

TEMPLATE OF OUTCOME-BASED CURRICULUM 2022



Institutional Quality Assurance Cell (IQAC)

Khulna University, Khulna 9208

Bangladesh

**Outcome-based Curriculum of
Master of Science in Fish Processing and Quality
Control**



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

OUTCOME-BASED CURRICULUM

PART-A

01. Title of the Academic Program

Master of Science in Fish Genetics and Biotechnology

Program Overview	
Degree	Master of Science in Fish Processing and Quality Control
Abbreviated form of the Degree	MS in Fish Processing and Quality Control
Discipline/Program Offering Entity (POE)	Fisheries and Marine Resource Technology Discipline
School	Life Science 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 and 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
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	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 Fish Processing and Quality Control

10. Description of the Program

Fisheries & Marine Resources Technology Discipline (FMRT) is one of the important disciplines under the Life Science School of Khulna University, which started its journey in 1992, the second year of establishment of Khulna University. FMRT Discipline has been rendering Master Program in Fish Processing and Quality Control since 2008, although MS in Fisheries started in 1997. FMRT Discipline is committed to improve 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 Fish Processing and Quality Control is to generate scholars who can take challenges for intellectual property protection, sustainable utilization and posterity through quality assessment, improvement and maintaining food safety procedures. The ultimate goal of the programme is to improve the quality of fish and sea foods and to ensure food safety issues in all aspects of food supply chain including harvesting, preservation, processing, transport and marketing.

11. Graduate Attributes

GA1	Comprehensive knowledge in research	[<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	To provide quality education with the highest academic excellence in line with the international educational standard;
PEO2	To generate skilled manpower in order to preserve and process fish and fishery products;

PEO3	To undertake fundamental and applied research in order to endow developed knowledge and experience to students about the fish processing and quality control;
PEO4	To produce capable manpower to contribute for fulfilling the global demands by equitable participation; and
PEO5	To impart technology based and need oriented higher education befitting the age.
PEO6	To provide quality education with the highest academic excellence in line with the international educational standard;

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	Acquire knowledge and understanding in various aspects of fish processing and quality control
PLO2	Expose innovative ideas, credentials and intellectuals in all levels in the field of fish processing and quality control
PLO3	Collect, analyze and interpret required data and make decision for probable solution for any raised problems associated with fish processing and quality control
B. Social Skills	
PLO4	Demonstrate social values and practice professional ethics in the conduct of science;
PLO5	Communicate and interact effectively for social, academic and professional purposes;
C. Thinking Skills	
PLO6	Judge the veracity and value of scientific outcomes related to fish processing and quality control
D. Personal Skills	
PLO7	To provide students with an introduction to the theoretical background and practical applications of fish processing and quality control

PLO = Program Learning Outcome

14. Mapping Mission of the University with PEOs

PEOs \ Missions	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

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	PEO5	PEO6
A. Fundamental Domain	PLO1	*					
	PLO2		*				
	PLO3		*	*			
B. Social Domain	PLO4					*	*
	PLO5				*		
C. Thinking Domain	PLO6		*	*			
D. Personal Domain	PLO7					*	

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 FPQC 5101	Wet Fish Handling and Quality Loss	X	X			X				X
0311 06 FPQC 5103	Applied Fisheries Microbiology	X	X	X	X			X		
0311 06 RM 5102	Seminar-I Research Methodology	X	X				X		X	
<i>Optional Course</i>										
0831 06 FPQC 5105	Modern Fishing Technology	X	X		X	X			X	
0831 06 FPQC 5107	Advanced Fish Processing	X	X					X	X	
First Year Second Term										
<i>Core Course</i>										
0831 06 FPQC 5201	Legislation and Standards of Fishery Products	X	X		X	X		X		X
0831 06 FPQC 5203	Industrial Fish Processing and Quality Control	X	X			X			X	
0311 06 RM 5202	Seminar-II: Data Analysis and Management	X	X	X			X		X	X
0831 06 FPQC 5204	Dissertation – Part I	X		X			X		X	X
<i>Optional Course</i>										
0831 06 FPQC 5205	Fishery Products and By-Products Technology	X	X			X			X	
Second Year First Term										
<i>Core Course</i>										
0831 06 FPQC 6102	Seminar-III	X	X	X			X		X	X
0831 06 FPQC 6104	Dissertation- Part II	X		X			X		X	X

OUTCOME-BASED CURRICULUM

PART-B

17. Structure of the Curriculum

a) Duration of the Program	1.5 years	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 43 credits including core 32 and optional 9 credits	
d) Total Class Weeks in a Term*	14	
e) Minimum CGPA Requirements for Graduation	3.0	
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	1	3	09
	Sessional	3	6	
Core/Compulsory Courses	Theory	4	12	34
	Sessional	5	6+16	
Optional/Elective Courses	Theory	3	9	9
	Sessional			
Capstone Courses***	Sessional	2	16	16
Total				

** 14% from GED courses

*** Thesis, project, internship etc. courses

g2) Category of Courses

Area	Course Type	Course Title	Credits
General Education (GED) Courses	Theory	1. Applied Fisheries Microbiology	03
	Sessional	1. Seminar I 2. Seminar II 3. Seminar III	06
Core/Compulsory Courses	Theory	1. Wet Fish Handling and Quality Loss 2. Applied Fisheries Microbiology 3. Legislation and Standards of Fishery Products 4. Industrial Fish Processing and Quality Control	12
	Sessional	1. Seminar I 2. Seminar II 3. Seminar III	06
Optional/Elective Courses	Theory	1. Modern Fishing Technology 2. Advanced Fish Processing 3. Fishery Products and By-Products Technology	12
	Sessional		
Capstone Courses	Sessional	1. Dissertation I 2. Dissertation II	16
Total			

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 FPQC 5101	Wet Fish Handling and Quality Loss	Core	3		3	None
0831 06 FPQC 5103	Applied Fisheries Microbiology	Core	3		3	None
0311 06 RM 5102	Seminar-I Research Methodology	Core		3	2	None
Optional Course						
0831 06 FPQC 5105	Modern Fishing Technology	Optional	3		3	None
0831 06 FPQC 5107	Advanced Fish Processing	Optional	3		3	None
Total	Core: Theory - 02; Sessional – 01, Optional: Theory - 02		18	3	14	
First Year 2nd Term						
Course Code	Course Title	Course status	Contact hours/week		Credits	Prerequisites
			Core Course			
0831 06 FPQC 5201	Legislation and Standards of Fishery Products	Core	3		3	None
0831 06 FPQC 5203	Industrial Fish Processing and Quality Control	Core	3		3	None
0311 06 RM 5202	Seminar-II: Data Analysis and Management	Core		3	2	None
0831 06 FPQC 5204	Dissertation – Part I	Core		8	4	None
Optional Course						
0831 06 FPQC 5205	Fishery Products and By-Products Technology	Optional	3		3	None
Total	Core: Theory - 02; Sessional – 02, Optional: Theory - 01; Sessional - 0		18	11	15	
Second Year First Term						
Course code	Course Title	Course status	Contact hours/week		Credits	Prerequisites
			Theory	Sessional		
Core Course						
0831 06 FPQC 6102	Seminar-III	Core		3	2	
0831 06 FPQC 6204	Dissertation – Part II	Core		24	12	
Total	Core Sessional Course - 02			27	14	

19. Course Description

First Year First Term

Course Code: 0831 06 FPQC 5101	Year: 1st	Term: 1st
Course Title: Wet Fish Handling and Quality Loss		
Course Status: Core		
Credit:3.0		
Prerequisite(s): None		
Rationale	The course will provide basic scientific knowledge on adequate fishing, handling and preservation techniques of wet fish. It will particularly focus on different on-board and on-shore sorting, grading, transportation, icing, freezing and other preservation methods, as well as domestic marketing. Major discussion in this course will be made on i) how fishing methods affect the quality of fish; ii) wet fish preparation, distribution and preservation techniques iii) problems in fish preservation; iv) hygienic procedures of wet fish handling and preservation; v) discuss live carriage of fish and shellfish	

Course Contents		CLOs
Section A		
1	Harvesting methods and their impacts on quality of wet fish: general principles of fish preservation, methods of harvesting and its impact on fish quality, abusive handling, stress at the time of harvesting, effect of stress on post-harvest quality, ways of controlling physical stress and injury	1
2	Handling and preservation of fish: handling of fish on-board fishing vessel, icing and chilling of fish, bulk icing at deep sea, icing after landing, handling of ice, alternatives to direct icing, chilling by refrigerated sea water (RSW) and chilled sea water (CSW); handling and icing of fish at landing, during distribution and marketing; washing of fish.	1
3	Fish spoilage mechanisms and quality assurance: spoilage of fish, factors aggravating spoilage, delaying of spoilage, chemical and microbiological changes during spoilage, rigor mortis in fish and its effects on fish quality, gapping and drip loss during preservation.	1,2
4	Wet fish preparation techniques: washed & dressed fish, gutted fish, fish chunk, fish fillets, boned fish, boneless fish, split fish, skinned fish, steaking, fish fingers, fish loins and fish mince/surimi; peeled and deveined shrimp/prawn, butterfly prawn, etc.	3
5	Problems during fish preservation: pigmentation in shrimp and prawn, control measures, infestation in preserved fish and ways to control, dehydration and freeze-burn, gapping and drip-loss	4
6	Post-harvest loss in wet fish during distribution and preparation: types of post-harvest loss and its causes, present status, landing and distribution of fish in Bangladesh, fish in food security, assessment of post-harvest loss and its prevention	5
Section B		CLOs
7	Hygienic procedures: hygiene for equipment and utensils, equipment safety and hygiene regulations, hygienic clothing, personnel hygiene and occupational safety, on-board hygiene maintenance, hygiene during handling and transport of wet fish	6

8	Cleaning and disinfection: cleaning, disinfection and control; cleaning agents, characteristics of ideal cleaning agents; cleaning system, disinfection, commonly used disinfectants, control of disinfection	6
9	Live carriage of food fish: general principles, advantages, approach to international and domestic markets, design and criteria of containers and vehicles, recent development in live carriage of fish and shellfish in Bangladesh	7
10	Ice and cold storage: types and application of ice, hygienic preparation of ice, ice crushers, design and construction of chill stores - physical and technical parameters	8

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	explain fishing methods and their impacts on quality of harvested fish	
CLO2	acquire insight into mechanisms behind quality changes of wet fish		PLO1, PLO2, PLO4
CLO3	apprehend different methods of on-board and on-shore fish handling and preservation		PLO1, PLO2, PLO4
CLO4	identify the problems associated with wet fish handling and preparation		PLO1, PLO2, PLO4
CLO5	acquire a detailed knowledge on post-harvest loss due to improper handling and preservation		PLO1, PLO2, PLO4
CLO6	acquire a detailed knowledge on hygiene practice in every handling sectors and procedures of cleaning and disinfection of the material used for different purposes		PLO1, PLO2, PLO4
CLO7	know the process of live fish transportation systems		PLO1, PLO2, PLO4
CLO8	know the process of different types of ice preparation and their uses		PLO1, PLO2, PLO4, PLO7

Mapping CLOs with the Teaching-Learning and Assessment Strategy		
CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Demonstration	Assignment, Oral Presentation, Written Exam
CLO2	Lecture, Audio-visual material	Written Exam
CLO3	Lecture, Demonstration	Written Exam
CLO4	Lecture, Demonstration	Assignment, Oral Presentation, Written Exam
CLO5	Lecture, Audio-visual material	Assignment, Oral Presentation, Written Exam
CLO6	Lecture, Demonstration	Assignment, Oral Presentation, Written Exam
CLO7	Lecture, Audio-visual material	Written Exam
CLO8	Lecture, Demonstration	Written Exam

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation, demonstration

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none">1. I J Clucas and A R Ward. Post-Harvest Fisheries Development: A Guide to Handling, Preservation, Processing and Quality. Natural Resources Institute.2. Sheelagh Johnson and Ivor Clucas. Maintaining Fish Quality. Natural Resources institute3. Nowsad, A.K.M. 2014. Post-harvest Fishery Losses and Mitigation Measures.346 p.4. Nowsad, A.K.M., 2007. Participatory training of trainers: a new approach applied in fish processing. BFRF.5. Burgess, G. ed., 1966. Fish handling & processing (Vol. 21). HM Stationery Office.
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Course Code: 0831 06 FPQC 5103	Year: 1 st	Term: 1 st
Course Title: Applied Fisheries Microbiology		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		

Rationale	The course will provide basic scientific knowledge on microbes and their potential role in spoilage of fish and shellfish. There are some common food spoilage bacteria associated public health concern and some are associated with causing hazard in industrial fish processing units. Therefore, concepts of applied and industrial microbiology are impertinent to ensure safe fish and fish products for human consumption.
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Course Contents		CLOs
Section A		
1	Microbes in fish: Virus, bacteria, fungus; their importance in aquaculture, fish spoilage, food poisoning and their sources.	1
2	Microbes in fish processing: microbiology in chilled, canned, frozen, smoked, dried and fermented fishery products.	1
3	Public health hazards: significance; public health indicator organisms in fish and shellfish; recovery of public health pathogen, food infection and food poisoning.	2
4	Shellfish microbiology: Molluscan and crustacean microbes and their management.	1
5	Control of microbes in wet and processed fish: wet and dressed fish, fish fillet and other wet fish products, frozen, dried, smoked, canned, fermented and salted fish; fish mince and value-added products.	3
Section B		
7	Rapid detection of microbes: sampling and sample preparation, alternative methods for the cell count procedure, new methods for estimation of microbial population and biomass, miniaturized microbiologic techniques	4
8	Basic Microbial genetics: nature, structure and function of genetic materials of bacteria and virus, application of genetic engineering	5
9	Applied Microbial genetics: tools & techniques; recombinant DNA technology; transgenic organisms; genetic treatment, safety issues and ethics of genetic engineering	5
	Industrial microbiology: role of microbes in food production; industrial microbiology and its future, fermentation, enzyme production	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	describe how microbes affect the quality of fish and shellfish	PLO1, PLO2, PLO4,
CLO2	describe different genera of microbes responsible for fish spoilage	PLO1, PLO2, PLO4,	
CLO3	discuss possible ways of controlling microbes responsible for fish spoilage	PLO1, PLO2, PLO4,	
CLO4	Isolation and confirmation of pathogenic bacteria	PLO1, PLO2, PLO3	
CLO5	Molecular identification and sequencing of bacteria	PLO1, PLO2, PLO3, PLO4,	
CLO6	use of microbes for industrial food production	PLO1, PLO2, PLO3, PLO4	

Mapping CLOs with the Teaching-Learning and Assessment Strategy		
CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group discussion	Assignment, Oral Presentation
CLO2	Lecture, Group discussion	Assignment, Oral Presentation, Written Exam
CLO3	Lecture, Group discussion	Assignment, Oral Presentation
CLO4	Lecture, Video, Demonstration	Written Exam
CLO5	Lecture, Video, Demonstration	Assignment, Oral Presentation
CLO6	Lecture, Video, Demonstration	Written Exam
CLO7	Lecture, Video, Demonstration	Oral Presentation, Written Exam

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Borgstrom G, editor. Fish as food VI: production, biochemistry, and microbiology. Elsevier; 2012 Dec 2. 2. Tortora, G.J., Funke, B.R. and Case, C.L. 2006. Microbiology: an introduction. 8 th edition, Pearson Education, Inc 3. C.O. Chichester and H.D. Graham. 1973. Microbial safety of fishery products. Academic press. New York. 4. J.J Conell. 1980. Advances in fish science and technology. Fishing news books. London.UK 5. Rheinheimer, G. 1978. Aquatic micro biology. McGill data Publishing house. London.
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Course Code: 0311 06 RM 5102	Year: 1 st	Term: 1 st
Course Title: Seminar-I Research Methodology		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course is designed to provide knowledge on practical aspects of research methodology, processing of research problems and planning, sampling and research design and writing and presentation of research results, so that students can identify the problems, realize the way of doing scientific research, plan and design a research, and ultimately write a report/ thesis in a systematic way.	

Course Contents		CLOs
1	General Aspects of 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	
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)	7

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. 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.
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Course Code: 0831 06 FPQC 5105	Year: 1 st	Term: 1 st
Course Title: Modern Fishing Technology		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course will provide basic scientific knowledge on modern fish harvesting technologies. Major discussion will be focused on i) traditional and modern fishing crafts and gears; ii) fish behavior and factors affecting fish aggregation iii) Modern navigational instruments iv) artificial reefs and v) fish aggregating devices. Thus this course will be very much useful in the profession line as well.	

Course Contents		CLOs
Section A		
1	Concepts of modern fishing: Types of fisheries: artisanal fisheries, commercial fisheries and industrial fisheries; comparison between small-scale fisheries, subsistence fisheries and artisanal fisheries; concepts of recreational fisheries and its application in eco-tourism	1
2	Fishing crafts and gears: types, mode of operation, advantages and disadvantages, development trend	1, 2
3	Gear used in major fisheries in Bangladesh: hilsa fishery, small and large pelagic fishing, prawn and shrimp fisheries, carps and catfishes in capture fisheries	2
4	Quality of fish based on gears used: Net materials, wounding, bagnet, longline, gill net etc.	2
5	Fish behavior and population: modern techniques of fish aggregation, fish schooling behavior, factors limiting abundance	3
Section B		CLOs
6	Navigational instruments: Compass, Radar, Echo Sounder, Sonar, Electronic Chart Display and Information System (ECDIS), EPIRBs (Emergency Position Indicating Radio Beacons, Global Maritime Distress and Safety System (GMDSS)	4
7	Location and detection of fish school: remote sensing and GIS-based technique	4
8	Aggregation of fish: Aggregation process, Impact, Fish Aggregating Devices (FAD), legal aspects and regulations, Artificial reefs:	4
9	Mechanized fishing in the sea: trawl fishing, trawl nets, trawlers, principles and operations	5

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	describe types of fishing nets	PLO1, PLO2, PLO4, PLO5
	CLO2	describe modern fishing gears and their relative advantages	PLO1, PLO2, PLO4
	CLO3	describe fish behavior and abundance in context of harvesting	PLO1, PLO2, PLO4, PLO7
	CLO4	describe modern technique for detection of fish school	PLO1, PLO2, PLO4, PLO5
	CLO5	describe the principles of modern gears for fishing	PLO1, PLO2, PLO5, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Quiz, Assignment
CLO2	Lecture, Audio-visual materials	Quiz, Assignment

CLO3	Lecture, Audio-visual materials	Presentation, Final Exam
CLO4	Lecture, Audio-visual materials	Presentation, Exam
CLO5	Lecture, Audio-visual materials	Quiz, Assignment, Presentation

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Burgess, G. ed., 1966. Fish handling & processing (Vol. 21). HM Stationery Office. 2. Gabriel, O., Lange, K., Dahm, E. and Wendt, T. eds., 2008. Von Brandt's fish catching methods of the world. John Wiley & Sons. 3. Rautenstrauss, B.W. and Liehr, T. eds., 2012. FISH technology. Springer Science & Business Media. 4. Hameed, M.S. and Boopendranath, M.R., 2000. Modern fishing gear technology. Daya Books.
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Course Code: 0831 06 FPQC 5107	Year: 1 st	Term: 1 st
Course Title: Advanced Fish Processing		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course will provide basic scientific knowledge on modern fish processing technologies.	

Course Contents		CLOs
Section A		
1	Structure and composition of fish: basic anatomical and histological structures of fish and shellfish, compositions and their impacts on processability and quality, musculature and nutrigenomics	1
2	Post-mortem quality changes: rigor mortis progress, mechanisms of organoleptic, biochemical and microbiological changes, factors affecting quality changes in fish	1, 2
3	Assessment and assurance of fish quality: sensory, biochemical and microbiological methods, freshness index, assurance of fish quality	2
4	Freezing: principles and methods, advances in modern freezing technology, equipment and machineries, technology for IQF and plate freezing, large scale block freezing, sanitation and hygiene maintenance in freezing, frozen-storage-principles and machineries	2
5	Fish drying, salting and fermentation: principles and methods, traditional sun drying and mechanical drying, salting of hilsa and salt-fermentation, factors affecting production, storage and marketing of quality products, production of pesticide-free dried and salted fish, principles and techniques of fish fermentation, smoking of fish and small shrimp, factors affecting production, storage and marketing of smoked products	3
Section B		CLOs
6	Fish canning: principles and methods, advances in fish canning and smoking industries, prospects of fish canning in Bangladesh, canning of fish and shrimp, factors affecting production, storage and marketing of canned products	4
7	Recent advances in fish processing: overview of modern fish processing technology, high pressure processing (HPP), infrared and radiofrequency processing technologies, microwave and ultrasound processing, bio- and enzymatic preservation	4
8	Texturization in fish muscle and surimi using biotechnology: theory of fish protein gelation, gel strengthening by microbial transglutaminase, analog products formulation	4
9	Advances in fish packaging technology: modern packaging in fish and seafood preservation, modified atmosphere packaging (MAP), application of MAP in safe dry fish production, modified humidity packaging (MHP), vacuum packaging, vacuum cooling, irradiation of packaged products, active and intelligent packaging, shelf-life extension and pathogen control, quality and nutritional value for seafood	5

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	describe the mechanism of post-mortem quality changes in fish and shellfish	PLO1, PLO2, PLO4, PLO5

	CLO2	explain quality assessment techniques and the ways to assure quality of fish and shellfish	PLO1, PLO2, PLO4
	CLO3	explain modern techniques of fish drying, freezing and salting	PLO1, PLO2, PLO4, PLO7
	CLO4	discuss modern techniques of fish canning, smoking and fermentation	PLO1, PLO2, PLO4, PLO5
	CLO5	discuss advanced fish packaging technologies	PLO1,PLO2,PLO5, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Quiz, Assignment
CLO2	Lecture , Audio-visual materials	Quiz, Assignment
CLO3	Lecture, Audio-visual materials	Presentation, Final Exam
CLO4	Lecture, Audio-visual materials	Presentation, Exam
CLO5	Lecture, Audio-visual materials	Quiz, Assignment, Presentation

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Sen DP. Advances in fish processing technology. Allied Publishers; 2005 Feb 21. 2. Nura A. Advances in food packaging technology-a review. Journal of Postharvest Technology. 2018 Oct 28;6(4):55-64. 3. National Research Council. Fisheries technologies for developing countries. National Academies Press; 1988 Feb 1. 4. I J Clucas and A R Ward. Post-Harvest Fisheries Development: A Guide to Handling Processing and Quality. Natural Resources Institute. 5. Sheelagh Johnson and Ivor Clucas. Maintaining Fish Quality. Natural Resources insti 6. Nowsad, A.K.M. 2014. Post-harvest Fishery Losses and Mitigation Measures.346 p. 7. Nowsad, A.K.M., 2007. Participatory training of trainers: a new approach applied i processing. BFRF. 8. Burgess, G. ed., 1966. Fish handling & processing (Vol. 21). HM Stationery Office
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First Year 2nd Term

Course Code: 0831 06 FPQC 5201	Year: 1 st	Term: 2nd
Course Title: Legislation and Standards of Fishery Products		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course will describe all the major legislation and standards for fish and fishery products.	

Course Contents		CLOs
Section A		
1	Standard organizations and programmes: national and international standard organizations, coordination, overview of Bangladesh Food Safety Authority (BFSA), Bangladesh Standard Testing Institute (BSTI), Fish Inspection and Quality Control of DOF (FIQC), Codex Alimentarius Commission (CAC), ISO, EU, FDA, WHO, FAO, Japanese Fishery Standard Programmes.	1
2	National and international standards: Codex Alimentarius standards, WHO, The European Communities, FDA/EPA, ISO and other national standards in Bangladesh, EU, USA and in Asian country standards (Japan, China, India) for raw, frozen, dried, salted, fermented and canned fish and crustaceans.	1, 2
3	Standard methods of quality analysis: methods for sampling and quality assurance criteria in fish products, protocol and procedure followed by FIQC (Fish Inspection and Quality Control wing of DOF, recommendations from FDA, AOAC International methods for sensory, biochemical and microbiological assessments of fish and fishery products	2
4	Legislation for fishery products: Legislations for fish and fishery products by FAO and WHO, The European Communities legislation, United States legislation and monitoring, legislation in other countries (Japan, China), Legislations for fish and fishery products in Bangladesh.	2
Section B		CLOs
5	HACCP and ISO: concepts and approaches of HACCP and ISO, hazards, CCP, HACCP principles, defect action point (DAP) analysis, detail application and procedure of HACCP: product description, hazard and defect analysis, identification of hazards and defects, determination of CCP and DAP, establish critical limits, monitoring procedures, corrective action, verification procedures, documentation, review plans	4
6	Code of practice for fin fish: Code of practice for fishery products by FAO/WHO, definitions, general considerations for the handling of fresh fish, defect action point (DAP) analysis, code of practice for processing fresh, frozen, minced, salted, dried, fermented, smoked, canned fish and value-added products.	4
7	Code of practice for shellfish: code of practice for shellfish products by FAO and WHO, considerations for the handling of shrimp, crab and other seafood, code of practice for processing shrimps, prawns, crabs, lobster, canned shellfish, cephalopods, live and raw bivalve molluscs	4
8	Labeling and Traceability of fish products: principles and application of traceability, labeling and data recording system, fresh fish quality traceability, legislation, e-traceability	5

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	explain national and international standards for fish	PLO1, PLO2, PLO4, PLO5
CLO2	explain national and international standards for crustaceans	PLO1, PLO2, PLO4	

	CLO3	describe standard methods of quality analysis	PLO1, PLO2, PLO4, PLO7
	CLO4	acquire knowledge on important legislation for fishery products	PLO1, PLO2, PLO4, PLO5
	CLO5	discuss HAACP, ISO and codes of practices for fish and crustaceans	PLO1,PLO2,PLO5, PLO8

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Quiz, Assignment
CLO2	Lecture , Audio-visual materials	Quiz, Assignment
CLO3	Lecture, Audio-visual materials	Presentation, Final Exam
CLO4	Lecture, Audio-visual materials	Presentation, Exam
CLO5	Lecture, Audio-visual materials	Quiz, Assignment, Presentation

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. J.J Conell. Control of fish quality. Fishing news books. London.UK 2. World Health Organization. Code of Practice for fish and fishery products. Food & Agriculture Org.; 2020 Oct 9. 3. Nicolae CG, Bahaciu GV, Elia E, Dumitrache F, Marin MP, Pogurschi E, Badulescu L. A review of the quality standards for frozen beef meat and fish. InThe International Conference Agriculture for Life, Life for Agriculture of the University of Agronomic Sciences and Veterinary Medicine of Bucharest 2016 Jun 9 (pp. 302-307).
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Course Code: 0831 06 FPQC 5203	Year: 1 st	Term: 2 nd
Course Title: Industrial Fish Processing and Quality Control		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course will describe major industrial fish processing techniques and the ways of quality control.	

Course Contents		CLOs
Section A		
1	Design of fish processing plant: Location, general hygienic criteria for site selection and design, water supply, power supply, factory yards; vermin and insect control, general equipment and tools used in fish processing plants.	1
2	Hygiene and sanitation in fish industry: principles for hygienic design for premises, equipment and utensils, equipment safety and hygiene regulations, hygienic clothing, personnel hygiene, occupational safety.	1, 2
3	Cleaning and disinfection in fish industry: cleaning, disinfection and control; cleaning agents, characteristics of ideal cleaning agents; types, functions, and limitations of cleaning agents; cleaning system, control of cleaning; physical and chemical disinfectants.	2
4	Quality aspects in fish industry: pathogenic bacteria, (indigenous and non-indigenous bacteria), viruses, bio-toxins, biogenic amines, parasites, chemicals; spoilage; physical, chemical and biological contaminants	3
Section B		CLOs
5	Fish quality and risk assessment- traditional methods: aspects of risk assessment and risk management, identification and characterization of hazards, principles and guidelines for sensory evaluation, quality index method, ; biochemical assessment,	4
6	Advanced methods of quality and risk assessment: principles and method of determination-biogenic amines, antibiotics, formalin, pesticides, bio-toxins, ATP-derived products and K-value determination, visible and near infrared (VIS/NIR) spectroscopy, electronic nose and electronic tongue, colour measurement, differential scanning calorimetry (DSC), instrumental texture measurement, image processing, measuring electrical properties, microbiological methods, protein-based methods, lipid profile analysis, vitamins, minerals, DNA-based methods, liquid chromatography tandem mass spectrophotometry (LCMS-MS), GCMS-MS, electron microscopy of texture.	5

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	describe the mechanism of post-mortem quality changes in fish and shellfish	PLO1, PLO2, PLO4, PLO5
	CLO2	explain quality assessment techniques and the ways to assure quality of fish and shellfish	PLO1, PLO2, PLO4
	CLO3	explain modern techniques of fish drying, freezing and salting	PLO1, PLO2, PLO4,
	CLO4	discuss modern techniques of fish canning, smoking and fermentation	PLO1, PLO2, PLO4, PLO5
	CLO5	discuss advanced fish packaging technologies	PLO1,PLO2,PLO5

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Quiz, Assignment
CLO2	Lecture , Audio-visual materials	Quiz, Assignment

CLO3	Lecture, Audio-visual materials	Presentation, Final Exam
CLO4	Lecture, Audio-visual materials	Presentation, Exam
CLO5	Lecture, Audio-visual materials	Quiz, Assignment, Presentation

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation, seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. Nura A. Advances in food packaging technology-a review. Journal of Postharvest Technology. 2018 Oct 28;6(4):55-64. 2. Sen DP. Advances in fish processing technology. Allied Publishers; 2005 Feb 21. 3. Nowsad, A.K.M. 2014. Post-harvest Fishery Losses and Mitigation Measures.346 p. 4. National Research Council. Fisheries technologies for developing countries. National Academies Press; 1988 Feb 1. 5. I J Clucas and A R Ward. Post-Harvest Fisheries Development: A Guide to Handling Processing and Quality. Natural Resources Institute. 6. Sheelagh Johnson and Ivor Clucas. Maintaining Fish Quality. Natural Resources insti 7. Nowsad, A.K.M., 2007. Participatory training of trainers: a new approach applied i processing. BFRF.
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Course Code: 0311 06 RM 5202	Year: 1 st	Term: 2 nd
Course Title: Seminar-II: Data Management and Analysis		
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 (pp.575)</i>. Fishing News Books, University Press.
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Course Code: 0831 06 FPQC 5205	Year: 1 st	Term: 2 nd
Course Title: Fish By-Products Technology		
Course Status: Core		
Credit: 3.0		
Prerequisite(s): None		
Rationale	The course has been designed to describe production and potential uses of different fishery by products, importance and the techniques to utilize the by-products at different fields. Fermented fish products, and many other by-products produced by applying biotechnological approaches have enormous applications. Therefore, it is important to know the process of fish by-product production and their application.	

Course Contents		CLOs
Section A		
1	Introduction: scope, types, present status and future potential in Bangladesh, recent development	1
2	Protease in seafood industry: introduction, general properties and applications , criteria for selection of protease in industry, classification and application	2
3	Application of biotechnology in crustacean wastes recycling: introduction, quality and composition of crustacean waste, recovery and application of crustacean waste components; general properties of chitin and chitosan, methods for preparing chitosan, advantages of biological versus chemical methods for preparing chitin/Chitosan.	2
4	Fish meal and fish oil technology: Scope, Potential, recent advances, production technique, storage	3
Section B		CLOs
5	Production of fish protein concentrate and hydrolysate: introduction, fish meal and fish protein concentrate, fish protein hydrolyze, characteristics and functional properties of fish products, utilization of fish products. Solubilization of fish mince, microbial proteases, biotechnological approaches to fish meat solubilization, solubilization of fish meat immobilized microbial cell, future prospects.	4
6	Production of fish silage: introduction, raw materials, composition and chemical changes, production methods. Physical properties of silage, metal corrosion in silage production, processing silage, silage quality, nutritional value, use of fish skin and scales for value-added products	4
7	Lactic acid and propionic acid fermentations of fish hydrolysates: introduction, enzymatic hydrolysis of fish tissue, effectiveness of lactic acid and propionic acid fermentations, characteristics of the lactic acid and propionic acid bacteria, growth media and culture maintenance, materials and methods, results and discussion, commercial sources of lactic acid bacteria, propionic acid bacteria and papain; crustacean and mollusk processing wastes as fermentation substrate	5
8	By-product recovery from waste water: Sources, compositions and characteristics of seafood processing waste waters, treatment and recycling technologies, technology selections.	6

Course Learning Outcomes (CLOs)	Upon completion of this course the students will be able to:		Mapping with PLOs
	CLO1	acquire basic knowledge on production of fermented fish, fish protease in fish industry	PLO1, PLO2, PLO4
	CLO2	describe the potential application of crustacean	PLO1, PLO2, PLO4

		wastes in biotechnology	
	CLO3	Know how to produce cheap fish meal and technology of producing high valued fish oil	PLO1, PLO2, PLO4, PLO8
	CLO4	formulation of by-products for human and other animal consumption	PLO1, PLO2, PLO4, PLO5, PLO8
	CLO5	Use of bacteria for lactic acid and propionic acid fermentation	PLO1, PLO2, PLO4
	CLO6	describe waste water treatment in fish industries	PLO1, PLO2, PLO4, PLO8

Teaching –learning strategies: Audio-visual Lecture, discussion, group discussion, video presentation,

seminar, oral presentation

Assessment strategies: assignment, report writing, oral presentation, written exam

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Audio-visual materials	Quiz, Assignment, Exam
CLO2	Lecture , Audio-visual materials	Quiz, Assignment, Exam
CLO3	Lecture, Audio-visual materials, Group Discussion	Presentation, Assignment, Exam
CLO4	Lecture, Audio-visual materials, Group Discussion	Presentation, Assignment, Exam

Learning Materials

Recommended Readings	<ol style="list-style-type: none"> 1. A.M. Martin. Fisheries processing. Biotechnological applications. Chapman and hall. New York. 2. Gopakumar, 2002. Textbook on Fish Processing 3. I J Clucas and A R Ward. Post-Harvest Fisheries Development: A Guide to Handling, Preservation, Processing and Quality. Natural Resources Institute.
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Course Code: 0831 06 FPQC 5204	Year: 1 st	Term: 2 nd
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

Second Year First Term

Course Code: 0111 06 RM 6102	Year: 2 nd	Term: 1 st
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 bluffing; answered the question(s) asked (asked for clarification or restatement of the question).	6, 7

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. <u>Bhamrah, H.S., Sandhu, G.S. and Gupta, K.C.</u>, 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.
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Course Code: 0831 06 FPQC 6104	Year: 2 nd	Term: 1 st
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.
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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 Grading Scale

a) 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 the project, thesis design, etc. course)	X	

20.1.1 Evaluation of Theory Courses

a) All theory courses will be evaluated out of 100 marks, the distribution of which is given below:

Sl. No.	Items	Marks
1	Attendance and Class Participation	10
2	Continuous Assessments	30
3	Term Final Examination	60
Total		100

b) The basis for awarding marks for class attendance and participation will be as follows:

Attendance & Participation	Marks
90% or above	10
85 to below 90%	9
80 to below 85%	8
75 to below 80%	7
70 to below 75%	6
65 to below 70%	5
60 to below 65%	4
Below 60%	0

c) The continuous assessments of the theory courses may be conducted in the form of class tests, assignments, homework, presentation, quiz, viva voce, etc. The course teacher(s) will evaluate every continuous assessment and share the result with the students within 2(two) weeks of conducting that continuous assessment.

d) The duration of a class test may be 20-45 minutes, and it will preferably be given during class hours.

e) If a student does not attend the class test for reasons satisfactory enough to the course teacher, the course teacher may allow the student one more chance for such assessment during the term; however, it must be held before the term final examinations. A student who has been absent for a short period, up to a maximum of three weeks due to illness, should approach the course teacher(s) or Coordinator(s) for make-up of quizzes/class tests or assignments, etc., immediately on returning to the classes. Such request should be supported by a medical certificate endorsed by the Chief Medical Officer of the University. The medical certificate issued by a registered medical practitioner (with the registration number shown explicitly on the certificate) and endorsed by the Chief Medical Officer of the University will also be acceptable only when the student has valid reasons for his/her absence from the University.

f) The number of Continuous Assessments (CAs) in each course will be as follows:

No. of credit(s)	Total no. of CA required	CAs to be considered for grading
3 - 4	4 (2 in each section)	Section best assessments shall be averaged for grading
1.5 - 2	3 (at least one in each section)	

g) If two teachers teach a course, both the teachers will conduct continuous assessments individually.

h) Answer scripts of the continuous assessment may be shown to the students to identify their strengths and weaknesses, but those would not be returned to them. The concerned teacher would submit the evaluated continuous assessment answer scripts and attendance register to the Head of the Discipline/Program Offering Entity (POE). The final score of attendance and class participation (out of 10) and continuous assessment (out of 30) should be displayed on the Discipline's notice board/ Discipline website/ Course web page before starting the term final examination.

i) The course teachers must submit the continuous assessment mark sheets to the Chair of the Examination Committee before the starting of the term final examination.

j) The Term Final Examination will carry 60 marks. There will be two separate answer scripts for Section A and Section B in the Term Final Examination.

k) When a student repeats a course in which he/she previously obtained an F grade, he/she will be given just an immediate lower grade that he/she obtained in the repeated course. However, in case he/she obtains a D grade, that will be maintained, and this grade will be shown in the transcript. If a student has to repeat a course due to punishment on him/her, the grade obtained will be maintained. If a student obtains a grade other than an F in a course, he/she will not be allowed to repeat the course for grade improvement.

l) 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 for grade improvement.

m) While registering for a retake/re-retake theoretical course, a student must be given an option to decide whether s/he intends to sit for continuous assessment of the course. If

s/he opts to sit for continuous assessments, his/her fresh mark will be counted to prepare the result. However, the class attendance and participation marks will be taken from the previous record.

n) 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 registration limit of 25 credits per term. However, s/he may not choose to register the optional backlog/retake/re-retake courses first.

o) In addition, 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 a maximum registration limit of 25 credits per term, and **(v)** the desired advance courses are offered by the Discipline/POE in the current term. However, such advance course registration option will not be applicable for capstone courses like Thesis/ Project/ Internship/ Research study/ Monograph/ Portfolio, and so on.

p) A Special Term may be offered for the final year students who have retake/re-retake course(s). In this case, the maximum credit limit for a student will be 15 credits. This will be a Non-Taught Term. The Examination of Special Term will start 4 (four) weeks after publishing 4th-year 2nd Term results and will continue not more than 2 (two) weeks. The continuous assessment marks (40%) will be carried over from previously registered theory course(s), and Special Term Final Examination will carry the remaining (60%) marks. Final Year Term Thesis/Dissertation/Design or Core Sessional(s) supervisor(s)/course teacher(s) in consultation with the Head may allow the student(s) to re-submit the Thesis/Dissertation Design or Core Sessional(s) within the Special Term schedule. However, it must be within the allowed limits of the Special Term credits.

20.1.2 Evaluation of Sessional Courses

a) All sessional courses will be evaluated out of 100 marks, the distribution of which is given below:

Sl. No.	Items	Marks
1	Attendance/Class Participation/Contact with teachers	10
2	Sessional Evaluation/Internal criticism/Observation	60
3	Viva Voce/ Final Jury	30
Total		100

b) Sessional evaluation would be done through a laboratory test, class test, quiz, assignment, assigned project, report, oral test, performance/behavior of the students, etc. The course teacher(s) will complete every sessional evaluation and share the result with the students within 2(two) weeks of conducting that item. Attendance and sessional evaluation mark sheets (out of 10+60=70) will be displayed on the Discipline's notice board/Discipline website/Course web page before starting the term final examination.

c) Viva Voce of each sessional course will usually be conducted by the course teacher(s). The senior most among the course teachers (if any) will be the Chair of the

viva board. However, such viva voce/final assessment of a sessional course can also be done through jury board in applicable cases. The jury board will be headed by the Head of the Discipline or any other senior teacher of the Discipline/POE not below the rank of Assistant Professor. The Chairman of the viva/jury board may appoint other teacher(s) as a board member if necessary. A student must attend a sessional evaluation and viva voce. In case of absence in any component, he/she will get an F grade in that course.

d) The course teachers must submit the continuous assessment mark sheets to the Chair of the Examination Committee before the starting of the term final examination.

e) A student may register sessional courses as retake/re-retake (if applicable) on the Discipline Head's written approval. For retake/re-retake sessional courses, no previous records/marks will be counted.

20.1.3 Evaluation of Capstone Courses

a) The distribution of marks for a Capstone (Thesis/ Monograph/ project paper/ etc.) course will be as follows:

No.	Description	Marks
i)	Contact/Discussion/Communication with the Supervisor	10
ii)	Evaluation	60
iii)	Oral presentation and/or Viva voce	30
Total		100

b) There will be two examiners (including the Supervisor) to examine the Thesis. Each examiner will evaluate the Thesis separately, and the average marks will be considered for grading. However, if the marks given by the First and Second Examiners vary 20% or more, a Third Examiner to be appointed by the concerned Examination Committee from the outside the University will evaluate the Thesis Monograph/Project paper. Among these numbers, the average of the closest two numbers will be considered for grading. However, if the marks given by the Third Examiner happen to stand at the middle of the marks given by the first two Examiners, the average of the three marks will be considered for grading.

c) For the thesis/dissertation/final project/other projects like the thesis of the final year students, there will be a presentation and defense session before the board (Jury/ other board). If deemed necessary to the concerned Examination Committee, these sessions might be arranged online. The chairman of the board normally will be the Discipline Head or any other senior teacher of the Discipline/POE not below the rank of an Assistant Professor. All supervisors of the thesis/ project/ internship/ research study/ monograph/ portfolio courses will be the concerned board members. The chairman may appoint other teacher(s) as member(s). Every member of the board will evaluate individually and the final marks will be calculated by averaging all the marks given by the members.

d) A Discipline might allow some students to register for an Internship program/ Project paper/ Monograph/ Research study according to the course curriculum of the respective Discipline. Such an internship program/ Project paper/ Research study course might be considered as the substitute of Thesis for those students. The evaluation and related activities of such Internship program/ Project paper/ Research study courses will be

similar to Thesis. Usually, a Thesis will carry double weight in terms of credit compared to other alternatives like Project/ Internship/ Research study/ Monograph/ Portfolio and so on.

e) A Discipline might allow splitting the thesis/similar course into more than one term. 'X' grade may be assigned for continuing the same course in multiple terms to assign a complete grade in the last term. Alternatively, multiple courses under thesis/similar course might be assessed by providing complete grades at the end of each term. The curriculum of the concerned Discipline/Entity will clarify all such issues.

20.1.4 Evaluation of Viva Voce

a) There might be a grand viva voce in each term. A student will not usually be allowed to register for more than one course of this type bearing 01 (one) credit in a term. The concerned Examination Committee of that Term will conduct the viva and assess the students. The distribution of marks for viva voce will be as follows:

Description	Marks
Viva voce	100

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,

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

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:

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

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.

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.

20.6 Retake

Retake related issues are reported in sections 20.1.1 and 20.1.2.

20.7 Grade Improvement

Grade improvement related issues are reported in section 20.1.1.

20.8 Dropout/Cancellation of Studentship

a) A first-year first term student's admission will stand cancelled if he/she fails to complete course registration by ten working days from the beginning of the classes.

b) A first-year first term student's admission will stand cancelled if he/she fails to attend at least 50 percent of classes during ten working days from the beginning of the classes. However, in case of severe illness/accident this provision may be relaxed subject to submission of a medical certificate issued by a registered medical practitioner (with the registration number shown explicitly on the certificate) and endorsed by the Chief Medical Officer of the University.

c) A student's studentship will stand cancelled if he/she fails to comply with registration of minimum credit requirements under article 12.2 of the latest (July 2022) 'Ordinance for Undergraduate Program' of Khulna University. According to that article, a student must register for at least 15 credits per term and may be allowed to register for up to a maximum of 25 credits if recommended by his/her Discipline Head. The Discipline/POE might offer less than, greater than or equal to 25 credits per term as per the approved curriculum. The student will enjoy the option of choosing backlog, re-take, re-retake, advance courses (subject to compliance with applicable requirements/restrictions, as reported in other articles of the Ordinance) in addition to fresh courses to comply with the restriction of maximum 25 credits per term. If any student fails to register, in any

way, for minimum credits (15 credits), his/her studentship at the University will stand canceled. This minimum 15-credit registration limit may be relaxed if: (i) the student requires less than 15-credit to complete his/her graduation, or (ii) the sum of applicable (for the student) credits offered by the Discipline is less than 15-credit in the corresponding term for any valid reason.

d) A student's studentship will stand cancelled if he/she fails to earn minimum credits under article 12.5.2 of the latest (July 2022) 'Ordinance for Undergraduate Program' of Khulna University. According to that article, when a student is going to register for his/her courses in the 3rd year 2nd term, his/her earned credits up to 2nd year 2nd term must be at least 36. Otherwise, his/her studentship at the University will stand canceled.

Approval Records	
Approving Authority	Date of Approval
Curriculum Committee of the Discipline	
Executive Committee of the School	
BOAS (if applicable)	
Academic Council	
Syndicate (if applicable)	

Concerned Committee of the Discipline/POE (if applicable)

Serial No.	Name and Address	Designation in Committee	Remarks

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- IQAC 2022. Template of Outcome-based Curriculum, Institutional Quality Assurance Cell (IQAC), Khulna University. pp. 1-18.
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