

**TEMPLATE OF
OUTCOME-BASED
CURRICULUM
2022
(for Masters program)**



**Institutional Quality Assurance Cell (IQAC)
Khulna University, Khulna 9208
Bangladesh**

**Outcome-based Curriculum of
Master of Science in Aquatic Resource Management**



**Fisheries and Marine Resource Technology Discipline
Khulna University
Date: June 2022**

01. Title of the Academic Program

Master of Science in Aquatic Resource Management

Program Overview			
Degree	Master of Science in Aquatic Resource Management		
Abbreviated form of the Degree	MS in Aquatic Resource Management		
Major (if applicable)	Aquatic Resource Management		
Discipline/Program (POE)	Offering	Entity	Fisheries and Marine Resource Technology Discipline
School	Life School		
Awarding Institution	Khulna University		
Location	Khulna, Bangladesh		
Bangladesh National Qualifications Framework (BNQF) Level	9		
International Standard Classification of Education (ISCED) Code	[0831]		
Mode of Study	Full Time & Master's by Mixed Mode (Dissertation)		
Language of Study	English		
Applicable Session	2022-23 and onwards		

02. Name of the University

Khulna University

03. Vision of the University

Khulna University strives to create a knowledge-based just society through accelerating inclusive and transformative growth of Khulna, Bangladesh and the world. The university aims to achieve this vision through cross-cutting research, scholarly enquiry and development of new knowledge.

04. Mission of the University

UM1	To explore human potential to its fullest extent and produce self-motivated, aspiring leaders to work for the betterment of the humankind.
UM2	To create a transformative educational experience for students focusing on poverty eradication, food and nutritional security, environmental sustainability, socio-economic well-being and climate resilient development through judicious management of natural resources of the country.
UM3	To foster creative learning, entrepreneurship and inquisitiveness among students based on moral values, professional ethics, and social responsibilities.
UM4	To ensure a quality educational experience that enables graduates to make demonstrable economic and social impacts through translating knowledge and innovation into practice.
UM5	To nurture an enabling environment that produces human resource inspired by wisdom, freethinking, creativity and unhindered intellectual exercises.

UM = University Mission

05. Name of the Discipline/Program Offering Entity (POE)

Fisheries and Marine Resource Technology Discipline

06. Vision of the Discipline/POE

To be a globally recognized center of excellence in education, research, entrepreneurs for sustainable fisheries and marine resource development.

07. Mission of the Discipline/POE

M1	To generate pioneer scholars through quality education in all aspects of fisheries sciences.
M2	To conduct innovative research for the improvement of fisheries sector.
M3	To establish an effective collaboration with reputed institutions of home and abroad for strengthening institutional capacity.
M4	To promote a culture of continuous learning to build up a knowledge-based community, dynamic leadership, and competent civil services.

M = Mission of the Discipline/POE

08. Objectives of the Discipline/POE

O1	To provide quality education and to maintain the highest academic standard in all aspects of fisheries and marine science in line with the international standard of education;
O2	To build up high level analytical and critical thinking skills for solving emerging problems in the field of fisheries and marine science;
O3	To undertake fundamental and applied research in order to endow developed knowledge and experience to students;
O4	To enhance communication skills, leadership capacity, adaptability, and social interactions;
O5	To impart technology based and need oriented higher education befitting the age;
O6	To generate skilled manpower in order to fulfill the global demands by equitable participation.

O = Objective of the Discipline/POE

09. Name of the Degree

Master of Science in Aquatic Resource Management

10. Description of the Program

Bangladesh has inland water areas of 6.7 million ha, of which 94% are open water capture fisheries. Rivers (479,735 ha), estuaries (551,828 ha), Haor and Beel (114,161 ha), floodplains (5,486,609 ha), mangrove environments, and the Kaptai Lake (68,800 ha) are among the potential inland aquatic resources. Bangladesh is one of the leading fish-producing countries, with 43.84 lakh MT of fish production in 2018–2019. Thus, Bangladesh is fortunate in possessing potential water resources. Furthermore, Bangladesh's inland fisheries are among the most significant fisheries resources, ranking third in inland fisheries production throughout the world. The greater Khulna region, the south-west part of Bangladesh has been characterized by a unique blend of aquatic habitats; fresh, brackish and marine waters supporting a wide diversity of biological and physical resources. Situated a few kilometers away from the Bay of Bengal this region is blessed with the Sundarbans, the world's largest mangrove forest crisscrossed by numerous creeks and canals.

Understanding the potential of such resources to the prospects of the country, the Fisheries and Marine Resource Technology (FMRT; then Marine Biology) Discipline was established in 1992 with the mandate to establish an avenue for research and academic programs in all aspects of fisheries for the first time in the country. FMRT Discipline of Khulna University, that is located in the coastal part of the country and that vows for production of competent fisheries manpower in the country, has come out as an excellent centre of fisheries education in the country. Khulna being a coastal district of Bangladesh and being located at close proximity of the world famous mangrove Sundarbans, the Discipline has been fortunate to have in its reach the problems and prospects of the resources to work on. No other institutions in the country as FMRT are in such an advantageous position.

FMRT Discipline commits itself to continuously improving the quality of fisheries education; competence of its faculty to meet the changing needs of fisheries education, research and extension services. The vision of Master Program in Aquatic Resource Management is generating forerunner scholars who take challenges for intellectual property protection, sustainable utilization of natural resources, improvement and conservation of fish and non-fish aquatic resources. The program is highlighted on different types of aquatic habitats, potential resources therein, present status of the resources, their exploitation and future prospects.

11. Graduate Attributes

GA1	Comprehensive knowledge	[<i>fundamental domain</i>]
GA2	Critical thinking, problem solving and decision making skills	[<i>thinking domain</i>]
GA3	Competency in information and communication technology	[<i>fundamental domain</i>]
GA4	Integrity and professionalism	[<i>personal domain</i>]
GA5	Leadership and communication skills	[<i>social domain</i>]
GA6	Competence in Ethics and morality	[<i>social domain</i>]
GA7	Lifelong learning skills and self-awareness	[<i>personal domain</i>]

GA = Graduate Attributes

12. Program Educational Objectives (PEOs)

PEO1	Provide state of the art and standard education as preparation for higher studies or future employment in positions of responsibility across a worldwide range of aquatic resources management, conservation and aquatic business.
PEO2	Graduates will be able to describe the status of fisheries in Bangladesh and overseas, explain the need for fisheries resources, identify fisheries resources management issues, outline the principles of fisheries management, describe the components of the fisheries management process and identify the criteria for effective fisheries management.
PEO3	Develop students' knowledge and skills in systems thinking and systems approach as an alternative to the scientific method to analyze aquaculture and aquatic resources systems.
PEO4	Identify constraints and issues to be addressed to make the systems sustainable in the long run.
PEO5	Provide students with the importance of biological diversity of aquatic life zones that cover three fourth of the earth surface encompassing natural and modified habitats in both marine and freshwater aquatic systems.
PEO6	Provide opportunities to recognise and develop the key skills necessary for graduates to be capable of reaching their full potentials and play a full role in society including careers in environmental and other professions, industry and commerce.
PEO7	Produce graduates who can think critically about the aquatic environment in the contemporary world and are able to pursue independent study in the subject with enthusiasm.

PEO = Program Educational Objective

13. Program Learning Outcomes (PLOs)

After successful completion of the degree, the learner will be able to:

A. Fundamental Skills	
PLO1	Describe the formal and informal arrangements for water resources management including conservation, pollution, policies, laws and institutions.
PLO2	Demonstrate the key concepts and challenges of integrated, multidisciplinary and interdisciplinary aquatic resource management.
PLO3	Describe and predict the main hydrological, hydraulic, chemical and biological processes for a given water resources system, and how these processes are dynamically linked with aquatic ecosystems as well as with human activities such as land and water use and pollution
B. Social Skills	
PLO4	Communicate, express and interact effectively for social, academic and professional purposes.
PLO5	Demonstrate social values, ethics and professionalism.
C. Thinking Skills	
PLO6	Analyze the key economic and ecological terms for designing and planning of water resources at various spatial and temporal scales.
PLO7	Demonstrate the ability to design and execute a scientific research plan and hypothesis without excessive guidance.
D. Personal Skills	
PLO8	Adapt to the professional environment to fulfil employment, entrepreneurial and lifelong learning skills
PLO9	Show competencies in ICT skills in daily and professional life.

PLO = Program Learning Outcome

14. Mapping Mission of the University with PEOs

Missions PEOs	UM1	UM2	UM3	UM4	UM5
PEO1	2	1	3	3	1
PEO2	2	3	2	2	3
PEO3	3	2	3	1	2
PEO4	2	2	2	2	3
PEO5	2	2	2	3	2
PEO6	1	2	2	2	3
PEO7	1	3	2	1	2

Level of Correlation: 3=High, 2=Medium, 1=Low

15. Mapping PLOs with PEOs

Program Learning Outcomes (PLOs)		Program Educational Objectives (PEOs)				
		PEO1	PEO2	PEO3	PEO4	PEO?
A. Fundamental Domain	PLO1		*		*	
	PLO2	*		*		
	PLO3		*			*
B. Social Domain	PLO4			*		
	PLO5	*			*	
C. Thinking Domain	PLO6		*			
	PLO7					
D. Personal Domain	PLO8			*		
	PLO9				*	

16. Mapping Courses with PLOs

Course Code and Course Title		PLOs								
		Fundamental Domain				Social Domain		Thinking Domain		Personal Domain
		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
First Year First Term										
<i>Core Course</i>										
0831 06 ARM 5101	Applied Fish Population Dynamics	X	X			X				X
0831 06 ARM 5103	Inland Fisheries Management	X	X	X	X			X		
0111 06 ARM 5102	Seminar 1: Research Methodology	X	X				X		X	
<i>Optional Course</i>										
0831 06 ARM 5105	Aquatic Resource Potentials	X	X		X	X			X	
0831 06 ARM 5107	Water Pollution and Biomonitoring	X		X	X			X		
0831 06 ARM 5109	Stock Enhancement Techniques	X	X					X	X	
First Year Second Term										
<i>Core Course</i>										
0831 06 ARM 5201	Fisheries Conservation and Alternative Options	X	X			X			X	
0831 06 ARM 5203	Applied limnology and ecosystem Dynamics	X	X		X	X		X		X
0111 06 ARM 5202	Seminar-II: Data Analysis and management	X	X	X			X		X	X
0831 06 ARM 5204	Dissertation Part-I									
<i>Optional Course</i>										
0831 06 ARM 5205	Integrated Coastal Zone Management	X	X			X			X	
0831 06 ARM 5207	Climate Change and Aquaculture	X	X		X	X	X	X	X	
0831 06 ARM 5209	Fisheries Legislations and Compliance	X	X			X			X	
0831 06 ARM 5211	Fisheries Projects and Data Management	X	X			X		X		
Second Year First Term										
<i>Core Course</i>										
0111 06 ARM 6102	Seminar-III									
0831 06 ARM 6204	Dissertation Part-II									

17. Structure of the Curriculum

a) Duration of the Program	1.5years	3 terms
b) Admission Requirements	Candidates seeking admission into a Master's program must possess a Bachelor of Science in Fisheries or equivalent degree from a recognized university (home and abroad)with 16 years schooling and a minimum CGPA/class/division of 3.00 will be eligible for admission into this program. Other terms and conditions are set or revised periodically by the appropriate authority subject to the approval of EC, BOAS, and AC.	
c1) Graduating Credits / Total Minimum Credit Requirement to Complete the Program	40	
c2) Available Credits	Total 64creditsincluding 34 of core and 30of optional	
d) Total Class Weeks in a Term*	14	
e) Minimum CGPA Requirements for Graduation	3.00	
f) Maximum Academic Years of Completion	5 years	

Program type	Min. credit requirement from major area ⁱ			
	Coursework (Min.)	Dissertation (Min.)	Dissertation (Max.)	Min. from Major Area
Coursework	20	-	-	20
Mixed-mode (Dissertation)	9	15	20	20
Mixed-mode (Project)	12	3	6	20
Mixed-mode (Internship)	12	3	6	20
Research	-	45	60	45

* For achieving a Master's degree with a major in a specified field under a mixed-mode or 'Master's by Research' scheme, the concerned dissertation must be directly linked with the 'major area' under consideration.

* Term Duration				
Teaching and Learning	Preparatory Leave	Term Final Examination	Term Break	Total
14 Weeks	2 Weeks	4 Weeks	2 Weeks	22 Weeks

g1) Area-wise Credit Distribution

Area	Course Type	Number of Courses	Credits	Total Credits
General Education (GED) Courses**	Theory	01	03	07
	Sessional	02	04	
Core/Compulsory Courses	Theory	03	09	11
	Sessional	01	02	
Optional/Elective Courses	Theory	10	30	30
	Sessional			
Capstone Courses***	Sessional	02	16	16
Total		19	64	64

** 11% from GED courses

*** Thesis, project, internship etc. courses

g2) Category of Courses

Area	Course Type	Course Title	Credits
General Education (GED) Courses	Theory		
	Sessional	1. Seminar 1: Research Methodology 2. Seminar-II: Data Analysis	04
Core/ Compulsory Courses	Theory	1. Applied Fish Population Dynamics 2. Inland Fisheries Management 3. Fisheries Conservation and Alternative Options 4. Applied limnology and ecosystem Dynamics	12
	Sessional	Seminar III	02
Optional/ Elective Courses	Theory	1. Aquatic Resource Potentials 2. Water Pollution and Biomonitoring 3. Stock Enhancement Techniques 4. Integrated Coastal Zone Management 5. Climate Change and Aquaculture 6. Fisheries Legislations and Compliance 7. Fisheries Projects and Data Management	21
	Sessional		
Capstone Courses	Sessional	01. Dissertation <i>Part - I</i> 02. Dissertation <i>Part - II</i>	16
Total			55

18. Year/Term-wise Distribution of Courses

First Year First Term						
Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
0831 06 ARM 5101	Applied Fish Population Dynamics	Core	3		3	None
0831 06 ARM 5103	Inland Fisheries Management	Core	3		3	None
0111 06 RM 5102	Seminar I: Research Methodology	Core		3	2	None
0831 06 ARM 5105	Aquatic Resource Potentials	Optional	3		3	None
0831 06 ARM 5107	Water Pollution and Biomonitoring	Optional	3		3	None
0831 06 ARM 5109	Stock Enhancement Techniques	Optional	3		3	None
Total	Core: Theory - 02; Sessional – 01, Optional: Theory - 03		15	03	17	
			18.0			
First Year Second Term						
Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
0831 06 ARM 5201	Fisheries Conservation and Alternative Options	Core	3		3	None
0831 06 ARM 5203	Applied limnology and ecosystem Dynamics	Core	3		3	None
0311 06 RM 5202	Seminar-II: Data Analysis and Management	Core		3	3	None
0111 06 ARM 5204	Dissertation Part-I:	Core		8	4	None
0831 06 ARM 5205	Integrated Coastal Zone Management	Optional	3		3	None
0831 06 ARM 5207	Climate Change and Aquaculture	Optional	3		3	None
0831 06 ARM 5209	Fisheries Legislations and Compliance	Optional	3		3	None
0831 06 ARM 5211	Fisheries Projects and Data Management	Optional	3		3	None
Total	Core: Theory - 02; Sessional – 02, Optional: Theory - 04		18	11	25	
			29.0			
Second Year First Term						
Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
0111 06 RM 6102	Seminar-III	Core		3	2	None
0831 06 ARM 6204	Dissertation Part-II	Core		24	12	None
Total	Sessional Courses: 02			27	14	
			27			

19. Course Description

First year first term

Course Code: 0831 06 ARM 5101	Year: MS First	Term: First
Course Title: Applied Fish Population Dynamics		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Understanding of fish population dynamics is prerequisite to control population with a view to conserve and manage the fisheries resources following rules and regulation.	

Course Contents		CLOs
Section A		
1	Distribution and Abundance: Distribution – the unit stock; Absolute and relative abundance; Estimation of Abundance – Partial Count Method, Stratified Sampling Method, Swept Area method, Mark-recapture Method, Depletion Method, Underwater visual census method, Acoustic method, Egg production method.	1
2	Stock Assessment: Overview and background; Population survey methods; Interpreting the trends of populations from previous records; Size-based methods; Age determination and sampling methods for stock assessment; Time series analysis to population and its application; Empirical methods and models for multispecies stock assessment.	2
3	Size Relationship: Linear regression; Length-weight relationships; Condition factors; Estimation of population sizes; Estimation of past population sizes using virtual population analysis and cohort analysis.	2
4	Selectivity of Fishing Gear: Covered codend experiments; Alternate haul experiments.	3
5	Growth: Von Bertalanffy growth equation; One Sample Ford-Walford Plots; Multiple Samples von Bertalanffy Plots; Graphical and Computer-based analyses of growth; Mark-recapture data; Hard part analysis; Non-linear methods of fitting growth curves.	4
Section B		CLOs
6	Reproduction and Recruitment: Timing of Reproduction; Length at sexual maturity; Timing of recruitment; Length at recruitment; Stock-recruitment relationship.	5
7	Mortality and Life History Patterns: Introduction and Definitions; Estimation of Mortality.	6
8	Yield: Concepts of Maximum sustainable yield and Maximum economic yield; Surplus yield models; yield per recruit models; biomass models; Simulation models; Potential yield analyses.	7
9	Fish Migration and Bypass: Migratory behaviour of fish; Factors affecting fish migration; Fish passage facilities; Identifying migration; Interruption of continuum by barriers and its consequences; River engineering and its impact on fish population; Upstream and downstream passage – technology, provision and damage assessment; Designing nature-like bypass.	8
10	Problems of Population Dynamics and Contemporary Fishery Management: Introduction; Problems of Managers; Performance of Population Dynamics; Future Developments.	9

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Assess distribution stock and abundance of fish population.	PLO1, PLO2, PLO3, PLO4, PLO6 PLO7, PLO8, PLO9
	CLO2	Acquire the length weight relationship of particular fish stock for proper	PLO1, PLO2, PLO3, PLO4, PLO7, PLO8, PLO9
	CLO3	Know about the gear size for harvesting.	PLO1, PLO2, PLO3, PLO4, PLO7, PLO8, PLO9
	CLO4	Understand the various tools for determination of population growth in particular area.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
	CLO5	Quantify recruitment and reproduction patterns of any fish population.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
	CLO6	Know the development pattern of fish and the reason of mortality	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
	CLO7	Estimate maximum sustainable and economic yield of any fishery	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
	CLO8	Know the migration behaviour of fish	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7 PLO8, PLO9
CLO9	Identify the problems and solve the problems through proper management	PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8	

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Class test
CLO4	Lecture	Quiz
CLO5	Lecture and video tape	Quiz
CLO6	Group discussion	Presentation, Final Exam

Teaching –learning strategies: Lecture, demonstration, discussion, project, modular, field visit, group discussion, video tape, debate, case study, simulation game, seminar, workshop, cooperative learning, problem-based learning, enquiry-based learning

Assessment strategies: Quiz, class test, assignment, written exam, viva, presentation,

Learning Materials

Recommended Readings	<ol style="list-style-type: none">1. "Fish Migration and Fish Bypass" by Mathias Jungwirth 1998, Fishing News Books. SL-7872. "Stock Assessment" by Vincent F. Gallucci 1996, Lewis Publishers, London. SL-8063. "Stock Assessment in Inland Fisheries" by I.G. Cowx 1996, Fishing News Books. SL-7934. "Fish Population Dynamics" by J.A. Gulland 1977, John Wiley and Sons. SL-8345. King, M. 1995. Fisheries Biology, Assessment and Management. Fishing News Books. 342 pp.6. Pauly, D. 1984. Fish population dynamics in tropical waters. A manual for use with programmable calculators. ICLARM, Manila. 325 pp.7. Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 191: 382 pp.8. Sparre, P., E. Ursin, and S. C. Venema. 1989. Introduction to tropical fish stock assessment. Part 1. Manual. FAO Fisheries Technical Paper. No. 306.1. Rome, FAO. 337 pp.9. Sparre, P., E. Ursin and S. C. Venema. 1989. Introduction to tropical fish stock assessment. Part 2. Exercises. FAO Fisheries Technical Paper. No. 306.2. Rome, FAO. 429 pp.
Supplementary Readings	

Course Code: 0831 06 ARM 5103	Year: MS First	Term: First
Course Title: Inland Fisheries Management		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	This course is designed to provide scientific studies on inland fisheries management and conservation issues	

Course Contents		CLOs
Section A		
1	Fisheries Assessment and Monitoring: Data requirements; data collection; data analysis and stock assessment; financial analyses; fisheries monitoring	1
2	Institutional, legal and policy framework: Institutions; their activities and regulations; organization behaviour and administration; Govt. policy	2
3	Policy formulation and implementation: Techniques and conditions for policy formulation; strategic actions for implementation	3
4	Development management: Water body characterization and SWOT analysis; Development planning and execution; Conflict resolution	4
Section B		
5	Management of Capture Fishery: Types of inland open water reservoirs; Resource status and management practices in rivers, estuaries, lakes, haors, baors, beels, floodplains etc.	5
6	Fisheries Management Measures: Restrictions on the efficiency of fishing unit; bag limit; catch limit; season ban; market control; award system; penalty system etc.	6
7	Management of Fish Marketing: Availability, consumption and demand of fish; Status of fish markets and analysis of different case studies; Management of intermediaries and other relevant stakeholders; Market control, and strategies for market promotion and development.	7
8	Community-Based Fisheries Management: Concept and justification; Principles and Implementation; Current practices, models and case studies.	8

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Know about the means of fish assessment and monitoring in an area.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
CLO2	Know about the activities of govt. institutions for the development and conservation of this sector.	PLO1, PLO4, PLO7 PLO8,	
CLO3	Understand the capture fishery resources both water bodies and fishes.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7 PLO8,	
CLO4	Know about the restriction of fish resources harvesting.	PLO1, PLO2, PLO4, PLO5, PLO6, PLO7 PLO8	
CLO5	Identify the potential uses of aquatic resources.	PLO2, PLO4, PLO6, PLO7, PLO8,	

	CLO6	Guide to conserve the aquatic resources in cooperation with adjacent communities.	PLO1, PLO4, PLO5, PLO6, PLO7, PLO8
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Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Class test
CLO4	Lecture	Quiz
CLO5	Lecture and video tape	Quiz
CLO6	Group discussion	Presentation, Final Exam

Teaching –learning strategies: Lecture, demonstration, discussion, project, modular, field visit, group discussion, video tape, debate, case study, simulation game, seminar, workshop, cooperative learning, problem-based learning, enquiry-based learning

Assessment strategies: Quiz, class test, assignment, written exam, viva, presentation,

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. “Fishery Management” by S.C. Agarwal Ashish Publishing House, New Delhi - 110026. SL-828 2. “Economics of Fisheries Management: A Critique in Third World Perspective” by RamakrishnanKorakandy. 1996, Daya Publishing House, Delhi - 110035. SL-850 3. “Freshwater Fisheries Management” by Robin G. Templeton 1995, Fishing News Books. SL-833 4. “Inland Fisheries Ecology and Management” by R.L. Welcome 2001, Fishing News Books. SL-795 5. “Management and Ecology of River Fisheries” by I.G. Cowx 2000, Fishing News Books. SL-798 6. Cowx, I. G. 2000. Management and Ecology of River Fisheries. Fishing News Books, Blackwell Science Limited, Oxford OX2 0EL, UK. 7. Templeton, R. G. 1995. Freshwater Fisheries Management. Fishing News Books, Farnham, Surrey, UK. 8. Tsai, C. and M. Y. Ali. 1997. Open water Fisheries of Bangladesh. The University Press Limited, Dhaka 1000, Bangladesh. 9. Welcomme, R. L. 2001. Inland Fisheries: Ecology and Management. Fishing News Books, Farnham, Surrey, UK. 10. Ali, M. 1997. Fish, Water and People: Reflection on Inland Open water Fisheries Resources of Bangladesh. The University Press Limited, Dhaka 1000, Bangladesh. 11. Anderson, L. G. and J. C. Seijo. 2010. Bioeconomics of Fisheries Management. Blackwell Publishing Ltd, Oxford OX4 2DQ, UK. 12. Berkes, F., R. Mahon, P. McConney, R. Pollance and R. Pomeroy. 2001. Managing Small-Scale Fisheries: Alternative Directions and Methods. International Development Research Center, Canada. 13. Cunningham, S. and T. Bostock. 2005. Successful Fisheries Management: Issues, Case Studies, Perspectives. Eburon Publishers, Delft, USA. 14. FAO. 2003. The Ecosystem Approach to Fisheries. Technical Guidelines for Responsible Fisheries No. 4, Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy. 15. Graff, G. D., B. Born, A. M. U. Kamal and F. Martin. 2001. Floods, Fish and Fishermen. The University Press Limited, Dhaka 1000, Bangladesh.
Supplementary Readings	

Course Code: 0111 06 RM 5102	Year: First	Term: First
Course Title: Seminar–I: Research Methodology		
Course Status: Core		
Credit: 2.0		
Prerequisite(s): None		
Rationale	This course is intended to expose post-graduate students to a broad range of environmental and occupational research, practice, and policy areas in order to assist them with career exploring and planning within the Fisheries major. To learn, practice, and critique effective scientific seminar skills. Students develop presentation skills that will be essential during their entire professional careers. These skills will improve as students respond to critical feedback, and seek to make scientific information understandable to scientists, peers, and the general public.	

Course Contents		CLOs
1	General Aspects of Oral Presentation: Presented at level that is appropriate to the audience; clear and informative visual aids (simple, sufficient time).	1, 2, 3
2	Introduction: Overview of problem area provided; unfamiliar terms introduced; appropriate literature abstracted and presented clearly; research hypothesis of the study identified.	4
3	Methods: Brief overview of the equipment and materials used, and how obtained; brief overview of the experimental design used and any other parts of the methods employed; materials and/or equipment described; procedures followed to conduct the experiment presented.	5
4	Results: Anticipated and actual results reported; statistics clearly presented.	6
5	Discussion: Implications if the hypothesis is supported clearly stated; implications if the hypothesis is not supported clearly stated; limitations of your study discussed; future research addressed.	
6	Questions: Demonstrated knowledge of the material; poised and confident, but no bluffing; answered the question(s) asked (asked for clarification or restatement of the question).	

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Communicate science in a 30-40 minute oral scientific presentation.	PLO1, PLO2, PLO3
CLO2	Understand and critique scientific presentations	PLO3, PLO4, PLO7	
CLO3	Create and implement a career plan to prepare for their identified career goals.	PLO3, PLO4, PLO7	
CLO4	Identify actions to take in areas of fisheries science education, including research, and internship / experiential learning.		
CLO5	Understand workplace expectations, communicate professionally, and identify and solve workplace conflicts.		
CLO6	Understand the different types of interview questions and craft focused answers in response.		
CLO7	Construct a professional network.		

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Group discussions, short lectures, strong student involvement	Presentation
CLO2	Group discussions, guest panelists, strong student involvement	Presentation
CLO3	Group discussions, guest panelists, strong student involvement	Presentation
CLO4	Group discussions, guest panelists, strong student involvement	Presentation
CLO5	Group discussions, guest panelists, strong student involvement	Presentation
CLO6	Group discussions, guest panelists, strong student involvement	Presentation
CLO7	Group discussions, guest panelists, strong student involvement	Presentation

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Bennett, B. 2001. The three P's of scientific talks: Preparation, practice, and presentation. Society for Economic Botany Newsletter. 15: 6-9. 2. Jan Recker. Scientific Research in Information Systems. A Beginner's Guide. Springer International Publishing. 2013. P.164. ISBN 978-3-642-30048-6. 3. David Hitchcock. Patent searching made easy: how to do patent searches on the internet & in the library. 4. Sixth edition. Berkeley, CA: Nolo, April 2013 p.257. ISBNs: 9781413318722, 141331872X, 9781413318739. 5. Yvonne N. Bui. How to Write a Master's Thesis. Third Edition. SAGE publications, Inc. 2020. P.298. ISBN-13: 978-1506336091, ISBN-10: 1506336094.
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Course Code: 0831 06ARM 5105	Year: MS First	Term: First
Course Title: Aquatic Resources Potentials		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course is designed to provide information on different types of aquatic habitats, potential resources therein, present status of resources, their exploitation and future prospects.	

Course Contents		CLOs
Section A		
1	Living Plant Resources – Aquatic plants including Bacteria, Fungi, micro and macro algae, angiosperms.	1
2	Living Animal Resources of the World including Bangladesh aquatic animals including micro- and macro-zooplankton, crustaceans, nematodes, molluscs, fish, reptiles, amphibians, mammals.	2
3	Non-living resources - water, sediments, minerals, oil & gas and radio isotopes.	3
4	Living and non-living resources in Bangladesh	1, 2, 3, 4
Section B		CLOs
5	Environmental impacts on Aquatic Resources: Environmental degradation, impact of pollutants, impact of anthropogenic activities, control.	5
6	Development of relevant industries and technology: Aquatic resource exploration and exploitation, endangered living resources and their conservation	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Describe the world-wide available flora resources, their exploitation and utilization and future potentials.	PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9
CLO2	Explain the world-wide available faunal resources, their exploitation and utilization and future potentials.	PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9	
CLO3	Give details of the world-wide non-living resources, their exploitation and utilization and future potentials.	PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9	
CLO4	Compare the resources both living and non-living in the country	PLO1, PLO2, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9	
CLO5	Explain the reasons of losing biodiversity	PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8	
CLO6	Determine what are the immediate measures needed to be restocked these natural resources through proper exploration and exploitation	PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8	

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Class test
CLO4	Lecture	Quiz
CLO5	Lecture and video tape	Quiz
CLO6	Group discussion	Presentation, Final Exam

Teaching –learning strategies: Lecture, demonstration, discussion, project, modular, field visit, group discussion, video tape, debate, case study, simulation game, seminar, workshop, cooperative learning, problem-based learning, enquiry-based learning

Assessment strategies: Quiz, class test, assignment, written exam, viva, presentation,

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. “Industrial Utilization of Marine Non-living Resources” by United Nations 1993, UNIDO, 11T, Madras, India. 2. “Distribution and important biological features of coastal fish resources in Southeast Asia” by FAO 1986, FTP No. 278 Website: http://www.fishbase.org 3. Helfman G.S. 2007. Fish conservation: a guide to understanding and restoring global aquatic biodiversity and fishery resources. Island Press, Washington, USA. 688 pp. 4. Rahman, A.K.A. 1989. Freshwater Fishes of Bangladesh, Zoological Society of Bangladesh, Dhaka. 364 pp. 5. Tsai, C. and M. Y. Ali. 1997. Open water Fisheries of Bangladesh. Bangladesh Centre for Advanced studies. The University Press Limited, Dhaka. 212 pp. 6. DOF. 1998. National Fisheries Policy. Department of Fisheries, Dhaka, Bangladesh. 7. DOF. 2008. Hilsa fisheries conservation, development and management techniques. 2nd Edition. Department of Fisheries, Dhaka, Bangladesh. 8. DOF. 2009. Fisheries Statistical Yearbook of Bangladesh 2007-2008. Volume 25, Number 1. Fisheries Resources Survey System, Department of Fisheries, Dhaka, Bangladesh. 9. DOF. 2010. Fish Acts and Regulations. Department of Fisheries, Dhaka, Bangladesh. 10. IUCN Bangladesh. 2003. Bangladesher Bipanno Bonno Prani, IUCN-The World Conservation Union. xiv+294 pp. 11. Rahman, A. K. A., S. M. H. Kabir, M. Ahmad, A. T. A. Ahmed, Z. U. Ahmed, Z. N. T. Begum, M. A. Hassan and M. Khondker. 2009 (eds.). Encyclopedia of Flora and Fauna of Bangladesh, Vol. 24. Marine Fishes. Asiatic Society of Bangladesh. 485 pp. 12. Siddiqui, K. U., M. A. Islam, S. M. H. Kabir, M. Ahmad, A. T. A. Ahmed, A. K. A. Rahman, E. U. Haque, Z. U. Ahmed, Z. N. T. Begum, M. A. Hassan, M. Khondker, and M. M. Rahman. 2007 (eds.) Encyclopedia of Flora and Fauna of Bangladesh, Vol. 23. Freshwater Fishes. Asiatic Society of Bangladesh, Dhaka 300 pp. 13. TARA. 2002. Fish Sanctuary. Progressive Book Corner, Dhaka, Bangladesh. 136 pp.
Supplementary Readings	

Course Code: 0831 06 ARM 5107	Year: MS First	Term: First
Course Title: Water Pollution and Biomonitoring		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	At present, water pollution is one of the most concern issues in the world. Therefore, this course is designed to gain insights of water pollution and its biomonitoring, impacts and mitigation strategies.	

Course Contents		CLOs
Section A		
1	Water Pollution Problems and Solutions: Sources, The scale of water pollution, Metalliferous rivers, Toxicity and the status of fisheries	1
2	Sources and Effects of Water Pollutants: The nature of effluents, The environmental requirements of aquatic organisms, Organic pollution, Nutrient pollution, Thermal pollution, Toxic pollution, Suspended solids, Extreme pH and acidification, Detergents, Oil and petroleum products	1
3	The Toxicity of Pollutants to Aquatic Organisms: Lethal toxicity and its measurement, Factors influencing toxicity, Biotic Factors Influencing Toxicity, Applications of lethal toxicity measurements, Sublethal toxicity, Evaluating toxicological data	2
4	Water Pollution and Public Health: Water pollution and pathogens, Bacterial Pathogens, Viral Pathogens, Parasitic Infections, Pathogens in the Aquatic Environment, Water pollution and water supply	3
5	Wastewater as a resource: Introduction, Types of reuse, Implementing or upgrading agricultural reuse systems, Technical aspects of health protection, Waste Water Treatment Processes	4
Section B		CLOs
6	Biological Monitoring of Water Quality: The conceptual basis of biological monitoring, Definition and types of biomonitoring, Possibilities of biomonitoring, sampling methods, Evaluating Sampling Techniques, Data analysis and interpretation, Pollution Indices, Diversity Indices, Biotic Indices, Similarity Indices, Other Multivariate Techniques	4
7	Biomonitoring and Bioassessment: Introduction, History of Water Quality Assessment, The Saprobic System, Biotic Indices and Scoring, The Multivariate Approach, The Multi-metric Approach, Integrative Assessment Systems	4
8	Biomonitoring Indicator Groups: Algae, Macrophyte, Zooplankton, Protozoa, Crustacean, Insect, Bivalve molluscs, Gastropod, Fish, Amphibian, Others	5
9	Biological Wastewater Treatment Processes: Lagoons and Stabilization Basins, Aerated Lagoons, Activated Sludge Processes, Trickling Filtration, Rotating Biological Contactors, Anaerobic Decomposition, Laboratory Evaluation of Anaerobic Treatment	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand the concept of water pollution, pollutants and its sources.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8
	CLO2	Determine the toxicity level of pollutants to aquatic organisms.	PLO1, PLO2, PLO4, PLO7, PLO8, PLO9
	CLO3	Evaluate the impact of water pollution on public health.	PLO1, PLO2, PLO3, PLO4, PLO5, PLO7, PLO8, PLO9
	CLO4	Utilize biomonitoring tools to assess water quality as well as water pollution.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO5, PLO6, PLO7, PLO8 PLO9
	CLO5	Identify different biomonitoring indicator groups.	PLO1, PLO2, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9
CLO6	Illustrate different biological wastewater treatment processes.	PLO1, PLO2, PLO4, PLO7, PLO8, PLO9	

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Class test
CLO4	Lecture	Quiz
CLO5	Lecture and video tape	Quiz
CLO6	Group discussion	Presentation, Final Exam

Teaching –learning strategies: Lecture, demonstration, discussion, project, modular, field visit, group discussion, video tape, debate, case study, simulation game, seminar, workshop, cooperative learning, problem-based learning, enquiry-based learning

Assessment strategies: Quiz, class test, assignment, written exam, viva, presentation,

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Monitoring water quality in the future. Volume 3: biomonitoring, Dick de Zwart RIVM, Bilthoven, The Netherlands, April, 1995 2. Industrial Water Pollution Control (Third Edition) .W.Wesley Eckenfelder, Jr. 2000 by the McGraw-Hili Companies, Inc. 3. Biomonitoring: An appealing tool for assessment of metal pollution in the aquatic ecosystem Qunfang Zhou, Jianbin Zhang, Jianjie Fu, Jianbo Shi, Guibin Jiang <i>analyticachimicaacta</i> 606 (2008) 135–150 4. Water Pollution Control A guide to the use of water quality management principles Edited by Richard Helmer and IvanildoHespanhol World Health Organization E & FN Spon An imprint of Thomson Profess czxXV 5. ional London. Weinheim. New Yor3333\k. Tokyo. Melbourne. Madras Year of Publication.Z
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	<ol style="list-style-type: none"> 6. Water Pollution Biology, Second Edition, P.D.ABEL, Taylor & Francis is an imprint of the Taylor & Francis Group This edition published in the Taylor & Francis e-Library, 2002. 7. Boyd, C. E. 1988. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publisher B. V., Amsterdam. 318 pp. 8. Calhoun, Y. 2005. Water Pollution. Chelsea House Publishers. 164 pp. 9. Calow, P. 1993 (ed.) Handbook of Ecotoxicology. Volume One. T.J. Press (Padstow) Ltd., Padstow, Cornwall, Great Britain. 289 pp. 10. Carmichael, W.W. 1981 (ed.). The Water Environment: Algal Toxins and Health. Plenum Press. New York. 491 pp. 11. Chorus, I. 2001 (ed.). Cyanotoxins – Occurrence, Causes, Consequences. Springer. 357 pp 12. Falconer, I.R. 1993. Algal Toxins in Sea Food and Drinking Water. Academic Press. 224 pp. 13. Laws, E.A. 2000. Aquatic Pollution: An Introductory Text. 3rd Ed. Wiley. 639 pp. 14. Saxena, M.M. 1990. Environmental Analysis: Water, Soil and Air. Second Edition. Agro Botanical Publishers (India). 186 pp. 15. Smol, S. 2005. Pollution of Lakes and Rivers. A Hodder Arnold Publication. 16. Ulrich, F. 1981. Metal Pollution in the Aquatic Environment. Springer Verlag. 17. Lloyd, R. 1992. Pollution and Freshwater Fish. Fishing News Books, Oxford, UD. 176 pp
Supplementary Readings	<ol style="list-style-type: none"> 1. 2. 3. 13.

Course Code: 0831 06 ARM 5109	Year: MS First	Term: First
Course Title: Stock Enhancement Techniques		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Fish stock enhancement is prerequisite to achieving sustainable fisheries. Therefore, from a fisheries point of view, a responsible and ecologically sustainable stock enhancement approach should be adopted.	

Course Contents		CLOs
Section A		
1	Fish stock propagation: Background, Enhancement in marine resource management (effective and ineffective enhancement, examples of enhancement efforts, global extent of enhancements, developing and reforming enhancements), Management consideration (The fisheries system and management context, stakeholder involvement, identify appropriate biological and technical system design, stock dynamic and management, aquaculture production and enhancements, genetic management, pathogen interactions, impact of marine ecosystems)	1
2	Important considerations in stock enhancement: Prioritize and select target species, Develop a species management plan that identifies harvest opportunity, stock rebuilding goals, and genetic objectives, Define quantitative measures of success, Use genetic resource management to avoid deleterious genetic effects, Include disease and health management guidelines, Consider ecological, biological, and life history patterns when forming enhancement objectives and tactics, Identify released hatchery fish and assess stocking effects, Use an empirical process to define optimum release strategies, Identify economic and policy guidelines, Use adaptive management	2
3	Stock enhancement in different water bodies: Stock enhancement of inland waters in Asia (Rivers and floodplains, Lakes and reservoirs), Stock-enhancement in small and medium-sized inland water bodies (Stock enhancement and/or culture-based fisheries in Asia, Constraints to culture-based fishery development, Species combinations and stocking ratios, Seed supplies, Management structures/institutions, Harvesting and marketing, Fingerling production for stock enhancement).	3
Section B		
5	Stock enhancement of floodplain fisheries in Bangladesh: Stock enhancement in floodplains and beels, lakes, reservoirs (Species used and production, Fingerling/seed supplies, Economic analysis, Administrative arrangements/management of stock-enhanced fisheries, Socio-economic impacts)	4
6	Stock enhancement (Case Studies): Enhancing the European Lobster (<i>Homarus gammarus</i>) Stock at Kvitsøy Islands: Perspectives on Rebuilding Norwegian Stocks; An Approach to Evaluating the Potential for Stock Enhancement of Brown Tiger Prawns (<i>Penaeus esculentus</i> Haswell) in Exmouth Gulf, Western Australia; Stock Enhancement of the Short-spined Sea Urchin, <i>Strongylocentrotus intermedius</i> in Hokkaido, Japan; Enhancement of Pacific Threadfin (<i>Polydactylus sexfilis</i>) in Hawaii: Interactions between Aquaculture and Fisheries; Stock Enhancement of Barramundi, <i>Lates calcarifer</i> (Bloch), in a Coastal River System in Northern Australia: Stocking Strategies, Survival and Benefit-cost.	4
7	Socio-economics of Stock Enhancement: Averting Food Crisis in the Twenty-first Century: The Role of Stock Enhancement and Sea Ranching; The Role of Stock Enhancement in the Management Framework for New Zealand's Southern Scallop Fishery	5

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Determine fish stock dynamic and management consideration.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO9
	CLO2	Develop a species-specific management plan for harvesting, and stock rebuilding.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO8, PLO9
	CLO3	Understand stock enhancement in different water bodies.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO9
	CLO4	Apply the knowledge of different stock enhancement techniques to ensure sustainable fisheries.	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO9
	CLO5	Understand the socio-economic context of different stock enhancement programmes.	PLO4, PLO5, PLO6, PLO7, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Class test
CLO4	Lecture	Quiz
CLO5	Lecture and video tape	Quiz
CLO6	Group discussion	Presentation, Final Exam

Teaching –learning strategies: Lecture, demonstration, discussion, project, modular, field visit, group discussion, video tape, debate, case study, simulation game, seminar, workshop, cooperative learning, problem based learning, enquiry based learning

Assessment strategies: Quiz, class test, assignment, written exam, viva, presentation,

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Stock enhancement and sea ranching (developments, pitfalls and opportunities) Second Edition, EDITED BY K.M. LEBER, S. KITADA, H.L. BLANKENSHIP, T. SVASAND. 2004 by Blackwell Publishing Ltd 2. Kai Lorenzen et al. (2016). Fish stock propagation, The first global integrated marine assessment, World ocean assessment I. 2006, United Nation. 3. De Silva, S.S. and Funge-Smith, S.J. 2005. A review of stock enhancement practices in the inland water fisheries of Asia. Asia-Pacific Fishery Commission, Bangkok, Thailand. RAP Publication No. 2005/12, 93 p. 4. Southeast Asian Fisheries Development Center, Aquaculture Department (2001). Important considerations in stock enhancement. SEAFDEC Asian Aquaculture, (5-6), 18-19, 40. 5. Chakrabarty, N.M., Chakraborty, P.P. and Mondal, S.C. 2010. Biology, Breeding and Farming of Important Food Fishes. Narendra Publishing House. 98 pp.
Supplementary Readings	

First year second term

Course Code: 0831 06 ARM 5201	Year: First	Term: Second
Course Title: Fisheries Conservation and Alternative Options		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Bangladesh is rich in vast fisheries resources. These fisheries resources require appropriate conservation and management plan to ensure sustainable development.	

Course Contents		CLOs
Section A		
1	Understanding fisheries diversity and conservation: Overview and Background; Database of fisheries diversity; Dimension and Utilization of Fisheries Diversity; Concept of conservation and its relation with society; Priority basis conservation and their selection criteria; Conservation Ethics – Communicating the way towards protection and sustainable use of Aquatic Biodiversity	1, 2
2	Introduction to fisheries conservation and management: Conservation tools and their applications; Current practices employed in the conservation and management of aquatic habitats	1, 2
3	Conservation policy: Strategy and action plan; Conservation vs. Management; National Conservation Policy Issues and their effective implementation	2
Section B		CLOs
4	Fish conservation biology: Environmental degradation and habitat destruction, Impact of fishing and aquaculture on environment and biodiversity, Concept	3
5	of minimum viable population size, Endangered species and restoration ecology	4
6	Cryo-preservation and other genetic methods: population genetics; cryo-preservation techniques; efficient breeding technologies and hybridization; use of advanced genetic tools	4
7	Sanctuary and Menagerie Techniques: Sanctuary techniques – Preparation of Shelter, Measures to prohibit their catch; Menagerie Techniques – Establishment of safari park of different aquatic invertebrates and vertebrates, wild and endangered species identification and their collection.	4

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Apply knowledge of fish diversity in conservation issues.	PLO1, PLO2, PLO6
	CLO2	Identify and apply fisheries conservation tools.	PLO1, PLO3,

			PLO6
	CLO3	Formulate action plan and effective implementation strategies for sustainable development.	PLO1, PLO3, PLO7
	CLO4	Understand the implication of fish conservation biology in fisheries management.	PLO1, PLO3, PLO5, PLO7
	CLO5	Prepare sanctuary management techniques for different aquatic invertebrates and vertebrates.	PLO1, PLO3, PLO7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture	Presentation, Class test, Final Exam
CLO5	Lecture and Group Discussion	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. "Conservation of freshwater Fishes: Options for the Future" by M.J. Collares-Pereira Fishing News Books. SL-842. 2. "National Biodiversity Strategy and Action Plan" by AinunNishat IUCN. SL-802. 3. "Red Book of Threatened Aquatic Species" IUCN. 4. "Protection of Aquatic Biodiversity" by David P. Philipp Oxford & IBH Publishing Co. Pvt. Ltd. SL-790. 5. "The Common Fisheries Policy: Origin, Evaluation and Future" by Mike Holden Fishing News Books. 6. Grafton, R. Q., R. Hilborn, D. Squires, M. Tait and M. Williams. 2009 (eds.). Handbook of Marine Fisheries Conservation and Management. Oxford University Press, 784 pp. 7. Helfman, G. S. 2007. Fish conservation: a guide to understanding and restoring global aquatic biodiversity and fishery resources. Island Press, Washington, USA. 688 pp. 8. King, M. 1995. Fisheries biology, assessment and management. Fishing News Books. 342 pp. 9. Tsai, C. and M. Y. Ali. 1997. Open water Fisheries of Bangladesh. Bangladesh Centre for Advanced studies. The University Press Limited, Dhaka. 212 pp. 10. Akerman, S. E. 1986. The Coastal Set Bagnet Fishery of Bangladesh: Fishing Trials and Investigations. BOBP/REP/34. 11. BOBP. 1985. Marine Small-Scale Fisheries of Bangladesh: A General Description. BOBP/INF/8. 12. Chowdhury, Z. A., M. Q. M. Huq, M. S. Islam, M. G. Khan, M. G. Mustafa, S. C. Paul, S. A. Quayum and M. N. Sada. 1993. Studies of Interactive Marine Fisheries of Bangladesh Bay of Bengal
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	<p>Programme (BOBP) for Fisheries Development - BOBP/WP/89. 125 pp.</p> <p>13. DOF. 2008. Hilsa fisheries conservation, development and management techniques. 2nd Edition. Department of Fisheries, Dhaka, Bangladesh.</p> <p>14. DOF. 2010. Fish Acts and Regulations. Department of Fisheries, Dhaka, Bangladesh.</p> <p>15. FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 41 pp</p> <p>16. FAO. 2007. The State of World Fisheries and Aquaculture. FAO Fisheries Department, Rome, Italy.</p> <p>17. Hoq, M. E. 2008. Sundarbans Mangrove: Fish & Fisheries – Ecology, Resources, Productivity and Management Perspectives. Graphic Media, Dhaka, Bangladesh. 271 pp.</p> <p>18. Rahman, A. K. A., S. M. H. Kabir, M. Ahmad, A. T. A. Ahmed, Z. U. Ahmed, Z. N. T. Begum, M. A. Hassan and M. Khondker. 2009 (eds.). Encyclopedia of Flora and Fauna of Bangladesh, Vol. 24. Marine Fishes. Asiatic Society of Bangladesh. 485 pp.</p>
Supplementary Readings	

Course Code: 0831 06 ARM 5203	Year: First	Term: Second
Course Title: Applied Limnology and Ecosystem Dynamics		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Bangladesh is endowed with diversified water bodies with different ecosystem dynamics. Therefore, to ensure proper management it is necessary to understand ecosystem dynamics of different water bodies.	

Course Contents		CLOs
Section A		
1	Basic concepts of Limnology: Definition, objectives, historical development, scope and present status of Limnology	1, 2
2	Physico-chemical characteristics of water and soil, soil-water interaction	1, 2
3	Limnology of wetlands and rivers: lentic systems, lotic systems, diversity of fishes in lentic and lotic systems	2
4	Plankton communities, productivity and eutrophication	3
5	Aquatic macrophytes and benthos	4
Section B		CLOs
6	Freshwater ecosystems, estuarine ecology, marine ecosystems	3
7	Ecology of floodplain: communities in floodplain, energy flow in floodplain, floodplain fisheries and modification of floodplain ecosystems	4
8	Bio-geochemical cycles in aquatic environment: phosphorus, nitrogen, silicon, calcium, iron, sulfur and carbon cycle	5
9	Population ecology: concept of population, population group properties, population density, natality, mortality, age distribution, biotic potential, environmental resistance, growth form, carrying capacity, population in dispersal and structure	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand the concept of limnology and its scope and historical development.	PLO1, PLO2, PLO6
	CLO2	Determine physico-chemical characteristics of water and soil.	PLO1, PLO3
	CLO3	Categorize different plankton communities and its productivity.	PLO1, PLO3
	CLO4	Understand the ecology of floodplain, communities and energy flow of floodplain.	PLO1, PLO2, PLO6
	CLO5	Demonstrate different bio-geochemical cycles in aquatic environment.	PLO1, PLO3
	CLO6	Understand the concept of population ecology and its practical implication.	PLO1, PLO3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, interactive learning	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture, interactive learning	Presentation, Class test, Final Exam
CLO5	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO6	Lecture and Group Discussion	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Fundamentals of Limnology and Aquaculture Biotechnology by DevashishKar, Daya publishing house, 2007. 2. A treatise on Limnology Volume II Introduction to lake biology and the limnoplankton by G. Evelyn Hytchinson, John Wiley & Sons, Inc., 1967. 3. A textbook of applied biology by B.B. Hosetti&Arvind Kumar. Daya publishing house, Delhi-110035, 2002. 4. Aquatic Ecology - A text book by G. Ragothaman& R.K. Trivedy. Agrobios (India), 2002. 5. A.P.H.A., 1976. Standard methods for the examination of water and wastewater including bottom sediments and sludge. 14th Ed. APH, New York. 6. Bellinger, E.G., 1992. A Key to Common Algae. The Institute of Water and Environmental Management. John Street, London. 138 pp. 7. Boney, A.D., 1975. Phytoplankton, Institute of Biology Study. 52, Crane, Russak Co, New York. 116 pp. 8. Boyd, C. E., 1979. Water quality in Warm water Fish Ponds. Auburn University Agricultural Experiment Station, Auburn, Alabama, 359 pp. 9. Goldman G.R and Horne, A.J., 1983. Limnology. McGraw-Hill Book Co. 10. Hutchinson G. E., 1967. A Treatise on Limnology Vol. 2. Introduction to Lake Biology and Limno plankton. John Willey & Sons., Inc., New York. 11. Pennak. R.W., 1978. Freshwater Invertebrates of the United States. 2nd Ed. Wiley, New York. 12. Pontin, R.M., 1978. A Key to British Freshwater Planktonic Rotifera. Publication No. 38. Scientific Publication. Wilson & Son Ltd., Britain. 178 pp. 13. Prescott G.W., 1962, Algae of the Western Great Lakes Area. 2nd Ed., William C. Brown Co., Dubuque, Iowa. 14. Rahman M. S., 1992. Water Quality Management in Aquaculture. BRAC prokashana, Dhaka –1212
Supplementary Readings	

Course Code: 0111 06 RM 5202	Year: First	Term: Second
Course Title: Seminar-II: Data Analysis and Management		
Course Status: Core		
Credit: 2.0		
Prerequisite(s): None		
Rationale	The course intends to provide students advance knowledge and hand-on experience on assembling, analysis and presentaion of data obtained from the primary research and secondary studies of fisheries, aquaculture, and other aquatic resources.	

Course Contents		CLOs
1	Introduction: Statistics in biological sciences, types of data, data sources, accuracy, precision, errors and their sources, error minimization and separation;	1, 2
2	Sampling: Sample size estimation, types of sampling and its uses, sampleing distribution;	
3	Studies and experimental units: aquaculture; Genetics, Microbiology, aquatic resource management, coastal sciences;	1, 2
4	Processing and presentation: Array Formation, Frequency Distribution/ Table, Graphic representation;	
5	Data analysis: growth trend, feeding level determination, performance indicators, sensitivity, cash flow; sex determination, genotypic and allelic frequencies and estimation, effective breeding number, heritability, QTL, selection index, microbial count and growth curve.	2

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	explain different types of data in relation to fisheries production and other aquatic resources;	A -PLO1, PLO2
CLO2	determine sample size and suitable sampling strategies;	A -PLO1, PLO2 C -PLO1	
CLO3	design survey and experimental research works;	A -PLO1, PLO2	
CLO4	analyze and present data	A -PLO1, PLO2	

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Seminar, group discussion, video tape	Quiz, viva
CLO2	Seminar, problem based learning	Assignment
CLO3	Seminar, problem based learning	Assignment, viva
CLO4	Seminar, group discussion, video tape	Assignment, presentation

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Bhujel, R.C., 2009. <i>Statistics for aquaculture</i>. John Wiley & Sons. 2. Kothari, C.R., 2004. <i>Research Methodology: Methods and techniques</i>. New Age International. 3. Bhamrah, H.S., Sandhu, G.S. and Gupta, K.C., 2006. <i>Research Techniques in Biological Science</i>. Dominant Publishers. 4. Pillay, T.V.R., 1990. <i>Aquaculture Principles and Practices</i> (pp.575). Fishing News Books, University Press.
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Course Code: 0831 06 CMS 5204	Year: First	Term: Second
Course Title: Dissertation-I		
Course Status: Core		
Credit: 4.0		
Prerequisite(s): None		
Rationale	This course is designed to provide the students an opportunity to conduct and write their thesis proposal.	

Course Contents		CLOs
1	This course serves as an introductory course in the dissertation methodology writing process. The focus of the course is to develop the MS student's dissertation proposal. The core objective of this course is to provide guidance and motivation to the MS students for their comprehensive understanding on the problem identification, literature review and methodology.	1

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Construct a research question that can be empirically addressed during experiment.	PLO1, PLO3, PLO7, PLO8
	CLO2	Design and execute a meaningful research project that demonstrates spatial thinking using knowledge and skills.	PLO7, PLO8
	CLO3	Undertake the research process and be aware of research obligations and pitfalls.	PLO10
	CLO4	Articulate research or project objectives clearly, situate research within an academic or scholarly context; state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.	PLO2, PLO9, PLO10,
	CLO5	Utilize the relevant software and bibliographic reference manager competently and efficiently to produce documents that meet MS in CMS program requirements.	PLO9, PLO11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration, project, modular, group discussion, seminar, workshop,	Presentation and viva

Course Code: 0831 06ARM 5205	Year: First	Term: Second
Course Title: Integrated Coastal Zone Management		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Bangladesh is endowed with vast coastal zone, covers an area of 47,201 km ² that constitutes 32% of the country. This coastal zone needs an integrated management practice to establish an integration among coastal people, policy and environment to achieve sustainable development.	

Course Contents		CLOs
Section A		
1	Introduction & concepts of ICZM, multiple uses of coastal zone	1, 2
2	Coastal zone management issues, resource use conflicts, horizontal and vertical migration	1, 2
3	ICZM planning cycle: coastal management plans, planning framework, planning process, implementation, monitoring & evaluation, case study	2
Section B		CLOs
4	Tools and techniques of ICZM: administrative (policy & legislation, guidelines, zoning), social (traditional practices, collaborative and community based management, capacity building), technical (EIA, risk and hazard management, landscape and visual resource analysis, economic analysis, GIS & remote sensing)	3
5	EIA: definition, purpose, importance & history of EIA in Bangladesh, EIA sequence, methodologies in EIA, guiding principles, problems and limitation of EIA	4
6	Case studies: Development activities and major areas of environmental concerns in Bangladesh (flood protection embankment, coastal aquaculture developments e.g. shrimp farming, solid waste disposal areas, green-house gases, industrial impacts, health impacts (risk assessment), impacts of Farraka-Barrage on coastal region of Bangladesh	4

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand concepts of ICZM and its issues.	PLO1, PLO2, PLO3, PLO6
	CLO2	Develop a management plan to handle coastal resource conflicts.	PLO1, PLO2, PLO4, PLO6
	CLO3	Identify and apply tools and techniques of ICZM.	PLO2, PLO3, PLO4
	CLO4	Understand the concept of EIA and its implication in coastal zone management in Bangladesh.	PLO2, PLO3, PLO4, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
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CLO1	Lecture, Interactive learning	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture and Enquiry based learning	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<p>5. Integrated management of coastal zone by John R. Clark, FAO, 1992.</p> <p>6. Integrated coastal management: South Asia by B.E. Brown, DFID, 1997.</p>
Supplementary Readings	

Course Code: 0831 06 ARM 5207	Year: First	Term: Second
Course Title: Climate Change and Aquaculture		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Climate change is a global alarming issue. It has serious impact on aquatic resources and ecosystem. This course will give an overview of the current food fish and aquaculture production and a synthesis of existing studies on climate change effects on aquaculture and fisheries.	

Course Contents		CLOs
Section A		
1	Global Climate change: Causes and concerns, Natural processes affecting the earth's water temperature	1, 2
2	Physical and ecological impact on climate change relevant to marine and inland capture fisheries	1, 2
3	Climate change and aquaculture: potential impacts, adaptation and mitigation	2
4	Impact of climate change on the parasites and infectious diseases of aquaculture farm.	3
5	Biodiversity and Climate Change in the Oceans, Detection and Attribution of Climate Change Effects on Biodiversity of Fish and Fisheries	4
Section B		CLOs
6	Climate change impact on Mangrove fisheries, crustacean, mollusks and benthos	3
7	Impacts of Climate Change on the coastal ecosystem, Impacts on livelihoods of fish farmer	4
8	Impact on seed production, hatchery operation, migratory behaviors, brood development and breeding	5
9	Management policy and mitigation: Adaptation and mitigation process, policy development, banning season and duration etc.	6
10	Climate change the major river, the Bay of Bengal, special importance to shrimp, crab and hilsa fishery	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand global climate change and its impact on marine and inland capture fisheries.	PLO1, PLO3, PLO6
	CLO2	Describe the impact of climate change on aquaculture, emergence of diseases and its adaptation as well as mitigation.	PLO3, PLO4, PLO6
	CLO3	Illustrate the impact of climate change on mangrove fisheries and different commercial aquaculture species.	PLO3, PLO4, PLO6

	CLO4	Formulate management policy and mitigation plan regarding climate change impact.	PLO3, PLO4, PLO8
	CLO5	Understand climate change impact on brood development, seed production, and fish migratory behaviors.	PLO3, PLO4, PLO6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture	Presentation, Class test, Final Exam
CLO5	Lecture and Group Discussion	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. and F. Poulain (Eds.). 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp. 2. Bloom, A.J. 2010. Global Climate Change: Convergence of Disciplines. Oxford University Press. 3. Phillips, B.F. and M.P. Ramírez. 2017. Climate Change Impacts on Fisheries and Aquaculture: A Global Analysis. John Wiley & Sons Ltd. 4. Alam, A.B.M.S., Chowdhury, M.S.M. and Sobhan, I. 2012. Biodiversity of TanguarHaor: A Ramsar Site of Bangladesh Vol. I: Wildlife, IUCN Bangladesh, Dhaka, Bangladesh. 234 pp. 5. Giri, S.S. (Ed.). 2016. Climate Change Impact on Coastal Fisheries and Aquaculture in South Asia. SAARC Agriculture Centre, Dhaka, Bangladesh. 6. Harrould-Kolieb, E., Huelsenbeck, M. and Selz, V. 2010. Ocean acidification: the untold stories. Oceana, USA.
Supplementary Readings	

Course Code: 0831 06 ARM 5209	Year: First	Term: Second
Course Title: Fisheries Legislation and Compliance		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	Bangladesh is rich in vast fisheries resources. To ensure appropriate conservation, management, and sustainable uses of fisheries resources legislation and implementation are prerequisites.	

Course Contents		CLOs
Section A		
1	Policy formulation and implementation: Common fisheries policy (CFP) of European Union and its importance; fisheries and subsidies; policy formulation for the proclamation and judicious implementation of fishery laws and regulations by national, international, and regional organizations	1, 2
2	Existing fishery regulations of Bangladesh: Marine Fisheries Act-2020; Bangladesh Fish Acts-1950 and subsequent amendments on 81, 89, 2000, 2006, 2007; Acts for Trade and Commerce	1, 2
3	Organizations involved in formulating and proclamation of laws: Department of Fisheries (DoF)-Marine Fisheries Wing, Regional commissions (BOBP, SAARC, etc); Ministry of Environment and Forest, Water Development Board, Local Government, International Sea Commission, FAO, International Whale Commission, Indo-Pacific Fisheries Commission, International Tuna Commission, GATT, WTO, FDA, EU/EC	3
Section B		CLOs
4	FAO-Code of Conduct for Responsible Fisheries (FAO-CCRF): Nature, scope and objective of the code; relationship with other international instruments; implementation, monitoring, and updating; special requirements of developing countries; fisheries management and fishing operations; integration of fisheries into coastal area management	4
5	Compliance of fishery regulations and FAO-CCRF: Participatory implementation of regulations; participatory monitoring, and evaluation of compliance; compliance of Bangladesh shrimp culture with FAO-CCRF	5
6	Implementation of the compliance and fish stock agreement: Administration, duties, and responsibilities of flag states; exchange of information; the scope of application of the compliance agreement; implementation into national law	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand common fisheries policy and help in policy formulation and implementation of fishery regulations.	PLO1, PLO4, PLO6, PLO8
	CLO2	Demonstrate the existing fisheries acts and	PLO4, PLO6,

		subsequent amendments of Bangladesh.	PLO8
	CLO3	Demonstrate different national and international organizations involved in the formulation and promulgation of fisheries laws and regulations.	PLO4, PLO7, PLO8
	CLO4	Implement the FAO-Code of Conduct for Responsible Fisheries in Bangladesh.	PLO4, PLO5, PLO6, PLO8
	CLO5	Analyzing the challenges of compliance of Bangladesh shrimp culture with FAO-CCRF.	PLO4, PLO6, PLO8
	CLO6	Understand the scope of application of compliance in Bangladesh and the implementation of compliance into national law.	PLO4, PLO6, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and interactive learning	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture and interactive learning	Presentation, Class test, Final Exam
CLO5	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO6	Lecture and Group Discussion	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Alam, S. N., Lin, C. K., Yakupitiyage, A., Demaine, H., & Phillips, M. J. (2005). Compliance of Bangladesh shrimp culture with FAO code of conduct for responsible fisheries: a development challenge. <i>Ocean & coastal management</i>, 48(2), 177-188. 2. FAO (2011). Code of conduct for responsible fisheries. FAO, Rome, Italy. 3. Freestone, D., Gudmundsdotti, E., & Edeson, W. (2001). Legislating for sustainable fisheries: a guide to implementing the 1993 FAO compliance agreement and 1995 UN fish stocks agreement. The World Bank. 4. Lado, E. P. (2016). The common fisheries policy: the quest for sustainability. John Wiley & Sons.
Supplementary Readings	

Course Code: 0831 06 ARM 5211	Year: First	Term: Second
Course Title: Fisheries Projects and Data management		
Course Status: Optional		
Credit: 3.0		
Prerequisite(s): None		
Rationale	To ensure sustainable fisheries management both GOs and NGOs of Bangladesh implement different fisheries projects. Therefore, knowledge of project implementation and data handling is essential for successful fisheries management.	

Course Contents		CLOs
Section A		
1	Introduction: Defining project and project management; project management vs. general management; goals and life cycles of projects; selecting projects to meet organizational objectives	1, 2
2	Project activity and risk planning: Project planning process; Sorting out the project—The Work Breakdown Structure (WBS); A whole-brain approach to project planning; identifying and understanding project stakeholders; risk identification and qualitative risk analysis; contingency plan; risk monitoring and control; SWOT analysis	1, 2
3	Evaluating and closing the project: project evaluation criteria and measurement; project auditing process; project closures and final report	3
4	Analyzing and evaluating different national and international fisheries projects: small and large scale fisheries	4
Section B		CLOs
5	Data and information: Defining research data and data management; categories and elements of data; Steven’s Scale of measurement, the necessity for managing research data, planning of data, data road map	5
6	Data management planning (DMP): Data sharing and documentation requirements; the extent of DMP; data and workflow	6
7	Data observation and recording: Fisheries data observation by humans; consideration for data observed by humans; fisheries data recording by humans; consideration for data recorded by humans; automated observation and recording; considerations for observation and recording with instrumentation; tasks associated with observation and recording; good data recording practices	5
8	Data structures and processing: Data collection formats; data storage structures; data integration; data exchange structures and concepts; data cleaning and standardization; mapping and formatting; conversions and calculations; data enhancement; data processing and research reproducibility	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Identify the goals of fisheries projects and select projects according to organizational objectives.	PLO1, PLO2, PLO7
	CLO2	Implement knowledge of project planning, identify risk, and analyze SWOT.	PLO3, PLO4, PLO6

	CLO3	Able to evaluate and audit different fisheries projects.	PLO1, PLO2, PLO7, PLO9
	CLO4	Categorize different fisheries data, implement data planning, and road map.	PLO1, PLO2, PLO7, PLO9
	CLO5	Apply different data collection tools and good data recording practices.	PLO1, PLO2, PLO7, PLO9
	CLO6	Integrate and standardize different fisheries data; map, format, and enhance data.	PLO1, PLO2, PLO7, PLO9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and interactive learning	Quiz
CLO2	Lecture and Enquiry based learning	Assignment
CLO3	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO4	Lecture and interactive learning	Presentation, Class test, Final Exam
CLO5	Lecture and Group Discussion	Presentation, Class test, Final Exam
CLO6	Lecture and Group Discussion	Presentation, Class test, Final Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> Mantel, S. J., Meredith, J. R., Shafer, S. M., & Sutton, M. M. (2001). Project management in practice. J. Wiley. Zozus, M. (2017). The data book: collection and management of research data. CRC Press.
Supplementary Readings	

Course Code: 0831 06 FGB5204	Year: First	Term: Second
Course Title: Dissertation Part - I		
Course Status: Core		
Credit: 4.0		
Prerequisite(s): None		
Rationale	This course is designed to provide the students an opportunity to conduct and write their thesis based on the knowledge of Project Work-1 and Research Methodology.	

Course Contents		CLOs
1.	This course serves as an introductory course in the dissertation methodology writing process. The focus of the course is the further development of the student's dissertation proposal of MS. The core objective of this course is to provide guidance and motivation to the MS student so those students have comprehensive understanding on the literature review and methodology.	1

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Understand the clear concepts about their thesis.	

			PLO8
	CLO2	Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.	
	CLO3	Undertake the research process and be aware of research obligations and pitfalls.	
	CLO4	Articulate research or project objectives clearly, situate research within an academic or scholarly context; state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.	
	CLO5	Utilize the relevant software and bibliographic reference manager competently and efficiently to produce documents that meet M.S. in FGB program requirements	

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration, project, modular, group discussion, seminar, workshop,	Presentation and viva

Second Year First Term

Course Code: 0111 06 RM 6102	Year: Second	Term: First
Course Title: Seminar–III		
Course Status: Core		
Credit: 2.0		
Prerequisite(s): None		
Rationale	The course is designed to have insights into practical aspects of review and research works relate to their thesis works.	

Course Contents		CLOs
1	Oral Presentation: Scientific papers presented at a level that is appropriate to the audience; clear and informative visual aids (simple, sufficient time).	1, 2, 3
2	Introduction: Overview of problem area provided; unfamiliar terms introduced; appropriate literature abstracted and presented clearly; research hypothesis of the study identified.	4
3	Methods: Brief overview of the equipment and materials used, and how obtained; brief overview of the experimental design used and any other parts of the methods employed; materials and/or equipment described; procedures followed to conduct the experiment presented.	5
4	Results: Anticipated and actual results reported; statistics clearly presented.	6
5	Discussion: Implications if the hypothesis is supported clearly stated; implications if the hypothesis is not supported clearly stated; limitations of your study discussed; future research addressed.	4,7
6	Questions: Demonstrated knowledge of the material; poised and confident, but no	6, 7

	bluffing; answered the question(s) asked (asked for clarification or restatement of the question).	
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Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Communicate science in a 30-40 minute oral scientific presentation.	PLO1, PLO2, PLO3
	CLO2	Understand and critique scientific presentations	PLO3, PLO4, PLO5
	CLO3	Create and implement a career plan to prepare for their identified career goals.	PLO3, PLO4
	CLO4	Identify actions to take in areas of fisheries science education, including research, and internship / experiential learning.	PLO1, PLO2, PLO3
	CLO5	Understand workplace expectations, communicate professionally, and identify and solve workplace conflicts.	PLO3, PLO4, PLO5, PLO9, PLO10
	CLO6	Understand the different types of interview questions and craft focused answers in response.	PLO3, PLO4
	CLO7	Construct a professional network.	PLO3, PLO9, PLO10, PLO11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Group discussions, short lectures, strong student involvement	Presentation
CLO2	Group discussions, guest panelists, strong student involvement	Presentation
CLO3	Group discussions, guest panelists, strong student involvement	Presentation
CLO4	Group discussions, guest panelists, strong student involvement	Presentation
CLO5	Group discussions, guest panelists, strong student involvement	Presentation
CLO6	Group discussions, guest panelists, strong student involvement	Presentation
CLO7	Group discussions, guest panelists, strong student involvement	Presentation

Learning Materials

Recommended Readings	
	<ol style="list-style-type: none"> 1. Kothari, C.R., 2004. <i>Research Methodology: Methods and techniques</i>. New Age International. 2. Bhamrah, H.S., Sandhu, G.S. and Gupta, K.C., 2006. <i>Research Techniques in Biological Science</i>. Dominant Publishers. 3. Yvonne N. Bui. <i>How to Write a Master's Thesis</i>. Third Edition. SAGE publications, Inc. 2020. P.298. ISBN-13: 978-1506336091, ISBN-10: 1506336094.

Course Code: 0831 06 CMS 6104	Year: First	Term: Second
Course Title: Dissertation-II		
Course Status: Core		
Credit: 12.0		
Prerequisite(s): None		

Rationale This course is designed for MS students to build on their research competencies. The purpose of this course is to get MS students going on their dissertation writing and become competent in basic research designs, which entails making judgments about matching research designs to particular research problems.

Course Contents		CLO
1	Possible methodological means of investigation around research topic.	1
2	Writing the dissertation	2, 3, 4
3	Presentation of the research work	4

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	Conduct research work (field arrangement, sample collection, data analysis) independently	PLO3, PLO4, PLO7, PLO8, PLO9, PLO10, PLO11
	CLO2	Articulate research objectives clearly, situate research within an academic or scholarly context; state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.	PLO7, PLO8, PLO9, PLO10, PLO11
	CLO3	Narrate the research process clearly in the form of a formal multi-chapter master's thesis manuscript, structured according to the approved MS thesis style in Khulna University.	PLO3, PLO4, PLO7, PLO8, PLO9, PLO10, PLO11
	CLO4	Describe research clearly and succinctly, in written and oral forms, to faculty, mentors, and potential sponsors.	PLO3, PLO4, PLO7, PLO8, PLO9, PLO10, PLO11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Instruction and guide.	Report and Presentation
CLO2	Instruction and guide.	Report and Presentation
CLO3	Instruction and guide.	Report and Presentation
CLO4	Instruction and guide.	Presentation, viva, Final dissertation report

20. Grading and Evaluation

20.1.1 Grading Scale

Letter Grades and corresponding Grade Points will be awarded following provisions shown below:

Numerical Grade	Letter Grade	Grade Point
80% or above	A+ (A plus)	4.00
75 to less than 80%	A (A regular)	3.75
70 to less than 75%	A- (A minus)	3.50
65 to less than 70%	B+ (B plus)	3.25
60 to less than 65%	B (B regular)	3.00
55 to less than 60%	B- (B minus)	2.75
50 to less than 55%	C+ (C plus)	2.50
45 to less than 50%	C (regular)	2.25
40 to less than 45%	D	2.00
Less than 40%	F	00
Incomplete	I	
Withdrawn	W	
Continuation (for project, thesis design, etc. course)	X	

20.1.2 Cumulative Grade Point Average (CGPA)

GPA will be calculated as per the standard practices at the undergraduate level of Khulna University. A student's performance will be evaluated in terms of three indices, viz. Term Grade Point Average (TGPA), Yearly Grade Point Average (YGPA), and Cumulative Grade Point Average (CGPA). The TGPA is computed by dividing the total points earned in a Term by the number of credits taken in the Term. The YGPA is computed by dividing the total grade points earned in two Terms in a year by dividing the number of credits taken in that year. The CGPA is computed by dividing the total grade points accumulated up to date by the total completed credits. Thus a student who has earned 275 grade points in attempting 100 credits of courses would have an overall CGPA of 2.75. The students will be awarded the Degree with Distinction, if their CGPA is 3.75 or above.

20.1.3 Evaluation of Theory Courses

All theory courses will be evaluated out of 100 marks. The marks will be distributed as follows:

Attendance:	10 Marks
Continuous Assessments:	30-40 Marks
Term Final:	50-60 Marks
Total:	100 Marks

20.1.4 Evaluation of Sessional Courses

All sessional courses will be evaluated out of 100 marks. The marks will be distributed as follows:

Attendance:	10 Marks
Sessional Assessments:	60 Marks
Viva voce:	30 Marks
Total:	100 Marks

- (a) For both theory and sessional courses, attendance shall carry 10 marks and the basis for awarding marks will be as follows:

Attendance (%)	Marks
≥ 90	10
85 to < 90	9
80 to < 85	8
75 to < 80	7
70 to < 75	6
65 to < 70	5
60 to < 65	4
< 60	0

- (b) The continuous assessments (30 to 40 marks) for theory courses may be conducted in the form of written class examinations, assignments, home-works, presentations, quizzes, viva voce, mid-term, etc. For any theoretical course, there shall be at least four assessments. Section best (A & B) assessments shall be counted. A mid-term Examination may be taken if a Discipline/POE opts for it. The concerned Discipline will allocate marks for mid-term and continuous other evaluations in such a case. The course teachers must submit the continuous assessment and sessional assessment mark sheets to the Chair of the Examination Committee before the starting of the Term final examination.
- (c) The remaining 50 to 60 marks will be allocated for the term final examination.
- (d) A student who fails in any course(s) in the Term final examinations or who registered for the course(s) but did not sit for the examination, the concerned course(s) will be considered as retake course(s).
- (e) A student retaking theory course(s) for clearing/passing or improvement must appear at the mid-term (if any) and Term final examinations. A student may attend continuous assessments also on the written approval of the Discipline Head; otherwise, the marks of continuous assessments will be maintained from the student's previous records. The marks of attendance will be carried forward from earlier Term. The obtained grade will be downgraded in case of retaking course(s).
- (f) Examination procedure related other guidelines of the latest 'Ordinance for Undergraduate Examination' of Khulna University will generally be applicable for the Master's programs, if not conflicting with this Ordinance.

20.1.5 Evaluation of Viva Voce

A Discipline may include Viva Voce of 01/02 credit(s) at the end of each Term. The concerned Examination committee of that Term will conduct the viva and assess the students out of 100 marks.

20.1.6 Dissertation under Mixed-mode

i) There will be two components of the Dissertation, namely Dissertation Part-I in one Term for proposal development, and Dissertation Part-II in another term for completing the Dissertation. The total credit for the Dissertation will be between **15 to 20 credits**. The credit allocation for proposal development and dissertation parts will be 3-5 credits and 12-15 credits, respectively.

ii) A Dissertation (both proposal and Dissertation) will be evaluated out of 100 marks.

Marks distribution of Dissertation Part-I will be as follows:

a) Assessment of Supervisor	30 marks
b) Proposal Presentation	70 marks

Marks distribution for Dissertation Part-II will be as follows:

a) Assessment of Supervisor	20 marks
b) Dissertation Evaluation	50 marks
c) Defense (Oral examination)	30 marks

iii) Dissertation Part-I will usually commence in the Master's first-year second-term and Dissertation Part-II in the second-year first-term (final Term).

iv) The final evaluation of the Dissertation Part-II will be made at the end of the final Term. However, the evaluation of the Dissertation Part-I will be done in the corresponding Term.

v) A student registered for Dissertation will undertake research work under the guidance of a supervisor and a co-supervisor (if necessary).

vi) The research needs to be carried out in this University or at the appropriate place(s) approved by the Supervisor in consultation with the Discipline Head.

vii) There shall generally be one Supervisor for each student, but a co-supervisor may also be appointed if needed. A teacher not below the rank of Assistant Professor will act as supervisor/co-supervisor. However, a Lecturer with MPhil/ Master's by Research/ Ph.D. degree is eligible to supervise/co-supervise a student. Co-supervision may also be allowed from other Disciplines of Khulna University/other universities or research institutes.

viii) If a student has any grievance about a Supervisor, or if a Supervisor has any complaint against a student, s/he may inform the Discipline Head about the issue in writing. The Discipline will decide such matters.

ix) Pursuant to the leave rules of Khulna University, a Supervisor can remain absent from Khulna University (not more than six months) while continuing as a Supervisor. The online defense may be arranged in such cases if deemed necessary. Otherwise, the Co-supervisor (if any) or any other competent person will act as the Supervisor as per the guideline of the concerned Examination Committee. This will be applicable for projects and internships also.

x) Every student submitting a dissertation in partial fulfillment of the requirements of a degree will be required to appear at proposal presentation for Dissertation Part-I and defense board of Dissertation Part-II respectively on the dates fixed by the Discipline Head in consultation with the Supervisor(s). Such presentation and defense may be arranged online if deemed necessary to the concerned authority. A student must satisfy the examiners that s/he is

capable of undertaking independent work and affording evidence of satisfactory knowledge related to the theory and techniques used in his/her research work.

- xi) A student must submit the required number of printed and soft copies of Dissertation Part-II in the approved format through the Supervisors to the Discipline Head by a date to be fixed by the Discipline. The Dissertation will not usually be considered for evaluation if the plagiarism detection system yields a similarity index of more than 25% (excluding bibliography/references, quotes, and small sources with source exclusion threshold of **ten-word** counts). This will be applicable to the dissertations written in English. The curriculum of the concerned program will provide a specific guideline on this issue.
- xii) Each student shall certify that the research work is his/her own and that the work was not submitted elsewhere for any other degree or diploma - the entire work has not been published as a monograph or a book before the Degree is awarded.
- xiii) If any change is required in the title/supervisor/co-supervisor/examiner/etc., the Discipline Head will send it to the BOAS through EC.

20.1.7 Project under Mixed-mode

- (i) A student undertaking a project work will register 03-06 credits usually in the second-year first-term (final Term) under the guidance of a Supervisor. A teacher with MPhil/ Master's by Research/ Ph.D. degree can supervise a student. The project work should be carried out in this University or at the appropriate place(s) approved by the Supervisor in consultation with the Discipline Head.
- (ii) A project will be evaluated out of 100 marks. Marks distribution of the project will be as follows:

Assessments of the Supervisor	20 marks
Project Report evaluation	50 marks
Defense (Oral examination)	30 marks

- (iii) Final evaluation of the project report will usually be made at the end of the final Term for the student.
- (iv) A student must submit the required number of printed and soft copies of the project report in the approved format through the supervisors to the Discipline Head by a date to be fixed by the Discipline. The project report will not usually be considered for evaluation if the plagiarism detection system yields more than 25% (excluding bibliography/references, quotes, and small sources with a source exclusion threshold of **ten-word** counts). This will be applicable to the reports written in English. The curriculum of the concerned program will provide a specific guideline on this issue.
- (v) Each student shall certify that the research work is his/her own and that the work was not submitted elsewhere for any other degree or diploma - the entire work has not been published as a monograph or a book before the Degree is awarded.

20.1.8 Internship under Mixed-mode

- (i) A student may be offered an internship usually in the second-year first-term (final Term). In such a case, the credit will be 03-06 Credits. There will be a Supervisor. A teacher with a

post-graduate degree is capable of supervising an internship. The evaluation of the internship will be as follows:

- | | | |
|----|--|----------|
| a) | Continuation of the work (by Supervisor) | 20 marks |
| b) | Report evaluation | 50 marks |
| c) | Defense (Oral examination) | 30 marks |

(ii) A student must submit the required number of printed and soft copies of the internship report in the approved format through the supervisors to the Discipline Head by a date to be fixed by the Discipline. The report will not usually be considered for evaluation if the plagiarism detection system yields more than 25% (excluding bibliography/references, quotes, and small sources with a source exclusion threshold of **ten-word** counts). This will be applicable to the reports written in English. The curriculum of the concerned program will provide a specific guideline on this issue.

(iii) Each student shall certify that the research work is his/her own and that the work was not submitted elsewhere for any other degree or diploma - the entire work has not been published as a monograph or a book before the Degree is awarded.

20.1.9 Master's by Research Program Note: miTHU ignore this section

(i) The students under 'Master's by Research' program have to register for four parts of the Dissertation as follows:

Sl. No.	Course	Year	Term	Min. credit	Max. credit
1	Dissertation Part-I	1	1	8	10
2	Dissertation Part-II	1	2	10	15
3	Dissertation Part-III	2	1	12	15
4	Dissertation Part-IV	2	2	15	20

(ii) A Dissertation (Part I-IV) will be evaluated out of 100 marks. Marks distribution of Dissertation Part-I, II, and III will be as follows:

- | | | |
|----|--------------------------|----------|
| a) | Assessment of Supervisor | 30 marks |
| b) | Presentation | 70 marks |

(iii) Marks distribution for Dissertation Part-IV will be as follows:

- | | |
|----------------------------|----------|
| Assessment of Supervisor | 20 marks |
| Dissertation Evaluation | 50 marks |
| Defense (Oral examination) | 30 marks |

(iv) Usually research topic selection, title, rationale, objective, research question, literature review, sampling, research design, experiment, survey, data/information collection, analysis, result, discussion, policy implication, limitation, reference, annex, etc. related various issues will be covered (as applicable) under these four parts. The curriculum of the concerned program will provide a detailed description of coverage, objective, learning outcome, credit, etc., of these four parts.

(v) A student registered for Dissertation will undertake research under the guidance of a Supervisor and a Co-supervisor (if necessary).

(vi) The research needs to be carried out in this University or at the appropriate place(s) approved by the Supervisor in consultation with the Discipline Head.

- (vii) There shall normally be one Supervisor for each student, but a co-supervisor may also be appointed if needed. A teacher not below the rank of Assistant Professor will act as Supervisor/Co-supervisor. However, a Lecturer with MPhil/ Master's by Research/ Ph.D. degree is eligible to supervise/co-supervise a student. Co-supervision may also be allowed from other Disciplines of Khulna University/other universities or research institutes.
- (viii) If a student has any grievance about a Supervisor, or if a Supervisor has any complaint against a student, s/he may inform the Discipline Head about the issue in writing. The Discipline will decide such matters.
- (ix) Pursuant to the leave rules of Khulna University, a Supervisor can remain absent from Khulna University (not more than six months) while continuing as a Supervisor. The online defense may be arranged in such cases if deemed necessary. Otherwise, the Co-supervisor (if any) or any other competent person will act as the Supervisor as per the guideline of the concerned Examination Committee.
- (x) Final evaluation of the Dissertation Part-IV will be made at the end of the final Term. However, the Dissertation Part-I, II, and III will be evaluated in the corresponding terms.
- (xi) Every student submitting a dissertation in partial fulfillment of the requirements of a degree will be required to appear at a seminar presentation for Dissertation Part-I, II, and III and defense board for Dissertation Part-IV respectively on the dates fixed by the Discipline Head in consultation with the Supervisor (s). Such seminar presentation and defense may be arranged online if deemed necessary to the concerned authority. A student must satisfy the examiners that s/he is capable of undertaking independent work and affording evidence of satisfactory knowledge related to the theory and techniques used in his/her research work.
- (xii) After successfully completing the seminar and dissertation defense boards, the Chairman of the concerned boards shall arrange to send six-monthly progress reports for each student in each Term to the Dean for approval. Accordingly, the Dean will approve the progress reports and report to BOAS. Progress reports shall be submitted before the end of each Term, even if the Supervisor is on leave; otherwise, the student(s) shall not be allowed to register for the following Term.
- (xiii) A student must publish (or at least accepted for publication) an article/paper in a peer-reviewed journal or a peer-reviewed conference paper in order to complete 'Master's by Research' Degree.
- (xiv) A student must submit the required number of printed and soft copies of Dissertation Part-IV in the approved format through the supervisors to the Discipline Head by a date to be fixed by the Discipline. The Dissertation will not usually be considered for evaluation if the plagiarism detection system yields a similarity index of more than 25% (excluding bibliography/references, quotes, and small sources with source exclusion threshold of **ten-word** counts). This will be applicable to the dissertations written in English. The curriculum of the concerned program will provide a specific guideline on this issue.
- (xv) Each student shall certify that the research work is his/her own and that the work was not submitted elsewhere for any other degree or diploma - the entire work has not been published as a monograph or a book before the Degree is awarded.
- (xvi) If any change is required in the title/supervisor/co-supervisor/examiner/etc., the Discipline Head will send it to the BOAS through EC.

20.1.10 Credit Requirement and Duration of the Program

The required credits and duration for Master's Programs are mentioned below.

Program type	Credit Requirement				Program Duration			
	Coursework (Min.)	Dissertation (Min.)	Dissertation (Max.)	Total (Min.)	Term (Min.)	Year (Min.)	Term (Max.)	Year (Max.)
Coursework	40	-	-	40	02	1.0	06	3.0
Mixed-mode (Dissertation)	20	15	20	40	03	1.5	06	3.0
Mixed-mode (Project)	20	3	6	40	03	1.5	06	3.0
Mixed-mode (Internship)	20	3	6	40	03	1.5	06	3.0
Research	-	45	60	45	04	2.0	06	3.0

The details of each Term Duration will be as follows:

Item	Duration
Teaching and continuous assessment/ Contact with Supervisor	14 weeks
Preparatory leave before: Final Examination/ Seminar/ Defense	02 weeks
Final Examination/ Seminar/ Defense	(Maximum) 04 weeks
Term Break	02 weeks
Total	22 weeks

20.1.11 Course Types

The courses included in the Master's curriculum may be divided into three groups as follows:

- (i) **Core Courses:** Core courses are obligatory for a degree.
- (ii) **Optional Courses:** Any other courses students may undertake to earn the Degree.
- (iii) **Major Courses:** A Discipline may offer courses from one or more major areas (if any), and after completing a certain number of credits from that area (as reported in the following table), a student can achieve a Master's degree with a major in a specified field, and that will be mentioned in the Transcript, e.g., MS in Agrotechnology (Horticulture). The curriculum of the concerned program will provide a detailed description of such cases.

Credit Requirements for Offering Major

Program type	Min. credit requirement from major area*			
	Coursework (Min.)	Dissertation (Min.)	Dissertation (Max.)	Min. from Major Area
Coursework	20	-	-	20
Mixed-mode (Dissertation)	9	15	20	20
Mixed-mode (Project)	15	3	6	20
Mixed-mode (Internship)	15	3	6	20
Research	-	45	60	45

* For achieving a Master's degree with a major in a specified field under a mixed-mode or 'Master's by Research' scheme, the concerned dissertation must be directly linked with the 'major area' under consideration.

(iv) **Viva Voce:** A Discipline may include Viva Voce of 01/02 credit(s) at the end of each Term. The concerned Examination committee of that Term will conduct the viva and assess the students out of 100 marks.

(v) **Assignment of Credit:**

Theory Courses: For theory courses, one-hour face-to-face learning (e.g., lecture, tutorial, seminar) per week will be equivalent to one credit.

Sessional Courses: For sessional courses, 1.5-hour face-to-face learning (e.g., lab work, studio, fieldwork, or clinical work) per week is equivalent to 1.0 credit. For industrial/ workplace learning, 2-hour learning per week is equivalent to 1.0 credit.

In addition to face-to-face and other means of learning, online teaching-learning might be exercised if deemed necessary to the Discipline/POE.

20.1.12 Course Registration

- (i) Each student will get oneself registered with the University. S/he will fill in the course registration form in consultation with the Program Coordinator under the guidance of the Discipline Head. The Program Coordinator will verify the form and submit it to the Discipline Head for forwarding it to the Registrar's office. Such submission might be made online, when and where applicable. The Registrar's office will be responsible for its distribution to relevant authorities (Disciplines and the Controller of Examinations). Course registration will be permitted within five working days at the beginning of each Term. Late registration will be permitted up to the next five working days on payment of a late fee. Student(s) having outstanding dues to the University shall not be permitted to register.
- (ii) A student has to register for the backlog/retake/re-retake core courses first followed by the fresh courses offered by the Discipline for the term s/he is going to enroll subject to the compliance with: (i) completion of prerequisite courses (if any) and (ii) maximum credit registration limit per Term. However, s/he may not choose to register the optional backlog/retake/re-retake courses first.
- (iii) A student may be allowed to register for advance course(s) in a term subject to: (i) his/her all backlog/retake/re-retake and offered core courses are either clear or registered, (ii) his/her current terms' offered all core courses are registered, (iii) completion of corresponding prerequisite courses (if any), (iv) compliance with maximum credit registration limit per Term, and (v) the desired advance courses are offered by the Discipline/POE in the current Term. However, such an advance course registration option will not be applicable for capstone courses like Thesis/ Project/ Internship/ and so on.
- (iv) A student retaking/re-retaking the course will be awarded the immediate lower grade he/she obtains, and this grade will be shown and maintained on the Transcript.
- (v) A Discipline/POE will not continue an optional course if less than 30 percent of students (of total seats for that batch) register for that course within ten working days from the beginning of classes. The situation will be solved by dropping that optional course through applying article 10.3 of MS Ordinance by the next five working days. The Coordinator will maintain such records and act accordingly. However, the concerned Discipline/POE might relax this clause for only final term/year optional courses if it is deemed necessary (for example, the studentship will be toward termination or the student will have to wait for additional term/year if the considered optional course(s) are not offered).

20.1.13 Limits on the Credits to be taken in a Term

Discipline Head may allow a student to register up to a maximum of 25 credits if recommended by the Program Coordinator. However, there is no minimum credit limit per Term in Master's level study.

20.1.14 Course Adjustment Procedure

A student will have the option to add or drop course(s) from his/her registration list within fifteen working days from the beginning of classes. This can be done with the advice of the concerned Program Coordinator and consent of the Discipline Head. Adjustment of initially registered courses in any Term can be made by duly filling in the Adjustment Form. The Registrar's office will do the needful.

20.1.15 Withdrawal from a Term

If any student cannot complete the Term Final Examination due to severe illness or serious accident, he/she may apply to the Dean through the Head for total withdrawal from the Term within eight working days after the end of the Term Final Examination. However, s/he may choose not to withdraw from any sessional courses if the grade obtained in such a course is 'C' or better. A medical certificate endorsed by the Chief Medical Officer of the University must support the application. The Dean of the concerned school will decide on such an application and inform the Registrar. If a student is allowed to withdraw from a Term, he/she will have to register as fresh for the Term he/she has withdrawn. However, he/she may be allowed to register for backlog courses, if offered.

20.1.16 Absence in a Term

A student may be absent from continuous assessments (quizzes/class test/field works, etc.) during the Term. Such absences will naturally reduce points/marks, which count towards the final grade. Absence in the Mid Term (if any) and the Term Final Examination will result in 'F' grade. A student who has been absent for short periods, up to a maximum of three weeks due to illness, should request the Course Teacher or Program Coordinator to makeup continuous assessments immediately on returning to the class. A medical certificate should support such request from the Chief Medical Officer of Khulna University. The medical certificate issued by registered medical practitioners (with the registration number shown explicitly on the certificates) and endorsed by the Chief Medical officer of the University will also be acceptable only in those cases where the student has valid reasons for his absence from the University.

20.1.17 Special Term

Students having any retake/re-retake course(s) may apply for a special Term to complete the total required course (maximum 09 credits) in that Term. The special Term will be offered for the final term students who have retake/re-retake courses. The examination will start four (04) weeks after publication of the result and will continue not more than 2 (two) weeks. The marks of both attendance and continuous assessments will be carried over from the previous record.

20.1.18 Registration for Improvement

If any student gets a 'D' to 'C+' grade in any course, s/he may be allowed to repeat that course to improve the grade. The previous grade will be replaced from the grade sheet in such a case.

20.1.19 Backlog

If a student obtains an 'F' grade in any Core course in any term, this 'F' grade will not be counted for Grade Point Average (GPA) but will be shown on the grade sheet, and in such case, he/she will have to retake the course to complete the Degree. If a student does not register for an offered Theory or Sessional course in his/her applicable Term (for example, '0541 12 Math 5101' course in his/her Master's first year first term, '0541 12 Math 5203' course in his/her Master's first year second term, '0541 12 Math 6104' course in his/her Master's second year first term), that course will be considered as a 'Backlog' course for that student in the subsequent terms. If a student gets an 'F' grade in an Optional course, he/she may, subject to availability, choose to take an optional substitute course. In such a case, that substitute course will be deemed as a fresh course. In case of registering for a Backlog Theory or Sessional course, a student has to face/appear/attend 100 marks evaluation, like a fresh course.

20.1.20 Credit Transfer/ Credit Waiver

This ordinance permits credit transfer to facilitate educational mobility. That transfer of credit(s) may be inward or outward. In the case of outward credit transfer, a student of Khulna University has to apply to the Registrar through the Head of the Discipline/POE for getting a credit transfer certificate. The application must be supported by necessary documents, including a copy of the grade sheet(s). Accordingly, the Registrar will issue a credit transfer certificate mentioning the number of credits already completed at Khulna University.

In case of inward credit transfer, students from other Universities/ Institutions may apply to the Registrar of Khulna University for credit transfer. The application must be supported by necessary documents, including a copy of grade sheet(s) and curriculum. The Registrar's office will forward the application to the concerned Discipline/POE. A three-member committee headed by the Discipline Head and two senior most teachers will assess the application and recommend for approval to the Registrar. The maximum limit of credit transfer from other Universities/ Institutions will be less than or equal to 50 percent of the total credits required to complete the concerned Degree. The final transcript of such students will show only the number of credits transferred.

The same process may be applied for handling the credit waiver related applications. However, the maximum limit of inward credit waiver from other Universities/ Institutions should be less than or equal to 20 percent of the total credits required to complete the concerned Degree.

20.2 Grades

Grade related issues are reported in section 20.1.

20.3 Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

a) Grade Point Average (GPA) is the weighted average of Grade Points obtained in all the courses passed/completed by a student. For example, if a student has passed/completed five courses in a term having credits of C1, C2, C3, C4, and C5 and his/her points in these courses are G1, G2, G3, G4, and G5, respectively, then,

$$\text{GPA} = \frac{\sum C_i G_i}{\sum C_i}$$

b) A Numerical Example: Suppose a student has completed five courses in a term and obtained the following grades:

COURSE	CREDIT	GRADE	GRADE POINT
A	3	A+	4.00
B	3	C+	3.00
C	3	A	3.75
D	2	B	3.25
E	1	B+	3.50

Then his/her GPA for the term will be computed as follows:

$$\text{GPA} = \frac{3(4.0) + 3(3.0) + 3(3.75) + 2(3.25) + 1(3.5)}{3 + 3 + 3 + 2 + 1} = 3.52$$

c) A student's performance will be evaluated in terms of three indices- Term Grade Point Average (TGPA), Yearly Grade Point Average (YGPA), and Cumulative Grade Point Average (CGPA). The TGPA is computed by dividing the total points earned in a Term by the number of credits taken in the Term. The YGPA is computed by dividing the total grade points earned in two Terms in a year by dividing the number of credits taken in that year. The CGPA is computed by dividing the total grade points accumulated till date by the total completed credits. Thus a student who has earned 275 grad points in attempting 100 credits of courses would have an overall CGPA of 2.75.

20.4 Course Withdrawal

- a) 'W' is the corresponding grade for withdrawn of a course, as mentioned in section 20.1.1.
- b) If any student cannot complete the Term Final Examination due to severe illness or serious accident, he/she may apply to the Dean through the Head of the concerned Discipline for total withdrawal from the Term within eight working days after the Term Final Examination. However, he/she may choose not to withdraw from any sessional course if the grade obtained in such a course is C or better. A medical certificate endorsed by the Chief Medical Officer of the University must support the application. The Dean of the concerned School will decide on such an application and inform the Academic Council. If a student is allowed to withdraw from a Term, he/she will have to register as fresh from the Term he/she has withdrawn. However, he/she may be allowed to register for backlog courses, if offered.

20.5 Incomplete (I) Courses

'I' is the corresponding grade for an incomplete course, as mentioned in section 20.1.1.

20.6 Retake

Retake related issues are reported in section 20.1.

20.7 Grade Improvement

Grade improvement related issues are reported in section 20.1.

20.8 Dropout/Cancellation of Studentship

Dropout/Studentship cancellation related guidelines of the latest 'Ordinance for Undergraduate Examination' of Khulna University will generally be applicable for the Master's programs, if not conflicting with this Ordinance.

20.9 Publication of Results

- (i) The Controller of Examinations will publish the result and preserve all the records for one year after the Degree is awarded. The result will be published subject to completing the required number of credits and fulfilling other requirements (for example, article/paper for 'Master's by Research' mode students) within the stipulated time limit, as applicable.
- (ii) A student can have his/her results re-examined by applying to the Controller of Examinations within 30 working days from the date of publication of results. However, s/he

has to pay a re-examination fee fixed by the concerned authorities. The Controller of Examinations will take necessary measures regarding the matter in consultation with the Chairman of the Examination Committee. Answer script re-scrutiny and result re-examination related rules of the latest 'Ordinance for Undergraduate Examination' of Khulna University will generally be applicable for the Master's programs also.

20.10 Subsequent Ordinances

For related/relevant issues, which are not covered (or not cleared) here, provisions of the latest 'Ordinance for Undergraduate Program' and 'Ordinance for Undergraduate Examination' of Khulna University may be consulted and applied, if not conflicting with this Ordinance.