

B. Sc-III (Fisheries)

I) Title: Fisheries

II) Year of implementation: Revised Syllabus will be implemented from June 2020 onwards.

III Preamble

1. To impart the knowledge of animal science to the pupils.
2. To make the pupil to use the knowledge in their daily life
3. To make the pupil aware of natural resources and environment
4. Application of knowledge in Fisheries for nutrition Aquaculture practice.
5. To provide practical experiences which form the part of their learning processes.
6. To develop aptitude for scientific work and ability to pursue studies far beyond graduation
7. To encourage the pupil to take life science as a carrier which is the need now a day
8. To make the pupil fit for the society

IV) General Objectives of the course

1. To impart the knowledge is the basic aim of education. The students are expected to acquire the knowledge of animal science, natural phenomenon, manipulation of nature and environment by man.
2. Understanding the scientific terms, concepts, facts, phenomenon and their interrelationships.
3. Applications of the knowledge
4. To develop skills in practical work, experiments and laboratory materials, instruments
5. To develop interest in the subject and scientific hobbies
6. To develop scientific attitude which is the major objective, this makes the students open minded, critical observations, curiosity, thinking etc.
7. Abilities to apply scientific methods, collection of scientific data, problem solving, organize science exhibitions, clubs etc.
8. Appreciation of the subject, contribution of the scientists, scientific methods, scientific programmes etc.

V) Duration:

1. The course shall be full time course
2. The duration of course shall be one year.

VI) Pattern:

Pattern of examination will be semester for theory and practical with internal assessment scheme.

(Seminar / Industrial Visit/ Educational Tour/ Project/ Field Visit)

VII) Medium of instruction:

The medium of instruction shall be in English

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara (Autonomous)
Department of Zoology & Fisheries

Syllabus for B.Sc. III (Fisheries)

1. Structure of Syllabus:

B.Sc.-III Semester-V

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
Compulsory Papers				BZFP508	10	4
Fishery Biology II and Aquaculture Management	BZFT501	3	2			
Biotechniques and Biostatistics	BZFT503	3	2			
Molecular Cell Biology and Animal Biotechnology	BZFT504	3	2			
English	BSCE-521	3	2	BZFP509 + Project	10	4
Elective Papers (Any one)						
Fish Physiology II, Fish breeding, Fish seed production and Transportation.	BZFT502	3	2			
Fishery Economics, Fish Marketing, Fishery Extension & Co-operatives, Financing in Fishery, Disaster Management	BZFT505	3	2			
Fish Products and Byproducts Technology	BZFT506					
Numerical skill	SECCZT507	2	1	SECCZFP510	4	1

B.Sc.-III Semester-VI

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
Compulsory Papers				BZFP608	10	4
Marine Ecology and Fisheries	BZFT 601	3	2			
Immunology	BZFT 603	3	2			
Applied Zoology - II	BZT 604	3	2	BZFP609 + Project	10	4
English	BSCE 621	3	2			
Elective Papers (Any one)						
Fish Pathology and Fishery Technology	BZFT 602	3	2			
Fish nutrition	BZT 605					
Fishery education, extension and economics of aquaculture	BZT 606					
Entrepreneurship Development	SECCZT 607	2	1	SECCZP610	4	1

PAPER-V BZFT- 501 Fishery Biology II and Aquaculture Management

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. To impart knowledge about fish nutrition, methods of determining the food of fishes.
2. To study functional anatomy of different systems of bivalve.
3. The students will gain knowledge of fish farming with Agriculture: rice cum fish culture and culturable species in rice fields, rotational and simultaneous culture.
4. The students will gain knowledge of sewage fed fisheries, culture of air breathing fishes.
5. The students will gain knowledge of cold water fisheries, fish farm management, brood stock and hatchery management.

Unit I

- A. Method in gut content analysis 3
- B. i. Fish nutrition: principle of fish nutrition and terminologies. 10
- ii. Nutritional requirements of cultivable fin fishes: larvae, juvenile and adults.
- iii. Nutritional biochemistry: classification, nutrients quality and evaluation of protein, lipid and carbohydrates.
- i. Role of nutrients: amino acid and fatty acid

Unit II

- A. Type study - Prawn (*Palaemon* sp.) 11
 - i. Systematic position
 - ii. Habits and habitat
 - iii. External morphology
 - iv. Functional anatomy of:
 - a) Digestive system
 - b) Respiratory system
 - c) Circulatory system
 - d) Excretory system
 - e) Nervous system and sense organs- Eye and Statocyst.
 - f) Reproductive system and life cycle

B. Prawn culture: Stocking, pond, Maintenance and harvesting. 7

Unit III 7

Type study Bivalve.

- i. Systematic position
- ii. Habits and habitat
- iii External morphology
- iv Functional anatomy of
 - a) Digestive system
 - b) Excretory system
 - c) Reproductive system
 - d) Respiratory system

Oyster culture (Edible and pearl). 4

- i) Species- edible and pearl.
- ii) Culture methods

Unit IV

Integrated fish farming and its economics. 7

A. Fish farming with Agriculture:

Rice cum fish culture

i Culturable species in rice fields

ii. Rotational and simultaneous culture

B. Fish farming with live stock-Duck, Pig& Cattle fish culture

C. Sewage fed fisheries

D. Culture of air breathing fishes.

E. Cold water fisheries (Mahaseer fish)

F. Fish farm Management:

G. Brood stock and hatchery management, Nursery management, Rearing and Stocking.

Learning Outcomes:

1. The students can setup cold water fisheries, fish farm and hatchery.
2. The student gain knowledge of fish nutrition, methods of determining the food of fishes.
3. Students should understand the functional an anatomy of: different system of bivalve.
4. The students gain knowledge of Systematic position, Habits and habitat, External morphology of bivalve.

REFERENCES:

1. Theory and practice of induced breeding in fish, by Harvey B.J. and W.S.Hoor , 1979, IDRC- TS . Ottawa, Canada.
2. Introduction to aquaculture - Mathew and Landew
3. Aquaculture – Rath
4. Fish and fisheries of India. byJhingran V.G.
5. Principles and practice of pond culture: A state of the art review. Lannan J.F.H.D. Smitherman and G. Tehobanglous (eds)1983, Oreggaon state University, U.S.A

BZFT -503 Biotechniques and Biostatistics

Theory: 30 hrs. (Credits 2)

Course Objectives: Student should understand

1. Introducing the students to the field of Biotechniques and Bioinformatics.
2. enable them understand the concepts of statistics in biology
3. Understanding the applications of transgenic animals and plants.
4. Introduce students to the principles, practices and application of animal cell culture.
5. Know the applications and limitations of different bioinformatics and statistical methods.

Unit I: Genetically Modified Organisms

9

1. Production of cloned and transgenic animals:
 - a. Nuclear Transplantation
 - b. Retroviral Method
 - c. DNA microinjection
2. Applications of transgenic animals:
 - a. Productions of pharmaceuticals
 - b. Production of donor organs
3. Knockout mice.

Unit II: Culture Techniques and Applications

6

- a. Animal cell culture: Introduction, principle and applications
- b. Stem Cells: Introduction to stem cells
 - i) Potency of stem cells: Totipotency, Pluripotency, Multipotency, Unipotency
 - ii) Sources of stem cells-Embryo, Fetal, Adult, Bone marrow

Unit III: Biostatistics

15

- i. Classification of Biological data
- ii. Frequency distribution
- iii. Tabulation
- iv. Graphical representation of data
- v. Measures of central tendency (Mean, Median, Mode)
- vi. Dispersion – Mean deviation & standard deviation
- vii. Correlation – Scattered diagram, Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.

Unit IV : Research Tools

- i. ANOVA
- ii. Chi square test
- iii. Student t test
- iv. Probability

Course Outcomes: After completion, students are able to

1. Understand the Methods and techniques in cell culture.
2. Apply the basic knowledge of cell culture in various fields of biotechnology.
3. Know the theory behind fundamental bioinformatics analysis methods.
4. Be familiar with widely used bioinformatics databases.

REFERENCES:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. I Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009)
2. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA. Snustad, D.P. and Simmons, M.J. (2009).
3. Principles of Genetics. V Edition, John Wiley and Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007).
4. Recombinant DNA Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA. Beauchamp, T.I. and Childress, J.F. (2008).
5. Principles of Biomedical Ethics. VI Edition Oxford University Press.
6. Elements of Biotechnology - P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
8. Concept of Genes-Pearson Edition 9. Cell and Molecular Biology

BZFT -504 Molecular Cell Biology and Animal Biotechnology

Theory: 30 hrs. (Credits 2)

Course Objectives:

- 1.To build upon the undergraduate level knowledge of basic Molecular Techniques.
- 2.The course shall make the students aware of various terms and concepts of Molecular Biology.
- 3.Sensitize the students about basic and fundamental processes in Gene manipulations.
- 4.Introduce students to the principles, practices and application of animal biotechnology.

Unit 1: Molecular Biology –

7

1. DNA Replication (Semi conservative mode)
2. DNA Damage and Repair mechanism
3. Regulation of gene expression- Operon concept
4. Genetic Code:
 - i) Properties of Genetic code
 - ii) Codon assignment
 - iii) Wobble hypothesis

Unit 2: Protein synthesis

8

- A) Transcription
 - i. Process in prokaryotes and eukaryotes
 - ii. RNA polymerase
 - iii. Post transcriptional modification in RNA
- B) Translation in prokaryotes and eukaryotes
 - i) Initiation
 - ii) Elongation
 - iii) Termination

Unit 3: Molecular Techniques in Gene manipulation

15

1. Restriction enzymes: Nomenclature, detailed study of Type II.
2. Characteristics of Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophages
3. Gene cloning: Transformation techniques by Calcium chloride method and electroporation
4. Construction of genomic and cDNA libraries
5. Southern, Northern and Western blotting
6. DNA sequencing: Sanger method
7. Polymerase Chain Reaction,
8. DNA Finger Printing
9. DNA micro array

10. ELISA

11. Gene Farming

Course Outcomes: On completion of this course, students should be able to:

1. Gain fundamental knowledge in Molecular Biology.
2. Understand the molecular basis of various Techniques used in Molecular biology and biotechnology.
3. Work theoretically and practically with different advanced techniques and instruments used in gene manipulations.
4. Students will able to know the functional and working aspect of sophisticated instruments used in Biotechnology.

REFERENCES:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J. (2009).
2. Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009).
3. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA. Snustad, a. D.P. and Simmons, M.J. (2009).
4. Principles of Genetics. V Edition, John Wiley and Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007).
5. Recombinant DNAGenes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA. Beauchamp, T.I. and Childress, J.F. (2008).
6. Principles of Biomedical Ethics. VI Edition, Oxford University Press.
7. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia.
8. Cell Biology, C.B. Powar, Himalaya Publication House.
9. Cell and Molecular Biology, E.J. Dupraw, Academic Press, New York.
10. Cell Structure and Function - A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
11. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, K. Roberts & James D. Watson, Garian Publishing, New York

PAPER-VI BZFT- 502 Fish Physiology II, Fish breeding, Fish seed production and Transportation.

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. The student should acquire the knowledge of endocrine glands.
2. The students will learn about breeding of ornamental fishes.
3. The students will learn about fish Seed resources and their transport.
4. The students will learn about nutritional value of feed ingredients and live feed, Importance of natural food.

Unit I

A. Study of endocrine glands

Anatomy, role of hormones and their regulation with reference to:5

- a) Pituitary gland
- b) Thyroid gland

Unit II

A. Study of endocrine glands

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Histology, role of hormones and their regulation with reference to:

- a) Pituitary gland
- b) Inter-renal gland
- c) Corpuscles of Stannius
- d) Gonads
- e) Hepato pancrease
- f) Thyroid gland

B. Ecological and hormonal influence maturation of gonads and spawning.

3

Unit III

Breeding in Indian Major Carps.

6

- i Natural breeding
- ii Induced breeding .

- iii breeding of ornamental fishes 4
- a) Oviparous
 - b) Live bearers.

Unit IV

Fish Seed resources and their transport 8

- a) Fish seed from river, hapas, hatcheries
- b) Fertilization of eggs by stripping.
- c) Transport of fish seeds.
- d) Transport of fingerlings and brood fishes.

- a) Feed Resources: Nutritional value of feed ingredients and live feed. 7
- b) Importance of natural food to nutrient requirements of fish
- c) Feed additives -attractants, growth stimulants and probiotics and binders

Learning outcomes:

1. The students gain knowledge of endocrine glands.
2. The students gain knowledge role of hormones and their regulations.
3. The students gained knowledge of histology, role of different hormones including pituitary gland, Inter-renal gland, corpuscles of stannius, Gonads etc.
4. The students gained knowledge fish Seed resources and their transport.
5. The students gained knowledge nutritional value of feed ingredients and live feed, Importance of natural food.

REFERENCES:

1. Ichthyology by Lagler, K.F.J.E.Bvardach and R.R. Miller
2. A History of fishes by Greenwood
3. Fishes: An introduction to Ichthyology by Moyle P.B. and J.J.Cech.
4. The Biology of fishes by Kyle H.M.T. .FH.Publi
5. The life of fishes by Marshall N.

**BZFT- 505 Fishery Economics, Fish Marketing, Fishery Extension & Co-operatives,
Financing in Fishery, Disaster Management**

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. The students will learn about Law of diminishing returns, laws of increasing, constant and decreasing utility and returns.
2. The students will learn about definition, Aim, Characteristic, Types and Stages of fish marketing. ii) Marketing channels and supply chain, Marketing margins, Marketing environment, Methods of selling fish, Exports of fish and fishery products.
3. The students will learn about Aim and role of co-operative in fishery economy. Organization of fishermen co-operatives.
4. The students will learn about) Role of District Fishery Development Office, Role of insurance in Fish Farming Industry.

Unit I

Fishery Economics

13

i) Principles of economics: Definition, Law of diminishing returns, laws of increasing, constant and decreasing utility and returns. ii) Importance of economics in aquaculture development. iii) Economic value of fishes, iv) Maximum Sustainable Yield (MSY), Maximum Economic Yield (MEY), Optimum Sustainable Yield (OSY) v) Overfishing, Aquaranching(Culture based capture method) vi) Economy of fishermen: Fishermen populations, GDP from fisheries sector, foreign exchange earnings and employment potential of fishing industry.

Unit II

Fish Marketing

13

i) Fish marketing- definition, Aim, Characteristic, Types and Stages of fish marketing. ii) Marketing channels and supply chain, Marketing margins, Marketing environment, Marketing strategies, Consumer Behavior iii) Fish markets and marketing in India, Problems of fish marketing in India. iv) Cold storage and other marketing infrastructure in India. v) Methods of selling fish, Price Determination marketing organization and improvement. vi)

Exports of fish and fishery products, trends and problems therein. Role of MPEDA in exports of fish and fishery products.

Unit III

5

Fishery Extension & Co-operatives i) Fishery co-operative- Aim and role of co-operative in fishery economy. Organization of fishermen co-operatives. ii) Fisheries extension- Definition, extension philosophy and Methodology iii) Fishing community and their socio-economic problems. iv) Fish farmers development Agencies (FFDA)

Unit IV

Scopes & Financing in Fishery Management

6

i) Study, Training & Research opportunities in Fisheries in India with special reference to NER ii) Credit Requirements & Role of credit for fisheries iii) Schemes of National Fishery Development Board (NFDB) & NABARD iv) Role of District Fishery Development Office. v) Role of insurance in Fish Farming Industry.

Unit-V: Skill based 20%

8

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

2. Research Design

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

3. Teaching Methodology

Materials development and syllabus design, Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management.

Learning outcomes

1. The students gained knowledge about law of diminishing returns, laws of increasing, constant and decreasing utility and returns.

2. The students gained knowledge about definition, Aim, Characteristic, Types and Stages of fish marketing. ii) Marketing channels and supply chain, Marketing margins, Marketing environment, Methods of selling fish, Exports of fish and fishery products.
3. The students gained knowledge role of fishery economy. Organization of fishermen co-operatives.
4. The students gained knowledge of District Fishery Development Office, Role of insurance in Fish Farming Industry.

References:

1. Ichthyology by Lagler, K.F.J.E. Bvardach and R.R. Miller
2. Fishes: An introduction to Ichthyology by Moyle P.B. and J.J. Cech.
3. Fresh water prawn farming :A manual of the culture of *M. rosenbergii*, New, M.B. and S. Sngholka, 1982, FAO , Fish. Tech. Pap. 225 FAO, Rome.

BZFT- 506 - Fish Products and Byproducts Technology Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. The student will learn about Processing of fish by traditional methods.
2. Different types of spoilage in salt cured fish. Quality standard for salted and dry fish..
3. 2-The student will learn about Fish maws, shark leather, Chitin, chitosan, fish glue, fish gelatin, isinglass, pearl essence, shark fin rays, beach de mer, and biochemical and pharmaceutical products.
4. The student will learn about Utilization of seaweeds: agar agar, algin, carrageenan.
5. 2-The student will learn about Diversified fish products: battered and braided products-

fishfinger,.fish cutlet, fish wafer, and fish soup powder etc and imitation products.

Unit I

12

Principle of fish preservation and processing. Processing of fish by traditional methods – salting, sun drying, smoking, marinading and fermentation. Theory of salting, methods of salting –wet salting and dry salting. Drying and dehydration- theory, importance of water activity in relation to microbial growth .Sun drying and artificial drying- solar dryer.

Packaging and storage of salted and dried fish. Different types of spoilage in salt cured fish.

Quality standard for salted and dry fish.

Unit II

12

Preservation by smoking- Chemical composition of wood smoke and their role in preservation. Methods of smoking and equipments used for smoking. Carcinogenic compound in wood and methods to remove them. Hurdle technology in fish preservation and processing. Marinaded and fermented fish products – role of acids in marinades, Fish and prawn pickles, fish sauce and Fish paste, traditional Indian fermented products. Principles and methods of preparation of various fish paste products like fish sausage, fish ham, surimi, fish cake, kamaboko etc. Fish muscle structure, myofibriller protein and their role in elasticity formation.

Unit III

9

Extruded products – Theory of extrusion, equipments used, advantages of extruded products, methods of preparation of extruded products. Fish protein concentrate. Fish hydrolysate, partially hydrolyzed and deodorized fish meat, functional fish protein concentrate and their incorporation to various products. Fish meal and oil. Dry reduction and wet reduction methods. Fish maws, shark leather, Chitin, chitosan, fish glue, fish gelatin,

isinglass, pearl essence, shark fin rays, beach de mer, and biochemical and pharmaceutical products.

Unit IV

5

Utilization of seaweeds: agar agar, algin, carrageenan. Diversified fish products: battered and braided products-fish finger, fish cutlet, fish wafer, and fish soup powder etc and imitation products. Value addition, HACCP in safe products production.

Unit V: Skill based 20%

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

2. Research Design

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

3. Teaching Methodology

Materials development and syllabus design, Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management.

Learning outcomes

1. The student gained knowledge about Processing of fish by traditional methods.
2. The student gained knowledge of different types of spoilage in salt cured fish. Quality standard for salted and dry fish.

3. The students gained knowledge of preservation by smoking, Hurdle technology in fish preservation and processing.
4. The student gained knowledge of how to utilize seaweeds: agar agar, algin, and carrageenan.
5. The student learn to prepare the diversified fish products: battered and braided products- fish finger,. fish cutlet, fish wafer, and fish soup powder etc and imitation products.

References:

1. Fishes: An introduction to Ichthyology by Moyle P.B. and J.J.Cech.
2. Fresh water prawn farming :A manual of the culture of *M. rosenbergii*, New,M.B. and S. Sngholka, 1982, FAO , Fish. Tech. Pap. 225 FAO, Rome.
- 3.Fisheries-Its methods and applications by Rounsfell G.A. and W.H. Everhart

SECCZT 507: Numerical Skills

Lecture: 30 Credit: 02

Learning Objectives-

- ❖ To understand Mathematical Reasoning and Aptitude
- ❖ To make students aware about some tricks in mathematics.
- ❖ To Study some basic concepts of reasoning.

Unit 1:

Mathematical Reasoning and Aptitude: Mathematical Aptitude: Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc. Number series, Letter series, Codes and Relationships. Mathematical Aptitude (Fraction, Time & Distance, Ratio.

Unit 2:

Logical Reasoning: Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Uses of language, Connotations and denotations of terms, Classical Square of opposition. Analogies, Venn diagram: Simple and multiple use for establishing validity of arguments, Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data. Probability: concept, types, application in biological sciences.

Learning Outcomes:

- ❖ Students should understand the basic fundamentals in basics of Math's and Reasoning
- ❖ Student should gain an insight in the fascinating topics like Graphical representation

References:

1. Quantitative Aptitude for Competitive Examinations by Dr. R. S. Agarwal.
2. NTA UGC - NET/SET/ JRF Paper I - Sikshan Evam ShodhAbhiyogita, second Edition
3. Vidyabhartee SET/NET Anivarya Paper Margadarshak 2017by BrijmohanDayma
4. UGC NET Mathematical Sciences 2018 by Pawan Sharma

FISHERY PRACTICAL-III

BZFP 508 Practical I (based on papers V and VI) Marks-50 (Credits: 02)

Course Objectives:

1. To impart knowledge about fish nutrition, methods of determining the food of fishes.
2. To study functional anatomy of different systems of bivalve.
3. The students will gain knowledge of fish farming with Agriculture: rice cum fish culture and culturable species in rice fields, rotational and simultaneous culture.
4. The students will gain knowledge of Sewage fed fisheries, culture of air breathing fishes.
5. The students will gain knowledge of cold water fisheries, fish farm Management, Brood stock and hatchery management.

Unit I

Dissection of Prawn

4

- a. Digestive system.
- b. Nervous system.
- c. Mountings.
 - i. Mouth parts
 - ii. Thoracic appendages
 - iii. Abdominal appendages
 - iv. Cornea

v. Statocyst

Unit II

Micro technique Microtechnique of following

3

Pituitary gland / endocrine gland Testis Intestine/ oesophagus, stomach.

Group B:

Dissection of Bivalve .

4

- a. Digestive system
- b. Nervous system
- c. Study of: Gills, Heart

Study of <i>Glochidium</i> larva	2
Identification of larval/life cycle stages of Prawn/shrimp <i>Mytilus</i> Fish	2
Identification of following	4
a. Weeds: Eichornia, Marcelia, Hydrilla, Pistia, Spirogyra.	
b. Weed fishes: Rasbora , Puntius, and Tilapia	
c. Predatory fishes: Clarius, Anabas and Eel.	
d. Food and fertilizers: Lime, NPK fertilizers and fish meal.	

Unit III

- 1 Study of locally available feed ingredients (Any 5)
- 2 Estimation of crude protein from feed ingredients and feed.
- 3 Estimation of lipid from feed ingredients and feed.
- 4 Estimation of carbohydrate from feed ingredients and feed.
- 5 Estimation of vitamin from feed ingredients and feed.
6. Method of gut content analysis.

Unit IV

Field visit to fish farm/ report writing on fish seed transport.

Learning Outcomes:

1. The students can setup cold water fisheries, fish farm and hatchery.
2. The student gain knowledge of fish nutrition, methods of determining the food of fishes.
3. Students should understand the functional anatomy of: different system of bivalve.
4. The students gain knowledge of Systematic position, Habits and habitat, External morphology of bivalve

References:

1. Poddar T. K., S. Mukherjee & S. K. Das (2002) An Advanced Laboratory Manual of Zoology, Laxmi Publications .

2.Sinha, J.K. , Chatterjee, A.K. and P. Chattopadhyay (2015) Advanced Practical Zoology, Books & Allied (P) Ltd

3. Damodaran G K (2016). Practical Biochemistry, 2nd edition Jaypee Brothers Medical Publishers;

4. Singh SP (2013). Practical Manual of Biochemistry. 7th edition, CBS Publishers & Distributors

BZP 509 Practical –VI (Credits-02)

Molecular Biology, Animal Biotechnology, Biostatistics & Biotechniques

Course Objectives: Student should understand

1. Understands concepts and application of Microtechnique and different Biotechniques.
2. Biostatistics teaches them to use the best data analysis methods in their research projects
3. Gives insight into blotting techniques.

Part- I Microtechnique

1. Preparation of permanent histological slides by H-E technique
2. Histochemical technique
 - a. AB PH 1 technique
 - b. AB PH 2.5 technique
 - c. PAS technique

II] Biotechniques

1. Chromatography – Separation of amino acid by paper chromatography
2. Isolation of DNA using any suitable material
3. Demonstration of DNA by Feulgen technique
4. To study the following technique (photographs)
 - a) Southern blotting
 - b) Northern blotting
 - c) Western blotting
 - d) DNA sequencing (Sanger's method)
 - e) PCR
 - f) DNA fingerprinting

Part- III] Biostatistics

Any 10 example based on theory

Project (any suitable work possible in local area or from the syllabus) Report of the same to be submitted at the time of practical examination.

Course Outcomes: After completion, students are able to

1. Students gain skills in histological, immunological and electrophysiological techniques.
2. Students gain skills in application of Microtechnique and different Biotechniques.
3. Application of internet and statistical bioinformatics in research

References:

1. Twyman (2002) Advanced Molecular Biology. Viva Publication.
2. Verma & Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology. S. Chand
3. Stem Cell Biology (2001) Cold Spring Harbor Laboratory Press
4. Practical course in Cytology –A.K.Indurkar.
5. Staining methods (Histology & Histochemical)-J.F.A Me Mann & R.W Mowry
6. Histological and Histochemical technique- H.A . Davenport

B.Sc.-III Fisheries Semester-VI

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
Compulsory Papers				BZFP608	10	4
Marine Ecology and Fisheries	BZFT 601	3	2			
Immunology	BZFT 603	3	2			
Applied Zoology - II	BZT 604	3	2	BZFP609 + Project	10	4
English	BSCE 621	3	2			
Elective Papers (Any one)						
Fish Pathology and Fishery Technology	BZFT 602	3	2			
Fish nutrition	BZT 605					
Fishery education, extension and economics of aquaculture	BZT 606					
Entrepreneurship Development	SECCZT 607	2	1	SECCZP610	4	1

PAPER-VII BZFT- 601 Marine Ecology and Fisheries

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. Students should be aware of physicochemical parameters.
2. The students should know about the different types of oceanographic instruments.
3. Food and feeding and economic importance of marine water fishes.
4. To impart knowledge of capture and culture fisheries.
5. Students should learn feed formulation and processing.

Unit I

Marine habitat

- a. Physical parameters
- b. Chemical parameters
- c. Classification of habitat
- d. Physico-chemical parameters of estuary

Oceanographic instruments: 6

- i. Grabs
- ii. Dredges
- iii. Sacchi disc
- iv. Water samplers
- v. Reversing and non-reversing thermometers
- vi. Plankton net

Unit II

Brackish water habitat fisheries: 4

- a) Definition of Brackish water
- b) Definition of estuary
 - Types of estuary

Characteristics and fauna of: 11

- i. Rocky shore
- ii. Muddy shore
- iii. Sandy shore

Fauna in estuary -Permanent and migratory.

Unit III

Study of fisheries Crustacean Fisheries Molluscan fisheries 12

Study of fisheries of commercial importance with respect to Bionomics, food, feeding and economic importance of :

- a. Mackerel
- b. Pomfret
- c. Bombay duck

d. Sardine

Unit IV

Capture and culture fisheries:

4

Milk fish, Tilapia, Perches, Anguilla, Hilsa, Asian sea bass and Mullet.

- i. Feed Manufacture : feed formulation and processing.
- ii. On farm feed manufacture.
- iii. Commercial feed manufacture.
- iv. Feed storage.
- v. Supplementary feed.
- vi. Feeding methods and scheduling.
- vii. Feed performance and economics.

Learning outcomes

1. The students acquire knowledge of physicochemical parameters
2. Student learnt how to operate different oceanographic instruments and their applications with operations,
3. Students acquired knowledge regarding the importance of different types of capture and culture fisheries.
4. Students gain knowledge of feed formulation and processing.

REFERENCES:

1. The marine and fresh water fishes of Ceylon by Munro
2. Commercial sea fishes of India by Talwar P.K. and R.K. Kacher
3. FAO species identification sheets for fishery purpose. Vol.I,II
4. An introduction to the Pacific Fisheries. by Royce U.F.
5. Giant prawn farming , New .M.B. (ed). Elsevier Scientific Publishing Co. Amsterdam.
6. Fresh water prawn farming :A manual of the culture of *M. rosenbergii*, New,M.B. and S. Sngholka, 1982, FAO , Fish. Tech. Pap. 225 FAO, Rome.
7. The biology and culture of Tilapias. Pull in R.S.V. and R.H. Lowe – Mcconel (Eds)

8. Bivalve culture in Asia and Pacific , Davy, F.B. and M. Brahm (Eds), 1982, IDRC-200. IDRC Asia, Regional office , Singapore.

9. Fish and fisheries of India by Thingrajan V.G., 1982, Hindustan Publishing Corporation, New Delhi.

PAPER-VIII BZFT- 602 Fish Pathology and Fishery Technology

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. Students are introduced to fishing gear technology
2. They should be aware of material used in fishing gears,
3. They must learn net making, fish spoilage.
4. Student should be aware of different fish diseases.
5. Students are introduced to fish marketing and its risk.
6. Students should learn different fish preservation techniques.
7. Students should learn different fish products and by products.

Unit I

- A. Fishing gear technology 6
- i Materials used in fishing gears
 - ii Properties and numbering system of gear making fibers
 - iii Net making by braiding and cutting , mounting of webbing, rigging of various gears, principles of mending. Knots, hitches and bends. iv. Purse seine
- B . Fish spoilage: 4
- a) Criteria for freshness of fish
 - b) Post mortem changes i. Rigor mortis ii. Bacterial spoilage iii. Chemical spoilage.

Unit II

Fish pathology: 13

A) Etiology, symptoms and control measures for the following:

- i. Viral diseases
- ii. Bacterial diseases
- iii. Fungal diseases
- iv. Protozoan diseases
- v. Epizootic ulcerative syndrome (EUS)
- vi. Worm diseases
- vii. Crustacean diseases

B) Fish Marketing

6

- a. Definition.
- b. Marketing channel
- c. Risk of fish marketing.
- d. Co-operative society in aquaculture (public sector in aquaculture).
- e. FFDA organization.

Unit III

A) Fish preservation and processing techniques Principles and methods with reference to: 6

- a. Refrigeration and freezing b. Drying c. Salting d. Smoking e. Canning

B) Fish products and by-products:

5

- a. Fish body oil b. Fish liver oil c. Fish meal d. Isinglass e. Fish protein concentrate f. Fish glue
- g. Fish manure

Learning outcomes:

1. Students understand fishing gear technology.
2. They learnt which material is used in fishing gears.
3. They learn net making, fish spoilage.
4. Student made aware of different fish diseases
5. Students acquire knowledge of fish marketing and its risk.
6. Students learnt different fish preservation techniques
7. Students learnt different fish products and by products.

REFERENCES:

1. Fisheries technology - Balchandran
2. General topics in fishery by Ravi Reddy, Mohan Babare, Ramraopatil.
3. Fisheries-Its methods and applications by Rounsfell G.A. and W.H. Everhart
5. Manual of methods in fish biology by S.P. Biswas
6. Inland fishes of India and adjacent countries (vol.I,II) by Talwar P.K. and A.G.Jhingran.
8. Hand book of museum techniques by Aiyyappan A. and S.T. Satyamurthy.
10. Fisheries Ecology by Pitcher T.J. and P.J.T. Hart.
11. Fish stock assessment : A manual of basic methods.
12. Manual of methods of fisheries biology, Pisciculture by Laevastu T.
13. History of fishes by Norman
14. Fish and fisheries by B.N. Yadav
15. The Cambridge Natural History by HimeshShiploy
16. Proceedings of the symposium on living resources of the seas around
17. India-CMFRI-1073Spl. pub. Cochin
18. Standard methods for the examination of water and waste water APHA 19. 1981, American public health association, Washington D.C.

BZFT-603 IMMUNOLOGY

Theory: 30 hrs. (Credits 2)

Course Objectives:

1. Student should understand the basic concept in immunology.
2. Student should know about vaccination.
3. Student should know about the cells and organs of immune system.
4. Student should know about the structure and function of antibody.
5. Student should understand antigen- antibody interactions.
6. Student should know about the Hybridoma Technology.

Unit 1: Overview of the Immune System

7

1. Introduction to basic concept in immunology
2. Principles of innate and adaptive immune system
3. Immuno- therapeutic strategies against pathogens vaccination

Unit 2: Cells and Organs of the immune system

8

1. Haematopoeisis
2. Lymphocyte synthesis

Unit 3 : Antigens

7

1. Basic properties of antigens
2. B and T cell epitopes

Unit 4: Immunoglobulin / Antibodies

8

1. Structure, Classes and Functions of Antibodies
2. Antigen – Antibody interactions
3. Hybridoma Technology: Monoclonal Antibodies in diagnosis and therapeutics
4. Disposal and pollution of Pharmaceuticals

Course Outcomes:

1. Student will get the knowledge basic concept in immunology.
2. Student will understand the vaccination.
3. Student will get the proper knowledge about the cells and organs of immune system.
4. Students are able to understand the structure and function of antibody.
5. Students able to understand antigen- antibody interactions.

REFERENCES:

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006).
2. Immunology, VI Edition. W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R. (2006).
3. Immunology, VII Edition, Mosby, Elsevier Publication. Abbas, K. Abul and Lechtman Andrew (2003.)
4. Cellular and Molecular Immunology. V Edition. Saunders Publication

BZFT-604 Applied Zoology - II

Theory: 30 hrs. (Credits 2)

Course Objectives:

1. To maintain small apiaries for demonstration, pollination, extraction and by-product of beekeeping.
2. Student should know about the proper management of the domestic animals.
3. Student should know about the indigenous and exotic breeds of domestic animals.
4. Student should understand to develop high yielding breeds of animals.
5. Student should understand the process of pearl formation.
6. Student should understand the genetic improvements in aquaculture industry.

Unit 1: Apiculture

8

1. Types and casts of honey bee
2. Honey Comb
3. Bee Keeping
 - a. Artificial models of bee hive – Newton and Langstroth models
 - b. Bee keeping Equipments
 - c. Extraction of Honey
4. Medicinal Value of Honey

Unit 2: Animal Husbandary

5

1. Indigenous and exotic breeds of cattle
2. Preservation and artificial insemination in cattle

3. Induction of early puberty
4. Synchronization of estrus in cattle
5. Commercial importance of dairy farming

Unit 3: Pearl culture

4

1. Species of oyster
2. Process of Pearl formation: natural and artificial
3. Maintenance of oysters
4. Harvesting
5. Importance of Pearl

Unit 4: Freshwater prawn culture

3

1. Species of Prawn
2. Site selection
3. Farm Construction
4. Production system: fertilization, Larval Development, Food and feeding
5. Harvesting

Unit 5: Fish Technology

5

Genetic improvements in aquaculture industry:

1. Induced breeding
2. Transportation of fish seed
3. Feeding and development
4. Harvesting and Marketing

Unit 6 : Production and marketing of milk products

Course Outcomes:

1. Students are able to understand about handle bee keeping system and bee keeping management.
2. Students are able to understand about bee colony management.
3. Student will develop the management for the production of the domestic animals.
4. Student will understand nutrition of domestic animals to increase the milk production.
5. Student will get the knowledge about process of pearl formation.

REFERENCES:

1. Mollusca - Hyman.
2. Prawn and Prawn Fishery of India - Kurian.
3. Fish Culture - K. H. Alikuhni.
4. Fish Culture - Lagter.
5. Fishes of India. - Khanna.
6. Hand Book of Animal Husbandary and Dairy - Mudlyer.
7. Bee keeping in India - Sardar Sing.
8. Bee Keeping in India- M. G. Smith.

9. Poultry keeping in India - Naidu P.N.M.
10. Poultry Husbandary - M. A. Jule. 18. Poultry Husbandary - Moorthy.
11. Outlines of Dairy Technology - Sukumar De.
12. Milk and milk products - Clarence Henry Eckles, Willes Barnes Combs, Harold Macy

BZFT- 605 -Fish nutrition

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. Students will acquire knowledge about Principles of nutrition, Adaptations to various types of feeding in finfish, crustaceans and mollusks.
2. like milk fish, tilapia, carp, sea bass, tiger shrimp and *Macrobrachium rosenbergi*.
3. Students are introduced to different nutritional diseases of fishes.
4. Students should learn molluscs and crustaceans and control measures.

Unit I

Nutritional physiology

10

Principles of nutrition, Adaptations to various types of feeding in finfish, crustaceans and mollusks; Mechanism of food capture, food ingestion and role of feeding stimulants; Digestion assimilation and conversion of nutrients; Roles of gut microbes in digestion; Nutritional bioenergetics in finfish and shellfish.

Unit II

Nutritional requirements

12

Gross protein requirements; Nitrogen balance; Essential and non-essential amino acids and their quantitative requirements; Protein quality and sources; Lipid – their

functions; Essential fatty acids; phospholipid & sterol requirements; Protein sparing action of lipids; Negative aspects of lipids; Carbohydrates – their sources and utilization; Gross energy requirements; Factors altering energy requirements; Water and fat soluble vitamins, ; Deficiency and hyper dosage syndromes; antivitamin factors; Mineral requirements, importance of minerals; recommended dietary allowances; deficiency and hyper dosage syndromes.

Unit III

Management of feeding

10

Feeding strategies. Feeding equipment's. Feeding rate and frequency. Recording of feeding and monitoring water quality. Feeding of commercially important species like milk fish, tilapia, carp, sea bass, tiger shrimp and *Macrobrachium rosenbergi*.

Unit IV

Nutritional diseases

5

Nutritional diseases of cultured varieties of fishes, mollusks and crustaceans and control measures.

Unit V : Skill based 20%

8

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

2. Research Design

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

3. Teaching Methodology

Materials development and syllabus design, Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management.

Learning outcomes :

1. Students acquired knowledge about Principles of nutrition, Adaptations to various types of feeding in finfish, crustaceans and molluscs.
2. Students acquired knowledge of Feeding of commercially important species like milk fish, tilapia, carp, sea bass, tiger shrimp and *Macrobrachium rosenbergi*.
3. Students learnt different nutritional diseases of fishes.
4. Students learnt molluscs and crustaceans and control measures.

References:

1. Theory and practice of induced breeding in fish, by Harvey B.J. and W.S.Hoor , 1979, IDRC- TS . Ottawa, Canada.
2. Introduction to aquaculture - Mathew and Landew
3. Aquaculture – Rath
4. Fish and fisheries of India. by Jhingran V.G.
5. Principles and practice of pond culture: A state of the art review. Lannan J.F.H.D. Smitherman and G. Tehobanglous (eds)1983, Oreggaon state University, U.S.A

PAPER-VII BZFT- 606 Fishery education, extension and economics of aquaculture

Theory: 36 hrs. Marks-50 (Credits: 02)

Course Objectives:

1. As per future prospective students should be aware of various Fisheries training and education in India.
 2. Scope and Institutional funding to fisheries and aquaculture sector.
 3. Students should be aware of importance of Economics of aquaculture.
- Students should be aware of Economic viability, data requirement, analysis of data .Financial and economic feasibility, risk and insurance.

Unit – I :

Fisheries training and education in India: Training Institutes, Universities, Research Organizations, etc. 2. Institutional funding to fisheries and aquaculture sector.

Unit II

Socio-economic conditions of fishermen and fish farmers 4. Fishermen Co-operative Societies.

Unit – III :

Role of government agencies – Role of NABARD and other central government agencies in the upliftment of fisher folk. Role of state government agencies in various fishery activities – Loans and credits, policies . Integrated coastal zone management, ocean policy, role of NGO's CRZ.

Unit – IV :

Economics of aquaculture, Economic viability, data requirement, analysis of data, Financial and economic feasibility, risk and insurance.

Unit V : Skill based 20%

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

2. Research Design

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

3. Teaching Methodology

Materials development and syllabus design, Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management.

Learning outcomes:

1. As per future prospective students made aware of various Fisheries training and education in India.
2. Students gain knowledge about Scope and Institutional funding to fisheries and aquaculture sector so that they can use it to complete their higher studies.
3. Students learnt importance of Economics of aquaculture.
4. Students learnt economic viability, data requirement, analysis of data .Financial and economic feasibility, risk and insurance.

References:

1. Theory and practice of induced breeding in fish, by Harvey B.J. and W.S.Hoor , 1979, IDRC- TS . Ottawa, Canada.
2. Introduction to aquaculture - Mathew and Landew
3. Aquaculture – Rath
4. Fish and fisheries of India. by Jhingran V.G.
5. Principles and practice of pond culture: A state of the art review. Lannan J.F.H.D. Smitherman and G. Tehobanglous (eds)1983, Oreggaon state University, U.S.A

SCCCZT607: Entrepreneurship Development (EDP)

Theory: 24 Lectures, 48 Minutes (18 Hours)

Course Objectives:

1. Identification of opportunities for development.
2. To learn mechanism of finance and fund raising.
3. To understand the importance of marketing for better business opportunities.
4. To understand the Entrepreneurship Development skill in Apiculture & Sericulture.

Unit I: Entrepreneurship Development.

03

Introduction to entrepreneurship, Identification of opportunities for entrepreneurship, Concept of different occupations: business, employment and profession, Function of an Entrepreneur, Business idea plan, Types of businesses/ ownership- Sole proprietorship, Partnership, Private limited company, Public limited company, Joint stock Company, Co-operative society.

Unit II: Sources of finance.

02

Preparation of project report for business, Sources of finance- government and non government agencies, working capital, Cash flow, Fund flow, preparation of basics of financial statements, costing and pricing, Policies and incentives.

Unit III: Marketing management.

03

Small business management and entrepreneurship, Woman Entrepreneurship, Features of small business firms, Process of management in small business, Concept of data and information, Information as a commodity, Study of marketing strategy and marketing mix, decision-making models, Types of decisions, Decision support systems, Introduction to e-commerce, Types- B2B, B2C, C2B, C2C, Case study on small scale industries in India.

Unit IV:

Entrepreneurship Development in Sericulture:

08

Emergence and objectives of EDP, essential qualities to become an entrepreneur; selection of a potential entrepreneur. Central government Schemes for the promotion of sericulture in India, State Government schemes for the promotion of sericulture in Maharashtra. Policies for bank loan for sericulture. Export policies of cocoon.

Entrepreneurship Development in Apiculture:

08

Emergence and objectives of EDP, essential qualities to become an entrepreneur; selection of a potential entrepreneur. Government Schemes for the promotion of Apiculture. Policies for bank loan for Apiculture. Export policies of Bee products

Course Outcomes: After completion, students are able to

Understand about Entrepreneurship, Creativity & Opportunities.

1. Avail the financial and marketing skills.
2. To prepare the proposal for small scale industry.
3. To understand the Entrepreneurship Development skill in Apiculture & Sericulture

Reference books:

1. Energy management, W.R. Murphy, G. McKay, Butterworth-Heinemann Ltd., 1981.
2. Energy management principles, Craig Smith Kelly Parmenter, Elsevier Publishers., 2015
3. Efficient Use of energy, I.G.C, Dryden, Elsevier Publishers. (2nd Ed.) 1982
4. Energy Economics, A.V. Desai, New age publishers, 1996.
5. Entrepreneurship, Alpina Trehan, Wiley India publishers, . (1st Ed.) 2011.
6. Complete guide to successful Entrepreneurship, G.N. Pande, S. Chand (G/L) & Company Ltd., 1994.

BZFP- 608 FISHERIES PRACTICAL-III

(Based on papers VII and VIII) Marks-50 (Credits: 02)

Course Objectives:

1. Students will be able to acquire knowledge about estimation of fish blood chloride, estimation of haemoglobin of fish
2. Students will be able to know about practical knowledge of determination of fecundity, moisture content of fish, fish Morphometry.
3. Students will be able to know about Ovo-diameter and stages of maturity, GSI and conditioning factor.
4. Students will be able to gain practical knowledge about oceanographic instruments.

Unit I

1. Estimation of fish blood chloride. 5
2. Total RBCs and WBCs counts.
3. Estimation of hemoglobin of fish

Unit II

1. Determination of fecundity 5

2. Determination of moisture content of fish.
3. Ovo- diametry& study of stages of maturity.
Gonadosomatic index (GSI) and conditioning Factor

Unit III

1. Fish morphometry – Length-weight relationship 5
2. Study of ecological adaptations of the following:
 - a. *Mytilus*
 - b. *Echeneis*
 - c. Exocoetus
 - d. *Anguilla*
 - e. Pleuronectes
3. Study of oceanographic instruments.
4. Observations of mortality with respect to:
 - a. Stocking density
 - b. Use of different chemicals – LC50
5. Study of Economic importance of:
 - a. Bombay duck
 - b. Mackerel
 - c. Pomfret
 - d. Sardine

Unit IV

1. Study of pathological condition of fish and treatment. 4
 - a. Fin rot
 - b. Argulus
 - c. Nematode
2. Study of knots, hitches &bends.
3. Organoleptic tests for freshness of fish.

Visit to seashore/ fish market /processing factories.

Course Outcomes: After completion, students are able to

1. Practical knowledge about oceanographic instruments
2. Ovo-diametry and stages of maturity, GSI and conditioning factor.
3. Estimation of fish blood chloride, estimation of haemoglobin of fish

References:

- 1.J. D. H. Strickland and T. R. Parsons (1972): A Practical Handbook of Seawater Analysis; BULLETIN 167 (Second edition); FISHERIES RESEARCH BOARD OF CANADA
2. Manual of methods in fish biology by S.P. Biswas

3. Standard methods for the examination of water and waste water APHA 19. 1981, American public health association, Washington D.C.

FISHERY PRACTICAL – II (CREDITS-02)

BZP 609: Applied Zoology – II and Immunology

APPLIED ZOOLOGY

Learning Objectives:

1. To understand the concepts of Apiculture, bee keeping equipments.
2. Introduce and describe the pearl culture and fresh water prawn culture.
3. Understand basic histology of glands related to immunity.
4. Introduction and description of Goat farming.

1. Apiculture:

- a. Casts of Honey Bees
- b. Bee Hive (Photographs or models)
- c. Pollen Basket
- d. Sting Apparatus
- e. Honey
- f. Newton's model of Bee Hive (Photographs or models)
- g. Bee keeping Equipments (Photographs or models)

2. Preservation & Artificial insemination in cattles

3. Pearl culture

- a. Species of oyster
- b. Process of Pearl formation: natural and artificial
- c. Importance of Pearl

4. Freshwater prawn culture

- a. Species of Prawn
- b. Site selection
- c. Farm Construction
- d. Production system
- e. Harvesting

5. Goat farming

- a. Breeds (any four = 2 Indigenous and 2 Exotic)
- b. Housing
- c. Feeding

6. Economic importance of Milk and Milk byproducts

7. Visit to goat farm or animal breeding center – submission of visit report

II) IMMUNOLOGY

1. Study of lymphoid organ's (Photograph, Models, Videos)
2. Histological study of (slides or photographs)
 - a. Spleen
 - b. Thymus
 - c. Lymph nodes
3. Preparation of stained blood smears to study various types of blood cells
4. Determination of ABO blood groups.
5. Demonstration of
 - a. ELISA
 - b. Immuno-electrophoresis
6. Cell counting and viability test from splenocytes of farm breed animals / cell line

III) PROJECT

Course Outcomes: After completion, students are able to

1. Define the concepts of the applied subjects like Apiculture, Prawn culture and goat farming.
2. Able to plan their own startups or set up of Apiculture, Prawn culture and goat farming.
3. Able to practically use different immunohistochemical instruments.
4. Be able to clearly state the role of the immune system.

References:

1. Singh S., Beekeeping in India, Indian council of Agricultural Research, NewDelhi
2. Introduction to aquaculture - Mathew and Landew
3. Aquaculture – Rath
4. Abbas, K. Abul and Lechtman H. Andrew (2011.) Basic Immunology: Functions and Disorders of Immune System. Saunders Elsevier Publication.
5. Khan FH (2011) the Elements of Immunology Pearson