

Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
(W.e.f. Academic Year 2019-20)



SYLLABUS FOR
B.Sc.I (Fishery Science)

June-2019-20

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS), LATUR.
SEMESTER PATTERN CURRICULUM UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
Faculty of Science B.Sc. F.Y. SEM-I and Sem-II
Sub: Fishery Science
w.e.f. - 2019-20

Marks: 50

Lect.: 45

Credits: 2

Semester	Course Code		Paper No. and Title	Total period /week	Marks		Credits
					Internal	External	
SEM-I	CCF-I	A	Taxonomy, Ecology and General topics	45 3/week	20	30	2
		B	Morphology, Anatomy and Physiology	45 3/week	20	30	2
	CCFP -I	A	Lab Course-I	45 3/week	20	30	2
SEM-II	CCF-II	A	Fish seed production technology	45 3/week	20	30	2
		B	Indian fisheries, Brackish water and Mericulture	45 3/week	20	30	2
	CCFP-II	A	Lab Course-II	45 3/week	20	30	2

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Faculty of Science B.Sc. F.Y. SEM-I
Sub: Fishery Science
Paper: Taxonomy, Ecology and General Topics
Course Code: U-FIS-162

Marks: 50

Lect.: 45

Credits: 2

Course Objectives

- This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.
- The course objectives are to provide the students with an introductory knowledge of fish classification.
- The students will be able to identify common species available in and around their region using morphological keys. .
- Enable students to understand special adaptive features in fishes like light producing, Electric, Sound producing organs, Poison glands, etc.

Course Outcomes

After successful completion of the course the students will:

- Develop an understanding of the role of taxonomy in identification of fishes.
- On completion of the course the student should have obtained valuable skills in fish taxonomy and ecology including adaptive features of fishes.
- Identifies, describes and evaluates the scientific importance of fish taxonomy.
- Identifies, describes common species available in and around their region using morphological keys. .
- Identifies, describes and evaluates policies for monitoring and conserving the marine environment.
- Identifies, describes and evaluates the social and economic importance of marine ecosystems.
- identify the adaptations of special adaptive features of fishes

UNIT: I Introduction, definition, scope and importance of fishery science (12 Hours)

- Origin of cartilaginous and bony fishes
- Evolution of fishes.
- General characters, Identification and systematic position of fishes among chordates.
- Introduction, classification up to class level. (Berg, 1940, Romer, Bertin and Arambourg, Greenwood *et. al.*, Lander, Lien and Pough *et. al.*) .
- **Fish identification techniques:**
 - a) Study of morphometric characters in fishes.
 - b) Study of meristic characters in fishes
 - c) Study of anatomical characters in fishes.

UNIT: II

- Introduction, self regulation of stock density in the event of change in food supply. Primary productivity of water mass and fish production, Trophic levels of fish in the food chain, pyramid of numbers and fish communities in it.
- Predator-prey relationship.
- Physico-chemical properties of freshwater and marine water.
- Ecology of freshwater- Lakes, rivers, streams, reservoirs and lakes.
- Ecology of Sea and estuaries and mangroves
- Plankton and blooms.

UNIT: III

- **Migration in fishes**- General account of migration, types of migration,
- Advantages of migration and factors influencing migration.
- **Air bladder**- Location of air bladder, different types of air bladder, their Structure and functions.
- **Weberian ossicles in fishes** – structure and functions.
- Parental care in fishes.

UNIT IV

- **Light producing organs in fishes** – occurrence, nature, location and structure of light producing organs, significance of luminescence in fishes.
- **Electric organs in fishes** – Occurrence, location and general structure and Functions of electric organ. Electric organs in *Torpedo* and Electric eel.
- **Sound producing organs in fishes** - Location, structure and functions.
- **Poison glands in fishes** – Location, structure and functions. Difference
- Between poisonous and venomous fishes.

Reference Book:

1. Text book of Fish Biology and Fisheries - By S. S. Khanna and H. R.Singh (2003 Ed.), Narendra Publishing House, Delhi – 110006
2. Encyclopedia of Fishes and Fisheries of India – By A. K. Pandey and G. S.Sandhu, Vol I to IV, Amol Publications, New Delhi.
3. A text book of Fishery Science and Indian Fisheries – By C.B.L.Srivastava (Kitab Mahal)
4. An Introduction to Fishes – S. S. Khanna, Central Book Depot, Allahabad.
5. The Ecology of fishes – By G. Y. Nikolski. Academic Press

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Faculty of Science B.Sc. F.Y. SEM-I
Sub: Fishery Science
Paper: Morphology, Anatomy and Physiology-II
Course Code: U-FIS-163

Marks: 50

Lect.: 45

Credits: 2

Course Objective

- Enable students to understand structure, types, functions of Teeth & Gill rockers, Digestive System, Respiratory system, Cardiovascular System, Nervous system, Excretory system, Reproductive system and skeleton system
- To understated the structure and functions of sense organs.
- This is accomplished through lecture, class discussion and examination of selected specimens by showing power point presentation, animated video of organ structure and function.
- This course has been designed to understand morphology of fishes viz. Body forms Fins and their functions.

Course Outcomes

- After successful completion of the course the students will:
- Develop an understanding of the role of anatomy and physiology in study of fishes.
- On completion of the course the student should have obtained valuable skills in fish anatomy and physiology including regulatory mechanisms.
- Recalls aspects of the internal body organization using relevant conventions, terminology.
- Students will capable to differentiate morphological features of various species of fishes.

Unit : I

- Introduction and External Characters of Fishes.
- Body forms in fishes
- Locomotion in fishes: Types of locomotion.
- Fins and their functions: Types of median and paired fins and their origin, Gill arch theory and fin fold theory
- Structure and Functions of skin, Types of Scales and their uses, Coloration.

Unit: II

- Teeth and Gill Rakers: structure, types, function and modifications.
- Food: Types of food and feeding habits.
- Digestive System – Coelom and Alimentary canal, Associated glands – Liver, Pancreas, Gall bladder, Physiology of digestion.
- Respiratory system – Structure and functions of gills and physiology of Respiration.
- Cardiovascular System : Structure of heart, Arterial system, Ventral aorta and afferent branchial vessels, dorsal aorta and its branches.
- Venous system : Anterior cardinal system, posterior cardinal system, Hepatic portal system.
- Composition of blood.

Unit : III

- Nervous system – Structure of brain, Cranial nerves their origin and distribution
- Excretory system – Types, structure and functions of kidney, Physiology of excretion
- Endoskeleton: Axial Skeleton: Typical trunk vertebra, and caudal vertebra.
- Appendicular Skeleton: Pectoral girdle and fin and Pelvic girdle and fin.
- Reproductive system: Male and female reproductive organs, maturation and spawning.

UNIT: IV

- Sense organs
- Lateral line canals: Structure and functions.
- Pit organs: Structure and functions.
- Internal ear (membranous labyrinth) - Structure and functions.
- Olfactory organs - Structure and functions.
- Photoreceptor organ (eye) : Structure and functions.
- Endocrine glands in fishes : Structure and functions of pituitary and Thyroid Gland.

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Faculty of Science B.Sc. F.Y. SEM-I
Sub: Fishery Science
Lab. Course: I
Course Code: U-FIS-164

Marks: 50

Lect.: 45

Credits: 2

Course Objective

- This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.
- The course objectives are to provide the students with an introductory knowledge of fish classification.

Course Outcomes

After successful completion of the course the students will:

- Develop an understanding of the role of taxonomy in identification of fishes.
- Identifies, describes and evaluates the scientific importance of fish taxonomy & morphology
- Identifies, describes common species available in and around their region using morphological keys. .
- Identifies, describes and evaluates fish scales
- Identifies, describes and evaluates the social and economic importance of marine ecosystems.
- identify the adaptations of special adaptive features of fishes

1. Fish identification techniques (any locally available fish)

- Study of any five morphometric characters.
- Study of any five meristic characters.

2. Identification, Classification and diagnostic characters –

- Freshwater fishes (any 5)
- Marine water fishes (any 5)
- Adaptations in fishes (any 5)
- Fishes with specialized organs (any 5)

3. Permanent mounting of fish scales and submission of prepared slides:

- Placoid, Cycloid and Ctenoid

4. Water analysis:

- Estimation of amount of dissolved Oxygen from given water sample
- Estimation of amount of dissolved carbon dioxide from given water sample
- Estimation of amount of dissolved chloride from given water sample
- Estimation of amount of dissolved carbonates from given water sample
- Estimation of amount of dissolved sulphur and Nitrogen from given water sample
- Estimation of pH of water sample by pH meter from given water sample

5. Collection, Identification of planktons and submission of plankton slides:

- Phytoplankton and zooplankton of freshwater and Marine water

6. Demonstration (*Labeo*):

Digestive system, Urinogenital system (male and female), Gills, Ventral aorta and afferent branchial arteries, Brain and Cranial nerves, Air bladder, Weberian ossicles

7. Skeleton study:

Trunk vertebra, Caudal vertebra Pectoral girdle, Pelvic girdle

8. Visit to a water reservoir to study its ecology.

Reference Book:

1. Growth and Ecology of Fish Population – By A. H. Weatherley Academic Press.
2. Fish and Fisheries – By B. N. Yadav. Daya Publishing House, Delhi.
3. History of fishes – J.R.Norman. Ernest Benn. Ltd., London.
4. Ecology and Environment – By P.D. Sharma. Rastogi Publications, Meerut.
5. A manual of Freshwater Ecology – By R. Santharam, P. Velayutham and G. Tegatheesan. Daya Publishing House, New Delhi.
6. General and applied ichthyology – S.K. Gupta, P.G. Gupta, S. Chand Publishing Co., New Delhi.
7. Text book of fish, fisheries and technology – K.P. Biswas, Narendra Publishing House, New Delhi.
8. An Introduction to fishes – H.S.L. Bhamrah and K. Juneja, Anmol Publication, New Delhi.

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SEMESTER PATTERN CURRICULUM UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
Faculty of Science B.Sc. F.Y. SEM-I
Sub: Fishery Science
Paper: Fish Seed Production technology-III
Course Code: U-FIS-165

Marks: 50

Lect.: 45

Credits: 2

Course Objectives

- Enable students to understand the Breeding Techniques
- Enable students to understand Fish seed trade and transport
- Enable students to understand Hatcheries and management (Principle, structure and management)
- Enable students to understand different river systems of India.

Course Outcomes

After successful completion of the course the students will:

- Develop an understanding of different Breeding Techniques and modern method.
- recalls aspects of the reverie environment using relevant conventions, terminology and symbols
- Demonstrates safe and responsible use of a range of materials use in hatchery management in different aquaculture system.
- Demonstrates safe and responsible use of pituitary injection.
- Students are enabling to design different hatchery models.
- Enables students to understand behavior of spawn in relation to hydro biological characters.

UNIT: I

- Breeding Techniques:
- Bundh breeding: Types of bundhs: a) dry bundhs b) Wet bundhs c) Modern bundhs Artificial fertilization by stripping
- Induced breeding by hypophysation:
- Definition, Hormones responsible for induced breeding
- Dissection and removal of pituitary gland
- Preservation and storage of pituitary gland.
- Preparation of gland suspension for injection and dosage.
- Collection, rearing and selection of brooders
- Synthetic hormones used in induced breeding.

UNIT: II

- Fish seed trade and transport
- Classification of fish seed and identification techniques
- Different units of fish seed counting
- Fish seed trade in india
- Fish seed transportation system : open and close transportation system.
- Causes of mortality in transportation,

- Use of chemicals in live fish transportation.
- Anesthetic drugs used in transport.
- Antiseptic and antibiotics used in transportation.
- Technique of fish seed release.

UNIT : III

Hatcheries and management (Principle, Structure and Management)

- Hatching hapa
- Glass jar hatchery
- Bin hatchery
- CIFE D 80 model (Dwivedi - 80)
- CIFE D 81 model (Dwivedi - 81)
- Chinese hatchery

UNIT: IV

- The Ganga River system
- Brahmaputra river system
- iii) Riverine spawn resources investigation technique – Selection of spawn collection site, Gears used for collection of spawn and their diversities,
- Methods of collection of spawn.
- Behavior of spawn in relation to hydrobiological characters.
- Present status and future prospects of freshwater fish seed in India.

Reference Books

1. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and marine organisms
2. Thomas P.C (Ed) Current and emerging trends in aquaculture
- Coche, A.G., Muir, J.F. Simple methods for aquaculture: Pond construction for freshwater
- Introduction to aquaculture Pillai, T.V.R., Aquaculture principles and practices
- Jonathan Shepherd, C. (Ed) Intensive Fish Farming
10. William Royce, F., An introduction to the practice of fishery science.
11. Planning of Aquaculture Development. FAO, Fishing News Books
12. Advances in Aquaculture. FAO, Fishing News Books.
13. Pullin, R.S.V. and Chehadeh, Z.H. (Eds.). Integrated Agriculture-Aquaculture Farming Systems. ICLARM.
- 14 Aquaculture Systems and Practices – A Selected Review. UNDP, FAO

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Faculty of Science B.Sc. F.Y. SEM-I

Sub: Fishery Science

Paper: Fish Seed Production technology-III

Course Code: U-FIS-165

Marks: 50

Lect.: 45

Credits: 2

Learning Objectives

Students will develop Knowledge, understanding and appreciation of marine and aquatic environments

- Enable students to understand the Oil Sardine, Bombay duck, Mackerel fishery.
- Enable students to understand brackish water and Mericulture.
- Enable students to understand Study of important estuaries of India and their fisheries.
- Enable students to understand Study of different river system in India.
- To acquaint the students with diversities in different marine fishes and their life.

Course Outcomes

After successful completion of the course the students will:

- identifies and describes a range of marine ecosystems and investigates their complex interrelationships
- identifies, describes and evaluates the social and economic importance of brackish and marine water fish culture
- Enables student to understand about different fishery activity in marine water.
- Selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings.
- Explains why aquaculture provides an economically sustainable source of food.
- Students learn to culture different non fish organisms and plants.

UNIT I:

- Oil Sardine fishery
- Bombay duck fishery
- Mackerel fishery.
- Shrimp fishery.

UNIT II:

- Hilsa fishery.
- Pomfret fishery.
- Mollusc fishery (Cephalopod, Chanks)
- Tuna fishery.
- Sole fishery.

UNIT III:

- Brackish water and Mericulture:
- Fin fish culture

- Shrimp culture.
- Mussel culture (Edible)
- Pearl culture.
- Sea weeds culture

UNIT IV:

- Study of important estuaries of India and their fisheries:
- Hoogly – Malda estuary.
- Chilika lake.
- Pulicat lake.
- Kolleru lake.

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Faculty of Science B.Sc. F.Y. SEM-I

Sub: Fishery Science

Lab Course: II

Course Code: U-FIS-165

Marks: 50

Lect.: 45

Credits: 2

Learning Objectives

- Students will develop Knowledge, understanding and appreciation of marine and aquatic environments
- Enable students to understand the Oil Sardine, Bombay duck, Mackerel fishery.
- Enable students to understand Dry or seasonal bundh and Wet or perennial bundh.
- Enable students to understand Identification of spawn, fry, fingerling of *Catla catla*, *Labeo rohita* and *Cirrhina mrigala*.
- Enable students to understand Removal of Pituitary gland, Preservation of pituitary glands, Preparation of pituitary gland extract for injection, Determination of dose for injection.
- To acquaint the students with Study of principle and working of Hatcheries.

Course Outcomes:

- After successful completion of the course the students will:
- identifies and describes a range of marine ecosystems and investigates their complex interrelationships
- Identifies, describes and evaluates the social and economic importance of brackish and marine water fish culture
- Enables student to understand about structure and construction of Dry or seasonal bundh and Wet or perennial bundh.
- Selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings.
- Explains Study of principle and working of Hatcheries viz. Glass jar hatchery, Bin hatchery, Modern carp hatchery, Hatching hapa, Chinese hatchery

Practicals:

1. Study of Bundhs – Dry or seasonal bundh and Wet or perennial bundh.
2. Study of fish seed – Identification of spawn, fry, fingerling of *Catla catla*,
3. *Labeo rohita* and *Cirrhina mrigala*.
4. Hypophysation study
5. Removal of Pituitary gland, Preservation of pituitary glands, Preparation of pituitary gland extract for injection, Determination of dose for injection.
6. Study of fish seed collection gears.
7. Study of Fish seed transportation.
8. Study of marine fishes:
 - a. Oil Sardine (*Dardanelle longiceps*)
 - b. Bombay duck (*Harpodon neherius*)
 - c. Mackerel (*Rastrelliger kanagurta*)
 - d. Shrimp species
 - e. Hilsa (*Hilsa ilisha*)

- f Pomfret (*Stromateus* species)
- g. Mollusc (Edible species)
- g. Pearl Oyster (*Pinctata fucata*)

9. Study of principle and working of Hatcheries:

- i) Glass jar hatchery ii) Bin hatchery iii) Modern carp hatchery
- iv) Hatching hapa v) Chinese hatchery

10. Visit to fish seed production center.

References Book for Paper III and IV

Jhingran and Srivastava (1983) Fisheries Development in India. Concept Publishing Co. New Delhi, 606p

Srivastava and Vathsala (1984) Strategy for development of Inland fisheries resource of India. Concept Publishing Co. New Delhi

Panayotou, T. (1982) Management concepts for small scale fisheries Economic and Social aspects. Fisheries Tech. Tech. Pap. No. 228. Rome.

Cunningham, D and Whitmarsh, (1985) Fisheries economics, an introduction.

IRDC (1982) Aquaculture economic research in Asia. Singapore.

Anderson.L. (1977) The economics of fisheries management. John Hopkins.

Geoffrey Waugh. Fisheries Management – Theoretical developments and contemporary applications.

Ian Chaston. Managerial effectiveness in fisheries and aquaculture.

Colin Clark, W., Bioeconomic modeling and fisheries management.

Revin Crean and David Symes (Ed), Fisheries management in crisis.

Subba Rao, N., Fisheries development and management in India.

Ian Chaston, Business management in fisheries and aquaculture.

Rowena Lawson, Economics of fisheries development.