Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technolgy, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

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This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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Deputy Registrar,
Academic Section.

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431001

B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure and Syllabus for B.Sc. I st year

(Revised)

(AS PER NEP-2020)

Subject (Major): Fishery Science

Effective from 2024-25

Ic - Chairman
Board of Studies
Fishery Science

PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject (Major): Fishery Science

BSc First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory	**FISH/DSC-1**	**Taxonomy and Anatomy of Fish**	2	-	2		2+2 = 4
	FISH/DSC-2	**Practical based on FISH/DSC-1**	-	4	-	2	
Major (Core) M2 Mandatory	DSC-1		2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1		2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-1	To be chosen from other faculty	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	**SEC-1**	**1) Fish collection and preservation 2) Fish identification techniques**	1		1		2
	SEC-2	**Practical based on SEC-1 1) Fish collection and preservation 2) Fish identification techniques**		2		1	
AEC, VEC, IKS	AEC-1	**English (Common for all the faculty)**	2		2		2+2 =4
	IKS-1	Choose any one from pool of courses	2		2		
OJT/ FP/CEP/CC/RP	CC-1	**Health and Wellness (Common for all the faculty)**		4		2	2
			13	**18**	**13**	**09**	**22**

GE/OE -1 : Endocrinology and Physiology of Fishes (This course will be available for the students from other faculty

BSc First Year: 2nd Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory	**FISH/DSC-3**	**Limnology**	2		2		2+2 = 4
	FISH/DSC-4	**Practical based on FISH/DSC-3**		4		2	
Major (Core) M2 Mandatory	DSC-3		2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Major (Core) M3 Mandatory	DSC-3		2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-2	To be chosen from other faculty	2		2		2
VSC (Vocational Skill Courses) (Choose any one from pool of courses)	**VSC-1**	**1) Collection and identification of aquatic weeds 2) Manufacturing of compost fertilizers**	1		1		2
	VSC-2	**Practical based on VSC-1 1)Lab Course on Collection and identification of aquatic weeds 2) Manufacturing of compost fertilizers**		2		1	
AEC, VEC, IKS	AEC-1	**English (Common for all the faculty)**	2		2		2+2 =4
	VEC-1	**Constitution of India (Common for all the faculty)**	2		2		
OJT/ FP/CEP/CC/RP	CC-2	**Yoga Education / Sports and Fitness (Common for all the faculty)**		4		2	2
			13	**18**	**13**	**09**	**22**
Exit Option: Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor							

GE/OE-2 : Aquatic pollution (This course will be available for the student from other faculty

Students will have to choose any three subjects as a **Major 1, Major 2, Major 3,** from Basket 1 under the Faculty of Science and Technology.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of one subject **as a major subject** in the beginning of second year **out of three major options M1, M2 and M3 (which were opted in the first year).**

Detailed Illustration of Courses included in 1st and 2nd semester:

1) **Major** (Core) subject are mandatory.

   FISH/DSC-1 : This is a 2-credit theory course corresponding to Major (core) subject
   FISH/DSC-2: This is a 2-credit practical course based on FISH/ DSC-1
   FISH/DSC-3: This is a 2 credit theory course corresponding to Major (core) subject
   FISH/DSC-4: This is a 2-credit practical course based on FISH/DSC-3

2) **Generic / Open Elective (GE/OE)**: (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

   GE/OE -1 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.
   GE/OE -2 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

3) **SEC** (Skill Enhancement Courses) : Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.

   SEC-1 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.
   SEC-2 : This is a 1 credit practical course based on SEC-1.

4) **VSC** (Vocational Skill Courses) : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

   VSC-1 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.
   VSC-2 : This is a 1 credit practical course based on VSC-1

5) **AEC** (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills.

   AEC-1 : English
   This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2 : English
This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

6) **IKS** (Indian Knowledge System) : The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.

IKS-1 : To be chosen from the pool of courses designed by the University
This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty

7) **VEC** (Value Education Courses): The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1 : Constitution of India
This is a 2 credit theory course based on value education. It will be common for all the faculty

8) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.

CC-1 : Health and Wellness
This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

CC-2 : Yoga education / Sports and Fitness
This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Guidelines for Course Selection

1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.
2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from **Basket 1** under the Faculty of Science and Technology (based on the available options in the respective college).
3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
4) In the beginning of second year, students will have to select / declare choice of **one major subject** and **one minor subject** from three major options **M1, M2 and M3 (which were opted in the first year)**
5) Once the students finalize their **Major Subject** and **Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
6) Students are required to select **Minor subject** from **other discipline of the same faculty**
7) Students are required to select **Generic /Open Elective** (vertical 3 in the credit framework) **compulsorily from the faculty different than that of their Major / Minor subjects**.
8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject
9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

Programme Educational Objectives (PEOs):

Programme Educational Objectives (PEOs) for the Bachelor of Science Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge**: Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.

2. **Interdisciplinary Proficiency**: Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.

3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.

4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.

5. **Global Citizenship and Cultural Sensitivity**: Graduates will possess a global perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1. The citizenship and society:** Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

- **PO2. Environment and sustainability**: Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

- **PO3. Ethics:** Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.

- **PO4. Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

- **PO5. Communication:** Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO6. Project management and finance**: Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.

- **PO7. Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

PSO 1: **Identify and classify different fish** species based on their morphological characteristics and ecological preferences.

PSO 2: **Analyse fish population dynamics** using statistical methods and modelling techniques to assess stock status and sustainability.

PSO 3: **Design and implement fishery management** plans that promote sustainable harvesting practices and conservation of fish stocks.

PSO 4: **Evaluate the environmental impact** of fishing activities on aquatic ecosystems and develop strategies for mitigating negative effects.

PSO 5: **Demonstrate proficiency in fish health management** by identifying common diseases, parasites, and pathogens affecting aquaculture and wild fish populations.

PSO 6: **Assess the socio-economic implications of fishery** policies and regulations on local communities, industry stakeholders, and resource sustainability.

PSO 7: **Utilize geographic information systems (GIS)** and remote sensing technologies to map fish habitats, monitor fish movements, and assess ecosystem health.

PSO 8: **Conduct research on innovative aquaculture techniques,** such as recirculating systems, integrated multitrophic aquaculture, and biofloc technology, to enhance fish production efficiency.

PSO 9: Evaluate the role of fishery science in addressing food security challenges, promoting nutrition, and enhancing livelihoods in resource-dependent communities.

PSO 10: **Communicate effectively with diverse** stakeholders, including fishers, government agencies, conservation organizations, and the public, to promote sustainable fishery practices and conservation efforts

B.SC. First Year
Semester-I

FISH/DSC-1: Taxonomy and Anatomy of Fish

Total Credit :02 **Total Contact Hours: 30 Hrs. (2hrs./Week)**

Maximum Marks: 50

Learning objectives of the course:

i)This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.

ii)The course objectives are to provide the students with an introductory knowledge of fish classification.

iii)The students will be required to identify common species available in and around their region using morphological keys.

iv)This is accomplished through lecture, class discussion and examination of selected specimens.

Course Outcomes (CO)

On successful completion of this course students will be:

i)To impart knowledge on the classification of major groups of fishes and their important characters and demonstrate the structure and function of skin and scales having taxonomic importance in fishes.

ii): To understand the natural food of different groups of fishes, their feeding habits and adaptations with application of this knowledge to aquaculture

iii) To explain the methods of determining age and growth in fishes, and the respiratory system in various groups of fishes with their importance in aquaculture.

iv: To demonstrate the structure and function of cardiovascular, nervous, excretory and Osmo regulatory systems in various groups of fish.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1)Introduction 2)-Scope and Importance of Fishery Science 3) Classification of Fishes Class: - Cyclostomata, Class: - Elasmobranch, Class: - Holocephali, Class: - Depnoi Class: - Teliostomes	**10 Hrs**
II	4)Importance of Taxonomy 5)Kinds of Classification 6) Zoological Nomenclature	**10 Hrs**
III	7). General Anatomy of Shark and Ray 8)Axial Skeleton 9) Visceral and Appendicular Skeleton	**10 Hrs**

Text Books:

1) Lovell J. 1989. Nutrition and Feeding of Fish. Van Nostrand Reinhold, New York.

2) Moyle PB and Joseph J. Cech Jr. 2004. Fishes: An Introduction to Ichthyology. 5 th Ed. Prentice Hall.

3) Nikolsky GV. 1963. Ecology of Fishes, Academic Press.

Reference Books:

1) Bond E. Carl. 1979. Biology of Fishes, Saunders.

2) Halver JE. 1972. Fish Nutrition. Academic Press.

3) Hoar WS and Randall DJ. 1970. Fish Physiology, Vol. I-IX, Academic Press, New York.

FISH/DSC-1: Laboratory Course (Taxonomy and Anatomy of Fish)

Total Credit :02 **Total Contact Hours: 60 Hrs. (4 hrs./Week**

Learning objectives of the Course

i)This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.

ii)The course objectives are to provide the students with an introductory knowledge of fish classification.

iii)The students will be required to identify common species available in and around their region using morphological keys.

iv) This is accomplished through lecture, class discussion and examination of selected specimens.

Course Outcome (CO)

i)To impart knowledge on the classification of major groups of fishes and their important characters and demonstrate the structure and function of skin and scales having taxonomic importance in fishes.

ii) To understand the natural food of different groups of fishes, their feeding habits and adaptations with application of this knowledge to aquaculture

iii) To explain the methods of determining age and growth in fishes, and the respiratory system in various groups of fishes with their importance in aquaculture.

iv) To demonstrate the structure and function of cardiovascular, nervous, excretory and Osmo regulatory systems in various groups of fishes.

v) To describe the structure and function of endocrine glands with their significance in reproduction and growth of fishes, and various aspects of reproductive biology to be useful and applicable for aquaculture.

Syllabus Content:

Module No	Topics / actual contents of the syllabus	Contact Hours
I	1) Identification of spawn, fry and fingerlings of Indian Major Carps. 2) Fish Identification Techniques (Any locally available fish): i) Study of any five morphometric characters. ii) Study of any five meristic characters.	**20 Hrs**
II	3) Identify, Classify and Describe following fishes: a) Indian Major Carps: i) Catla catla ii) Labeo rohita iii) Cirrhinus mrigala b) Exotic Carps: i) Hypophthalmichthys molitrix ii) Ctenopharyngodon idella iii) Cyprinus carpio 4) Permanent mounting of fish scales (Submission): i) Placoid ii) Cycloid iii) Ctenoid	**20 Hrs**
III	5) Dissection of any locally available teleost: i) Reproductive System ii) Air bladder iii) Weberian ossicle iv) Neuromast organs 6) Visit to fish market and submission of report.	**20 Hrs**

Text Books:

1) Lovell J. 1989. Nutrition and Feeding of Fish. Van Nostrand Reinhold, New York.

2) Moyle PB and Joseph J. Cech Jr. 2004. Fishes: An Introduction to Ichthyology. 5 th Ed. Prentice Hall.

3) Nikolsky GV. 1963. Ecology of Fishes, Academic Press.

Reference Books:

1) Bond E. Carl. 1979. Biology of Fishes, Saunders.

2) Halver JE. 1972. Fish Nutrition. Academic Press.

3) Hoar WS and Randall DJ. 1970. Fish Physiology, Vol. I-IX, Academic Press, New York.

FISH/SEC-1 [A]: Fish collection and preservation

Total Credit:01 **Total contact Hrs.15(1 hrs/Week)**

Maximum Marks:50

Learning Objective of the Course

i)Ability to identify different fish species based on physical characteristics.

ii)Understanding of proper techniques for collecting fish specimens in the field.

iii)Knowledge of various preservation methods such as freezing, drying, and chemical preservation.

iv)Skills in preparing and preserving fish specimens for research or educational purposes.

v)Understanding of ethical considerations and regulations related to fish collection and preservation.

Course Outcome (CO):

On successful Completion of this Course Students will be

i) Develop an understanding of the importance of proper fish collection and preservation techniques in scientific research and conservation efforts.

ii)Acquire knowledge of different fish species and their habitats, behaviour's, and ecological roles.

iii)Gain practical skills in safely and effectively collecting fish specimens in the field.

iv)Learn various methods of fish preservation, including freezing, drying, and chemical preservation.

v)Develop the ability to properly prepare and preserve fish specimens for research or educational purposes.

Syllabus Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Introduction and need 2. Sampling and Preservation 3. Sampling for taxonomic studies Fish identification 4.Fish collection Methods: Data collection, geographical Location, Date of Collection, Name of the Collector, Coordinates, Colour.	**05 Hrs**
II	5. Collection of specimens 6. Preservation 7. Fixation	**05 Hrs**
III	8. Fixation procedure 9. Labels and Labelling 10. Genetic sampling	**05 Hrs**

Text Books:

1. "Fisheries Management: A Manual for Still-Water Coarse Fisheries" by Peter Dawson
2. "Fisheries Oceanography: An Integrative Approach to Fisheries Ecology and Management" by Paola B. Lopez-Duarte
3. "Practical Fisheries Management: A Handbook for Development Practitioners" by Michael S. Sutherland
4. "Fisheries Biology, Assessment and Management" by Michael King

Reference Books:

1. The Ultimate Guide to Fish Health: A Comprehensive Source Book for Keeping Fish Healthy and Thriving" by Nick Fletcher
2. "Fish and Fisheries of India" by V. G. Jhingran
3. "Fish Conservation: A Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources" by Gene S. Helfman
4. "Fisheries Biology, Assessment and Management" by Michael King

FISH/SEC-1: [A] Laboratory Course (Fish collection and preservation)

Total Credit :01 **Total Contact Hours: 30 Hrs. (2 hrs./Week**

Learning Objective of the Course

1. **Identify Fish Species**: Students will be able to identify common fish species based on their external characteristics, habitat preferences, and behaviour.
2. **Understand Fish Sampling Techniques**: Students will learn and apply various fish sampling techniques to collect specimens from different aquatic environments, such as lakes, rivers, and oceans.
3. **Master Fish Handling Skills**: Students will develop proper fish handling skills to minimize stress and ensure the well-being of fish during collection and preservation activities.
4. **Learn Fish Preservation Methods**: Students will understand and apply different fish preservation methods, such as formalin fixation, freezing, and taxidermy, to maintain specimen integrity for research and educational purposes.
5. **Conduct Fish Dissections**: Students will gain practical experience in fish dissections to study the anatomy, internal organs, and physiological adaptations of fish species.

Course Outcome (CO): On successful Completion of this Course Students will be

1. **Proficiency in Fish Identification**: Students will demonstrate the ability to accurately identify a variety of fish species based on their external characteristics and habitat preferences.
2. **Effective Fish Sampling Techniques**: Students will be able to select and apply appropriate fish sampling techniques to collect specimens from different aquatic environments.
3. **Proper Fish Handling Skills**: Students will develop proper fish handling skills to minimize stress and ensure the well-being of fish during collection and preservation activities.
4. **Knowledge of Fish Preservation Methods**: Students will understand and apply various fish preservation methods, such as formalin fixation and freezing, to maintain specimen integrity.
5. **Anatomy and Physiology Understanding**: Students will gain knowledge of fish anatomy and physiology through dissections, allowing them to study internal organs and adaptations of fish species.

Syllabus Content:

Module No	Topics / actual contents of the syllabus	Contact Hours
I	1. **Fish Identification**: Learn to identify different fish species based on their physical characteristics, habitat, and behaviour. 2. **Fish Sampling Techniques**: Understand and practice various methods for sampling fish populations in different aquatic environments. 3. **Fish Handling**: Learn proper techniques for handling fish to minimize stress and ensure their well-being during collection and preservation.	**10rs**
II	**4 Fish Preservation Methods**: Explore different methods of preserving fish specimens for research or educational purposes, such as formalin fixation, freezing, or taxidermy. **5 Fish Dissection**: Conduct fish dissections to study their anatomy, internal organs, and physiological adaptations. **6 Morphometrics**: Measure and analyse the morphological eristics of fish specimens to study variations within and between species.	**10 Hrs**
III	**7.Fish Biodiversity Survey**: Conduct field surveys to assess the biodiversity of fish species in a particular ecosystem using sampling techniques. **8.Fish Habitat Assessment**: Study the habitat preferences of different fish species and how environmental factors influence their distribution. **9.Fish Taxonomy**: Learn about fish classification and taxonomy, including the use of keys and guides to identify fish species. **10.Fish Data Analysis**: Analyze data collected from fish collection and preservation activities to draw conclusions about fish populations, diversity, and ecological relationships.	**10 Hrs**

Text Books:

5. "Fisheries Management: A Manual for Still-Water Coarse Fisheries" by Peter Dawson
6. "Fisheries Oceanography: An Integrative Approach to Fisheries Ecology and Management" by Paola B. Lopez-Duarte
7. "Practical Fisheries Management: A Handbook for Development Practitioners" by Michael S. Sutherland
8. "Fisheries Biology, Assessment and Management" by Michael King

Reference Books:

5. The Ultimate Guide to Fish Health: A Comprehensive Source Book for Keeping Fish Healthy and Thriving" by Nick Fletcher
6. "Fish and Fisheries of India" by V. G. Jhingran
7. "Fish Conservation: A Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources" by Gene S. Helfman
8. "Fisheries Biology, Assessment and Management" by Michael King

FISH/SEC-1 [B]: Fish identification techniques

Total Credit:01 **Total contact Hrs.15(1 hrs/Week)**

Maximum Marks:50

Learning Objective of the Course

i) Understand the importance of accurate fish identification for conservation and management purposes.

ii)Develop the ability to distinguish between different fish species based on visual characteristics.

iii)Learn how to use taxonomic keys and field guides to identify fish species in various habitats.

iv)Gain knowledge of the anatomical features that are key for fish identification.

Course Outcomes (CO)

On successful completion of this course students will be:

i)Demonstrate proficiency in identifying common fish species using visual observation and anatomical features.

ii)Apply taxonomic keys and field guides effectively to accurately identify fish species in various habitats.

iii)Utilize molecular techniques, such as DNA barcoding, for precise fish species identification.

iv)Understand the importance of accurate fish identification for conservation and management efforts.

Syllabus Content:

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1) Identification of spawn, fry and fingerlings of Indian Major Carps. 2) Fish Identification Techniques (Any locally available fish): i) Study of any five morphometric characters. ii) Study of any five meristic characters. 3) Identify, Classify and Describe following fishes: a) Indian Major Carps: i) Catla catla ii) Labeo rohita iii) Cirrhinus mrigala b) Exotic Carps: i) Hypophthalmichthys molitrix ii) Ctenopharyngodon idella iii) Cyprinus carpio	**05 Hrs**
II	4) Permanent mounting of fish scales (Submission): i) Placoid ii) Cycloid iii) Ctenoid	**05 Hrs**

III	5) Dissection of any locally available teleost: i) Reproductive System ii) Air bladder iii) Weberian ossicle iv) Neuromast organs 6) Visit to fish market and submission of report	**05 Hrs**

Text Books: "

1)Fisheries Management: A Manual for Still-Water Coarse Fisheries" by Peter Dawson

2)"Fisheries Oceanography: An Integrative Approach to Fisheries Ecology and Management" by Paola B. Lopez-Duarte

3)"Practical Fisheries Management: A Handbook for Development Practitioners" by Michael S. Sutherlan

4)"Fisheries Biology, Assessment and Management" by Michael King

Reference Books:

1)The Ultimate Guide to Fish Health: A Comprehensive Source Book for Keeping Fish Healthy and Thriving" by Nick Fletcher

2)"Fish and Fisheries of India" by V. G. Jhingran

3)"Fish Conservation: A Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources" by Gene S. Helfman

4)"Fisheries Biology, Assessment and Management" by Michael King

FISH/SEC-1: [A] Laboratory Course (Fish identification techniques)

Total Credit :01 **Total Contact Hours: 30 Hrs. (2 hrs./Week**

Learning Objective of the Course

1. **Recognize External Characteristics**: Students will be able to identify and describe key external characteristics of fish species, such as body shape, coloration, fin morphology, and scale patterns.
2. **Utilize Identification Keys**: Students will learn how to use dichotomous keys, field guides, and online resources to identify fish species based on specific characteristics and traits.
3. **Understand Habitat Preferences**: Students will gain an understanding of how fish species' habitat preferences and behaviour can aid in their identification in different aquatic environments.
4. **Differentiate Similar Species**: Students will develop the ability to differentiate between closely related fish species by recognizing subtle differences in morphology, coloration, and other identifying features.
5. **Apply Taxonomic Concepts**: Students will learn basic taxonomic concepts and classification systems to categorize fish species into families, genera, and species based on shared characteristics.

Course Outcome (CO):

On successful Completion of this Course Students will be

1. **Proficient in Identifying Fish Species**: Students will demonstrate the ability to accurately identify a wide range of fish species based on their external characteristics, habitat preferences, and behaviour.
2. **Competent in Using Identification Keys**: Students will be able to effectively use dichotomous keys, field guides, and online resources to identify fish species and differentiate between similar species.
3. **Knowledgeable in Fish Taxonomy**: Students will have a solid understanding of basic taxonomic concepts and classification systems, allowing them to categorize fish species into appropriate taxonomic groups.
4. **Skilled in Differentiating Similar Species**: Students will develop the skills to differentiate between closely related fish species by recognizing subtle differences in morphology, coloration, and other identifying features.
5. **Capable of Field Identification**: Students will be able to apply their knowledge of fish identification techniques in field settings, accurately identifying fish species in their natural habitats

Syllabus Content:

Module No	Topics / actual contents of the syllabus	Contact Hours
I	1. **Morphological Analysis**: Examining the physical characteristics of fish, such as body shape, fin placement, scale patterns, and coloration, to identify different species. 2. **Meristic Counts**: Counting the number of specific body parts, such as scales, fin rays, or vertebrae, which can vary between fish species. 3. **Otolith Analysis**: Studying the ear bones of fish, called otoliths, to determine the species, age, and even the environmental history of an individual fish.	**10Hrs**
II	**4 DNA Barcoding**: Using molecular techniques to analyze a specific region of DNA in fish samples, which can help differentiate between closely related species. **5.Isotope Analysis**: Examining the stable isotopes in fish tissues to understand their diet, habitat, and movement patterns, which can aid in species identification. **6.Electrophoresis**: Separating proteins or DNA fragments in an electric field to create unique banding patterns that can be used for species identification.	**10 Hrs**

III	**7.Radiographic Imaging**: Using X-rays or CT scans to visualize internal structures of fish, such as skeletal features or organ arrangements, for species identification. **8.Behavioral Observations**: Studying the behavior of fish in their natural habitat, such as feeding habits, mating rituals, or territorial displays, to help identify different species. **9.Geospatial Analysis**: Utilizing geographic information systems (GIS) and satellite imagery to map fish distributions and study their spatial ecology for species identification. **10 Acoustic Techniques**: Using underwater 10 recordings and analysis to identify fish species based on their unique vocalizations or acoustic signatures.	**10 Hrs**

FISH/ GE/OE-1: Endocrinology and Physiology of Fishes

(This course will be available for the students from other faculty)

Total Credit :02 **Total Contact Hours: 30 Hrs. (2 hrs./Week)**
Maximum Marks: 50

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i)Understand the endocrine system of fishes, including the major hormone-producing glands and their functions.

ii)Describe the physiological mechanisms involved in hormone production, release, and regulation in fish.

iii)Explain the role of hormones in controlling various physiological processes in fish, such as growth, reproduction, metabolism, and osmoregulation.

iv)Discuss the adaptations of the endocrine system in fish to different environmental conditions, such as temperature, salinity, and photoperiod.

Course Outcome (CO)

i)Demonstrate a comprehensive understanding of the endocrine system in fishes, including the major hormone-producing glands and their functions.

ii)Analyse the physiological mechanisms involved in hormone production, release, and regulation in fish.

iii)Evaluate the role of hormones in controlling various physiological processes in fish, such as growth, reproduction, metabolism, and osmoregulation.

iv)Apply knowledge of the adaptations of the endocrine system in fish to different environmental conditions to predict and explain physiological responses.

v)Critically assess the interactions between the endocrine system and the nervous system in regulating fish physiology and behaviour.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. History of endocrinology 2. Hypothalamus as a neuroendocrine organ 3. Fish pituitary gland: Structure and functions of different cells involved 4. Role of fish pituitary gland in reproduction 5. Structure and function of other endocrine glands of fishes: Pineal, Thyroid, Adrenal, Islets of Langerhans, gonads, etc	**10 Hrs**
II	6)Hormonal regulation in Carbohydrate, Protein and Calcium Metabolism 7. Study of Hypophysation technique and different commercial synthetic hormones used for induced breeding of fishes 8. Water as a biological medium for fishes	**10 Hrs**
III	9) History of artificial reproduction in fishes 10). Different methods used for isolation of fish pituitary gland 11) Preparation of crude fish pituitary gland extract and preservation techniques 12)Methods of administration of crude pituitary gland extract in fish for induce breeding 13). Influence of temperature and salinity on metabolism of fishes	**10 Hrs**

Textbook:

1. Endocrinology of Fishes" by G. K. Puvanendran and M. F. Rahman
2. "Fish Physiology: Homeostasis and Toxicology of Essential Metals" by C.M. Wood and A.P. Farrell

Reference Books:

1) The Physiology of Fishes -Suzane Currie and David H Evanas
2) The physiology of Finfish and Shellfish -Kasturi samantary

B.SC. First Year

Semester-II

FISH/DSC-3: Limnology

Total Credit :02 **Total Contact Hours: 30 Hrs. (2hrs./Week)**

Maximum Marks: 50

Learning objectives of the Course:

1. Understand the basic principles and concepts of limnology.
2. Identify the physical, chemical, and biological characteristics of freshwater ecosystems.
3. Analyse the interactions between biotic and abiotic factors in freshwater environments.
4. Evaluate the importance of freshwater ecosystems for biodiversity and ecosystem services.
5. Describe the processes of nutrient cycling and energy flow in freshwater systems.

Course Outcomes (CO)

1. Students will be able to describe the physical, chemical, and biological characteristics of freshwater ecosystems.
2. Students will demonstrate an understanding of the principles and concepts of limnology.
3. Students will be able to analyse the interactions between biotic and abiotic factors in freshwater environments.
4. Students will be able to apply field and laboratory techniques to study freshwater ecosystems.
5. Students will be able to evaluate the importance of freshwater ecosystems for biodiversity and ecosystem services.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1.Introduction 2.Development of Limnology 3.Inland waters, distribution of inland waters. 4.Ponds, Laker, Streams, River. 5.Physical Limnology Nature of Inland water environment	**10 Hrs**
II	6.Physical Characteristics – Pressure, compressibility Density, Mobility, Buoyancy, Movement of water, Surface film, Temperature, thermal, Stratification, Light, Colour, Colour and Turbidity 7)Dissolved gases: Oxygen, Carbon dioxide and other dissolved gases 8)Dissolved solids and dissolved organic matter	**10 Hrs**
III	9). Biological Limnology 10). Classification of organisms in water 11). Distribution of Plankton 12). Food of Plankton organisms 13). Nekton - composition, distribution movements. 8). Benthos -Classification of benthic regions, Zones and distribution	**10Hrs**

Text Books:

1)"Limnology" by Robert G. Wetzel

2)"Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters" by

3)Werner Stumm and James J. Morgan

4)Current Trends IN Limnology Edited by Nalin Shastree

Reference Books:

1. "Limnology" by Robert G. Wetzel
2. "Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters" by Werner Stumm and James J. Morgan
3. "Ecology of Freshwater and Estuarine Wetlands" by Darold P. Batzer and Rebecca R. Sharitz
4. "Methods in Stream Ecology" edited by F. Richard Hauer and Gary A. Lamberti
5. "Freshwater Ecology: Concepts and Environmental Applications" by Walter K. Dodds and Matt R. Whiles

FISH/DSC-4: Laboratory Course (Limnology)

Total Credit :02 **Total Contact Hours: 60 Hrs. (4 hrs./Week**

Learning Objective of The Course:

1. Students will be able to demonstrate proficiency in using field sampling equipment and techniques specific to limnology.
2. Students will be able to identify and classify freshwater organisms commonly found in limnological studies.
3. Students will be able to analyse water quality parameters and interpret their significance in freshwater ecosystems.
4. Students will be able to design and conduct experiments to investigate ecological processes in freshwater systems.

Course Outcome (CO)

1. Students will be able to demonstrate proficiency in conducting field sampling and laboratory analysis techniques specific to limnology.
2. Students will be able to identify and classify a variety of freshwater organisms and understand their ecological roles in limnological systems.
3. Students will be able to analyse and interpret water quality data to assess the health and functioning of freshwater ecosystems.
4. Students will be able to design and execute experiments to investigate specific ecological questions related to limnology.
5. Students will be able to apply statistical methods to analyse and interpret data collected during limnology practical sessions.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**1)Field Sampling Techniques**: Students practice using equipment such as plankton nets, water samplers, and secchi disks to collect water samples and measure physical parameters in a freshwater ecosystem. **2)Identification of Freshwater Organisms**: Students learn to identify and classify common freshwater organisms, including algae, macroinvertebrates, and fish, using taxonomic keys and microscopes. **3)Water Quality Analysis**: Students analyse water samples for key parameters such as pH, dissolved oxygen, nutrients (nitrogen and phosphorus), and turbidity to assess water quality.	**20Hrs**
II	**4)Biotic Index Calculation**: Students calculate biotic indices (e.g., BMWP, ASPT) based on the presence and abundance of macroinvertebrates to assess water quality and ecological health. **5)Primary Productivity Measurement**: Students measure primary productivity in a freshwater ecosystem using techniques such as oxygen production, chlorophyll-a concentration, or carbon uptake. **6)Nutrient Cycling Experiments**: Students conduct experiments to study nutrient cycling processes in freshwater ecosystems, such as nutrient uptake by plants or nutrient release from sediments.	**20 Hrs**
III	**7)Aquatic Habitat Assessment**: Students assess aquatic habitats for factors such as substrate composition, flow velocity, and vegetation cover to understand habitat preferences of aquatic organisms. **8)Sediment Analysis**: Students analyse sediment samples for organic matter content, grain size distribution, and nutrient concentrations to study sediment-water	**20Hrs**

	interactions. **9)Limnological Research Project**: Students design and conduct an independent research project on a limnological topic of their choice, applying practical skills and knowledge gained throughout the course.	

Text Books:

1)"Limnology" by Robert G. Wetzel

2)"Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters" by

3)Werner Stumm and James J. Morgan

4)Current Trends IN Limnology Edited by Nalin Shastree

Reference Books:

1)"Limnology" by Robert G. Wetzel

2)"Aquatic Chemistry: Chemical Equilibria and Rates in Natural Watersby Werner Stumm and James J. Morgan

3)Ecology of Freshwater and Estuarine Wetlands by Darold P. Batzer and Rebecca R. Sharitz

4)Methods in Stream Ecology" edited by F. Richard Hauer and Gary A. Lamberti

5)Freshwater Ecology: Concepts and Environmental Application by Walter K. Dodds and Matt R. Whiles

FISH/VSC-1- [A] Collection and identification of aquatic weeds

(Vocational Skill Courses)

Total Credit :01 **Total Contact Hours: 15 Hrs. (1 hrs./Week)**
Maximum Marks: 50

Learning objectives of the course:

1. Understand the importance of aquatic weeds in freshwater ecosystems.
2. Identify common aquatic weeds found in different water bodies.
3. Learn about the characteristics and morphology of aquatic weeds.
4. Understand the ecological impact of aquatic weeds on aquatic ecosystems.
5. Develop skills in collecting aquatic weed samples for further analysis.

Course Outcome (CO)

1) Students will be able to demonstrate a thorough understanding of the importance of aquatic weeds in freshwater ecosystems.

2)Students will be able to accurately identify and differentiate common aquatic weeds found in various water bodies.

3)Students will be able to describe the characteristics and morphology of different aquatic weed species.

4)Students will be able to analyse and evaluate the ecological impact of aquatic weeds on aquatic ecosystems.

5)Students will be proficient in collecting and handling aquatic weed samples for further analysis.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. What is aquatic plants? 2. Vital role of aquatic plants in aquatic ecosystem 3. Difference between aquatic plant and weed	**5 Hrs**
II	4. Disadvantages of aquatic weeds in aquaculture or aquatic body 5. Different types of aquatic weed: a. Algae – Micro and Filamentous algae b. Macrophytes: Submersed, emerged, floating and emergent	**5 Hrs**
III	6. Collection of Aquatic weed from different freshwater bodies 7. Identification of aquatic weed from different freshwater bodies 8. Management of aquatic weed a) Manual or mechanical control b) Biological control c) Chemical control	**5 Hrs**

Text Book:

1. "Aquatic Weeds: The Ecology and Management of Nuisance Aquatic Vegetation" by Julie D. M. Champion
2. "Aquatic Weeds: Problems, Control and Management" by P. K. Mishra
3. "Identification and Control of Common Aquatic Weeds" by S. R. Qasim

Reference Book

1)"Aquatic Weed Management: Control Methods and Applications" by R. K. Kohli

2)Aquatic Weeds: Identification and Management" by Inderjit Singh and David M. Clements

3)"Field Guide for the Identification and Control of Aquatic Invasive Plants in Michigan" by Jo Latimore and others

FISH/VSC-1[B] Manufacturing of compost fertilizers

(Vocational Skill Courses)

Total Credit :01 **Total Contact Hours: 15 Hrs. (1 hrs./Week)**
Maximum Marks: 50

Learning objectives of the course:

1. Understanding the principles of composting and the importance of compost in sustainable agriculture.
2. Learning the different methods and techniques for composting organic materials.
3. Identifying the key components required for successful composting, such as carbon-rich (browns) and nitrogen-rich (greens) materials.
4. Understanding the process of decomposition and microbial activity involved in composting.
5. Learning how to monitor and manage the composting process to optimize nutrient content and microbial activity.
6. Exploring the different types of composting systems and technologies available

Course Outcome (CO)

1. Demonstrate a comprehensive understanding of the principles and processes involved in composting organic materials to produce fertilizers.
2. Apply different composting methods and techniques to efficiently convert organic waste into high-quality compost fertilizers.
3. Identify and select appropriate carbon-rich and nitrogen-rich materials for composting to achieve optimal nutrient balance.
4. Analyse and evaluate the factors influencing the decomposition process and microbial activity in composting.
5. Implement monitoring and management strategies to control temperature, moisture, and aeration levels during the composting process.
6. Design and operate composting systems effectively, considering factors such as scale, site selection, and equipment requirements.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Introduction 2. Principles of composting	**5 Hrs**
II	3) Process of composting: i)Biological, ii)chemical and physical 4. Stages of composting 5)Methods of composting	**5 Hrs**
III	6)Factors affecting composting processing 7) Properties of compost 8) Benefits of composting	**5 Hrs**

Text book:

1. "The Complete Compost Gardening Guide" by Barbara Pleasant and Deborah L. Martin
2. "Let it Rot!: The Gardener's Guide to Composting" by Stu Campbell
3. "Compost Everything: The Good Guide to Extreme Composting" by David the Good
4. "The Rodale Book of Composting: Easy Methods for Every Gardener" by Grace Gershuny and Deborah L. Martin

Reference Book

1. "Compost Engineering: Principles and Practice" by Eliot Epstein

2. "Handbook of Solid Waste Management and Waste Minimization Technologies" by Nicholas P. Cheremisinoff
3. "Composting for Sustainable Agriculture" by Donald L. Klass
4. "The Science of Composting" by Eliot Epstein and Harold W. Garber

FISH/ VSC-2 [A]: Lab Course on Collection and identification of aquatic weeds

Total Credit :01 **Total Contact Hours: 30 Hrs. (2 hrs./Week)**
Maximum Marks: 50

Learning objectives of the course:

1. Understand the importance of identifying aquatic weeds in managing water bodies
2. Learn various methods for collecting aquatic weeds for analysis
3. Develop skills in identifying common aquatic weed species
4. Gain hands-on experience in using tools and equipment for weed collection and identification
5. Learn about the ecological impact of aquatic weeds and the importance of their management
6. Understand the legal and regulatory aspects related to aquatic weed control

Course Outcomes (CO)

1)Demonstrate proficiency in collecting aquatic weeds using appropriate techniques and tools.

2)Identify common aquatic weed species accurately based on key characteristics.

3)Apply knowledge of aquatic weed ecology to understand their impact on aquatic ecosystems.

4)Analyse the importance of managing aquatic weeds for environmental conservation and water quality.

5)Interpret and apply legal regulations related to aquatic weed control and management

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1) Field Trip: Visit a local water body to observe and collect different aquatic weed species. 2) Laboratory Session: Students will practice proper techniques for preserving and storing collected aquatic weed samples. 3) Species Identification Exercise: Students will be given a set of preserved aquatic weed 4) specimens and tasked with identifying the species using dichotomous keys and other identification tools	**10 Hrs**
II	5)Virtual Simulation: Engage in a virtual simulation where students can practice identifying aquatic weeds in a controlled environment. 6) Group Project: Divide students into groups and assign each group a specific aquatic weed species to research and present on. 7)Guest Speaker Lecture: Invite a guest speaker who is an expert in aquatic weed management to discuss real-world challenges and strategies for controlling invasive aquatic plants	**10 Hrs**
III	8)Hands-on Weed Removal: Organize a practical session where students participate in hands-on removal of aquatic weeds from a designated area. 9)Field Study Report: Students will conduct a field study at a nearby water body to assess the prevalence of aquatic weeds and their impact on the ecosystem.	**10Hrs**

Text Book:

4. "Aquatic Weeds: The Ecology and Management of Nuisance Aquatic Vegetation" by Julie D. M. Champion
5. "Aquatic Weeds: Problems, Control and Management" by P. K. Mishra
6. "Identification and Control of Common Aquatic Weeds" by S. R. Qasim
7. **Reference Book**

1)"Aquatic Weed Management: Control Methods and Applications" by R. K. Kohli

2)Aquatic Weeds: Identification and Management" by Inderjit Singh and David M. Clements

3)"Field Guide for the Identification and Control of Aquatic Invasive Plants in Michigan" by Jo Latimore and others

FISH/ VSC-2 [B]: Lab Course Manufacturing of compost fertilizers

Total Credit :01 **Total Contact Hours: 30 Hrs. (2 hrs./Week)**
Maximum Marks: 50

Learning objectives of the course:

1. Understand the principles and benefits of composting in agriculture.
2. Learn about different methods and techniques used in the manufacturing of compost fertilizers.
3. Identify the key ingredients required for successful composting.
4. Develop skills in monitoring and managing the composting process to optimize fertilizer production.
5. Gain knowledge of the scientific principles behind composting and its role in sustainable agriculture.

Course Outcomes (CO)

1) Understanding the process of manufacturing compost fertilizers

2) Knowledge of the raw materials required for making compost fertilizers

3) Ability to select and mix the right ingredients for composting

4) Skill in operating composting equipment and machinery

5) Knowledge of the different methods of composting

6) Understanding the importance of temperature and moisture control in the composting proces

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Determine the raw materials: Identify the organic waste materials that will be used to create the compost fertilizer, such as kitchen scraps, yard waste, and manure. 2. Shredding or grinding: Shred or grind the raw materials into smaller pieces to facilitate the composting process and speed up decomposition. 3. Mixing: Combine the shredded raw materials in the correct proportions to create a balanced mix of nitrogen-rich (green) and carbon-rich (brown) materials for optimal composting.	**10Hrs**
II	4). Moisture management: Ensure that the compost pile has the right level of moisture (around 50-60%) by adding water as needed. Proper moisture is crucial for the decomposition process. 5)Turning: Regularly turn the compost pile to aerate it and promote the breakdown of materials. Turning the pile helps distribute heat and oxygen, speeding up decomposition. 6)Temperature monitoring: Use a compost thermometer to monitor the temperature of the compost pile. The ideal temperature range for composting is between 120-160°F (49-71°C).	**10Hrs**

III	7)Curing: Allow the compost to cure for a few weeks to a few months, depending on the materials used and the desired maturity of the compost fertilizer. Curing allows the compost to stabilize and mature. 8)Screening: Screen the compost to remove any large particles or uncomposed materials. This will result in a finer, more uniform compost fertilizer product. 9)Packaging: Package the finished compost fertilizer in bags or containers for storage and distribution. Label the packages with information on the nutrient content and application instructions. 10)Testing and quality control: Conduct regular testing of the compost fertilizer to ensure that it meets quality standards in terms of nutrient content, pH, and maturity. Adjust the manufacturing process as needed to improve the quality of the final product.	**10Hrs**

Text book:

5. "The Complete Compost Gardening Guide" by Barbara Pleasant and Deborah L. Martin
6. "Let it Rot!: The Gardener's Guide to Composting" by Stu Campbell
7. "Compost Everything: The Good Guide to Extreme Composting" by David the Good
8. "The Rodale Book of Composting: Easy Methods for Every Gardener" by Grace Gershuny and Deborah L. Martin

Reference Book

1)"Compost Engineering: Principles and Practice" by Eliot Epstein

2)"Handbook of Solid Waste Management and Waste Minimization Technologies" by Nicholas P. Cheremisinoff

3)"Composting for Sustainable Agriculture" by Donald L. Klass

4)"The Science of Composting" by Eliot Epstein and Harold W. Garber

FISH/ GE/OE-2: Aquatic pollution

(This course will be available for the students from other faculty)

Total Credit :02 **Total Contact Hours: 30 Hrs. (2 hrs./Week)**
Maximum Marks: 50

Learning objectives of the course:

1. Understand the sources and types of pollutants in aquatic environments.
2. Recognize the impact of aquatic pollution on ecosystems and human health.
3. Identify the methods and technologies used to monitor and assess aquatic pollution.
4. Analyse the regulatory frameworks and policies aimed at preventing and mitigating aquatic pollution.
5. Evaluate the effectiveness of different pollution control measures in aquatic systems.

Course Outcome (CO)

1. Understand the key concepts and principles of aquatic pollution, including sources, pathways, and impacts on aquatic ecosystems.
2. Identify and analyse the major pollutants affecting aquatic environments, such as chemicals, nutrients, pathogens, and plastics.
3. Evaluate the ecological and human health consequences of aquatic pollution, and assess the importance of maintaining water quality.
4. Demonstrate knowledge of monitoring techniques and tools used to assess water quality and detect pollutants in aquatic systems.
5. Analyses case studies and real-world examples of successful pollution control and remediation efforts in aquatic environments.

Syllabus Content:

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1)Introduction to pollution 2)Classification of pollution 3)Classification of water pollution 4)Sources of pollution 5)a. Changes in the physio-chemical parameters of water due to pollution b. Effect of aquatic pollution on ecology 6) Eutrophication	10 Hrs
II	**Effect of aquatic pollution on fishes:** 1. Food and feeding grounds of fishes 2. Effect on breeding & spawning grounds: 3. Diseases 4. Behaviour 5. Nutrition and food chain 6. Effects on fishing and fishery products 7. toxins and fish poisoning	10 Hrs
III	1) Control measures for Aquatic pollution: Dilution, Efficient use (Reuse), Alternative use, Appropriate technology, Waste treatment/Purification, Trapping, Water pollution legislation, 2. Indicators of the pollution 3. Present status of aquatic pollution in India	10 Hrs

Text book:

1)Testbook of Aquaculture- Amitabh Patel Sathya Narayan Pathak

2)Fresh water Aquaculture- Rajendra Kumar Rath

3)Fisheries and Aquaculture- Neelima Gupta, D.K. Gupta

4)SaraS, Aquaculture and Fisheries -N. Arumugam

Reference Books

1) Handbook of Fisheries and Aquaculture -Indian Councial of Agricultural Research New Delhi

2) Aquaculture and Fisheries -Arvind Kumar

3) Aquaculture In India-S.D. Tripathi, W.S. Lakra, N.K. Chadha

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