

**CURRICULUM FOR TWO-YEAR M. Tech. PROGRAM IN
DREDGING AND HARBOUR ENGINEERING**

(Tentative)

First Semester

S.No.	Subject No.	Subject Name	L	T	P	C	Hrs in a week
1.	DH50001	Port and Harbour Structures	3	2	0	3	5
2.	NA50003	Safety, Pollution Control and Security	3	2	0	3	5
3.	DH50005	Port and Coastal Hydrodynamics	3	2	0	3	5
4.	DH50007	Marine Materials and Corrosion	3	2	0	3	5
5.	DH50009	Dredgers and Harbour Craft	3	2	0	3	5
6.	NA50901	Industrial Seminar	0	0	3	2	3
7.	NA50701	Ship Drawing	0	0	3	2	3
8.	DH50703	Laboratory	0	0	3	2	3
9.	DH50801	Harbour Structural Analysis Project	0	0	3	2	3
		TOTAL	15	10	12	23	

Second Semester

Sl. No.	Subject No.	Subject Name	L	T	P	C	Hrs in a week
1.	DH50002	Dredging Equipment and Slurry Transportation	3	2	0	3	5
2.	DH50004	Ship Handling in Ports and Harbours	3	2	0	3	5
3.	DH50006	Sea-bed Mechanics	3	2	0	3	5
4.		Elective – I	3	2	0	3	5
5.		Elective – II	3	2	0	3	5
6.	NA50902	Computer Software Laboratory	0	0	3	1	3
7.	DH50802	Dredging/ Port Design Project	0	0	12	6	12
		TOTAL	15	10	15	22	

Third Semester

S.No.	Subject No.	Subject Name	L – T – P	C	Hrs in a week
10.		Elective - III	3 2 0	3	5
11.		Elective - IV	3 2 0	3	5
12.	DH50801	Comprehensive Viva-voce		3	-----
13.	DH50901	Project -I		14	
		TOTAL	6 4 0	23	

Fourth Semester

S.No.	Subject No.	Subject Name	L – T – P	C	Hrs in a week
8.	DH50902	Project - II		20	-----
		TOTAL		20	-----

TOTAL CREDITS FOR THE WHOLE COURSE**88**

Electives I to IV

Subject No	Subject Name	L	T	P	C
DH50008	Hydrographic Survey	3	2	0	3
DH50010	Cargo Handling in Ports	3	2	0	3
DH50012	Engineering Economics	3	2	0	3
NA50008	CAD CAM in Ship Design & Production	3	2	0	3
NA50010	Marine Machinery & Systems	3	2	0	3
NA50012	Design of Offshore Structures	3	2	0	3
NA50011	Advanced Structural Analysis	3	2	0	3
NA50013	Computational Fluid Dynamics	3	2	0	3
DH50011	Optimisation Methods	3	2	0	3
DH50013	Marine Management	3	2	0	3

Note: **L = Lectures**
 T = Tutorials
 P = Practicals
 C = Credits

SYLLABUS

Port and Harbour Structures

DH50001

3 0 0 = 3 Credits

Ports and harbours as the interface between the water and land infrastructure- an infrastructure layer between two transport media; Dry Infrastructure, Wet Infrastructure and Support Vessels; Different types of Breakwaters, jetties & quay walls and dolphins; Hydrodynamic loading on such structures and Structural Design aspects.

Safety, Pollution Control and Security

NA50003

3 0 0 = 3 Credits

Flotation and trim; Stability at small angles; Free surface effects; Effects of lifting and movement of large masses on stability; Stability at large angles; Cross-curves of stability; Curves of statical stability; Dynamical stability; Subdivision and flooding; Stability in damaged conditions - lost buoyancy and added weight methods; Probabilistic Damage Stability; ILLC; Fire Prevention and Control in Ships and ports, Occupational Hazards and Use of PPEs, ISM; Formal safety assessment; Oil tanker safety and Pollution prevention; Pollution due to sewage and garbage; MARPOL; Air pollution; Pollution due to ballast water and its control; Security in Ports – ISPS code.

Port and Coastal Hydrodynamics

DH50005

3 0 0 = 3 Credits

Introduction to the hydrodynamic environments: waves, tides & surges; Basic description of sea waves; introduction to wave transformation and wave-breaking, Wave action inside a harbour, harbour resonance, wave dissipation inside a harbour, wave runup and overtopping over different types breakwaters. Long waves in harbours. Wave-induced longshore currents. Wave monitoring and analysis for harbour design and operations; Tides, Analysis of tidal harmonics, basics of storm surge and surge modelling. Residual current in a port.

Marine Materials and Corrosion

DH50007

3 0 0 = 3 Credits

Material types - fabrication and service requirement; Classification society requirement- Selection of material for marine construction-, Types of shipbuilding quality steels - Mild steel, HTS, HSLA steel, etc; Heat treatment techniques - effect of thermal cycles on their micro-structure, Material composition of MS, HTS etc. and their effect on weldability and corrosion; Corrosion mechanism of steel - design aspects and prevention techniques. Aluminium alloys - alloy designation, welding requirements; Composites - types of resins, glass and carbon

fibers, their properties; Layup techniques, manufacturing requirements based on Classification society regulations.

Dredgers and Harbour Craft

DH50009

3 0 0 = 3 Credits

Types of dredgers, operational requirement of dredgers, economics of operation, design features; Tugs and supply vessels and their function, equipment and design features; Crane vessels, launches for port operation, pilot launches, pollution control vessels; Propulsion requirement of harbor craft.

Industrial Seminar

NA50901

0 0 3 = 2 Credits

External experts are to give invited talk to students once a week. Students are to appear for a viva voce examination at the end of the semester for evaluation.

Ship Drawing

NA50701

0 0 3 = 2 Credits

Lines plan drawing and computation of hydrostatics and stability of a given ship.

Mid-ship section drawing; Scantlings of different structural components as per the requirements of classification societies; Computation of section modulus.

Laboratory

DH50703

0 0 3 = 2 Credits

Simulation of port or harbour conditions in laboratory, wave conditions, manoeuvring studies.

Harbour Structural Analysis Project

DH50801

0 0 3 = 2 Credits

A structural analysis project using available software or based on student's own numerical analysis technique.

Dredging Equipment and Slurry Transportation

DH50002

3 0 0 = 3 Credits

Dredging equipment – mechanical system-cutters, backhoe etc., pneumatic system- suction, storage system – hopper and its operation, effect on stability; control system – hydraulic; slurry transportation through pipes; centrifugal pumps and their characteristics, pump cavitation; Environmental aspects; Design considerations – creating and restoring wetlands.

Ship Handling in Ports and Harbours

DH50004

3 0 0 = 3 Credits

Basic Ship Manoeuvring principles, Ship turning characteristics, Ship manoeuvring in restricted and shallow waters, Towing of ships – estimation of required tow force and requirement of tugs; Environmental loads on a moored or anchored vessels, Mooring of ships to a quay, jetty or dolphin, Mooring and anchoring equipment in ports; Floating docks, caisson dock gates and falling leaf type flap gates, Dry docks and docking of a ship – loads on blocks; trim and stability during docking.

Sea-bed Mechanics

DH50006

3 0 0 = 3 Credits

Types of sediments in port environments, basic notions of sediment movement-initiation of sediment movement, bedload transport and transport in suspension, wave boundary layer, mobile bed effects-bedforms under waves and currents, Equations for bed-load transport under current, bed-load transport due to waves, Equations for sediment transport in suspension, total sediment transport due to combined action of waves and currents, Sea-bed liquefaction due to action of waves and seismic activities, Qualitative description of movement of cohesive sediments.

Computer Software Laboratory

NA50902

0 0 3 = 1 Credits

Student has to work on one or more software packages available to solve an assigned problem.

Dredging/ Port Design Project

NA50802

0 0 12 = 6 Credits

Student has to complete a given dredging project assignment or do a port layout and design assignment. The work should be completed ready with specifications and cost estimation.

Hydrographic Survey

DH50008

3 0 0 = 3 Credits

Basic notions of surveying: survey requirements, survey scheduling, pre-survey planning, post-survey data analysis and review, Accuracy standards, quality control and quality assurances for navigation and dredging surveys, Project control, coordinate systems and datums; Depth measuring techniques-manual, single beam acoustic depth measurement, multiple transducer channel sweep systems for navigation projects, acoustic multi-beam survey systems. Navigation project clearance and object detection; Airborne Lidar Surveying, Dredging Support surveys, dredge measurement and payment volume computations, Contracted survey specifications and cost estimates.

Cargo Handling in Ports

DH50010

3 0 0 = 3 Credits

Chain and pulley blocks, span tackle arrangement in derricks – force diagram, union purchase of cargo handling; Cranes – different types, level luffing cranes, container handling cranes; container storage and handling in ships and ports; Floating cranes – arrangement and stability; Bulk cargo handling equipment – grabs, conveyor belts, automatic loading and unloading; Liquid cargo handling – centrifugal pumps, piping for cargo transportation, insulation for cryogenic cargo, oil jetty arrangements; Cargo movement on road ways and railways – port area, RORO ships and hinterland connection.

Engineering Economics

DH50012

3 0 0 = 3 Credits

Time value of money, interest relationships, NPV and yield or IRR; Trade pattern, Chartering of ships, time, voyage and bareboat charter, Freight rate and its fluctuations, Conferences; Loans and repayments, Operating expenses, Overhead expenses; Investment and Return on Investment; Role of Total Quality Management.

CAD CAM In Ship Design & Production

NA50008

3 0 0 = 3 Credits

Introduction; Engineering CAD systems; Analytical and parametric representation of curves; Interpolation techniques, control polygon techniques (Bezier, BSpline, NURBS); Ship curve design; Interrogation and fairing techniques for curves; surface representation, analytical and parametric

representation of surfaces; Surface interpolation techniques, control polygon techniques(Bezier, BSpline, NURBS); Interrogation and fairing techniques for surfaces; Ship surface design- ruled surface, developable surface, low curvature surfaces.

Marine Machinery & Systems

NA50010

3 0 0 = 3 Credits

Choice of Propulsion Systems – Gas turbines, steam turbines, diesel engines, electrical propulsion and combinations; Marine boilers – Oil fired, coal fired, nuclear; Power transmission system – Shafting system; HFO, MDO and LO storage, transfer and purification systems; FW and SW systems; Fire fighting and BW systems; Sludge control and oily water purification systems; Electrical load calculation, power generation and distribution systems; Cargo handling – dry break-bulk, unitized and bulk cargo, liquids in bulk, cryogenic liquids etc.; Pumps, piping and valves; Life saving and fire fighting systems; Steering and navigation systems; Anchoring and mooring systems.

Design of Offshore Structures

NA50012

3 0 0 = 3 Credits

Loads on Offshore Structures Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads; Concept of Fixed Platform Jacket and Deck; Steel Tubular Member Design; Tubular Joint Design for Static and Cyclic Loads; Submarine Pipelines and Risers; Design against Accidental Loads (Fire, Blast and Collision).

Advanced Structural Analysis

NA50011

3 0 0 = 3 Credits

Classical and Numerical approaches to buckling of columns, beam-columns and frames, Torsional buckling, Plate buckling, Introduction to fracture mechanics, Stationary crack under static loading, Crack growth, Fatigue; FEM application to Structural Analysis.

Probabilistic nature of forces acting on a structure at sea, Simulation of probabilistic structural resistance, Methods for reliability assessment of structures – first order second moment method, advanced second moment method, reliability based structural design codes.

Computational Fluid Dynamics**NA50013****0 0 3 = 1 Credits**

Formulation, methodology and techniques of numerical solutions of potential and viscous flow problems in ocean engineering, boundary integral methods – application to radiation and diffraction problems, Finite difference and finite volume methods – grid generation, solution of free surface flows and Navier Stokes equations around a body in water, numerical flow simulation.

Optimisation Methods**DH50011****3 0 0 = 3 Credits**

Introduction, Linear programming, Non-linear programming, unconstrained and Constrained Optimisation , numerical optimisation techniques, Genetic Algorithm, Fuzzy logic and Neural networks, Swarm Optimisation techniques, Application of optimization to marine engineering problems.

Marine Management**DH50013****0 0 3 = 1 Credits**

Queuing theory, Transportation problem, Inventory control, Material management, Supply chain management, ERP, PLM, Total quality management, Traffic Management, VTMS, Modeling & simulation techniques for cargo management.