



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. III Fishery Science (NEP 2.0)

Semester V

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2026-2027

STRUCTURE OF COURSE:

As per NEP-2020 (2.0)

Sem (Level)	Courses			OE	VSC/ SEC	AEC/ VEC/ IKS	OJT/ FP/ CEP/ CC/ RP	Total Credits
	Course I	Course II	Course III					
	Major Mandatory	Major Elective	--					
Sem V (5.5)	Major IX (2) Major X (2) Major XI (2) Major P V (2)	Major XII (Elect.) (2) Major P VI (Elect.) (2)	-	-	VSC III (2) (P) Major specific)	AEC III (2) (English)	OJT (4) CEP (2)	22
Sem VI (5.5)	Major XIII (2) Major XIV (2) Major XV (2) Major P VII (2)	Major XVI (Elect.) (2) Major P VIII (Elect.) (2)	-	-	VSC IV (2) (P) Major specific) SEC III (2) (T + P)	AEC III (2) (English)	FP (2) CC (2)	22
Credits	16	08	-	-	06	04	10	44
Total	48	24	12	08	14	16	10	132

COURSE TITLE

1) Fifth Semester

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code		Credits
1.	Major IX	BFT351	Biology and Culture of Shellfishes	2	2	BFP 356	1	2
2.	Major X	BFT 352	Marine Capture and Culture Fisheries	2	2	Major P V		
3.	Major XI	BFT 353	Biostatistics and Fish Biotechnology	2	2			
5	Major XII (E1)	BFT 354	Fishing Craft and Gear Technology	2	2	BFP 357 Major P VI	1	2
4.	Major X II (E2)	BFT 355	Coldwater Aquaculture and Recreational fisheries					
5	VSC III	BFPVSC III	Aquaculture Techniques I	--	--	BFPVSC III	1	2
6	AEC III	--	--	--	2	--	--	2
9.	OJT	--	--	--	4			4
10.	CEP	--	--	--	2			2

2) Sixth Semester

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	Major XIII	BFT361	Fish Breeding and Development	2	2	BFP 366 Major P VII	1	2
2.	Major XIV	BFT 362	Fundamentals of Fish Nutrition	2	2			
3.	Major XV	BFT 363	Fish Pathology	2	2			
5	Major XVI (E1)	BFT 364	Fish Preservation and Processing	2	2	BFP 367 Major P VIII	1	2
4.	Major XVI (E2)	BFT 365	Advanced Aquaculture					
5	VSC IV	BFPVSC IV	Ornamental Fish Technician	--	--	BFPVSC IV	1	2
6	SEC III	BFPSEC III	Soil and Water Quality Analysis Techniques	--	--	BFPSEC III	1	2
6	AEC III	--	--	--	2	--	--	2
9.	FP	--	--	--	2			2
10.	CC	--	--	--	2			2

EVALUATION STRUCTURE: 2026-27

Semester V (5.5)

Vertical	Course Category	Course Code	Internal Evaluation (Best of Two CCE)			ESE	Total Marks	Credits
			CCE-I	CCE-II	CCE-III			
DSC	T	BFT 351	10	10	10	30	50	02
	T	BFT 352	10	10	10	30	50	02
	T	BFT 353	10	10	10	30	50	02
	P	BFP 356	20			30	50	02
DSE (1 Theory Papers Out of 2)	T	BFT 354	10	10	10	30	50	02
	T	BFT 355	10	10	10	30	50	02
	P	BFP 357	20			30	50	02
AEC	T	AEC III	10	10	10	30	50	02
VSC	P	BFPVSC III	20			30	50	02
CEP	P	BFPCEP I	20			30	50	02
OJT	P	BFPOJT I	50			50	100	04
Total							550	22

Semester VI

Vertical	Course Category	Course Code	Internal Evaluation (Best of Two CCE)			ESE	Total Marks	Credits
			CCE-I	CCE-II	CCE-III			
DSC	T	BFT 361	10	10	10	30	50	02
	T	BFT 362	10	10	10	30	50	02
	T	BFT 363	10	10	10	30	50	02
	P	BFP 366	20			30	50	02
DSE (1 Theory Papers Out of 2)	T	BFT 364	10	10	10	30	50	02
	T	BFT 365	10	10	10	30	50	02
	P	BFP 367	20			30	50	02
AEC	T	AEC IV	10	10	10	30	50	02
VSC	P	BFPVSC IV	20			30	50	02
SEC	P	BFPSEC III	20			30	50	02
CC	T	BFPCC I	10	10	10	30	50	02
FP	P	BFPFP I	20			30	50	02
Total							550	22

Abbreviations: DSC: Discipline Specific Course; DSE: Discipline Specific Elective; CCE: Continuous Comprehensive Examination; AEC: Ability Enhancement Course; VSC: Vocational Skill Course; SEC: Skill Enhancement Course; OJT: On Job Training; FP: Field Project; CEP: Community Engagement Program; CC: Co-curricular Course; T: Theory; P: Practical

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : DSC	Marks: 50
	Credits : 2 (30Hrs)	From: A. Y. 2026-27
Name of the Course: Biology and Culture of Shellfishes (BFT 351)		
Course Objectives: Students should be able to 1) Study the external characters, integument, food, feeding habits, and reproductive biology of shellfishes. 2) Examine the functional anatomy of the various systems in prawns. 3) Understand the functional anatomy of the different systems in bivalves. 4) Acquire knowledge of various shellfish culture methods		
Course Outcomes: Students will be able to 1) Identify the taxonomy, distribution, and feeding habits of commercially important marine species. 2) Gain insights into the biology, distribution, and economic importance of mollusk and prawn fisheries. 3) Evaluate different fishing gears, understand their selectivity, leading to informed discussions on sustainable fishing practices. 4) Comprehend the principles of marine aquaculture and sustainable culture practices, preparing for practical applications in the field.		
Module	Title and Contents	Hrs
Module -1:	Introduction 1.1 Morphology and meristic characteristics of Crustacea and Mollusca 1.2 Structure and functions of skeleton of Crustaceans. 1.3 Food and feeding habits of shell fishes. 1.4 Reproductive biology–developmental biology of shell fishes.	08
Module -2:	Type study: Prawn (<i>Palaemon</i> sp.) 2.1 Systematic position 2.2 Habits and habitat morphology Functional anatomy of: a. Digestive system b. Respiratory system c. Circulatory system d. Excretory system	08

	e. Nervous system and f. Sense organs- Eye and Statocyst. g. Reproductive system	
Module -3:	Bivalve 3.1 Systematic position 3.2 Habits and habitat 3.3 Morphology 3.4 Functional anatomy of: a) Digestive system b) Circulatory system c) Respiratory system d) Excretorysystem e) Reproductive system	08
Module -4:	Shellfish Culture 4.1 Freshwater Prawn culture: Stocking, maintenance and harvesting. 4.2 Cultivable Molluscan resources and their culture a) Mussels b) Edible oyster	06
Reference Books:- 1) Chacko, S. S. H. Textbook of Fish Culture. New Delhi: Indian Council of Agricultural Research, 1994. 2) Dey, A. K., P. K. Saha, and A. C. K. Shaw. Aquaculture: Principles and Practices. New Delhi: Oxford & IBH Publishing Co., 2004. 3) Murthy, K. V. S. S. N. Molluscan Fisheries and Culture. New Delhi: Daya Publishing House, 2008. 4) Nair, M. G., and Chakrabarti.P.K Studies on the Biology of Prawns and Shrimps. Cochin: Central Marine Fisheries Research Institute, 2002. 5) Prasad, G. R. V., and Sahoo. S.K.Marine Biology. New Delhi: Daya Publishing House, 2010. 6) Rao, P. S. V. P. S. Fish and Shellfish Biotechnology. New Delhi: Allied Publishers, 2007. 7) Rao, V. V. R. Invertebrates of Indian Seas. New Delhi: Daya Publishing House, 2005. 8) Sundararaj, M. S. Indian Shellfish Resources and Their Culture. Kochi: Central Institute of Fisheries Technology, 1997.		

Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation: • CCE I • CCE II • CCE III	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : DSC	Marks: 50
	Credits : 2 (30Hrs)	From: A. Y. 2026-27
Name of the Course: Marine Capture and Culture Fisheries (BFT 352)		
Course Objectives: Students should be able to 1) Provide an overview of sea farming and shore-based aquaculture practices globally and in India 2) Study the commercially important fisheries of India with emphasis on the taxonomy, distribution, feeding habits, and catch trends. 3) Develop a comprehensive understanding of cultivable marine crustacean resources. 4) Gain knowledge of seaweed culture practices focusing on green algae, red algae, and brown algae		
Course Outcomes: Students will be able to 1) Demonstrate an understanding of sea farming and shore-based aquaculture practices in different parts of the world, including resource availability and practices in India. 2) Identify and describe commercially important fisheries of India, with specific reference to their taxonomy, distribution, feeding habits, and catch trends. 3) Analyze the culture techniques and biological characteristics of key cultivable marine crustacean resources. 4) Explain the methods of seaweed culture with a focus on the biological and cultivation aspects of green, red, and brown algae.		
Module	Title and Contents	Hrs
Module -1:	Introduction 1.1. An over view of sea farming and shore-based aquaculture in different parts of the world. 1.2. Resources for shore-based aquaculture and sea farming in India. 1.3. Traits of important cultivable fish and shellfish	

	a) Seabass b) Mullet c) Milkfish	10
Module -2:	Commercially important fisheries in India (Taxonomy; distribution, food and feeding and catch trends of the following fisheries: 2.1 Oil Sardine 2.2 Mackerel Bombay duck 2.3 Pomfret 2.4 Sole	06
Module -3:	Marine Aquaculture: 3.1 Site selection for marine aquaculture 3.2 Aquaculture species selection 3.3 Cage culture and pen culture 3.4 Aquaculture feed and nutrition	08
Module -4:	Culture of marine crustacean and Sea weed 4.1 Tiger Shrimp 4.2 White Shrimp 4.3 Sea weed culture a) Green Algae b) Red Algae c) Brown Algae	06
Reference Books:- 1) Prasad, G. R. V., and Sahoo.S.K Marine Biology. New Delhi: Daya Publishing House, 2010. 2) Kumar, S., and Singh.R.P "Marine Fisheries Resources of India: Status and Prospects." Indian Journal of Fisheries 50, no. 4 .2003. 3) Rao, P. S. V. P. S. Fish and Shellfish Biotechnology. New Delhi: Allied Publishers, 2007. 4) Chacko, S. S. H. Textbook of Fish Culture. New Delhi: Indian Council of Agricultural Research, 1994. 5) Nair, M. G., and Chakrabarti.P.K Studies on the Biology of Prawns and Shrimps. Cochin: Central Marine Fisheries Research Institute, 2002. 6) Sundararaj, M. S. Indian Shellfish Resources and Their Culture. Kochi: Central Institute of Fisheries Technology, 1997. Murthy, K. V. S. S. N. Molluscan Fisheries and Culture. New Delhi: Daya Publishing House		
Evaluation Pattern:		

Total Marks: 50	
Internal Continuous Evaluation: • CCE I • CCE II • CCE III	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : DSC	Marks: 50
	Credits : 2 (30Hrs)	From: A. Y. 2026-27
	Name of the Course: Biostatistics and Fish Biotechnology (BFT 353)	
Course objectives: Students should be able to		
1) To introduce fundamental concepts of biostatistics and their application in fisheries and aquaculture research. 2) To develop skills in data collection, analysis, and interpretation relevant to fish biology and biotechnology. 3) To provide knowledge of biotechnological tools and techniques used in fish and shellfish improvement. 4) To understand the role of biotechnology in fish health management, breeding, and conservation.		
Course outcomes: Students will be able to		
1) Apply appropriate statistical methods to analyse biological and fisheries data. 2) Interpret experimental results and make scientific conclusions in fisheries research. 3) Demonstrate understanding of key fish biotechnology techniques such as genetic manipulation, molecular markers, and breeding methods. 4) Gain knowledge of applications of biotechnology in aquaculture, disease control, and resource management.		
Module	Title and Contents	Hrs
Module -1:	Introduction to Biostatistics 1.1 Classification of Biological data 1.2 Frequency distribution 1.3 Tabulation 1.4 Graphical representation of data	04

Module -2:	Statistical techniques 2.1 Measures of central tendency (Mean, Median, Mode) 2.2 Dispersion – Mean deviation and standard deviation 2.3 Correlation – Scattered diagram, Karl Pearson’s correlation coefficient and Spearman’s rank correlation coefficient. 2.4 Probability 2.5 Testing of hypotheses 2.6 ANOVA	06
Module -3:	Nucleic acids 3.1 Salient features of DNA and RNA; Watson and Crick Model of DNA. 3.2 DNA Replication: DNA Replication: Enzymes of DNA replication, Mechanism of DNA replication, Fidelity of DNA replication. 3.3 Types of DNA repair mechanisms- nucleotide and base excision repair, SOS repair. 3.4 Transcription and Translation in prokaryotes and eukaryotes 3.5 Post Transcriptional modifications and processing of eukaryotic RNA: Capping, splicing and polyadenylation.	10
Module -4:	Biotechnological approaches in fisheries 4.1 Isolation of DNA and RNA: PCR, Western, Southern and Northern Blotting, 4.2 Cloning vectors- , Plasmids, Cosmids, Bacteriophages 4.3 Construction of genomic and cDNA library. 4.4 Recombinant DNA Technology 4.5 Transgenic Fish Production and advantages and disadvantages of transgenic fish	10

Reference Books:-

- 1) Bajpai, P. K., and Agrawal. R. C. Fish Biotechnology: Genetic Engineering and Aquaculture. New Delhi: Daya Publishing House. 2003.
- 2) Bapat, V. S., and Rao.K.R. Principles of Fish Biotechnology. New Delhi: Narendra Publishing House. 2008.
- 3) Chaudhary, A. K., and Yadav.B.N. Biotechnology in Fish and Shellfish: Advances in Aquaculture. New Delhi: Daya Publishing House. 2007.
- 4) Jha, R. K. Aquaculture and Biotechnology. New Delhi: Daya Publishing House. 2012.
- 5) Jhingran, V. G. Fish and Fisheries of India. 2nd ed. New Delhi: Hindustan Publishing Corporation. 1991.

- 6) Patil, S. J. Applications of Biotechnology in Aquaculture. New Delhi: Daya Publishing House. 2011.
- 7) Singh, M. P. Biotechnology in Aquaculture: Recent Advances and Future Directions. New Delhi: ICAR. 2013.
- 8) Yadav, B. N., and Verma.R.K. Fish Biotechnology and Environmental Management. New Delhi: Daya Publishing House. 2010.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:

- CCE I
- CCE II
- CCE III

End Semester Examination:

- Question -1
- Question -2
- Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Zoology		
	Programme: B.Sc. III		Semester - V
	Type : DSC		Marks: 50
	Credits : 2 (60Hrs)		From: A. Y. 2026-27
	Name of the Course: Major Practical V (BFP 356)		
Course Objectives: Students should be able to			
1) Provide practical knowledge on the external morphology, exoskeleton, feeding habits, and dissection of shellfish species.			
2) Equip students with the ability to identify commercially important marine species,			
3) Enable students to comprehend the principles of marine aquaculture.			
4) Acquaint students with the study of marine capture fisheries for the identification of various species.			
Course Outcomes: Students will be able to			
1) Gain practical skills in dissecting and studying the external and internal anatomy of shellfish,			
2) Identify key marine species and understand the role of various fishing gears in marine capture fisheries.			
3) Acquire knowledge of marine aquaculture techniques, including hatchery operations and sustainable culture of shellfish and seaweeds.			
4) Develop experience in identifying shell fishes, shrimp species, molluscan species.			
Module	Title and Contents (Any 15 practicals of the following)		Hrs

	1) Dissection of Digestive system of Prawn 2) Dissection of Nervous system of Prawn 3) Mountings of the following parts of Prawn: - a.)Mouthparts b).Thoracic appendages c).Abdominal appendages - d).Cornea e).Statocyst 4) Dissection (Demonstration) of Bivalve- a . Digestive system 5) Dissection (Demonstration) of Bivalve -Nervous system 6) Study of <i>Glochidium</i> larva 7) Identification of Commercially important marine fishes: Oil Sardine, Mackerel, Bombay duck, Pomfret, Sole 8) Study of external morphology and key traits of important species: Seabass, Mullet, Milkfish, Grouper, Snappers, Pearlsport. 9) Study of culturable varieties of shell fishes 10) Study of culturable varieties of Sea weeds <i>Ulva</i> (green), <i>Gracilaria</i> (red), <i>Sargassum</i> (brown). 11) Calculation of arithmetic mean, median and mode 12) Exercises on mean deviation, variance, standard deviation. 13) Exercises on probability 14) Test of hypothesis based on normal, t, and chi-square. 15) Study Disease diagnosis using PCR 16) Study of Chromosomal manipulation- Androgenesis and Gynogenesis 17) Estimation of DNA by Diphenylamine reaction. 18) Determination RNA by orcinol method. 19) Study of blotting techniques-Southern blotting, Northern blotting, Western blotting 20) Visit Report to Marine Biology Research Institute	60
Reference Books:- 1) Ayyappan, S., J. K. Jena, A. Gopalakrishnan, and A. K. Pandey. 2011. Handbook of Fisheries and Aquaculture. New Delhi: Indian Council of Agricultural Research (ICAR). 2) Bensam, P., and K. V. N. Rao. 1989. Marine Fisheries Research and Development in India: A Review. Kochi: CMFRI. 3) CMFRI (Central Marine Fisheries Research Institute). 2006. Handbook of Marine Fisheries Resources of India. Kochi: CMFRI. 4) Devaraj, M., and P. Paramasivam. 1998. Marine Capture Fisheries in India: Status and Management		

Strategies. Chennai: Fisheries College and Research Institute.	
5) Gopakumar, G., ed. 2009. Handbook on Open Sea Cage Culture. Kochi: CMFRI.	
6) ICAR (Indian Council of Agricultural Research). 2013. Marine Fisheries Management and Conservation Handbook. New Delhi: ICAR	
Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Zoology		
	Programme: B.Sc. III		Semester – V
	Type : DSE		Marks: 50
	Credits : 2 (30Hrs)		From: A. Y. 2026-27
	Name of the Course: Fishing Craft and Gear Technology (BFT 354)		
Course objectives: Students should be able to 1) Studythe classification, fabrication, materials, and maintenance of fishing gears and crafts. 2) Learn traditional, conventional, and unconventional fishing methods used in inland and sea fisheries. 3) Understand the application of modern fishing technologies such as sonar, radar, gps, and fish finders. 4) Promote sustainable and responsible fishing practices for effective fisheries management.			
Course outcomes: Students will be able to 1) Classify, fabricate, and maintain different types of fishing gears and crafts. 2) Apply various fishing methods for effective fish capture. 3) Develop proficiency in using modern fishing equipment and technology. 4) Acquire skills to implement sustainable and responsible fishing practices.			
Module	Title and Contents		Hrs

Module -1:	Fishing Gears 1.1. Introduction and classification of fishing gears 1.2. Fabrication of fishing gear 1.3. Material used in manufacture of fishing gear 1.4. Fishing gear accessories Care, maintenance and preservation of fishing gear	04
Module -2:	Fishing craft 2.1. Introduction and classification of fishing craft 2.2. Material used for manufacture of fishing craft 2.3. Fishing craft accessories/deck equipment's 2.4. Care and maintenance of fishing crafts 2.5. Different fishing crafts: i) Inland fishing crafts ii) Marine fishing crafts	06
Module -3:	Fishing Methods 3.1. History/Evolution of Fishing 3.2. Methods of Fishing a). Traditional methods: fishing by hunting, fishing by plant poisons, Hooks and lines fishing, Trolling b) Conventional Methods: i. Active netting: Cast net, Dip Net, Bag net, Drag net, Purse seine net, Trawl net, Rampani net, Chinese fishing net Passive netting: Gill net, Drift net, Trammel net, Fixed bag net, Fixed traps	10
Module -4:	Unconventional fishing methods and equipment's 4.1. Unconventional fishing methods: a) Light Fishing b) Electro fishing c) Jigging (Fish attractant) 4.2. Equipments: a) Fish Finder/Echosounder b) SONAR c) GPS	10
Reference Books:- 1) Nair, R., and Pillai.S.K "Technological Advances in Sustainable Fishing Methods in Indian Waters 2) ." Marine Science Review 23, no. 1 ,2023.		

- 3) Shenoy, L. Fishing Gear and Craft Technologies for Sustainable Fishing. 2023.
- 4) Singh, P., and Kumar. R. "Current Trends in Aquaculture Development in India." Indian Journal of Fisheries Research 34, no. 4 ,2023.
- 5) Soni, S., and S. S. Soni. "A Case Study of Fishing Crafts and Gears along the Wainganga River." Journal of Inland Fisheries 1, no. 1,2023.
- 6) Soni, S., and Soni. S.S "Fabrication of Fishing Gear." Fishing Gear and Craft Technologies for Sustainable Fishing ,2023.
- 7) Soni, S., and Soni. S.S "Fishing Gear Materials and Accessories." Fishing Gear and Craft Technologies for Sustainable Fishing ,2023.
- 8) Soni, S., and Soni. S.S. "Improvising Indian Fishing Technology: Modernization, Impacts, and Strategies for Sustainable Fisheries." International Journal of Fisheries and Aquatic Studies 9, no. 3 ,2021.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:

- CCE I
- CCE II
- CCE III

End Semester Examination:

- Question -1
- Question -2
- Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : DSE	Marks: 50
	Credits : 2 (30Hrs)	From: A. Y. 2026-27
	Name of the Course: Coldwater Aquaculture and Recreational Fisheries (BFT 355)	

Course objectives: Students should be able to

- 1) Recall the fundamental principles and concepts of coldwater aquaculture and recreational fisheries.
- 2) Explain the ecological requirements and environmental factors affecting coldwater aquaculture and fish species.
- 3) Demonstrate the practical techniques involved in managing coldwater aquaculture systems, including water quality management and fish health monitoring.
- 4) Assess the economic and social impacts of recreational fisheries on local communities and ecosystems.

Course outcomes: Students will be able to 1) Identify the fundamental principles and concepts of coldwater aquaculture and recreational fisheries. 2) Understand the ecological requirements and environmental factors affecting coldwater aquaculture and fish species. 3) Demonstrate the practical techniques involved in managing coldwater aquaculture systems, including water quality management and fish health monitoring. 4) Analyze the economic and social impacts of recreational fisheries on local communities and ecosystems.		
Module	Title and Contents	Hrs
Module -1:	Introduction to Coldwater Fisheries 1.1 Definition and scope of coldwater fisheries 1.2 Geographical distribution of coldwater fisheries in India and the world 1.3 Importance of coldwater fish in aquaculture and capture fisheries. 1.4 Climatic and ecological conditions of coldwater ecosystems	10
Module -2:	Major Coldwater Fish Species 2.1. Indigenous species: Mahseer (<i>Tor spp.</i>), Snow Trout (<i>Schizothorax spp.</i>), Indian Hill Trout 2.2. Exotic species: Rainbow Trout (<i>Oncorhynchus mykiss</i>), Brown Trout (<i>Salmo trutta</i>) 2.3. Morphology, feeding habits, and life cycle of important coldwater fish Species 2.4 Trout Fishing Ethics	10
Module -3:	Introduction to Recreational Fisheries 3.1. Definition and scope of recreational fisheries 3.2. History and evolution of recreational fishing 3.3. Global and Indian perspectives on recreational fisheries 3.4 Economic and social significance of recreational fisheries	06
Module -4:	Fish Species in Recreational Fisheries 4.1 Major game fish species in freshwater and marine recreational fisheries a) Freshwater: Mahseer (<i>Tor spp.</i>), Catfish, Trout, Bass b) Marine: Tuna, Barramundi, Marlin 4.2. Biological and ecological characteristics of game fish 4.4.3 Habitat preferences and distribution of recreational fish species.	04
Reference Books:- 1) FAO. Handbook of Fishing Gear and Methods. FAO Publications, 1998. 2) FAO. Manual on Trout Culture. FAO Publication, 2000.		

- 3) Jha, B.C., and Ponniah. A.G. .Sport Fishing in India. Daya Publishing House, 2008.
- 4) Jhingran, V.G., and Sehgal. K.L. Coldwater Fisheries of India. J. Inland Fish. Soc. India, 1978.
- 5) Jhingran, V.G., and Sehgal. K.L. Coldwater Fisheries of India. Barrackpore, 1978. Sehgal, K.L., 1987.
- 6) Mehta, H.S. Mahseer: The Game Fish of India. ICAR, 1986.
- 7) Pitcher, Tony J., and Charles E. Hollingworth. Recreational Fisheries: Social, Economic, and Management Aspects. Wiley-Blackwell, 2007.
- Rather, M.A., F.R. Sofi, and Amin. A. Coldwater Fisheries and Aquaculture Management. CRC Press, 2023.
- 9) Raj, Tilak. Sport Fish and Fisheries in India. Bishen Singh Publishers, Dehradun, 1982.
- 10) Sarma, D., and Shahi.N. Coldwater Fisheries and Aquaculture. ICAR, 2019.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:

- CCE I
- CCE II
- CCE III

End Semester Examination:

- Question -1
- Question -2
- Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester - V
	Type : DSE	Marks: 50
	Credits : 2 (60Hrs)	From: A. Y. 2026-27
	Name of the Course: Major Elective Practical VI (E1) BFP 357	
Course objectives: Students should be able to		
1) Develop the ability to identify various fishing crafts and gears, 2) Gain practical knowledge of fishing gear construction, including net making techniques, tools, knots, and hitches used in the industry. 3) Understand the materials used in fishing gear construction, 4) Acquire hands-on experience in the construction and maintenance of fishing crafts.		
Course outcomes: Students will be able to		
1) Identify various fishing crafts and gears, 2) Construct fishing gears, including net making techniques, tools, knots, and hitches used in the industry. 3) Differentiate the materials used in fishing gear construction,		

4) Understand construction and maintenance of fishing crafts.

Module	Title and Contents	Hrs
	1) Study of traditional fishing crafts in India (dugout canoe, plank-built boats) 2) Identification of parts of a fishing boat (keel, hull, mast, deck, propeller) 3) Study of boat building materials (wood, FRP, steel, aluminum) 4) Basic boat design and model preparation (mini boat model) 5) Study of fishing gears: Cast Net, Gill net, Trawl Net, Purse Seine 6) Study of traditional Fishing Methods: hook & line, traps 7) Study of various fishing gear materials 8) Study of fishing accessories,(floats/sinkers/hook/synthetic and natural fibres, twines, ropes, iron wares). 9) Measurement of netting parameters (mesh size, twine diameter, hanging ratio) Study of different types of knots and hitches (reef knot, clove hitch, sheet bend, fisherman's knot) 11) Study of net making tools (netting needle, mesh gauge) 12) Study of Modern Fish Detection Equipment (SONAR, Echosounder, GPS) 13) Study of Unconventional Fishing Methods (Light fishing, Electrofishing, Jigging technique) 14) Study of preservation and storage of fishing crafts and gears 15) Visit to boat building yard and dry dock.	60

Reference Books:-

- 1) Nair, R., and Pillai.S.K. "Technological Advances in Sustainable Fishing Methods in Indian Waters." Marine Science Review 23, no. 1 .2023.
- 2) Shenoy, L. Fishing Gear and Craft Technologies for Sustainable Fishing. 2023.
- 3) Singh, P., and Kumar.R. "Current Trends in Aquaculture Development in India." Indian Journal of Fisheries Research 34, no. 4 .2023.
- 4) Soni, S., and Soni.S.S. "A Case Study of Fishing Crafts and Gears along the Wainganga River." Journal of Inland Fisheries 1, no. 1.2023.
- 5) Soni, S., and Soni.S.S. "Fabrication of Fishing Gear." Fishing Gear and Craft Technologies for Sustainable Fishing .2023.
- 6) Soni, S., and Soni.S.S. "Fishing Gear Materials and Accessories." Fishing Gear and Craft Technologies for Sustainable Fishing .2023.
- 7) Soni, S., and Soni.S.S. "Improvising Indian Fishing Technology: Modernization, Impacts, and Strategies for Sustainable Fisheries." International Journal of Fisheries and Aquatic Studies 9, no. 3,2021.

8) Soni, S., and Soni.S.S. "Sustainable Fisheries Development." Eprints@CMFRI .2012.	
Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : DSE	Marks: 50
	Credits : 2 (60Hrs)	From: A. Y. 2026-27
	Name of the Course: Major Elective Practical VI (E2) BFP 357	
Course objectives: Students should be able to		
1) Understand the cold water fisheries resources of India, including their distribution, ecological significance, and economic potential.		
2) Analyze the primary and secondary sexual characters in cold water fishes and their role in breeding.		
3) Gain practical knowledge in the identification of larval stages of commercially important species such as trout and mahseer.		
4) Design and prepare a hatchery layout suitable for cold water fish species.		
Course outcomes: Students will be able to		
1) Demonstrate knowledge of cold water fisheries resources in India, including their distribution, ecological importance, and economic role in aquaculture and conservation.		
2) Analyze the primary and secondary sexual characters in cold water fishes and apply this knowledge to breeding practices.		
3) Accurately identify larval stages of trout and mahseer, facilitating better hatchery management and fish stock enhancement.		
Develop and design a functional hatchery layout for cold water fish species, incorporating principles of efficient water management and breeding techniques.		
Module	Title and Contents	Hrs
	1) Cold water fisheries resources of India	
	2) Identification of indigenous coldwater fishes: Mahseer, Snow Trout	

	3) Identification of exotic species: Rainbow Trout and Brown Trout 4) Adaptations in coldwater fishes 5) Morphometric and meristic analysis of coldwater fishes 6) Gut content analysis of trout/mahseer 7) Study of coldwater fish farm layout and components. 8) Different breeding methods for coldwater fishes 9) Water quality analysis (temperature, pH, dissolved oxygen, alkalinity, hardness). 10) Identification of larval stages of Trout and Mahseer 11) Fish feed formulation methods 12) Study of recreational fishing gears and accessories: Rod, reel, hooks, artificial lures 13) Identification of freshwater game fishes: Mahseer, Bass, trout species 14) Identification of marine game fishes: Tuna, Barramundi, Marlin 15) Survey of recreational fisheries sites	60
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Reference Books:-

- 1) Ganie, P. A., R. Posti, D. Baruah, Kunal.K, Kunal.D, Sarma.D, and Pandey.P. "Land Suitability Modelling for Rainbow Trout Farming in the Eastern Himalayan Region, India, Using GIS– MCE Approach." Modeling Earth Systems and Environment 21:1-26. 2022
- 2) Iqbal, G., Mohanty S. S., A., and Bamanika.P. "Cold Water Fisheries Culture." In Cold Water Fisheries Culture, edited by AkiNik Publications, 2023.
- 3) ICAR. 2006. Handbook of Fisheries and Aquaculture.
- 4) Jhingran, V. G. Fish and Fisheries of India. 3rd ed. Hindustan Publishing Corporation. 1991
- 5) Jhingran, V. G., and Sehgal.K.L. Cold Water Fisheries of India. J. Inland. Fish. Soc. India. Sp. Publ. 1978.
- 6) Mahanta, P. C., Sarma.D. Coldwater Fisheries Management. ICAR. 2010.
- 7) Mahanta, P. C., Sarma.D. Coldwater Fisheries Management. Directorate of Coldwater Fisheries Research, Indian Council of Agricultural Research (ICAR). 2020.
- 8) Mahanta, P. C., Sarma.D, Vishwanath.W, and Anganthoibi.N. Coldwater Fishes of India: An Atlas. Directorate of Coldwater Fisheries Research, ICAR. 2020.

- 9) Rather, M. A., Sofi.F.R, Amin.A, and Saba.K. Coldwater Fisheries and Aquaculture Management. CRC Press. 2023.
- Singh, A. K.,Sarma.D, Akhtar.M.S, and Baruah.D. Souvenir – National Seminar on Strategies, Innovations, and Sustainable Management for Enhancing Coldwater Fisheries and Aquaculture. ICAR- DCFR, Bhimtal. 2017.
- 11) Singh, H. R., and Lakra. W. S. Coldwater Aquaculture & Fisheries. Narendra Publishing House. 2008.
- 12) Thomas, P. C., Rath S. C., and Mohapatra K. D. Breeding and Seed Production of Finfish and Shellfish. Daya Publishing House. 2003.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)

End Semester Examination:

- Question -1
- Question -2
- Question -3



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science, Satara

Board of Studies in Zoology

Programme: B.Sc. III

Semester – V

Type : Vocational Skill Course (VSC)

Marks: 50

Credits : 2 (60Hrs)

From: A. Y. 2026-27

Name of the Course: Aquaculture Techniques (BFPVSC III) (Practical Based Course)

Course Objectives: Students should be able to

- 1) Identify various freshwater finfish and shellfish species and describe their breeding and culture methods.
- 2) Apply appropriate techniques for water quality assessment, feed formulation, and disease detection in aquaculture systems.
- 3) Analyze the types and roles of live feed and demonstrate effective use of supplementary feeds in aquaculture.
- 4) Evaluate fish preservation techniques and develop value-added products while monitoring fish health and diseases.

Course Outcomes: Students will be able to

- 1) Recognize and classify various freshwater fish and shellfish species, broodstock, and developmental stages of eggs and larvae.
- 2) Measure and interpret water quality parameters and live feed types relevant to aquaculture practices.
- 3) Design and prepare nutritionally balanced and medicated feeds to promote sustainable fish health.
- 4) Construct and demonstrate models of cages and implement preservation and disease management strategies in field-based aquaculture scenarios.

Module	Title and Contents (Any 15 practicals of the following)	Hrs
	1) Identification of different freshwater fin fishes 2) Identification of different freshwater shell fishes 3) Identification of brooders 4) Estimation of GSI and fecundity in fish 5) Collection and identification of fertilized and unfertilized eggs. 6) Identification of live feed (rotifers, copepods and artemia). 7) Field methods of soil analysis 8) Estimation of total alkalinity. 9) Estimation of hardness. 10) Estimation of dissolved oxygen. 11) Estimation of free carbon dioxide. 12) Identification of aquatic weeds and their control 13) Identification and eradication of predatory insects in pond 14) Identification of common predatory and weed fishes 15) Feed formulation with different feed ingredients 16) Preparation of pituitary gland crude extract 17) Determination of freshness of fish by organoleptic method 18) Estimation of Proteins, carbohydrate, fibers in fish tissues 19) Identification and diagnosis of different types of bacterial and viral diseases in fish 20) Visit to fish farm /hatchery	60

Reference Books:-

- 1) Ayyappan, S., J. K. Jena, and K. K. Lal. Handbook of Fisheries and Aquaculture. 2nd ed. New Delhi: Indian Council of Agricultural Research (ICAR), 2011.
- 2) Boyd, Claude E. Water Quality in Ponds for Aquaculture. Auburn: Alabama Agricultural Experiment Station, Auburn University, 1990.
- 3) Halver, John E., and Ronald W. Hardy. Fish Nutrition. 3rd ed. San Diego: Academic Press, 2002.
- 4) Jhingran, V. G. Fish and Fisheries of India. 3rd ed. New Delhi: Hindustan Publishing Corporation, 1991.
- 5) Lavens, Patrick, and Patrick Sorgeloos. Manual on the Production and Use of Live Food for Aquaculture. Rome: FAO Fisheries Technical Paper No. 361, FAO, 1996.
- 6) New, M. B., and W. C. Valenti. Freshwater Prawn Culture: The Farming of Macrobrachium Rosenbergii. Oxford: Blackwell Science, 2000.
- 7) Pillay, T. V. R., and M. N. Kutty. Aquaculture: Principles and Practices. 2nd ed. Oxford: Blackwell Publishing, 2005.
- 8) Santhanam, R., N. Sukumaran, and K. Natarajan. A Manual of Freshwater Aquaculture. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 1990.
- 9) Subasinghe, R. P., et al. Health Management in Aquaculture. Rome: FAO Fisheries Technical Paper No. 402, FAO, 2001.

Evaluation Pattern:**Total Marks: 50****Internal Continuous Evaluation: 20 M** (student performance, attendance, journal records, and viva voce.)**End Semester Examination:**

- Question -1
- Question -2
- Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science & Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. Fisheries	Semester - V
	Type : Community Engagement Program (CEP)	Marks: 50
	Credits : 2 (60 Hrs.)	From: A. Y. 2026-27
Name of the Course: Community Engagement Program in Fisheries (BFPCEP I)		
Course objectives: Students should be able to		
1) To understand the role of community participation in fisheries development and management. 2) To develop communication and extension skills for working with fishing communities. 3) To create awareness about sustainable fisheries and aquatic resource conservation. 4) To promote socio-economic development and livelihood enhancement in fisheries sectors.		
Course objectives: Students will be able to		
1) Explain the importance of community engagement in fisheries management and development. 2) Demonstrate effective communication and extension approaches with fishing communities. 3) Apply sustainable fisheries practices and conservation measures at the community level. 4) Participate in planning and implementing fisheries-related community development programs.		
• Community Engagement program in Fishery Science • Report writing and Submission of report		

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science & Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – V
	Type : On Job Training (OJT)	Marks: 100
	Credits : 4 (120 Hrs.)	From: A. Y. 2026-27
Name of the Course: On-Job Training (BFPOJT I)		
Course objectives: Students should be able to		
1) To provide practical exposure to fisheries and aquaculture operations. 2) To develop technical skills in fish farming, fish health management, and hatchery practices. 3) To familiarize with fisheries-based industries, processing, and marketing systems. 4) To enhance professional competence, problem-solving ability, and workplace ethics in fisheries.		
Course objectives: Students will be able to		
1) Apply theoretical knowledge to practical fisheries and aquaculture activities.		

2) Perform basic operations related to fish culture, seed production, feeding, and health management. 3) Understand fish processing, value addition, quality control, and marketing practices. 4) Demonstrate professional skills, teamwork, and effective communication in fisheries-related workplaces.					
OJT will provide the opportunities for internship with local/regional industries, business organizations, health and allied areas, local government, etc. so that students may actively engaged with the employability opportunities. Students will undergo 4 credit work-based learning /OJT/internship.					
Evaluation Pattern:					
Total Marks: 100					
Presentation	Knowledge Depth & Demonstration Skill	Variety & relevance of learning experience	Practical application & relationships with concepts	Internship report	Attendance
20	20	10	10	30	10



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. III Fishery Science (NEP 2.0)

Semester VI

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2026-2027

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – VI
	Type : DSC	Marks: 50
	Credits : 2 (30Hrs)	From: A. Y. 2026-27
Name of the Course: Fish Breeding and Development (BFT 361)		
Course Objectives: Students should be able to 1) Understand the breeding and reproductive strategies of fishes 2) Analyze the structure and function of reproductive organs 3) Examine reproductive cycles and maturity stages. 4) Explore Gametogenesis and Early Development in Fishes.		
Course Outcomes: Students will be able to 1) Demonstrate the breeding and reproductive strategies of fishes. 2) Acquire the structure and function of reproductive organs in various fish species. 3) Learn the reproductive cycles and identify the maturity stages in fishes. 4) Explore the processes of gametogenesis and early developmental stages in fishes.		
Module	Title and Contents	Hrs
Module -1:	Reproductive Biology	06
	1.1 Breeding habits	
	1.2 Modes of reproduction in fishes (Hermaphroditism, sex reversal)	
	1.3 Sexual dimorphism in fishes.	
	1.4 Reproductive organs: Structure and function.	
	1.5 Spawning and courtship behavior	
	1.6 Parental care in fish	
Module -2:	Reproductive cycles in fishes	10
	2.1 Maturity stages in male and female fish (Teleost)	
	2.2 Assessment of fecundity:	
	2.3 Volumetric method	
	2.4 Gravimetric method	
	2.5 Von Bayer's methods	
	2.6 Study of Gonado Somatic Index (GSI).	

Module -3:	Developmental Biology 3.1 Gametogenesis in fishes: Oogenesis and spermatogenesis a) Types of eggs b) Fertilization of egg c) Cleavage 3.2. Embryonic and larval development of fishes- a) Morula b) Blastula c) Fate map of Blastula d) Gastrulation e) Hatching and post embryonic development	10
Module -4:	Natural and Induced Breeding of Carps 4.1 Breeding in natural environment 4.2 Criteria of selection of brood fishes for induced breeding 4.3 Collection, transportation and rearing of brood fish. 4.4 Identification of male and female brood fish. 4.5 Induced breeding 4.6 Environmental factors affecting reproduction and development of cultivable fin fishes	04
Reference Books:- 1) Jhingran, A. G. Fish and Fisheries of India. 2nd ed. New Delhi: Hindustan Publishing Corporation. 1991. 2) Kumar, N. Fish Biology and Reproduction. New Delhi: Daya Publishing House. 2011. 3) Lakra, W. S., and Kumar. P. S. Handbook of Fish Biology and Fisheries: Volume 1, Fish Biology. New Delhi: Daya Publishing House. 2013. 4) Pandey, N. P. Fish Reproduction and Development. New Delhi: Daya Publishing House. 2012. 5) Pillai, V. N. Reproductive Biology of Fishes. New Delhi: Daya Publishing House. 2004. 6) Sahu, P. K., and Ghosh .R. P. S. J. S. Fisheries and Fish Biology. 2nd ed. New Delhi: Daya Publishing House. 2009. 7) Saxena, A. K. Fish Reproduction and Breeding Technology. New Delhi: Daya Publishing House. 2005. 8) Singh, S. P., and S. Kumar. Aquaculture and Fish Reproduction. New Delhi: Allied Publishers. 2010. Srivastava, D. K. Fisheries Reproduction Techniques. New Delhi: New Age International Publishers. 2008.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: - CCE I - CCE II - CCE III		End Semester Examination: - Question -1 - Question -2 - Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Zoology		
	Programme: B.Sc. III	Semester - VI	
	Type : DSC	Marks: 50	
	Credits : 2 (30Hrs)	From: A. Y. 2026-27	
Name of the Course: Fundamentals of Fish Nutrition (BFT 362)			
Course objectives: Students should be able to 1) Examine fish digestive systems and feeding adaptations. 2) Evaluate essential nutrients and their roles in fish health. 3) Understand fish food organisms and their culture methods. 4) Explore feed formulation and additives in aquaculture.			
Course outcomes: Students will be able to 1) Differentiate between different digestive systems and feeding adaptations of fishes. 2) Explain the role of essential nutrients in fish health. 3) Understand fish food organisms and their culture methods. 4) Apply knowledge of feed formulation and additives in aquaculture			
Module	Title and Contents		Hrs

Module -1:	Nutritional physiology 1.1 Digestive system of fish: Digestive organs and their role; anatomy and histology of alimentary canal.(Herbivorous/carnivorous) 1.2 Adaptations to various types of feeding in finfishes. Mechanism of food capture, Factors affecting feed intake, digestion, absorption, assimilation. 1.3 Food ingestion and role of feeding stimulants; Digestion assimilation and conversion of nutrients; Roles of gut microbes in digestion.	10
Module -2:	Principles of nutrition 2.1.Nutritional biochemistry: Classification of proteins, lipids and carbohydrates. 2.2.Role of nutrients: amino acids, fatty acids, proteins, lipids, carbohydrates, vitamins and minerals. 2.3. Water and fat soluble vitamins, 2.4.Mineral requirements: importance of minerals and recommended dietary allowances.	10
Module -3:	Feed Resources 3.1.Nutritional value of feed ingredients and live feed. 3.2. Fish food organisms: Bacterioplankton, phytoplankton and zooplankton and their role in larval nutrition. 3.3.Methods of collection of fish food organisms: Maintenance and rearing of fish food organisms, different media used in culture, mass culture of fish food organisms and their application in hatcheries	06
Module -4:	Feed management 4.1. Supplementary feeding Methods of feed formulation, fish feed ingredients (plant & animal based feed ingredients) and feed management 4.2. Forms of feed: wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and demersal pellets. 4.3.Feed additives: binders, antioxidants, enzymes, pigments, growth promoters, feed stimulants.	04
Reference Books:- 1) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management.2024.		

- 2) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 2024.
- 3) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 2024.
- 4) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 2024.
- 5) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 2024.
- 6) Gautam, S., & Jiwatram, G. Protein and Amino Acid Requirements in Fish Nutrition. In Fish Nutrition: Protein and Amino Acid Requirements (pp. 1-20). Apple Academic Press. 2024.
- 7) Mohanta, K. N., Varghese, T., & Bhatt, S. "Some Recent Advancements in Fish Nutrition and Feed Technology in India." Aquaculture Reports, 24, 100924. 2024.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:

- CCE I
- CCE II
- CCE III

End Semester Examination:

- Question -1
- Question -2
- Question -3



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science, Satara

Board of Studies in Zoology

Programme: B.Sc. III

Semester - VI

Type : DSC

Marks: 50

Credits : 2 (30Hrs)

From: A. Y. 2026-27

Name of the Course: Fish Pathology (BFT 363)

Course objectives: Students should be able to

- 1) Learn about fish pathology.
- 2) Recall fish spoilage.

3) Explain fish preservation techniques and fish products and byproducts 4) Gain knowledge of fishing craft and gear technology.		
Course outcomes: Students will be able to 1) Recall and recognize common fish diseases, their causes, symptoms, and impacts on fish health. 2) Analyze different fish preservation techniques and fish products and byproducts 3) Demonstrate various fish preservation methods, including drying, salting, freezing, and smoking. 4) Explain the principles of gear design, operation, and sustainability in fishing practices.		
Module	Title and Contents	Hrs
Module -1:	Defense mechanisms in Fish 1.1.Non-specific defense mechanisms 1.2.Non specific humoral factors 1.3.Non-specific cellular factors 1.4.Specific defense mechanisms in fish 1.5Antibody molecule 1.5. Antibody effector mechanisms Factors affecting the immune response	10
Module -2:	Fish pathology 2.1.Aetiology, symptoms and control measures for the following: 2.2. Viral diseases 2.3. Bacterial diseases 2.4. Fungal diseases 2.5. Protozoan diseases 2.6 Parasitic diseases 2.7Crustacean diseases	10
Module -3:	Abiotic causes of Diseases 3.1Nutritional pathology- a).Absolute Nutritional Deficiency b) Imbalances of Major Dietary Components- amino acids, carbohydrates, essential fatty acids, vitamins and mineral 3.2.Toxic components of the diet – a).Dietary mineral toxicity: Selenium, Calcium, Magnesium, b)Mycotoxins c)Plant toxins and toxic algae.	06
Module -4:	Diagnosis of fish diseases	

	4.1.Principles of disease diagnosis 4.2.Case history and clinical sign in diagnosis 4.3.Normally found external signs in fish and causes a)Direct microscopical observation of the pathogen in the tissue sample b) Direct culture of the infectious agents and identification Antibodybased diagnostic techniques Nucleic acid based rapid diagnostics	04
Reference Books:- 1) Ayyappan, S., and George.P.K Fish Pathology and Health Management in Aquaculture. <i>New Delhi</i> : Daya Publishing House. 2000. 2) Babu, S. R., and Subramanian.R.V Fish Diseases and Management. New Delhi: Agrobios India. 2005. 3) Balan, T., and Mohan.T.M.S Handbook of Fish Pathology. Mumbai: Daya Publishing House. 2010. 4) Dinesh, S. R., and Arun.M.A.S Fish and Fishery Pathology. Kolkata: India Publishing House. 2004. 5) Kumar, M. V., and Shrivastava. S.NFish Pathology and Parasitology in Aquaculture. <i>New Delhi</i> : Daya Publishing House. 2013. 6) Mishra, S., and Sharma.R.S Fish Health Management and Diseases in Aquaculture. <i>Delhi</i> : Daya Publishing House. 2010. 7) Natarajan, S., and Shankar.K.K Fish Health Management in Aquaculture. <i>Cochin</i> : Central Institute of Fisheries Technology. 2007. 9) Patel, P. D., and Joshi. M.A. Fish Pathology and Disease Management in Aquaculture. Ahmedabad: Scientific Publishers. 2006. 10) Sajeev, M., and Reshmi.K.M Diseases of Fish: Identification, Diagnosis, and Management. Kerala: College of Fisheries, Kerala Agricultural University. 2011. 11) Siva, M. V. G. S., and Rajan.K.P Pathological Investigations in Fish and Shellfish. <i>Chennai</i> :Chennai Publishing. 2008.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: • CCE I • CCE II • CCE III	End Semester Examination: • Question -1 • Question -2 • Question -3	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Zoology		
	Programme: B.Sc. III		Semester – VI
	Type : DSC		Marks: 50
	Credits : 2 (60Hrs)		From: A. Y. 2026-27
Name of the Course: Major Practical VII (BFP 366)			
Course Objectives: Students should be able to 1) Examine Fish Mouth Structures and Feeding Habits. 2) Identify and Culture Fish Food Organisms. 3) Prepare and Evaluate Artificial Feeds. 4) Implement Mass Culture of Fish Food Organisms. 5) Different Forms of Feed and Feed Additives			
Course Outcomes: Students will be able to 1) Explain digestion, feed intake, and nutrient absorption in fish. 2) Identify key nutrients and their effects on fish health. 3) Culture fish food organisms. 4) Apply feed formulation and evaluate different feed types.			
Module	Title and Contents (Any 15 practicals of the following)		Hrs
	1) Study of parental care in fishes 2) Study of Sexual dimorphism in fishes 3) Identification of eggs and larvae commercially important species 4) Morphometry of eggs and larvae of finfishes 5) Fish milt quality analysis – morphology, quantification and motility 6) Identification of larval stages in fish 7) Estimation of Gonadosomatic index and fecundity 8) Study of different types of mouth in fishes according to feeding habits 9) Identification of fish food organisms 10) Culture of live fish food organisms (Infusoria, tubifex, earthworm). 11) Preparation of artificial feeds using locally available feed ingredients. 12) Estimation of moisture and protein using fish muscles 13) Determination of moisture of feed ingredients		60

	14) Study of different forms of feed 15) Study of floatability of fish feed using water tanks, buoyancy and sinking time 16) Study of diseases of fishes (protozoan, helminthic, bacterial, viral etc.) from permanent slides and museum specimens. 17) Collection, separation and identification of fish leucocytes 18) Separation of blood plasma and serum 19) Differential count of RBCs and WBCs by Haemocytometer 20) Precipitin reaction tests	
Reference Books:- 1) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. (2024). Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 2) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. (2024). Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 3) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. (2024). Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 4) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. (2024). Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 5) Felix, S., Maheswari, K. S., Porkodi, M., Rujan, J., & Kumar, U. G. (2024). Developing Sustainable Feed Ingredients for Fish Nutrition and Climate Resilient Aquaculture. National Institute of Agricultural Extension Management. 6) Gautam, S., & Jiwatram, G. (2024). Protein and Amino Acid Requirements in Fish Nutrition. In Fish Nutrition: Protein and Amino Acid Requirements (pp. 1-20). Apple Academic Press. 7) Mohanta, K. N., Varghese, T., & Bhatt, S. (2024). "Some Recent Advancements in Fish Nutrition and Feed Technology in India." Aquaculture Reports, 24, 100924.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Zoology		
	Programme: B.Sc. III	Semester - VI	
	Type : DSE	Marks: 50	
	Credits : 2 (30Hrs)	From: A. Y. 2026-27	
Name of the Course: Fish Preservation and Processing (BFT-364)			
Course objectives: Students should be able to 1) Perform processing of fish by traditional methods. 2) Learn about fish maws, shark leather, chitin, chitosan, fish glue, fish gelatin, isinglass, pearl essence, shark fin rays, beach demer, and biochemical and pharmaceutical products. 3) Explain the uses of seaweeds: agar agar, algin, carrageenan. 4) Analyze the various types of diversified fish products, identifying their processing methods, market trends, and uses.			
Course outcomes: Students will be able to 1) Recall about processing of fish preservation by different methods. 2) Evaluate different types of spoilage in salt cured fish. Quality standard for salted and dry fish. 3) Understand technology in fish preservation and processing. 4) Illustrate the diversified fish products: battered and braided products-fish finger, fish cutlet, fish wafer, and fish soup powder etc. and imitation products.			
Module	Title and Contents	Hrs	
Module -1:	Fish spoilage 1.1.Introduction 1.2.Biochemical composition of fish 1.3. Causes of fish spoilage: Chemical, Bacterial, Enzymatic 1.4.Post mortem changes in fish: Rigor Mortis 1.5.Test for freshness of fish: Chemical, organoleptic Sources of contamination of fish.	10	
Module -2:	Fish preservation and processing techniques Principles and methods with reference to: 2.1. Refrigeration and freezing 2.2. 2.2Drying 2.3. Salting 2.4. Smoking	10	

	2.5. Canning 2.6 Use of chemical and radiation for fish preservation	
Module -3:	Different types of fish by-products: 3.1. Fish oil: Body oil, liver oil 3.2. Fish meal 3.3. Fish Guanos 3.4. Fish flour 3.5. Fish manure 3.6. Prawn manure 3.7. Fish glue 3.8. Isinglass 3.9. Fish Silage 3.10. Fish skin	04
Module -4:	Problems in fish preservation: 4.1 Denaturation due to freezing 4.2. Food poisoning and allergies from fish food. 4.3. Food poisoning from consumption poisonous fish. 4.4 Food poisoning of bacterial origin.	06
Reference Books:- 1) Balachandran, K. K. Post-Harvest Technology of Fish and Fish Products. New Delhi: Daya Publishing House. 2001. 2) Bhat, K. M., and P. M. Arora. Fish Preservation and Processing Technology. New Delhi: A. P. H. Publishing Corporation 2007. 3) Gopakumar, K. Fish Processing Technology. New Delhi: Indian Council of Agricultural Research (ICAR). 2000. 4) Kaur, S. Principles of Fish Preservation and Processing. New Delhi: New Age International Publishers. 2009. 5) Muralidharan, S., and Anjaneyulu. K.S.R Fish Processing and Preservation. Hyderabad: Scientific Publishers. 2010. 6) Ravindran, A. Fish Preservation and Processing. New Delhi: Daya Publishing House. 2005. 7) Reddy, A. S. Fish Preservation Techniques and Processing. Chennai: Tamil Nadu Fisheries University. 2011. 8) Sen, D. P. Advances in Fish Processing Technology. New Delhi: Allied Publishers. 2005.		

9) Thampy, D. M. Fishery Technology and Preservation. Mumbai: Maharashtra University Press. 2000.	
10) Yadava, R. L. Fish Preservation and Proc. 2006.	
Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation: • CCE I • CCE II • CCE III	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashvantrao Chavan Institute of Science, Satara		
	Board of Studies in Science and Technology		
	Programme: B.Sc. III	Semester - VI	
	Type : DSE	Marks: 50	
	Credits : 2 (30Hrs)	From: A. Y. 2026-27	
	Name of the Course: Advanced Aquaculture (BFT 365)		
Course objectives: Students should be able to 1) Review aquaculture systems, including extensive, semi-intensive, and intensive practices. 2) Explain modern aquaculture techniques such as ras, biofloc, and integrated culture systems. 3) Describe shellfish culture methods, seed production, and fattening processes for commercial aquaculture. 4) Discuss mariculture regulations, MPEDA’s role, and sustainable aquaculture practices.			
Course outcomes: Students will be able to 1) Differentiate between various aquaculture systems and their applications. 2) Evaluate modern aquaculture technologies for improved productivity. 3) Demonstrate knowledge of shellfish culture, feed technology, and species selection. 4) Understand regulatory frameworks and sustainable practices in mariculture			
Module	Title and Contents	Hrs	
Module -1:	Aquaculture systems: 1.1 Extensive, semi-intensive and intensive culture of fish and prawn. 1.2. Types of aquaculture systems: raceways, tanks, flow-through systems, polyculture, and composite fish culture. Cages and enclosure. 1.3. aquaculture systems: a).aquaponics	10	

	b)RAS, flow- through systems land-based aquaculture systems.	
Module -2:	Modern Aquaculture Practices: Bio-floc culture 2.2 Biofloc technology: Principles of biofloc, different carbon sources, 2.3. design of aeration system and biofloc reactor, carrying capacity, C:N ratio 2.4 , harvesting of biofloc, biofloc quality and quantity, biofloc as feed ingredient 2.5 stocking of fish and shellfish species. Bioremediation in wastewater aquaculture.	10
Module -3:	Criteria for selection of fish species for aquaculture 3.1 Fish species for aquaculture: freshwater, brackish water and marine water. 3.2 Feed technology: Micro encapsulated feeds; micro coated feeds; micro particulate feeds and bio-encapsulated feeds; 3.3 Mycotoxins and their effects on feeds.	04
Module -4:	Methods of Shellfish Culture: 4.1 Rafts, Racks, Cages, poles and ropes, Sea ranching, Resources for shore-based aquaculture and sea farming in India, 4.2. Principles involved in seed production of lobsters crabs and mussels, Fattening process of crab and shrimps. 4.3. Principle of crab and shrimp culture (Pond design management of crab and shrimp farm). Factors influencing carrying capacity. Regulation for mariculture 4.4. Role of Marine Product Export Development Authority (MPEDA) and its activities.	06
Reference Books:- 1) Billard, R. Carp Biology and Culture. U.K.: Springer & Praxis Publishing House. 1994. 2) Datta Munshi, J. S., and G. M. Hughes. Air-breathing Fishes of India. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. 1992. 3) Jhingran, V. G. Fish and Fisheries of India. Delhi: Hindustan Publishing Corporation (India). 2007. 4) Kumar, H. D. Sustainability and Management of Aquaculture and Fisheries. Delhi: Daya Publishing House. 2003. 5) Mathew, L. Introduction to Aquaculture. New York: John Wiley & Sons, Inc. 1997. 6) Singh, H. R. Cold Water Aquaculture and Fisheries. Delhi: Narendra Publishing House. 1999. 7) Srivastava, C. B. L. Fishery Science and Indian Fisheries. Allahabad: Kitab Mahal. 1992. 8) Stickney, R. R. Principle of Aquaculture. New York: John Wiley & Sons, Inc. 1994. 9) The Macdonald Encyclopedia of Aquaria: A Handbook of Fishes, Plants and All Creatures for Your		

Aquarium. London: Macdonald Educational. 1972.

10) Vass, K. K., et al., eds. River Fisheries in India: Issues and Current Status. Delhi: Daya Publishing House. 2006.

11) Wheaton, F. W. Aquacultural Engineering. New York: John Wiley. 1997.

12) Bose, A. N., S. N. Ghosh, C. T. Yang, and A. Mitra. Coastal Aquacultural Engineering. Cambridge: Cambridge University Press. 1991.

13) Burnell, G., and G. Allan. New Technologies in Aquaculture: Improving Production Efficiency, Quality and Environmental Management. Boca Raton: CRC Press. 2009.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:

- CCE I
- CCE II
- CCE III

End Semester Examination:

- Question -1
- Question -2
- Question -3



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashvantrao Chavan Institute of Science, Satara

Board of Studies in Zoology

Programme: B.Sc. III

Semester - VI

Type : DSE

Marks: 50

Credits : 2 (60Hrs)

From: A. Y. 2026-27

Name of the Course: Major Elective Practical VIII (E1) BFP 367

Course Objectives: Students should be able to

- 1) Study the biochemical composition of fish.
- 2) Understand fish spoilage and quality control.
- 3) Explore fish preservation methods.
- 4) Gain knowledge of canning and packaging in fisheries.

Course Outcomes: Students will be able to

- 1) Students will be able to analyze the biochemical composition of fish and assess spoilage conditions in canned products.
- 2) Students will demonstrate an understanding of the sanitation protocols, plant layout, and proper handling of freezing and chilling equipment in fish processing.
- 3) Students will gain expertise in canning, freezing, and packaging different fishery products while

understanding the impact of preservation methods.

- 4) Students will be able to prepare fish manure, fish meal, and value-added fishery products, applying their knowledge in industrial visits and practical sessions.

Module	Title and Contents (Any 15 practicals of the following)	Hrs
	1) Study of external morphology and identification of fresh vs spoiled fish (colour, eyes, gills, slime, odour) 2) Study of moisture content in fish 3) Study of protein content in fish 4) Study of fat content in fish 5) Trimethylamine (TMA) estimation test 6) Organoleptic evaluation of fish freshness 7) Microbial load estimation in fresh vs spoiled fish (plate count method – demonstration level) 8) Preparation of dried fish (sun drying method) 9) Salt curing of fish (dry salting and brining) 10) Preparation of smoked fish (traditional smoking method) 11) Study of types of cans, canning equipment's and lay out of cannery. 12) Study of spoilage condition in canned products. 13) Study of packaging techniques for preserved fish products 14) Study of preservation methods on shelf life 15) Demonstration of canning process of different varieties of fish and shell fish. 16) Preparation of fish manure, prawn manure 17) Preparation of fish meal 18) Preparation of fish silage 19) Preparation of fish glue / isinglass preparation 20) Field visit to fish markets/ cold storage units/ fish processing plants	60

Reference Books:-

- 1) Aitken, A., I. M. Mackie, Merritt J. H., and Windsor M. L. Fish Handling and Processing. London: Ministry of Agriculture, Fisheries and Food. 1982
- 2) Balachandran, K. K. Post-Harvest Technology of Fish and Fish Products. New Delhi: Daya Publishing House. 2001.
- 3) Clucas, I. J., and A. R. Ward. Post-Harvest Fisheries Development: A Guide to Handling, Preservation, Processing, and Quality. Chatham Maritime, UK: Natural Resources Institute. 1996.
- 4) Gopakumar, K. Textbook of Fish Processing Technology. New Delhi: Indian Council of Agricultural Research (ICAR). 2002.
- 5) Hall, G. M., ed. Fish Processing Technology. London: Springer. 1997.
- 6) Hui, Y. H. Handbook of Meat, Poultry, and Seafood Quality. Hoboken, NJ: John Wiley & Sons. 2012.
- 7) Sen, D. P. Advances in Fish Processing Technology. New Delhi: Allied Publishers. 2005.
- 8) Sikorski, Z. E., ed. Seafood: Resources, Nutritional Composition, and Preservation. Boca Raton, FL: CRC Press. 1990.
- 9) Stansby, M. E. Industrial Fishery Technology. New York: Reinhold Publishing. 1963.
- 10) Tanikawa, E. Marine Products in Japan: Processing and Marketing. Tokyo: Koseisha-Koseikaku Publishing. 1985.

Evaluation Pattern:**Total Marks: 50**

Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)

End Semester Examination:

- Question -1
- Question -2
- Question -3

**Karmaveer Bhaurao Patil University, Satara**

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology**Yashvantrao Chavan Institute of Science, Satara****Board of Studies in Zoology****Programme: B.Sc. III****Semester - VI****Type : DSE****Marks: 50****Credits : 2 (60Hrs)****From: A. Y. 2026-27****Name of the Course: Elective Practical VIII (E2) BFP 367****Course Objectives: Students should be able to**

- 1) Understand Raceway and Tank Culture Systems.
- 2) Explore Polyculture and Composite Fish Culture.
- 3) Implement Biofloc Technology.

4) Learn Cage and Pen Culture Techniques		
Course Outcomes: Students will be able to 1) Understand the importance of water quality management in RAS. 2) Set up a small-scale Biofloc system for sustainable aquaculture. 3) Conduct practical demonstrations on species selection and stocking density 4) Install and maintain cages while monitoring fish growth and health.		
Module	Title and Contents	Hrs
	1) Study of Design and Layout of Fish Farm (Prepare a model layout of ponds, inlet, outlet, drainage) 2) Raceways and Tank Culture – Designing and demonstrating raceway for aquaculture. 3) Recirculatory Aquaculture System (RAS) –Demonstration of water filtration and circulation in a closed aquaculture system. 4) Polyculture and Composite Fish Culture – Practical demonstration of stocking density and species selection. 5) Biofloc Technology – Studyof Biofloc System 6) Analysis of water quality parameters Biofloc System 7) Identification of Aquaculture Species (Freshwater: <i>Oreochromis niloticus</i> , Brackish: <i>Penaeus monodon</i> ,Marine: <i>Lates calcarifer</i> 8) Preparation of Micro-encapsulated Feed 9) Detection of Mycotoxins in Feed 10) Study of Cage and Pen Culture – Site selection, installation of cages, and monitoring of fish growth. 11) Study of Shrimp and Crab Culture – Designing a pond layout for shrimp/crab 12) culture and studying water management techniques.Methods of Shellfish Culture – Practical demonstration of rafts, racks, cages, poles, and rope culture. Study of Aquaponics System – Setting up and operating a small- scale aquaponics system with fish and plants. 13) Study of Seed Production Techniques – Identification of larvae and seed stages of lobsters, crabs, and mussels. 14) Study of Crab and Shrimp Fattening – Demonstrating the fattening process and assessing growth parameters. 15) Study of Regulations in Mariculture – Case study on the role of MPEDA (Marine Product Export Development Authority) in aquaculture certification and export standards.	60

Reference Books:-	
1) Agarwal SC. A Handbook of Fish Farming. 2nd Ed. Narendra Publ. House. 2008 2) Beveridge MCM & Mc Andrew BJ. Tilapias: Biology and Exploitations. Kluwer. 2000. 3) De Silva SS. (Ed.). Reservoir and Culture Based Fisheries: Biology and Management. ACAIR Proceedings. 2001. 4) FAO. Manual on Freshwater Prawn Farming. . 2007. 5) Midlen& Redding TA. 1998. Environmental Management for Aquaculture. Kluwer. 6) New M B Freshwater Prawn Farming. CRC Publ. . 2000. 7) Pillay TVR. Aquaculture: Principles and Practices. Fishing News Books, Cambridge University Press, Cambridge. 1990.	
Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester - VI
	Type : Vocational Skill Course	Marks: 50
	Credits : 2 (60Hrs)	From: A. Y. 2026-27
Name of the Course: Ornamental Fish Technician BFPVSC IV		
Course Objectives: Students should be able to 1) Identify and classify aquarium fishes and plants. 2) Understand aquarium setup and maintenance. 3) Explore breeding techniques for ornamental fishes. 4) Analyze water quality parameters in aquariums.		
Course Outcomes: Students will be able to 1) Identify, classify, and describe at least five freshwater and marine ornamental fish and plants species. 2) Prepare and set up an aquarium tank of suitable size. 3) Breed commercially important ornamental fish species. 4) Estimate total alkalinity, water hardness, dissolved oxygen, and free carbon dioxide levels.		

Module	Title and Contents (Any 15 practicals of the following)	Hrs
	1) Identify classify and describe an aquarium fishes (any five). 2) Marine ornamental fishes 3) Breeding techniques of live bearer 4) Preparation of an aquarium tank of suitable size 5) Identify and describe the aquarium accessories with their use and maintains. 6) Fabrication of aquarium. 7) Maintenance of an aquarium 8) Breeding of commercially important ornamental fishes 9) Parental care in ornamental fishes 10) Identify and describe an aquarium plants (any five). 11) Study of different types of filters. 12) Determination of temperature, pH and turbidity. 13) Determination of TDS 14) Estimation of total alkalinity. 15) Estimation of hardness. 16) Estimation of dissolved oxygen. 17) Estimation of free carbon dioxide. 18) Cultivation of some common live food 19) Aquarium fish diseases 20) Visit to aquarium shop	60
Reference Books:- 1) Ahilan, B., N. Felix, and R. Santhanam. Textbook of Aquaculture. Delhi: Daya Publishing House. 2008. 2) Axelrod, Herbert R. Breeding Aquarium Fishes. Neptune City, NJ: TFH Publications. 1967. 3) Axelrod, Herbert R., and Wolfgang Vorderwinkler. Encyclopaedia of Tropical Fishes. Neptune City, NJ: TFH Publications. 1978. 4) Axelrod, Herbert R., and Myron E. Sweenen. The Fascination of Breedin Aquarium Fishes. Neptune City, NJ: TFH Publications. 1992. 5) Mills, Derek. Aquarium Fishes. Exeter: Kingfisher Books. 1981. 6) Sanford, Gerald, and Richard Crow. The Manual of Tank Busters. London: Salamander Books. 1991. 7) Saxena, A., ed. Aquarium Management. New Delhi: Daya Publishing House. 2003. 8) Spotte, Stephen. Fish and Invertebrate Culture. New York: John Wiley & Sons. 1979. 9) Thabrow de W. V. Popular Aquarium Plants. Melbourne: Thornbill. 1981.		
Evaluation Pattern:		
Total Marks: 50		

Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashvantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – VI
	Type : Skill Enhancement Course	Marks: 50
	Credits : 2 (60Hrs)	From: A. Y. 2026-27
	Name of the Course: Soil and Water Quality Analysis Techniques (BFPSEC III)	
Course Objectives: Students should be able to 1) Develop understanding of soil and water properties 2) Train in sampling and analytical techniques 3) Interpret data and evaluate quality 4) Identify problems and recommend management practices		
Course Outcomes: Students will be able to 1) Ability to explain soil and water quality parameters 2) Capability to interpret analytical data 3) Skill in diagnosing problems and suggesting solutions 4) Application of knowledge for sustainable management		
Module	Title and Contents (Any 15 practicals of the following)	Hrs
	1) Equipments used in soil and water analysis 2) Soil sampling techniques and preparation of soil samples. 3) Determination of soil texture by sedimentation (hydrometer method). 4) Measurement of soil pH and electrical conductivity (EC). 5) Estimation of soil organic carbon (Walkley-Black method). 6) Determination of available nitrogen, phosphorus, and potassium (NPK analysis). 7) Determination of soil moisture content and bulk density.	60

	8) Measurement of water temperature and pH using pH meter 9) Measurement of water transparency using Secchi disc 10) Determination of turbidity of water sample using turbidity meter (Nephelometer). 11) Estimation of TDS, TSS and TS from water sample 12) Estimation of Dissolved Oxygen (DO) from water sample by Winkler's method. 13) Estimation of biological oxygen demand (BOD) from water sample 14) Estimation of Chemical Oxygen Demand (COD) from water sample 15) Estimation of calcium from water sample 16) Estimation of free CO₂ from water sample 17) Determination of total hardness (EDTA titration method) from water sample. 18) Estimation of alkalinity (acid-base titration method) from water sample 19) Estimation of chlorides from water sample (Mohr's method). 20) Estimation of nitrate and phosphate of water sample (spectrophotometric method).	
Reference Books:- 1) Physical and Chemical Methods of Soil and Water Analysis- 1984 2) Standard Methods of Soil and Water Analysis- 2023 3) Standard Methods for Analysis of Soil, Plant and Water- 2024 4) Analytical Techniques and Industrial Methods in Soil, Plant and Water Analysis- 2022 5) Methods of Soil and Water Analysis-2020 6) Soil, Plant, Water and Fertilizer Analysis- 2009		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: 20 M (student performance, attendance, journal records, and viva voce.)	End Semester Examination: • Question -1 • Question -2 • Question -3	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science & Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – VI
	Type : Co-curricular Course	Marks: 50
	Credits : 2 (30 Hrs.)	From: A. Y. 2026-27
Name of the Course: CC in Fisheries (BFPCC I)		
Course objectives: Students should be able to		
1) To develop awareness about fisheries resources and their sustainable utilization. 2) To enhance practical skills in fish culture, fish handling, and fisheries-related activities. 3) To promote entrepreneurship and employability in the fisheries sector. 4) To encourage participation in extension, conservation, and community-based fisheries programs.		
Course outcomes: Students will be able to		
1) Understand the importance of fisheries resources and their management. 2) Demonstrate basic practical skills related to fisheries and aquaculture. 3) Identify entrepreneurial opportunities in fisheries and allied sectors. 4) Participate effectively in fisheries extension, conservation, and community outreach activities.		
• CC related to subject Fisheries • Report writing and Submission of report		

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science & Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Zoology	
	Programme: B.Sc. III	Semester – VI
	Type : Field Project (FP)	Marks: 50
	Credits : 2 (60 Hrs.)	From: A. Y. 2026-27
Name of the Course: Field Project in Fisheries (BFPFP I)		
Course objectives: Students should be able to		
1) Develop skills in planning and conducting field investigations related to fisheries and aquatic ecosystems. 2) Apply appropriate sampling, data collection, and monitoring techniques in fisheries and aquaculture systems. 3) Analyze and interpret field data using scientific methods and statistical tools. 4) Prepare technical reports and communicate research findings effectively through oral and written presentations.		

Course outcomes: Students will be able to

- 1) Design and execute a fisheries-related field project by identifying research problems, formulating objectives, and selecting suitable methodologies.
- 2) Collect, record, and organize biological, ecological, and environmental data from fisheries resources and aquatic habitats using standard field techniques.
- 3) Analyze field data, interpret results, and evaluate fisheries resources, water quality, biodiversity, or aquaculture practices using scientific approaches.
- 4) Prepare a comprehensive project report and effectively present project findings, demonstrating professional communication and problem-solving skills.

- Field Project related to the subject Fishery Science
- Report writing and submission of report
