Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara, (An Autonomous)

Syllabus under Autonomy

B. Sc. I Fisheries

Syllabus to be implemented from 2022

Syllabus for B.Sc. I (Fisheries)

Preamble:

1) To impart the knowledge of animal science to the pupils.
2) To make the pupils to use the knowledge in their daily life.
3) To make the pupils aware of natural resources and environment.
4) Application of knowledge in Fisheries for nutrition, agriculture & livestock.
5) To provide practical experiences which form a part of their learning processes.
6) To develop aptitude for scientific work & ability to pursue studies far beyond graduation.
7) To encourage the pupils to take life science as a carrier which is the need now a day.
8) To make the pupils fit for the society.
9) In Autonomous the addition of more syllabus will be very helpful to students which will improve their knowledge in depth.
10) To inculcate in the student's highest values of life, understand the human niche in nature and apply the knowledge of life sciences for betterment of society.
11) To inspire students to reach frontiers of life sciences through commitment, hard work, study and research.

General Objectives of the Program:

1. To impart knowledge is the basic aim of education. The students are expected to acquire the knowledge of animal science, natural phenomenon, manipulation of nature & environment by man.
2. Understanding the scientific terms, concepts, facts, phenomena & their interrelationships.
3. Applications of the knowledge.
4. To develop skills in practical work, experiments & laboratory materials, instruments.
5. To develop interests in the subject & 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, contributions of scientists, scientific methods, scientific programs etc.

Program Outcomes:

1. The student will graduate with proficiency in the subject of his choice.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in government organizations.
5. The student will be eligible to appear for jobs with minimum requirement of B. Sc. Program.

Program Specific Objectives:

1. The students are expected to understand the fundamentals, principles, concepts and recent developments in the Zoology.
2. The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in Zoology.
3. It is expected to inspire and boost interest of the students in Zoology.
4. To develop the power of appreciations, the achievements in science and role in nature and society.
5. To enhance student sense of enthusiasm for science and to involve them in an intellectually stimulating experience of Course in a supportive environment.

Program Specific Outcomes:

1. Understand the basics of Fisheries.

2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.

3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Fisheries.

4. Identify their area of interest in academic, research and development.

5. Perform job in various fields' like science, environment, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach.

1. **Title:** Fisheries

2. **Year of Implementation:** The syllabus will be implemented from June, 2022 onwards.

3. Duration: The course shall be a full time.

4. Pattern: Semester examination.

5. Medium of Instruction: English.

6. Structure of Course:

B.Sc. – I, Semester –I

Level	Semester	Course Code	Course Title	Course Category	No. of Lectures Per Week	Credits
5	I	Course-I: BZFT101	Fish Taxonomy and Identification	Theory Course -I	05	04
		Course-II: BZFT102	Fish Anatomy and Physiology	Theory Course -II		
		BZFP 103	Practical Course I	Practical Course -I	04	02
					Total Credits	06
	II	Course-III: BZFT201	Aquatic Ecology	Theory Course -III	05	04
		Course-IV: BZFT202	Aquaculture	Theory Course -IV		
		BZFP203	Practical-1	Practical Course -II	04	02
					Total Credits	06

Note: B: B. Sc. T=Theory and P= Practical

B. Sc. Part-I Semester-I

BZFT101: Course I - Fish Taxonomy and Identification (Credits: 02)

Course Objectives: Student will able to

1.Study classification of fin fish and shell fish.

2. Study different types of fins and their functions & morphometric characters in fishes.

3. Study structure of skin, types & function of skin scales in fishes.

4. Study types of locomotion and migration of fish.

Total Credits = 2

UNIT No.	SEMESTER-I BZT101: Course I - Fish Taxonomy and Identification	No. of hours per unit
UNIT - I	1. Introduction, definition, scope and importance of fishery science. 2. Classification of fish and shell fish (Berg, 1940) up to class level 3. External characters of Teleost and Elasmobranch 4. Difference between Teleost and Elasmobranch fishes.	12
UNIT - II	5. Different types of fins and their functions. 6. Fish identification techniques. 6.1. Study of morphometric characters in fishes. 6.2 Study of meristic characters in fishes	11
UNIT - III	9. Structure and functions of skin in fishes. 10. Study of different types of scales in fishes. 11. Colouration in fishes – Source of colour, colour changes in fishes, significance of colour changes.	11
UNIT - IV	7. Locomotion in fishes: Types of locomotion, special mode of locomotion, 8. Migration in fishes – general account of migration, types and significance of migration, advantages of migration, factors influencing migration. Tagging and marking	11

Course Outcomes: Student should be able to

1. Classify fin fish and shell fish.

2. Explain types of fins and their functions & morphometric characters in fishes.

3. Understand the structure of skin, types of scales & its functions.

4. Understand types of locomotion and migration of fish.

Reference Books:

1.Biswas K. P. (2011). Marine prawns and shrimps. Daya Publishing House, New Delhi-35 2. Day Francis. (2007). The fishes of India, Vol 1 &

2. Jagmander Book Agency, New Delhi.

3. Dholakia, A. D. (2010). Identification of prawns/shrimps and their culture. Daya Publishing House, New Delhi-35

4. Dholakia, A. D. (2011). Identification of marine and fresh water mollusc shells. Daya Publishing House, New Delhi-35.

5. Jayram, K. C. (2002). The fresh water fishes of India, A hand book. Zoological Survey of India.

6. Jyoti Sharma (2006). Fishes: Aid to collection and identification. Daya Publishing House, New Delhi-35.

7. Kar. Devashish(2013) Essentials of Fish Biology, dominant publishers and distributors(p) Ltd, Delhi-110053

8. Kar.Devashish (2012).Taxonomy,APH Publishing Corporation, Ansari Road,DaryaGanj, New Delhi-110002.

9. Khanna. S. S. & Singh. H. R. (2005). A Textbook of Fish Biology and Fisheries, Narendra Publishing House, Delhi-6.

10. Lagler, K. F. (1981). Fresh Water Fishery Biology. (2nd edition). W. M. C. Brown Company Publishers, Dubugur, IOWA.

11. Norman, J. R. (2002). A history of fishes: a complete known account of fishes. Asiatic publishing house, Delhi.

12. Parihar, R. P. (2004). A Text book of Fish Biology and Indian Fisheries. Central Publishing House, Allahabad

13. Sandhu, G. S. (2005). A Text book of Fish and Fisheries. Daya Publishing House, New Delhi-35.

14. Yadav, B. N. (2002). Fish and Fisheries, 2nd revised and enlarged edn .Daya Publishing House, Delhi – 35.

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BZFT102: Course II - Fish Anatomy and Physiology (Credits: 02)

Course Objectives: Student will able to

1. Study the composition & digestion of food.

2. Study physiology of respiration & excretion.

3. Study sex organs, sex hormones & modes of reproduction.

4. Study sense organs in fishes.

Total Credits = 2

Unit No.	SEMESTER-I **BZFT102:Fish Anatomy and Physiology**	No. of hours per unit
UNIT - I	**Food and feeding behavior:** Protein, carbohydrate, fat, vitamins and minerals in fish nutrition, Different types of mouth in fish. Role of digestive enzymes in the digestion. Digestion and assimilation of nutrients Energy and nutrient status of food, Influence of temperature on metabolism.	13
UNIT - II	Gas exchange across the gills, Oxygen consumption Osmoregulation in fresh water, brackish water and marine fishes. Excretion: ultrafiltration, reabsorption, secretion and formation of urine. ammonia excretion and carbon dioxide output Blood Composition, haemoglobin and circulation.	12
UNIT - III	**Reproductive physiology:** Organs and hormones associated with reproduction, sex hormones, maturation inducing hormones, Modes of reproduction in fishes	10
UNIT - IV	**Nervous System- Teleost& Elasmobranch Central Nervous system (Brain and Spinal chord)** **Sense Organs:** Touch, taste, temperature and salinity. Sense of smell, hearing and sight. Lateral line and neuromast organs. Stress related physiological changes. Structure and functions of important endocrine glands.	10

Course Outcomes: Student should be able to

1. Understand the composition & digestion of food.
2. Understand the physiology of respiration, excretion and circulation.
3. Relate sex organs, sex hormones & modes of reproduction.
4. Categories nervous system, sense organs and endocrine glands in fishes.

Reference Books:

1. Khanna S. S and H. R. Singh (2003): A text book of fish biology and fisheries, Narendra Publishing House, New Delhi – 110 006.
2. Khanna S. S: An Introduction to fishes. Central Book Depot, Allahabad.
3. Norman J. R: A. History of Fishes. Earnest Benn. Ltd. London.
4. Pandey A. K and Sandhu G.S: Encyclopedia of fishes and fisheries of India Vol. I and IV, Amol Publication, New Delhi.
5. Reddy K. R. and M. G. Babare: General topics in fishery Science.

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Practical: BZFP103 Practical I

Course Objectives: Student will able to

1.Identification &classification freshwater& marine water fin fish.

2.Identification &classification freshwater& marine water shell fish.

3. Study different types of fins & scales in fish.

4. Demonstration of different systems from dissected bony fish.

Total Credits = 2 PRACTICAL No.	**BFP103PRACTICAL-I** (Based on BZFT 101 and BZFT 102)
	Group A:
I	Identification and classification of fresh water fishes- Catla catla, Labeo rohita, Cirrhina mrigala, Clarius batrachus, Eel fish
II	Identification and classification of marine water fish- Scoliodon, Harpadon, Hippocampus, Pristis, Exocoetus
III	Identification and classification of other aquatic animals-Palaemon, Penaeus, Mytilus, Pila, Sepia, Pearl oyster
IV	Morphometric measurements of fish
V	Study of different types of fins-Unpaired and Paired fins
VI	Temporary mounting of scales.
VII	Colouration, Locomotion & Migration
	Group B:
VIII	Study of different types of mouth in fish. Dissection : Demonstration-Any locally available

	bony fish a)Digestive system. b) Respiratory system- Gills and accessory respiratory organs. c) Heart, Afferent and Efferent Branchial Vessels. d) Brain e) Sexual Dimorphism in fishes f) Male and Female Reproductive System.
IX	Project: Visit to fish market/ visit to fish seed production center

Course Outcomes: Student should be able to

1. Identify & classify freshwater& marine water fin fish.
2. Identify & classify freshwater & marine water shell fish.
3. Understand the types & functions of fins & scales.
4. Understand different systems from dissected bony fish.

Reference Books:

1. Vertebrate Zoology- R.L. Kotpal
2. Vertebrate Zoology – P.S.Dhami&J.K.Dhami
3. Vertebrate Zoology – S.S. Lal
4. Practical Zoology Invertebrates – S.S. Lal
5. Practical zoology B.Sc. I – Mutkekar, Shinde
6. Handbook of Practical Zoology B.Sc.I - Jadhav
7. Practical Zoology Chordates- Verma & Agarwal
8. Practical methods in ecology and environmental science- R K Trivedy, P K Goel, C.L.Trisal
9. Techniques in Life sciences –D.B.Tembhare
10. Anatomy and Physiology of Fishes- Szantosh Kumar, ManjuTembhre
11. Chordates- H.V. Bhaskar
12. Chordate Zoology- E.L. Jordan & P.S. Verma

B. Sc. Part I Semester- II

BZFT201: Course III - Aquatic Ecology (Credits: 02)

Course Objectives: Student will able to

1. Study aquatic ecosystem.
2. Study physico–Chemical Characteristics of Water:
3. Study trophic dynamics of aquatic ecosystem.
4. Study Aquatic pollution.

Total Credits = 2

Unit No.	SEMESTER-II BZFT- 201Aquatic Ecology	No. of hours per unit
UNIT - I	**1. Aquatic Ecosystem:** Diversity and composition of aquatic ecosystems (fresh water, marine and estuarine). Ecological differences between lentic and lotic environments. Aquatic environment, Flora and fauna: Components of aquatic systems, Animal associations: Symbiosis, commensalisms, parasitism, prey-predator relationship, host parasite relationship.	13
UNIT - II	**2.** Physico–Chemical Characteristics of Water: Temperature, light, salinity, tides, currents, pH, dissolved oxygen, free carbon dioxide, hardness, alkalinity, conductivity, suspended and dissolved solids.	12
UNIT - III	**3.** Trophic Dynamics in aquatic ecosystem: Food chains, pyramids , nutrient cycles and energy flow **4.** Trophic relationship in lentic and lotic biotopes. **5.** Basic concepts of primary productivity	10
UNIT - IV	**6.** Aquatic Pollution: Aquatic pollution and its types (biological, chemical, thermal and industrial), Eutrophication: Causative factors, consequences and control. **7.** Impact of water pollution on aquatic communities and its control measures. **8.** Bio-indicator species.	10

Course Outcomes: Student should be able to

1. Understand difference between lentic & lotic ecosystems.

2. Categorize physico–Chemical Characteristics of Water:

3. Understand trophic dynamics of aquatic ecosystem.

4. Understand aquatic pollution.

Reference Books:

1. Alex, M. & Theresa, A. (1998). Environmental Management of Aquaculture (Fish edition), Chapman & Hall, London.
2. Basheer, A. (1989). Marine Biology: Some Aspects of Marine Ecology and Marine Fisheries. DayaPublishing House, Delhi – 35.
3. Boyd, C. E. & Tucker, C. S. (1998). Pond Aquaculture Water Quality Management. Kluwer Academic Publishers.
4. Das.B and Kar. Devashish (2012). Basic Limnology and Fish Biodiversity, Manglam publishers and Distributors, Delhi-110053
5. Kar. Devashish;(2007). Fundamentals of Limnology and Aquaculture Biotechnology, Daya Publishing House, Delhi- 110035.
6. Kosygin, L (2009). Wetlands of North east India. Akansha publishing house, New Delhi
7. Kumar Arvind. (2008). Aquatic environment and toxicology. Daya Publishing House, Delhi – 35 8. Sakhare, V. B. (2007). Reservoir Fisheries and Limnology. Daya Publishing House, Delhi –35.
9. Sakhare, V. B. (2011). Limnology: current perspectives. Daya Publishing House, Delhi –35
10. Santhanam R, Velayatham&Jegathersan P.G. (1990). A Mannual of Fresh Water Ecology. Daya Publishing House, Delhi – 35.
11. Schowerbel, J. &Hemmings, B. (1991). Hand Book of Limnology. Scientific Publishers, Jodhpur.
12. Vijaykumar K. &vasanthkumar, B. (2010). Aquatic ecosystem and its management. Daya Publishing House, Delhi – 35.
13. Welcomme, R. L. (2007). Inland Fisheries: Ecology and Management/FAO. Daya Publishing House, Delhi – 110 035.

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BZFT202: Course IV - Aquaculture (Credits: 02)

Course Objectives: Student will able to

1. Study introduction of aquaculture, as well as to impart knowledge of types of aquaculture.
2. Gain the knowledge regarding layout of fish farm.
3. Learn about pond preparation for fish farming.

4. Aware about knowledge of ornamental fish and aquarium maintenance.

Unit No.	SEMESTER-II BZFT202: Course IV - Aquaculture	No. of hours per unit
UNIT - I	**Introduction to Aquaculture:** Basics of aquaculture, definition and scope. Concepts and history of aquaculture. Systems of aquaculture: Monoculture, polyculture and integrated culture systems. Difference between culture and capture fisheries. Types of aquaculture-Freshwater, Brackish water, Marine water: Extensive, semi-intensive, intensive and super intensive aquaculture.	12
UNIT - II	Lay out of fish farm Criteria of site selection, soil and water characteristics. Construction of fish farm: Nursery, rearing and stocking ponds. Criteria for selection of candidate species for aquaculture. Major candidate species for aquaculture	10
UNIT - III	Pond preparation, fertilization, liming, species selection, stocking density, feeding and harvesting. Water and soil quality in relation to fish production. Physical, chemical and biological factors affecting productivity of ponds. Aquatic weeds and their control. Effect of algal bloom, predatory insects, weeds fishes and their control.	13
UNIT - IV	**Ornamental fish and aquarium maintenance** World trade of ornamental fish and export potential. Different varieties of exotic and indigenous fishes. Principles of a balanced aquarium. Fabrication, setting up and maintenance of freshwater and marine aquarium. Water quality management. Aquarium plants and their propagation methods. Lighting and aeration. Aquarium accessories and decorative. Aquarium fish feeds-Dry, wet and live feeds.	10

Course Outcomes: Student should be able to

1.Understand history & types of aquaculture & difference between Culture & capture fisheries.

2.Describe pre-requisite of site selection and ideal layout of fish farm.

3. Enlist the physico-chemical parameters of water bodies and criteria for selection of major species of fish for aquaculture.

4.Understand different types of ornamental fish.

Reference Books:

1. Ahmed, S. H. (1998). Advance in Fisheries and Fish production. Narendra Publishing House, Allahabad.

2. Chakroff, M. (1982): Freshwater Fish Pond Culture and Management. Scientific Publishers Main Bhawan, Jodhpur.

3. Desilva, S. &Andensan, T. A. (1995). Fish Nutrition in Aquaculture. Chapman & Hall.

4. Jhingran, V. G. (2007). Fish and Fisheries of India. Hindustan Publishing Corporation (India) New Delhi.

5. Kumar, A. &Bandyopadhyay, P. (2008). Aquaculture and Fisheries. Daya Publishing House, Delhi-35.

6. Pandey, N. & Malik, D. S. (2008). Integrated Fish Farming. Daya Publishing House, Delhi- 35.

7. Sharma, U. & Grover, S. P. (1982). An Introduction to Indian Fisheries. BishensingMahendrapal Singh, Dehra Dun - 1.

8. Tilak, R. & Sharma, U. (1982). Game Fishes of India and Angling. International Book Distributors, Dehra Dun.

9. Timmernams, J. A. & Khan, H. (1979). Textbook of Fish culture, Breading and Cultivation of fish. Fishing New Book Ltd. England.

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Practical II: BZFP203 (credits: 02)

Course Objectives: Student will able to

1. Study identification of fishes from different habitats.
2. Study water analysis & estimation of primary productivity.
3. Study soil analysis & identification of aquatic plants & insects.
4. Study ornamental fishes.

Practical No.	**SEMESTER-II** **BZFP 203PRACTICAL-II (Based on BFT 201& BFT 202**
	Group A:
I.	Identification of Fishes From Different Habitat. a) Fresh water habitat – (Any Two) b) Brackish water habitat – (Any Two) c) Marine water habitat -(Any Two)
II	Identification of ornamental fish
III	Determination of primary productivity
IV	**Study of plankton**
V	Water Analysis collection and preservation of water samples. transparency, turbidity, determination of pH, electrical conductivity, salinity, chlorinity, total solids(TDS, TSS, TVS, TVDS), dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, Water quality criteria/ requirements for Aquaculture.
VI	**Soil analysis:** Determination of soil texture, soil pH, conductivity, soil available nitrogen, available phosphorus, and organic carbon.
VII	Collection, identification and control of aquatic weeds, insects, predatory fishes, weed fishes and eggs and larval forms of fishes.
VIII	Methods of collection and identification of different live food organisms. Evaluation of live food organisms.
IX	**Visit to any freshwater aquatic ecosystem/ Aquafarms/Ornamental fish culture unit/Cage culture unit**

Course Outcomes: Student should be able to

1. Identify fishes from different habitats.

2. Estimate primary productivity
3. Analyze water and soil parameters and identification of aquatic plants & insects.
4. Identify different ornamental fishes.

References Books:

1. Vertebrate Zoology- R.L. Kotpal
2. Vertebrate Zoology – P.S.Dhami&J.K.Dhami
3. Vertebrate Zoology – S.S. Lal
4. Practical Zoology Invertebrates – S.S. Lal
5. Practical zoology B.Sc. I – Mutkekar, Shinde
6. Handbook of Practical Zoology B.Sc. I - Jadhav
7. Practical Zoology Chordates- Verma & Agarwal
8. Practical methods in ecology and environmental science- R K Trivedy, P K Goel, C.L.Trisal
9. Techniques in Life sciences –D.B.Tembhare
10. Anatomy and Physiology of Fishes- Szantosh Kumar, ManjuTembhre
11. Chordates- H.V. Bhaskar
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