, Conformation of proteins and, Reverse turn and

Ramachandran plot.

Nucleic acids: DNA, RNA structure, functions and Biosynthesis of nucleotides

Unit IV

Lipids- structure, classification and function, Catabolism of fatty acid – Beta oxidation,

significance of beta oxidation, Biosynthesis of saturated and unsaturated fatty acids, Biosynthesis

of triglyceride, biosynthesis of membrane phospholipids, Biosynthesis of cholesterol, Steroidal

hormones- structure and functions.

Course Outcomes: After completion, students are able to

1. Knowledge on the structure and function of different biomolecules would enable the students to

consolidate their focus on understanding various metabolic pathways crucial for the sustenance of

living systems.

2. Understand the how to form proteins and how to work at molecular level.

3. Understand the metabolic pathways and their role in human bodies.

4. Get knowledge of micro and macromolecules and their concern diseases.

5. Acquired knowledge and importance of water for living system.

Suggested Reading:

1. A K Anderson- Essentials of physiological chemistry.

2. H. Harper- Review of physiological chemistry.

3. P. Karlson- Introduction to modern biochemistry

4. West E an Todd W- Text book of biochemistry

5. Mahler H and Cordes E – Biochemical chemistry

6. Lehninger's- Biochemistry – COX & Nelson.

7. Reithel F J- Concepts in Biochemistry

8. G H Bell , Je N Davdson and D E Smith- Text book of physiology and biochemistry

9. Mitlon and Toporely- Essentials of biochemistry

10. Outline of Biochemistry by Conn & Stump.

M.Sc. Fisheries

Academic Flexibility, Credit System

M. Sc. I Sem. II

MFT 202 - Quantitative Biology and Tools and

Techniques in Biology

Credit: (Theory – 04 Practical - 04) Theory Lectures: 60

Learning Objectives:

Students will able to1. Understand about the termsCentral tendency, correlations, regression and analysis of

variance.

2. Understand how to apply testing hypothesis, Probability distribution, Student t- test and

Chi- square test.

3. Understand how to separates molecules by using different techniques.

4. Understand analytical instruments and their applications in biology.

Unit I

1. Introduction, Application in Biology.

2. Measurement of Central tendency.

3. Measures of dispersion.

4. Correlation- Types and methods of correlation.

5. Regression- Regression lines and coefficients.

6. Analysis of Variance (ANOVA).

Unit II

1. Probability- Introduction, addition and multiplication theory.

2. Probability distribution- Binomial, Poisson and Normal.

3. Testing of hypothesis.

3.1 Tests of Significance.

3.2 Null hypothesis.

3.3 Alternative hypothesis.

3.4 Level of significance.

4. Student t- test.

5. Chi- square test (X2).

6. Confidence integral.

Unit III

Separation techniques:

2. Chromatographic techniques – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography.

3. Electrophoretic techniques – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing.

4. Density gradient centrifugation and its application

Unit IV

(A) Analytical instruments and their applications in Biology:

1. Spectroscopy (Spectrophotometry, Spectroflurometry, NMR, ESR).

(B) Microscopy, Radiometry &Immunochemical techniques.

1. Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM).

2. Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays &immunohisto

/cytochemistry.

Course Outcomes: After completion, students are able to

1. Identify analyses appropriate for diverse types of data, and explain their theoretical fundamentals.

2. Describe, present, and critically evaluate analytical methods, models and theories used in published

research, and identify, where relevant, more appropriate alternatives.

3. Apply and extend analytical methods, models and theories to biological datasets.

4.Acquire skills of separation technique, analytical instrumentation and their applications.

Suggested Reading:

1. Fundamentals of Statistics- Gupta S. C.

2. Basic Biostatistics and its applications- Datta A. K

3. Biostatistics and Biometry- Parihar and Parihar.

4. An Introduction to statistical Methods- C. B. Gupta.

5. Practical Biochemistry By Wilson and Walker

6. Cell : A molecular approach By Cooper

7. Molecular Biology of the Cell by Lodish et al.

9. Basic Biostatistics and its applications- Datta A. K

10. Biostatistics and Biometry- Parihar and Parihar.

11. An Introduction to statistical Methods- C. B. Gupta.

M. Sc. Fisheries

Academic Flexibility, Credit System

M.Sc.-I Sem.-II

MFT 203 –AQUACULTURE BIOTECHNOLOGY

Credit: (Theory – 04 Practical - 04)Theory Lectures: 60

Objective To provide an overview of the application of biotechnological tools in fishbreeding, nutrition, health, processing and other issues in fisheries.

Theory

Unit I

Reproductive biotechnology:

Induced breeding hormones and analogues. .

Manipulation of primordial germ cells and surrogacy.

Unit II

Chromosome manipulation: Ploidy manipulation, Sex manipulation,

Androgenesis, Gynogenesis and applications.

Transgenesis in fish; GMOs: Biosafety regulations and ethics.

Unit III

Nutritional & health biotechnology:

Probiotics, Biofilms, Biofloc, Single cell

protein, Bio-encapsulated feeds, Nutraceuticals, Nutrigenomics, Disease

diagnostic techniques and therapeutics.

Unit V

Gene Bank and conservation: Cryopreservation of gametes, embryos and stem

cells.IPR issues in Biotechnology

Suggested Reading

1. Dunham, R. A., (2004) Aquaculture and Fisheries Biotechnology: Genetic Approaches. CABI Publishing, Cambridge, USA. 385 pp. 2. Borowitzka, M.A. & Borowitzka, L.J. (1988) Micro-algal Biotechnology. Cambridge University Press, London, UK, 488 pp. 3. Chen, F. &Jiang, Y. (2001) Algae and their Biotechnological Potential. Springer Netherlands, 306 pp. 4. Gordon R. & Seckbach J. (2012) The Science of Algal Fuels. Springer Netherlands, 506 pp. 5. Lakra. W.S (2004) "Fisheries Biotechnology" Narendra Publishing House, New Delhi, 240 pp.

M.Sc. Fisheries

Academic Flexibility, Credit System

M.Sc. I Sem II

MFT 204 – APPLIED GENETICS IN AQUACULTURE

Credit: (Theory – 04 Practical - 04) Theory Lectures: 60

Objective

To impart knowledge on genetic basis of inheritance and breeding plans for commercially important fishes.

Theory

UNIT I

Introduction: Origin and advancement in genetics; physical basis of heredity; genetic correlation, domestication and local adaptation. Chromosome manipulation: Ploidy induction methods - triplody and tetraploidy, advantages and disadvantages of polyploids, androgenesis and gynogenesis. Sex determination: Sex differentiation and sex reversal in fishes, sex control and its role in aquaculture.

UNIT II

Selection: Scope, application and methods of selection, marker assisted selection-biochemical and molecular markers. Molecular tools for stock differentiation for selection. T V Hybridization: Heterosis, hybrid vigour, introgression.

UNIT VIII

Inbreeding: Methods of estimation, inbreeding depression and consequences, measures to reduce inbreeding in hatcheries.

Conservation genetics: Genetic resources of India and conservation, endangered species, cryopreservation of fish gametes.

UNIT IV

I Cytogenetics: Importance and karyotyping. UNIT IX Fish breeding: History and advancement of fish breeding, mode of reproduction, basic breeding methods and breeding programmes and goals.

Genetic management strategies: Environmental impacts, Lessons from the green revolution, Bioprospecting, GMOs and their detection.

Suggested Readings

Carvalho GR & Pitcher TJ. (Eds.). 1995. Molecular Genetics in Fisheries. Chapman & Hall. Falconer DS & Mackay. 1996.

Introduction to Quantitative Genetics. 4th Ed. Longman. Kanakaraj P. 2001.

A Text Book on Animal Genetics. International Book Distributing Co. Nair PR. 2008.

Biotechnology and Genetics in Fisheries and Aquaculture. Dominant Publ. Padhi BK & Mandal RK. 2000.

Applied Fish Genetics. Fishing Chimes. Pandian TJ, Strüssmann CA & Marian MP. 2005.

Fish Genetics and Aquaculture Biotechnology. Science Publ. Purdom CE. 1993.

Genetics and Fish Breeding. Chapman & Hall. Reddy PVGK. 2005.

Genetic Resources of Indian Major Carps. FAO Publ. Reddy PVGK, Ayyappan S, Thampy DM & Krishna G. 2005.

Text book of Fish Genetics and Biotechnology. ICAR. Ryman N & Utter F. (Eds.). 1988.

Population Genetics and Fishery Management. Washington Sea Grant Programmes, USA. Tave D. 1996.

Genetics for Fish Hatchery Managers. 2nd Ed. AVI Publ. Thorpe JE, Gall GAE, Lannan JE & Nash CE. (Eds.). 1995.

Conservation of Fish and Shellfish Resources, Managing Diversity.

M.Sc. Fisheries

Academic Flexibility, Credit System

M.Sc.-I, Sem.-I

MFP 205

(Practical based on paper – MFT 201& MFT 202)

Practical

- Estimation of glycogen.
- Estimation of lipids & phospholipids.
- Estimation of Vitamin C.
- Estimation of Cholesterol.
- Estimation of alpha-amino nitrogen by formoltitration.
- To find saponification value for a given fat.
- To prepare solution of given concentration change in normality/Molarity Prepare phosphate buffer of known pH and molarity- pH measurement, measurement of pH of lemon juice, urine and serum.
- To find absorption spectrum of hemoglobin, bovine serum albumin, tyrosine and (uv-visible).
- To estimate free amino acids by Ninhydrin method.
- To estimate protein content by Biuret method/ Lowry et.al./ Bradford method.
- To estimate the sugar by Nelson-Somogyi method and glucose.
- Separation of sugars by TLC.
- Spot test of amino acids.
- Serum cholesterol, Calcium estimation
- Examples based on different population genetical principles (Based on theory).
- To isolate proteins by salting out or by adjusting isoelectric point.
- To estimate tyrosine content by Folin-phenol method.
- To estimate the purity of ATP.
- Examples based on Chi-square test & student t-test.
- Examples based on regression.
- Examples based on Correlation coefficient.
- Examples based on Coefficient of variance
- Examples based on ANOVA. 24. Examples based on Probability.
- Any other practical set by the concerned teacher.

M.Sc. Fisheries

Academic Flexibility, Credit System

M.Sc.-I, Sem.-I

MFP 206

(Practical based on paper – MFT 203 & MFT 204)

Practical

Chromosomal manipulation- Gynogenesis, Triploidy,

Disease diagnosis using

PCR and ELISA, Spirulina culture, Cryopreservation of milt, Patent search.