Curriculum of
MSc in Coastal and River Engineering Programme

Department of Harbour and River Engineering

Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh

AUTHORITY OF PUBLICATION

1. A committee, formed vide memorandum no. BSMRMU/VC Secretariat/Admin-11/20/163 dated 30 November 2020 drafted the curriculum of MSc in Coastal and River Engineering (CRE). The committee comprises the following members:

a. Commodore M Ziauddin Alamgir, (L), NGP, fdc, psc, BN (Retd.) - President
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f. Mehran Islam - Member Secretary
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2. The Draft curriculum was discussed with the coastal engineering and port development Panel of IHE Delft. Based on the discussion, the committee made the 2nd draft.

3. Thereafter a meeting was conducted with the stakeholders and experts from relevant disciplines for making it more realistic that meets industrial needs. The final draft of the curriculum was prepared based on the outcome of the meeting.

4. The final draft of the curriculum proposed by the curriculum committee was discussed and recommended by the Academic Council with some modifications/suggestion (26th meeting held on XX January 2021. Item no- XX)

5. After incorporation of the suggestion of the Academic Council, the curriculum was presented to the syndicate (26th meeting held on 25 February 2021. Item no- XX). The syndicate approved the curriculum with some amendments/suggestions.

6. Based on the amendment /suggestion the curriculum was finalized and published here.

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INTRODUCTION TO THE UNIVERSITY

Background

The victory over maritime boundary delimitation with neighbouring countries opened a new window in the maritime arena of Bangladesh. The vast sea area along with scarcity in land-based resources has made it imperative to boost up our economy through an effective exploration of sea resources. Keeping this in perspective honourable Prime Minister Sheikh Hasina outlined the concept of a blue economy and underscored the importance of effective manpower in the maritime sector.

To create effective human resources, the first-ever specialized university Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh (BSMRMU) was established in 2013 after the name of the Father of the Nation Sheikh Mujibur Rahman. Our motto is "We Strive for Maritime Excellence". The University aims at bringing all maritime professionals to a common platform to share knowledge and carry out research for the advancement of the maritime sector and developing effective human resources in this sector.

Vision

The vision of the University is to promote and create a learning environment for higher maritime education with excellence, through state-of-the-art facilities and gadgets, competent faculty and staff, the expanding frontier of research-based knowledge, and international standards supportive of the new horizons in diverse fields by 2021.

Mission

BSMRMU is committed to providing quality education based on the state of the art technological support responsive to the emerging challenges at home and abroad. The university is dedicated to nurture and develop world-class professionals, who would serve mankind with a strong sense of ethical values and competence and ready to face the competitive world of maritime business, service, and employment.

Goals

The goals of the University are as follows:

- Achieve sustainable development and progress of the university through cooperation with other related universities/ institutions.
- Continue to upgrade educational services and facilities responsive to the demands and requirements of the nation.
- Bring all types of marine professionals on a common platform to share knowledge and perform research and development works for the advancement of the country's maritime sector.
- Enhance research consciousness in the maritime sector in discovering new dimensions with the upcoming challenges.
- Accelerate the participation of alumni students and professionals with educational programs and the development of projects designed to expand and improve academic standards.
- Teach students on marine science and technology and guide them towards research to enhance their contribution to the maritime profession.
- Conduct various educational programs and research works for sustainable development of the maritime service and industrial sector of the country.
- Educate students on different subjects of maritime management, law, and security and strategy and conduct research on allied fields.
- Create a conducive environment for students to prepare themselves to serve the nation as future planners/ policymakers/ leaders in maritime sectors in coordination with national and international organizations including the International Maritime Organization (IMO).

Faculties and Institutes

The university aspires to have seven teaching faculties and four research institutes. The name of faculties and institutes in the following:

- Faculty of Maritime Governance and Policy (FMGP)
- Faculty of Shipping Administration (FSA)
- Faculty of Earth and Ocean Science (FEOS)
- Faculty of Engineering and Technology (FET)
- Faculty of General Studies (FGS)
- Faculty of Computer Science &Informatics (FCSI)
- Faculty of Maritime Business Studies (FMBS)

Research institutes are the Institute of Professional Language, Institute of Bay of Bengal & Bangladesh Studies, Institute of Renewable Energy & Marine Resource, and Institute of Disaster management.

INTRODUCTION TO THE FACULTY

The objective of the Faculty of Engineering and Technology (FET) is to provide outstanding engineering education directed at enriching the quality of life in an emerging knowledge-based society. The mission of the faculty is to produce highly competent engineering graduates, who can conduct internationally recognized research and provide quality professional services.

Faculty of Engineering and Technology comprises of the following departments-

- Naval Architecture and Offshore Engineering
- Ocean Engineering
- Marine Engineering
- Harbour and River Engineering
- Electrical and Electronics Engineering
- Telecommunication Engineering
- Control Engineering & Mechatronics

INTRODUCTION TO THE DEPARTMENT

Harbour and River Engineering is increasingly vital in the realization of Delta Plan 2100. However, Bangladesh is yet to have any formal education in this sector. To fill this gap, the only specialized public maritime university BSMRMU has introduced the Department of Harbour and River Engineering. The department will help the nation to meet the engineering needs of the maritime and coastal industries by providing specialized knowledge pertinent to these industries.

- The department will conduct both undergraduate and postgraduate programmes in Harbour and River Engineering.

INTRODUCTION TO THE PROGRAMME

Master of Science in Coastal and River Engineering (CRE) programme is a 2-year full time regular postgraduate programme. Graduates from this programme will be able to develop their careers as River Engineer, Coastal Engineer, Structural Engineer, and Project Manager in the relevant discipline. In their challenging career, they will need to design, plan, and manage the construction, installation, operation, and maintenance of river and coastal infrastructures and systems.

The programme is divided into 4 semesters of six months each (2 semesters each year). The total credit hour of this programme is 48 including 18 credit hours for the thesis. Besides regular courses, workshops, seminars, guest lectures on contemporary issues are arranged frequently for the students. The programme also includes fieldwork during the 2nd semester. The duration of each semester is 26 weeks. Each semester is distributed as follows:

a. Classes 15 weeks

b. Mid Term Examinations 02 weeks

c. Preparatory Leave 02 weeks

d. Final Examination 03 weeks

e. Recess 04 weeks

In the first year, students will study courses on river engineering, fluids, materials, structures, planning, management, climate change, etc. In the final year, students will specialize in both the River and Coastal Engineering themes, such as riverbank structures, modelling, hydrodynamics, statistical analysis, maritime rules and regulation. Students will also conduct a thesis aimed at solving engineering challenges for the industry.

Programme Outcome

In general, the programme will enable its graduates to engineer shallow water coastal structures ports, and harbours, as well as mastering the design and building procedure of different types of river training work-related structures. On completion of the programme, graduates will be able to:

a. Apply knowledge of science, and engineering mathematics in the field of River and Harbour Engineering
b. Formulate engineering problems and develop practical solutions
c. Interpret the results of engineering experiments appropriate for Coastal and River Engineering
d. Design and analyze products and processes applicable to Coastal and River Engineering
e. Work effectively in teams and provide leadership
f. Understand the impact of engineering decisions in a global/societal/environmental context
g. Understand the managerial, professional, and ethical responsibility
h. Recognize the need to engage in lifelong learning
i. Acquire a broad education necessary to contribute effectively beyond their professional careers
j. Effectively communicate orally, graphically, and in writing.
k. Use the techniques, skills, and modern engineering tools necessary for engineering practices

ADMISSION INFORMATION

Admission Criteria

Eligibility for admission in the Coastal and River Engineering programme are as follows:

a. Applicants who have passed B.Sc. Engg. or equivalent examination with a minimum CGPA of 2.5 out of 4.0 or its equivalent in four years B.Sc. Engg. (or at least 50% marks) in Civil Engineering/ Water Resources Engineering/ Environmental Engineering/ Naval Architecture/ Ocean and Offshore Engineering/ Mechanical Engineering.

b. Applicants must have passed the HSC/equivalent examination and SSC/equivalent examination from the science group with a minimum GPA of 4.00 out of 5.00.

c. In HSC/equivalent examination, applicants must have obtained minimum ‘A’ grade in any two subjects from Mathematics, Physics, Chemistry and English with minimum ‘B’ grade in rest of the subjects.

d. Applicants with GCE must have passed minimum five subjects in O-Level including Mathematics, Physics and Chemistry and minimum two subjects in A-Level including Mathematics and Physics.

However, an applicant having more than two 'C' grades in O-Level and/or more than one 'C' grade in A-Level will be ineligible for admission.

Admission Procedure

The procedure for admission in MSc in Coastal and River Engineering programme are as follows:

a. **Admission Circular**: BSMRMU will invite applications from interested candidates for admission in MSc in Coastal and River Engineering programme by publishing advertisements in the national dailies and BSMRMU website.

b. **Admission Test:** All eligible applicants shall be required to appear the admission test as per BSMRMU admission policy/regulations for Master of Science in Coastal and River Engineering. Admission test shall normally be comprised of written test and viva voce. Only written test qualified applicant shall be called for viva voce.

c. **Final Selection:** The final selection for admission shall be based on the Admission Test result. Selected candidates shall be registered with the programme in accordance with the procedures as laid down by BSMRMU. The final merit list along with the waiting list will be published on the BSMRMU notice board as well as on the BSMRMU website.

Registration in the Programme

After final selection, the selected candidates will be registered under the programme following the procedures as laid down by BSMRMU. The candidates have to go through a medical checkup at BSMRMU designated Medical Centre to ascertain their medical fitness. The selected candidates have to collect Admission Form from the Admission Section, and complete admission and registration formalities within the given time frame by paying the required fees. The following rules will apply in this regard:

a. If any candidate fails to complete admission formalities within the prescribed date and time, the candidate's selection will be cancelled automatically.

b. If any student does not attend the class within two weeks of commencement of classes, the student's admission will be cancelled automatically.

TEACHING STRATEGY

The teaching strategy of the programme is mainly lecture-based theoretical courses. Other teaching strategy includes case studies, group discussion, workshop, seminar, and training, etc.

Assignment of Credits

a. For theoretical courses, one lecture of 50 minutes per week per term is equivalent to one credit hour.

b. For laboratory courses, 100 minutes per week per term is equivalent to one credit hour.

c. Credit hours are also assigned to study tour, industrial attachment, project, and thesis work taken by the students. The amount of time assigned to such work may vary depending on the requirements.

Conduct of Courses

The following guidelines will be followed for conducting the courses:

a. At the beginning of the term, the course teacher will prepare a course outline incorporating the course syllabus, performance evaluation, and grading system (as laid down in the policy), a list of suggested textbooks/references, and a tentative schedule of classes, examinations, and events.

b. Project and thesis work will be assigned, either individually or in groups on any issue about the course.
c. Several individual and group assignments, presentations, etc. will be assigned to students as per the course requirements.

ASSESSMENT STRATEGY

Grading System

Letter grades and corresponding grade points will be awarded following the provisions (unified UGC grading system) shown below:

Letter Grade	Grade points	Numerical Markings
A+	4	80% and above
A	3.75	75% to below 80%
A-	3.5	70% to below 75%
B+	3.25	65% to below 70%
B	3	60% to below 65%
B-	2.75	55% to below 60%
C+	2.5	50% to below 55%
C	2.25	45% to below 50%
D	2	40% to below 45%
F	0	below 40%
X	Thesis/Project continuation	-

PERFORMANCE EVALUATIONS

Theory Courses

Forty percent (40%) marks of theoretical course will be allotted for continuous assessment, i.e. quizzes, class tests, assignments, class evaluation, class participation, mid-term exam, etc. Term Final Examination is conducted centrally by BSMRMU. Term Final Examination will be normally of 3-hour duration and comprise of 60% marks. The distribution of marks for a given course is as follows:

a. Class Attendance : 05%

b. Class Participation/Observation : 05%

c. Term Paper/Assignment : 05%

d. Class Tests/Quiz : 10%

e. Mid Term Examination (01 Exam) : 15%

f. Term Final Examination : 60%

The number of quizzes/class tests of a theory course will be n+1, where n is the number of credit hours of the course. Evaluation of performance in quizzes/class tests will be based on the best n quizzes. The scheme of continuous assessment that a particular teacher wishes to follow for a course will be announced as a course outline on the first day of the term. The performance of a student will be evaluated in terms of two indices, viz. Semester Grade Point Average (SGPA), and Cumulative Grade Point Average (CGPA).

Thesis

The distribution of marks for the performance evaluation of the thesis is given below:

a. Report Submission : 50%

b. Presentation : 30%

c. Oral Examination : 20%

Skill Development Course

The distribution of marks for the performance evaluation of the skill development course is given below:

a. Class Attendance : 10%

b. Class Participation/Observation : 10%

c. Term Paper/Assignment : 30%

d. Presentation on Fieldwork : 25%

e. Seminar : 25%

The Requirements for Promotion to the Next Semester

The requirements for promotion to the next term are as follows:

a. A student has to take the required courses for a particular semester as per the syllabus of the programme.

b. A student will be promoted to the second semester of each year, irrespective of his/her results in the first term of the year.

The Requirements for Promotion to the Next Year

The requirements for promotion to the next term are as follows:

a. A student has to take the required courses for a particular year as per the syllabus of the programme.

b. A student will be promoted to the next year, provided he/she does not have 'F' grades in more than two subjects including backlog subjects (if any).

The Reexamination of Failed Subjects

Normally the re-examination of the failed subjects will be conducted at the beginning of the following academic year. A short term may be conducted for them during the year ending recesses. However, students may also opt to register the failed subjects and appear for the examination with the next batch.

Credit Earned

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained an 'F' grade will not be counted towards his/her earned credits. 'F' grade must be cleared within the designated period.

Degree Requirements

Degree requirements are as follows:

a. Completion of courses required for fulfilling the minimum credit hours of 48 (including a thesis of 18 credit hours) in a maximum period of 5 (five) academic years from the date of the first admission.
b. Appearing at the final examination in all the required courses as per the curriculum of the programme.
c. The successful defence of the thesis paper.
d. Scoring a CGPA 2.20 or above.

COURSE DESIGNATION SYSTEM

Each course is designated by a maximum of four-letter code identifying the programme or department offering the course followed by a four-digit number having the following interpretation:

a. The first digit corresponds to the postgraduate level studies.
b. The second digit corresponds to the semester in which the course is normally taken by the students.
c. The last two digits denote a course.

CURRICULUM STRUCTURE

Types of Courses
The courses included in MSc in Coastal and River Engineering Programme are divided into several groups as follows:

Compulsory Theory Courses
In each discipline a number of courses will be identified as compulsory courses which form the nucleus of the respective Master's degree program. A student has to complete all of the designated compulsory courses for his/her discipline.

Skill Development Courses
Some of the core courses are identified as skill development courses. A skill development course is one which is required to be completed before Degree Certificate can be given. Any such course may lead to certifications and industry-recognized credentials. Developing Course is comprised of two items. One is fieldwork and the other one is student concluding seminar and fieldwork presentation.

Optional Theory Courses
Apart from the compulsory courses, students will have to complete a course which is optional in nature in that students will have some choice to choose the required number of course from a specified group/number of courses.

MSc in Coastal and River Engineering Programme consists of a total of 9 theory courses excluding skill development course and divided into the following categories:

Category	No. of Theory Courses	No. of Lab/Practical Courses	No. of Skill Development Courses	Credit Hours
Compulsory Theory Courses (CRE)	8	-	-	24
Optional Theory Course (CRE)	1	-	-	03
Thesis	-	1	-	18
Skill Development Course	-	-	1	03
Total	**9**	**1**	**1**	**48**

Course Schedule

Year-1: Semester-1			
Course Code	**Course Name**	**Type**	**Credit Hours**
CRE 6101	Tides, Waves, and Coastal Processes	Theory	**3**
CRE 6102	Hydrodynamics and Morphodynamics of Rivers	Theory	**3**
CRE 6103	Integrated Coastal Zone Management	Theory	**3**
CRE 6104	Research Methodology	Theory	**3**
Total			**12**

Year-1: Semester-2			
Course Code	**Course Name**	**Type**	**Credit Hours**
CRE 6201	Design of Coastal Structures	Theory	**3**
CRE 6202	Port Planning and Inland Water Transport	Theory	**3**
CRE 6203	Climate Change Impacts and Adaptation in Deltas	Theory	**3**
DEV 6204	Fieldwork and Data Processing	Skill Development	**3**
Total			**12**

Year-2: Semester-1			
Course Code	**Course Name**	**Type**	**Credit Hours**
CRE 6301	Design of River Training and Bank Protection Works	Theory	**3**
CRE 6302	River and Coastal Water Modelling	Optional Theory	**3**
CRE 6303	Applied Statistics to Coast and River Engineering		
CRE 6000	Thesis	Thesis	**6**
Total			**12**

Year-2: Semester-2			
Course Code	**Course Name**	**Type**	**Credit Hours**
CRE 6000	Thesis	Thesis	**12**
Total			**12**

Grand Total: 48 Credits

List of Optional Theory Courses:

Students will take **one** optional theory course in the final year from the following list:

Year and Semester	Course Code	Course Name
Year-2: Semester-1	CRE 6302	River and Coastal Water Modelling
	CRE 6303	Applied Statistics to Coast and River Engineering

CORE COURSES (CRE)

CRE 6101: Tides, Waves, and Coastal Processes

3.00 Credit, 3 hrs. /wk

Objectives:

The objective of this course is to introduce the students to the key concepts of coasts and their classifications, tides, waves, and nearshore coastal processes.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Explain the key concepts of wave generation, wave propagation, and wave breaking (deep and shallow waters) from linear theory, observations and models, and describe the concept of radiation stress and its importance in forcing currents and shallow water level gradients at the coast.
- Generate wave statistics, showing an understanding of wave spectra and bulk parameters.
- Identify the basics of wave climate (from global to regional/local scales), and Understand the wave energy balance concept.
- Understand the governing processes in coastal and nearshore hydrodynamics and morphology.

Contents:

Coasts and coastal features; Tides – types, theories of tide generation, tide measurement, tide prediction; Wind-generated waves - characteristics, types, wave theories, wave propagation, refraction, reflection, diffraction, breaking, and damping; Waves in the nearshore zone: wave breaking processes, influence of bathymetry, types of breaking, radiation stress and wave set-up and set-down; Wave modeling and prediction - spectral wave energy balance, different wave models, global and regional domains, and downscaling; Coastal processes, longshore sediment transport, nearshore hydrodynamics, and coastal morphology; Storm surges; Tsunamis.

CRE 6102: Hydrodynamics and Morphodynamics of Rivers

3.00 Credit, 3 hrs. /wk

Objectives:

The objective of this course is to teach students about the governing processes of river and delta hydrodynamics. The impact of climate change and the effect of human activities and the subsequent consequences will be discussed.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Understand the river hydrology and hydraulics.
- Explain the governing processes in river and delta hydrodynamics and morphology.
- Assess the long-term and short-term impacts of human interventions and climate change.
- Apply hydrodynamic and morphological processes in real field problems of river.

Contents:

River hydrology and hydraulics; River planform and morphology; Delta evolution and morphodynamics; Bedforms in alluvial channels; River channel patterns; River sediment transport; Flood plain and their formations; Fluvial process in geomorphology; Hydrodynamics and morphodynamics of rivers in Bangladesh.

CRE 6103: Integrated Coastal Zone Management

3.00 Credit, 3 hrs. /wk

Objectives:

This course will facilitate the students in understanding the coastal zones of Bangladesh and their impact on our coastal management. The mapping of a sustainable ICZM and the challenges related to these concepts will be taught.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Explain the need for sustainable development in coastal zones.
- Diagnose multi-sectoral problems and conflict of interest in coastal zones.
- Map the interactions between disciplines and sectors (Stake Holders).
- Participate/Organize multi-stakeholder meetings.
- Develop scenarios and alternatives for ICZM strategies.
- Perform Multi-Criteria Analyses.
- Explain the need for Land Reclamation in Bangladesh.

Contents:

Introduction to ICZM; Stakeholder management and decision making in coastal zones: Coastal ecosystems Functions and services; Socio economy of coastal zones; Global changes and trends, and developing scenarios; Risk assessment and adaptation in coastal zones; Alternatives for ICZM strategies and multi-criteria analyses; Transboundary issues, water right, water law, conflict resolution, and management; Monitoring, conservation, and restoration; Coastal zone of Bangladesh; its resources and management; Best practices of coastal zone management activities from different countries; Role play exercise; Land reclamation, prospect, planning and management of land reclamation in Bangladesh.

CRE 6104: Research Methodology

3.00 Credit, 3 hrs. /wk

Objectives:

This course is designed to let the students plan, develop, and carry out qualitative research methods used most frequently by scholars, particularly within the domains of innovation and engineering studies.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Plan and design research work.
- Know how to compile, process, and present various types of observational/experimental data from coastal and delta areas.
- Write proposals and academic report.
- Identify common mistakes in research writing and avoid plagiarism in report writing.

Contents:

Fundamentals of Research and Thesis; Literature Review and its importance; Sources and collection of Data; Planning and design of Research work; Research Proposal; Report writing; Basic framework of the research process including research designs and techniques; Ethical dimensions in applied research; Components of scholarly writing and evaluation its quality; Research problem; Engineering research; Methodologies to do engineering research; Descriptions and characteristics of Theoretical, Experimental, and Computational research; Method of data collections, Data analyses and uncertainty analyses; Hypothesis, Models, Making effective Charts, Graphs, Tables, Gantt chart, Survey & interview methods for research; Case study research, Case studies formation, Case study exercises; Research planning, Research proposals, Budget preparation,

Legal research, Research ethics, Plagiarism, Copyright, Intellectual property rights; Thesis/Dissertation/Report/Paper writing format; Review paper structure; Reference styles; Bibliography, APA, MLA, IEEE, End Note, Foot note, Reference management tools; Presentation skills (Oral, Poster); Editing and Proofreading strategies; Building intellectual property rights.

CRE 6201: Design of Coastal Structures

3.00 Credit, 3 hrs. /wk

Objectives:

This course will introduce the students to the basic design consideration of the different types of coastal structures along with their risk assessment. The theories learned will be utilized in designing dikes and revetments.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Determine the governing factors and design conditions for the design of breakwaters;
- Design breakwaters from conceptual to detailed and prepare the detailed cross-sections;
- Design a physical scale model to test the design of breakwaters;
- Determine the main (Risk-based) forcing acting on a dike or revetment;
- Check for different possible failure mechanisms in a dike or revetment;
- Carry out a basic design of dikes and revetments.
- Learn to work in a small team.

Contents:

Description of types, functions, and design procedure for different types of breakwaters; Data collection: soils and wave boundary conditions and construction materials; Definition of requirements and governing parameters for breakwater design such as wave parameters and structural parameters; Hydraulic response: wave run-up, wave overtopping, wave transmission and wave reflection; Conceptual design of rubble mound breakwaters including crest level design and structural response. Types of breakwaters: rock structures, concrete armour, berm breakwaters, low-crested structures and vertical breakwaters (caissons); Description of construction methods; Basic principles of physical scale modelling and the procedure of designing those models for breakwaters Definition of the frequency of failure and risk analysis; Description of design methodology for dikes: hydraulic boundary conditions, wave run-up and overtopping; Geometrical design of dikes and revetments; Design criteria for placed block revetment and other types (bituminous, asphalt, etc.) Geotechnical aspects related to dikes: overall stability, design of the granular filter, geotextiles, geosystems; Improvement and maintenance of dikes and revetments.

CRE 6202: Port Planning and Inland Water Transport

3.00 Credit, 3 hrs./wk.

Objectives:

This course aims at introducing the students to the vast world of maritime trade and maritime vessels along with the requirement, types, mathematical models, and designing of the ports necessary for maintaining the maritime trade of a country like Bangladesh.

Learning outcomes:

On successful completion of this unit, students should be able to:

- List different types of sea and river going vessels and identify the main characteristics of the ship;
- Explain the international functions of a port and different aspects of port management;

- Implement various steps in port master-planning;
- Determine the main dimensions of different terminals in the port;
- Determine the alignment and dimensions of the approach channel and the main dimensions of the wet infrastructure of the port;
- Determine the main dimensions of inland navigation rout for safe IWT (inland water transport).
- Include uncertainty in port planning and management by adaptive planning.

Contents:

Overview of global maritime trade; Overview of different cargo transported by seagoing vessels; Overview of different seagoing vessels and their characteristics; Description of different functions of the ports and different steps in developing a master plan of a port (expansion); Logic and methods used in incorporating uncertainty in the port planning and develop adaptive plans for port development; Methods, standards and tools used in design of wet areas of the ports including entrance channel, turning circle, basins, etc.; Methods, standards and tools in design of port terminals including Container Terminals, General Cargo Terminals, Ro-Ro Terminals, Liquid Bulk Terminals, Dry Bulk Terminals, and LNG Terminals; Introduction to marine structures and functional requirements; Methods, standards and tools used in design of mooring and berthing systems (dolphins and fenders) including calculating the forces; Different aspects of marine structures project management; Description of loading platform and trestle concepts; Case study : analyzing the master plan of port of Chattogram; Port planning assignment; Management of river and tidal currents; layout and engineering of ports, terminals and equipment.

CRE 6203: Climate Change Impacts and Adaptation in Deltas

3.00 Credit, 3 hrs./wk.

Objectives:

The impact of climate change on the rivers and coastal zones will be discussed followed by the planning and modelling of integrated delta basins, and the coordinated management required to mitigate these effects.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Explain and evaluate the concepts and approaches for sustainable delta basin development in a given context.
- Describe the principles, approaches, and practices of environmental impact assessment.
- Apply a range of tools and models (e.g. problem tree, water allocation modelling, EIA, cost-benefit analysis, multi-criteria analysis) to develop scientifically sound delta basin development strategies.
- Explain integrated delta basin planning and management frameworks and appraise basin development and management plans.

Contents:

The climate system, feedbacks, delta plan management, cycles and self-regulation; The climates of the coasts, coastal catchments, and deltas; Coastal and delta hazards; Water cycle and fluvial and coastal sediment supply; Key principles and signs of climate change: ancient and recent past climate change, and how the global carbon cycle is changing; Impacts of climate change on the atmosphere and ocean; Climate change impacts and drivers on coastal catchments and coasts; Climate change impacts and drivers on urbanizing deltas and coastal megacities: Climate modeling: future climate projections and future scenarios; Different approaches for adaption measures (hard/soft, flexible/rigid, central/decentralized, etc.); The IPCC historic background.

SKILL DEVELOPMENT COURSE

DEV 6204: Fieldwork and Data Processing

3.00 Credit, 3 hrs. /wk

Objectives:

This skill development course is designed to let the students plan, develop, and carry out real-life experimental works individually or in groups to learn about the various coastal and delta systems. The practical approach of this course is also designed to encourage the students to gather data from the fieldwork for their thesis work.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Plan and carry out an experimental campaign for data acquisition, knowing how to use instrumentation and technologies suitable for the study and observation of coastal and delta systems.
- Understand the use of different discrete and continuous random variables, performing parameter estimation calculations with coastal and delta data sets.
- Handle the different time scales of analysis (seasonality, interannual variability, secular trends, etc.) of different environmental variables, being able to analyze data and its graphic manipulation: interpolation, adjustment and regression.

Contents:

Experimental campaign planning, including instrumentation and surveying and data acquisition strategy; Quality control and data processing; Parameter estimation calculations with coastal and river data sets.

CRE 6301: Design of River Training and Bank Protection Works

3.00 Credit, 3 hrs. /wk.

Objectives:

This course will teach the students the basic mathematical theories for designing river training and bank protection works.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Explain the concept of river training works.
- Describe the design consideration of standard bank protection structures – revetment, groyne.
- Differentiate the different types of geosystems and geotechnical aspects and correlate the theories for application from Bangladesh's point of view.
- Learn the design of river training and bank protection structures.

Contents:

River training and bank protection structures; Design conditions and hydraulic loads; Geometrical design of dikes and revetments; Design criteria for placed block revetment and other types (bituminous, asphalt, etc.); Geotechnical aspects related to dikes: overall stability, design of the granular filter, geotextiles, geosystems; Effect of river training on the morphology of river; Integrated planning, monitoring, quality control and maintenance of construction; River training and bank protection work with special reference to Bangladesh; Design examples; Dredging works, types of dredgers, methods of dredging, engineering concepts and aspects of inland and offshore dredging with examples.

CRE 6302: River and Coastal Water Modelling

3.00 Credit, 3 hrs. /wk.

Objectives:

This course will introduce different numerical analysis required for modelling the rivers, coasts, and deltas. The lessons learned in the previous courses may be applied in this course to design mathematical models of the theoretical concepts.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Apply commonly used numerical methods in the river and coast water modelling
- Choose the appropriate model for a given problem
- Apply commonly used hydrodynamic and morphodynamic model systems in a practical situation
- Apply input reduction and schematisation techniques.
- Translate the outputs of complex models into practical outcomes.

Contents:

Numerical methods; Introduction to river coastal modeling– hydrological, hydrodynamic, morphological, wave, etc.; Regional modelling; Detailed morphological modelling; Schematization and boundary conditions, calibration and validation, model simulation; Case study: set up and simulation of a river model/coastal model.

CRE 6303: Applied Statistics to Coast and River Engineering

3.00 Credit, 3 hrs. /wk.

Objectives:

The probabilistic and statistical approach to coastal and river engineering will be taught in this course. The computations and concepts of probability and statistics in the field of coastal and river engineering will be applied to the data sets.

Learning Outcomes:

By the end of the course, students will be able to:

- Explain clearly concepts from probability and statistics and how they can be applied to coastal and river engineering environment.
- Evaluate the various quantities for probability distributions and random variables.
- Perform statistical computations using coastal and river data sets.
- Develop simple probabilistic and statistical models for some applications, and apply statistical methods to a range of problems in coastal and river engineering environment.

Contents:

Characteristics of hydrologic phenomena; random phenomena and their distributions; Various probability topics on coastal and river engineering environment; Empirical distributions of hydrologic variables; Parameters and statistics; Probability distribution functions, estimation methods; Sampling theory, testing hypothesis and goodness of fit; Correlation and regression, autocorrelation and cross-correlation, analysis of variance; Time series, spectral and cross-spectral analysis; Statistical computations using coastal and river data sets; Stochastic models.

THESIS

CRE 6000: Thesis

18.00 Credit

Objectives:

This course intends to involve the students in carrying out specific research work related to the coastal and river engineering discipline. It will help them to learn how to carry out engineering research work, present and defend the research work, and write a thesis paper.

Learning outcomes:

On successful completion of this unit, students should be able to:

- Carry out a literature search, then write a literature review, research proposal and project plan.
- Write the final report in the form of a thesis paper.
- Defend research work.