

**CURRICULUM FOR TWO-YEAR M. Tech. PROGRAM IN
NAVAL ARCHITECTURE AND OCEAN ENGINEERING**

First Semester

S. No.	Subject No.	Subject Name	L	T	P	C	Hrs in a week
1.	NA50001	Introduction to Ships & Offshore Structures	3	2	0	3	5
2.	NA50003	Safety, Pollution Control and Stability	3	2	0	3	5
3.	NA50005	Ship Construction and Welding	3	2	0	3	5
4.	NA50007	Performance of Marine Vehicles – I	3	2	0	3	5
5.	NA50009	Strength of Ships and Offshore Structures	3	2	0	3	5
6.	NA50901	Industrial Seminar	0	0	3	2	3
7.	NA50701	Ship Drawing	0	0	3	2	3
8.	NA50703	Hydrodynamics Laboratory	0	0	3	2	3
9.	NA50801	Ship Structural Analysis Project	0	0	3	2	3
		TOTAL	15	10	12	23	

Second Semester

S. No.	Subject No.	Subject Name	L	T	P	C	Hrs in a week
1.	NA50002	Ship Design	3	2	0	3	5
2.	NA50004	Ship Production	3	2	0	3	5
3.	NA50006	Performance of Marine Vehicles – II	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.	NA50802	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
1		Elective - III	3 2 0	3	5
2		Elective - IV	3 2 0	3	5
3	NA50801	Comprehensive Viva-voce		3	-----
4	NA50901	Project -I		14	-----
		TOTAL	6 4 0	23	

Fourth Semester

S. No.	Subject No.	Subject Name	L – T – P	C	Hrs in a week
1	NA50902	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 Propulsion 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

Introduction to Ships & Offshore Structures

NA50001

3 0 0 = 3 Credits

Ocean Environment - waves, tides and currents; Ocean Resources – oil and gas, mineral modules, energy, food source etc. Types of ships, Hull forms & its definitions; sectional area and moments; hydrostatics calculations; space allocation & general arrangement; weights & CG; Volume & capacities; GRT & NRT.

Types of offshore structures, Jacket & gravity platforms, jack-up, semi-submersible & drill ships, TLP, spar & guyed tower, submarine pipeline, deep water complaint platforms, FPSO & sub-sea production systems.

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.

Ship Construction and Welding

NA50005

3 0 0 = 3 Credits

Aspects of shipbuilding technology; Structural components - bottom construction, shell plating, decks, fore and aft peak construction, superstructure and deckhouses, bulkheads; Framing system; Structural continuity; Steel material preparation - shot blasting, acid pickling etc; Plate cutting methods; Plate and section forming - mechanical methods and line heating techniques; Fusion welding – types of power source and their characteristics, welding methods - MMAW, GMAW, SAW, Electro-slag welding; Welding parameters and their effect on welded joints; Welding distortions-causes and prevention; Welding defects; Nondestructive testing, Corrosion and its prevention.

Performance of Marine Vehicles - I

NA50007

3 0 0 = 3 Credits

Components of ship resistance; Dynamic similarity; Froude hypothesis; Viscous resistance; Laminar and turbulent flows; Effect of roughness; Friction lines; Form resistance; Wave resistance; Kelvin wave pattern and waves generated by a ship; Wave interference; Air resistance; Appendage drag; Ship resistance in shallow water; Resistance data presentation; Estimation of effective power - methodical series and statistical methods- Hull form and resistance; High Performance Vehicles – Drag and propulsion.

Screw propeller geometry; Propeller theories; Laws of similarity for propellers; Propellers in "open" water; Propeller coefficients and design charts; Hull propeller interaction - wake, thrust deduction and relative rotative efficiency; Propulsive efficiency and its components; Propeller cavitation- Propeller blade strength; Propulsion experiments- Propeller design; Speed trials and service performance analysis; Unconventional propulsion devices.

Strength of Ships and Offshore Structures

NA50009

3 0 0 = 3 Credits

Materials of construction – properties and use

Forces acting on ship structure; Idealization of ship structure as hull girder; Longitudinal bending of hull girder – weight and buoyancy curves; Deflection, shear force and bending moment diagrams; Stresses in inclined conditions; Section modulus - Bending and shear stresses; Analysis of bulkheads and decks; Structural discontinuities and stress concentration; Analysis of beam and frame; Introduction to elasticity; Plane stress and plate bending problems.

Vibration induced in floating elastic structure like ship due to wave, propeller and machinery; Free and forced vibration of single degree of freedom system; Empirical formulae for the evaluation of frequencies in ship hull vibration; Free and forced vibration of multi-degree of freedom system; Vibration of a continuous system; Concept of added mass and its effect in ship hull vibration; Hull resonance diagram; Selection of engine and propeller based on vibration considerations, Vibration of machine shafts; Design of engine mounts.

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.

Hydrodynamics Laboratory

NA50703

0 0 3 = 2 Credits

Ship Model making; Calibration of dynamometer; Calm water resistance test and analysis; Propeller open water test and analysis; Model self-propulsion test and analysis; Experiment in regular waves. The experiments are to be organised based on tank testing facility available during the semester.

Ship Structural Analysis Project

NA50801

0 0 3 = 2 Credits

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

Ship Design

NA50002

3 0 0 = 3 Credits

Engineering design - Philosophy and definition; Marketing principles in marine environment; Engineering economic criteria and complexities, operating cost, optimal vessel design; Properties of cargo; Design spiral, concept design, objectives and constraints, preliminary design; Hull form design and development; General Arrangement design - Space and volume layout, access arrangements; Shipbuilding cost estimation; Specifications, tendering and contract.

Ship Production

NA50004

3 0 0 = 3 Credits

Overview of ship production systems – Shipbuilding process; Metal Manufacturing and Construction process – straightening, cutting, forming and welding, outfit process, materials handling; Shipyard layout; Information for shipbuilding production; Product standardization and work simplification- shipbuilding management – group technology – work breakdown; Product work breakdown and integrated zone engineering; Ship Design and Engineering; Planning, Scheduling and Production Control - linear programming concepts - network analysis - scheduling and resource allocation; Accuracy control; Developments in CAD/CAM and CIM in shipbuilding

Performance of Marine Vehicles -- II

NA50006

3 0 0 = 3 Credits

Regular surface waves and their properties; Irregular Waves – statistical representation, energy spectrum; Ship motions in regular waves: frequency of encounter, natural periods, RAO. Motions in irregular waves: response spectra. Derived responses: slamming, deck wetness, relative motions, seasickness ; Design considerations for sea keeping; Motion Stabilisers.

Introduction to maneuverability, directional stability. Basic motion equations of a maneuvering body. Hydrodynamic and control derivatives; Various definitive maneuvers: turning, zigzag, spiral; Heel during turn. Experimental determination of hydrodynamic derivatives; IMO maneuvering standards; Rudder torque estimation and design.

Computer Software Laboratory

NA50902

0 0 3 = 1 Credits

Student has to work out an assigned problem using software available in the laboratory.

Design Project

NA50802

0 0 12 = 6 Credits

Student has to complete the design of an assigned ship or offshore structure and draw up specifications suitable for tendering.

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.

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.

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.