DEPARTMENT OF Marine Engineering

M.TECH. (Naval Architecture and Marine Engineering) - Evening Course

(with effect from 2019-2020 Admitted batch)

I – SEMESTER

Code No	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Exam. Duration	Theory/Lab./Viva	Sess.		
NAME 1.1	Core subject 1 Basic Naval Architecture	4	-	4	3	70	30	100	3
NAME 1.2	Core subject 2 Ship design and Drawing	4	-	4	3	70	30	100	3
NAME 1.3	Core subject 3 Ship Construction and outfitting	4	-	4	3	70	30	100	3
NAME 1.4	Programme Elective 1 a. Powering of Ships b. Marine Machinery and Marine Engines c. Wave Engineering	4	-	4	3	70	30	100	3
NAME 1.5	Programme Elective 2 a.Marine Instrumentation and Stress Analysis b. Advanced FEA c. Elements of Ship Vibrations	4	-	4	3	70	30	100	3
NAME 1.6	Research Methodology and IPR	3	-	3	-	70	30	100	2
NAME 1.7	Audit Course-1	3	-	3	-	70	30	100	0
NAME 1.8	Seminar	--	3	3	Viva-voce	50	50	100	2
NAME 1.9	CFD Lab	--	3	3	Viva-voce	50	50	100	2
TOTAL		26	6	32	15	590	310	900	21

Note: The viva-voce for the labs/seminars shall be held with the course instructor/faculty member and an external examiner nominated by the university from any academic institution/industry/R&D organization.

II - SEMESTER

Code No	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Exam. Duration	Theory/Lab/ Viva	Sess.		
NAME 2.1	Core subject 4 Seakeeping and Manouverability	4	-	4	3	70	30	100	3
NAME 2.2	Core subject 5 Hydrodynamics and Computational Methods	4	-	4	3	70	30	100	3
NAME 2.3	Core subject 6 Advanced Marine Vehicles	4	-	4	3	70	30	100	3
NAME 2.4	Programme Elective 3 a. Marine Engineering - I Engineering b.. Ind Engg and Mgt c. Sub Sea Piping	4	-	4	3	70	30	100	3
NAME 2.5	Programme Elective 4 a. Marine Power Plant Engineering b. Advanced Fluid Mechanics c. Fishing Vessel Tech	4	-	4	3	70	30	100	3
NAME 2.6	Audit Course-2	3	-	3	-	-	-	-	0
NAME 2.7	CASD Lab	--	3	3	Viva-voce	50	50	100	2
NAME 2.8	Seminars	--	3	3	Viva-voce	50	50	100	2
NAME 2.9	Mini project with Seminar	--	3	3	Viva-voce	-	100	100	2
TOTAL		*23*	*9*	*32*	*15*	*450*	*350*	*800*	*21*

Note: The viva-voce for the labs/seminars shall be held with the course instructor/faculty member and an external examiner nominated by the university from any academic institution/industry/R&D organization.

III – SEMESTER

Code No	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Exam. Duration	Theory/Lab/ Viva	Sess.		
NAME 3.1	Programme Elective 5 a. Experimental Hydrodynamics b. Marine Engineering II c. Underwater Acoustics	4	-	4	3	70	30	100	3
NAME 3.2	Open Elective	4	-	4	3	70	30	100	3
NAME 3.3	Dissertation-I	--	-	-	-	-	100	100	6
TOTAL		*8*	-	*8*	*6*	*140*	*160*	*300*	*12*

Note: The Dissertation shall be evaluated through Viva-voce examination by a committee with HOD, Chairman, Board of studies and Research Guide as members. The marks shall be awarded in the ratio of 30,30 and 40 percent by the members respectively.

IV - SEMESTER

Code No	Subject	Scheme of Examination	Total Marks	Credits
NAME 4.1	Dissertation –II	Viva-voce	100	14

Note: The Dissertation shall be evaluated through Defence and Viva-voce examination by a committee with an External Examiner nominated by University, HOD, Chairman, Board of studies and Research Guide as members. The marks shall be awarded in the ratio of 20, 20, 20 and 40 percent by the members respectively.

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

Open Elective

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy

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M. Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)

Semester – I

NAME1.1 Basic Naval Architecture (Core Subject-1)

Examination: 70 **Sessionals : 30**

Periods per week : 4 **credits: 3**

Ship geometry & form co-efficient, Hydrostatics, Intact and damaged stability, Free surface effects, Subdivision & floodable length, IMO stability criteria, Launching calculations, Stability of submerged bodies

NAME1.2 Ship Design and Drawing (Core Subject-2)

Examination: 70 **Sessionals : 30**

Periods per week : 4 **credits: 3**

Types of ships, size, Principal particulars and ranges of form parameter and ratios, Basic hull form generations and lines plan, offset tables, Ship design procedures, Design spiral, General arrangement, Scantling calculations, Mid hip section ,Weight estimations, Deadweight, capacity and tonnage, Trim & Stability Booklets, Powering, Class notations, Safety and Classification Society Rules. Ship Drawing.

The Strength and structure of ships: Forces acting on ship structures, Ship strength and beam theory, Beam and load classification, Longitudinal bending of ship structures : Shear force and bending moment diagrams, section modulus and mid ship section. Structural stresses within a ship : hull girder stresses, local stresses, means of determining ships strength curves, Scantlings of ship structures, Structural analysis.

NAME1.3 Ship Construction and Outfitting (Core Subject-3)

Examination: 70 **Sessionals : 30**

Periods per week : 4 **credits: 3**

Brief on the major shipyards and ship building activities in the country, Ship building technology and practices, Construction of ship's hull and it's structural components : Bottom structure, shell plating, Decks, Bulkheads, Framing system etc., Structural alignment and continuity, Ship building steel, Steel material preparation (shot blasting etc.),

Lofting, Plate nesting and cutting methods, Plate and section forming techniques, Welding principles, Types of welding and methods, Causes of welding distortions and preventions, Welding defects, Weld inspection methods

NAME 1.4 (A) Powering of Ships (Programme Elective-I)

Examination: 70 **Sessionals : 30**

Periods per week : 4 **credits: 3**

Components of ship resistance, Dimensional analysis,, Froude's hypothesis and his experiments, Viscous resistance, Friction lines, Wave resistance, Kelvin wave pattern, Form resistance, Appendage drag, Computation of ship powering, Wake fraction, Thrust deduction, Propulsive efficiency, Model-ship extrapolation and correlations, Trial allowances, Resistance of submerged bodies

History and development of screw propellers, Types of propellers, Propeller geometry / drawings, Propeller action -momentum theory, Propeller coefficients, B-Series data, Interaction between hull and propeller, Cavitation, Types of cavitation, nature and causes, Strength of propellers

NAME 1.4 (B) Marine Machinery & Marine Engines (Programme Elective-I)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **03 credits**

Details of pumps for marine purposes- Ejectors and their purpose. Applications in Marine use. Details of construction.Various types of piping systems fitted in ships, expansion arrangements for pipes, valves and fittings. Types used in marine practice, materials and corrosion in pipes, color codes for different pipes.
Evaporators, distillers, waste heat recovery systems. Hot water, drinking water, cooling water (fresh water) and sea water systems. Fuel systems, lubricating oil systems, strainers and filters, coolers, centrifuges, purifiers and clarifiers. Bilge and Ballast systems- sewage's disposal system.

Cargo handling-dry cargo handling equipment-winches, cranes, cargo gears, Pontoon hatch covers, liquid cargo handling in tankers, cargo pipe layout systems-loading, unloading, ventilation, cleaning.
Steering gears: Different types-description of construction, operation and maintenance.
Docking methods: Docking methods for ships-Inspection and routine overhauling of under water fittings and hull.
Stern Tubes: Stern tubes and glands-oil lubricated stern tubes, shaft seals, shaft alignment, thrust block, reduction gearing.
Deck equipment: Engine room and Deck cranes, Windlasses, Mooring Winches, Anchors and Anchor chains, Lifeboats lowering, Shackles, and Chain blocks.
Safety systems: Safe working practices, precautions in overhauling machinery parts, mechanical safety in workshops, protective equipment.
Fire fighting: Fire Prevention – detection and extinction. Principles of operation, application and maintenance of fire extinguishers. Respirators, safety lamps, fire alarms and signals. Fixed fire detection and extinguishing arrangements for accommodation. Cargo holds and machinery spaces. Methods of fire fighting at sea. Pumping systems for fire fighting. Scavenge fires, and crank case explosion, oil mist detec
Marine Diesel Engines,Basic theory, Fuels, lubrication and cooling, Scavenging and supercharging, Starting, reversing and automation, maintenance. Medium speed engines and auxiliary engines.

NAME 1.4 (C) Wave Engineering (Programme Elective-I)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **credits: 3**

Conservation of mass, moment and Energy. Euler Equation – Bernoullis Equation. Potential and Stream function.

1. Classification of Ocean Waves. Linear wave theory: Governing Equation, Boundary Conditions and solutions, Dispersion relation, Constancy of wave period.
2. Wave Kinematics : Wave celerity, water particle velocities, accelerations, displacements and pressures. Approximations for deep and shallow water conditions. Integral properties of waves: Mass flux, Energy and energy flux, Group speed, Momentum and momentum flux.
3. Wave Transformations: Shoaling, bottom friction and damping, refraction, reflection and diffraction. Wave Breaking: Type of breaking, Surf similarity parameter. Keulegan-Carpenter number, Ursell Parameter, Scattering parameter, Reynolds Number. Wave Loads: Non breaking wave forces on slender structures – Morison equation; Diffraction theory, source distribution method-Introduction to non-linear wave theories-Strokes, Cycloidal and Solitary wave theory.

Text Books:

Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, inc., New York, 1978
Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., New Jersey, 1994
Sarpkaya, T. and Isaacson, M., Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold Co., 1981

References:

Shore Protection Manual Volume I and II, Coastal Engineering Research Centre, Dept, of the Army, US Army Corps of Engg
Weigel, R.L.Oceanographical Engineering, Prenticxe Hall Inc, 1982.
Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, New York, 1978.

NAME 1.5 (A) Marine Instrumentation and Stress Analysis (Programme Elective-II)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **credits: 3**

1. Generalized measuring systems – calibration – damping - Dynamic signals – Basic detectors Transducer elements – Intermediate modifying systems – terminating devices.
2. Measurement of force and torque, Measurement of pressure – High pressure and low pressure, Measurement of fuel flow – Positive displacement methods – Obstruction meters – Hotwire anemometer.
3. Measure of temperature – Thermocouples – Pyrometry, Vibration and shock measurement – Accelerometers – Vibrometers – Seismic devices. Acoustic measurements – Sound measuring techniques.
4. Stain gauges – Photo elastic, Electrical, resistance gauges, cements and cementing of Gauges – Bridge circuits – balanced and unbalanced, Calibration gauge rosettes – Evaluation of Principal stresses – Static and dynamic gauges for various applications.
5. Stress analysis – Whole field techniques by photo elasticity, brittle coatings, Grid methods & Moire – Applications to the solution of engineering problems.

Text Books:

1. Mechanical Measurements - T.G Beckwith & N.Lewis Buck.
2. Mechanical and industrial Measurements - R.K Jain.
3. Experimental methods for engineers. - J.P Holman
4. Applied Stress Analysis- A.J. Durelli.

NAME 1.5 (B) Marine Instrumentation and Stress Analysis (Programme Elective-II)

Periods/week : 4 **Ses. : 30** **Exam : 70**
Examination Theory: 3hrs. **Credits: 3**

1. Overview of finite element method, Discretization of the domain, Interpolation models, Higher order and isoparametric elements, Derivation of element matrices and vectors, Assembly of element matrices and vectors and derivation of system equations, Numerical solution of finite element equations, Analysis of trusses, beams, and frames
2. Analysis of plates and Shells
3. Three-dimensional problems
4. Vibration Analysis - Modal and Harmonic analysis
5. Fluid flow problems - Basic equations of fluid mechanics, Inviscid and incompressible flows

Textbook

1. The Finite Element Method in Engineering - S S Rao, 4th Edition, Elsevier Publications
2. Finite Element Modeling for Stress Analysis - R D Cook - John Wiley

NAME 1.5 (C) Elements of Ship Vibrations (Programme Elective-II)

Periods/week : 4 **Ses. : 30**
Exam : 70
Examination Theory: 3hrs. **Credits: 3**

1. Single degree of freedom systems: Free and forced vibrations, damping, classification and damped systems. Energy methods. Vibration isolation and transmissibility. Vibration measuring instruments such as displacement, velocity, acceleration and frequency measurements, Dunkerley's equation.
2. Two degrees of freedom system. Free, forced, damped and undamped motions matrix formulation, matrix method, using of Lagrange's equations to determine equations of motion, Dynamic vibration absorbers, principle of Orthogonality. Semi-definite systems. Combined rectilinear and angular modes. Torsional systems.
3. Multi degrees of freedom systems: Free and forced vibrations of Longitudinal, torsional, and lateral modes. Critical speeds of rotors Matrix formulation, stiffness and flexibility influence coefficients. Eigen value problem Matrix method, Matrix iteraction technique for eigen values and eigen vectors. Stodola's method, Hozler's Method.
4. Continuous Systems: Axial vibrations of bars, torisonal vibrations of shafts, transverse vibrations of strings and bending vibrations of beams. Free and forced vibration of strings classical and energy methods.
5. Ship vibration : Introduction to ship hull vibration-- Mathematical basis of ship vibration - calculation of ship hull vibration

Text books:

1. Ship Hull Vibrations: Todd
2. Mechanical vibrations, Schaum's outline series- William W. Seto
3. Mechanical Vibrations by S.S. Rao Mc-Graw Hill Publications

<u>Semester – I</u>

NAME 1.8 Seminars

Periods/week : 4 **Ses. : 50** **Exam : 50**
Examination Theory: 3hrs. **Credits: 2**

Each student has to present at least 4 seminars on a topic that is approved by the concerned teacher. The final seminar should be presented before a committee constituted by the Head of the Department

NAME 1.7 CFD Lab

Periods/week : 4 **Ses. : 50** **Exam : 50**
Examination Theory: 3hrs. **Credits: 2**

1. Exposure to CFD packages like Star-CCM+, Ansys
2. Geometry creation of simple 2-D and 3-D Objects
3. Mesh Generation
4. Boundary conditions
5. Solution for varying parameters like Reynolds Numbers, Froude Number etc
6. Application to Ship Drag calculation (pressure and Friction)
7. Presentation of results of ship drag compared with IITC values

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Semester –II

NAME 2.1 Sea keeping and Maneuvering (Core Subject 4)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **credits: 03**

Ship motions in a sea way : Ocean waves, Theory of simple gravity waves, Trochoidal Waves, Regular and irregular waves, Statistical representation of ocean wave patterns, Translational and rotational components of ship motions, Coupled motions, Effects of ship motions

Ship maneuvering and control : Path keeping and definitions of motion stability, Equations of motion, notations, Control fixed stability indices and stability criteria, Stability and control in horizontal and vertical planes, Standard maneuvers and evaluation of maneuverability and control characteristics

NAME 2.2 Hydrodynamics & Computational Methods (Core Subject 5)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **credits : 3**

Basic Fluid Mechanics, level Potential, Eulerized and Viscous Flows, Computational Methods for governing equations : Finite Difference and Finite Volume Methods, Discretization and Grid Generation, Transport equation with finite volume Method, Turbulent Flow, Turbulence Models

NAME2.3 Advanced Marine Vehicles (Core Subject 5)

Examination: 70 **Sessionals : 30**
Periods per week : 4 **credits : 3**

Classification of high speed crafts and types, comparison based on hydrodynamic performance, Structural design considerations, propulsors for high speed crafts.
Design features and powering characteristics of Semi-displacement crafts, Planing crafts, Hydrofoils, Air cushion vehicles, Surface effect ships, Wing-in-ground crafts.
Introduction to multi-hull ships : Catamaran, Trimaran, Pentamaran
Latest types of advanced marine crafts.

NAME2.4 (A) Marine Engineering –I (Programme Elective-3)

Periods per week: 4 **Examination: 70 Marks**
Credits: 3 **Sessionals : 30 Marks**

1. Marine Diesel Engines – Low speed and medium speed engines – Auxiliary engines – Scavenging and supercharging systems – Starting and reversing gear – Maintenance – Automation – Hazards in engine room.
2. Marine Nuclear power installation - Principles of operation of Atomic Reactors – Different types of Reactors – Use of Nuclear reactors in sea going vessels - Radiation hazards and safety – Radioactive waste disposal.
3. Marine Turbines – Steam turbine Classification based on impulse and reaction principles – Flow thro' blade passages and design – Losses and performance – Compounding, velocity triangles – Starting and Maintenance procedures.
4. Marine gas turbines – Practical cycles and shaft arrangements - Power turbine – Applications.
5. Marine Refrigeration – Cycles – Compressors, Condensers, Evaporators and thermostatic valves – Space coolers – Maintenance and Auxiliary equipment.
6. Marine Air-conditioning – cooling, Heating, Humidication process – Types of Air conditioning systems – Ducting controls.
7. Ventilation – Requirements and provision – Insulation protection of materials and maintenance.
8. Marine Boilers – Composite and water tube boilers – Waste heat boilers Arrangement of boiler room – Feed water treatment for Marine boilers – feed supply systems and control.

Text Books:

1. Marine Power plant Engineering - Akimov.P
2. Marine I.C Engines-A.B Kane
3. Principles and practice of Marine Diesel Engines – D.K Sanyal
4. Refrigeration and air-conditioning- P.L. Ballaney
5. Marine Steam Boilers- Milton J.H.

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Semester –II

NAME2.4 (B) INDUSTRIAL ENGINEERING AND MANAGEMENT (Programme Elective-3)

Periods per week: 4 Examination: 70 Marks
Credits: 3 Sessionals : 30 Marks

1. Management and Organization: Functions of Management, Principles of Management, Principles of Organization: Line, Staff and functional organizations, Forms of business ownership, Entrepreneurship.
2. Facilities location and Layout: Factors for selection of a location, Urban, Suburban and rural locations, Types of layouts, process and product layouts, Line balancing, Shipyards and port layouts.
3. Material Handling: Principles of material handling, Types of material handling equipment, Selection of material handling equipment.
4. Inventory control: Costs of inventory, ABC Analysis, Economic order quantity, Economic lot-size quantity, Basic inventory models.
5. Quality Control: Quality and product design, Control charts.
6. Network analysis: Network techniques of program management, CPM and its advantages, Difference in PERT & CPM, steps in CPM technique, Steps in the technique of PERT planning, Estimation of activity duration. Float or slack, Latest finish time, resource leveling program, crash of the project.
7. Management information Systems (MIS): Impact of MIS on management, accounting information system, Objective of information systems, Computer based information management system,

Management by direction, by result, management in objectives, Influence of computer based on management by direction.

8. Industrial Psychology and personnel management: Functions of functional management, Industrial legislation of India, Factories act and the industrial disputes act, Elements of industrial psychology, Hawthrone studies, Theories of motivation- Maslow, Mc Gregor.

Text Books:

1. Industrial engineering and management -O.P Khanna
2. Industrial Management - K.K.Ahuja, Khanna Publishers.

References:

1. Principles of Management - Koontz & O Donnel.
2. Production and Operations Management - Everette Adam &Ronald Ebert.
3. Operations Management - John Mc Clain & Joseph Thames

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Semester –II

NAME2.4 (C) Subsea Piping (Programme Elective-3)

Periods per week: 4 Examination: 70 Marks
Credits: 3 Sessionals : 30 Marks

Introduction: Material properties ,pipe production, pipe fabrication, specifications, Mothods of increasing corrosion resistance, CR alloys and their manufacturing, Evaluating corrosion resistance and external protection, Welding of pipelines,welding sequence, Manual, semiautomatic and automatic welding

1. Flexible and Composite Pipelines: Introduction, Fabrication techniques, Internal and external corrosion, sour service, Failure modes of flexible pipes, Composite pipelines
2. Internal Corrosion and its prevention: Corrosion mechanisms, Sweet corrosion, Corrosion in oil pipeline and effect of flow, Solids in Oil Pipelines, Corrosion in Gas pipelines and effect of flow, Sour corrosion, Corrosion Inhibition.
3. External Corrosion and pipeline hydraulics: External corrosion and coatings, Cathodic protection, concrete weight coatings, thermal insulation, Single-phase flow Newtonion fluids, heat transfer and flow temperature, hydrates, multiphase flow
4. Strength and stability: Introduction, Design to resist Internal and external pressures, Longitudinal stress, Bending , Indentation, and Impact, Design currentsand waves, Hydrodynamic forces, laterl resistance, Stability design
5. Marine pipeline construction and Shore approaches: Lay-Barge construction, reel construction, pull and tow, trenching, costal Environment, site Investigation, horizontal drilling, Tunnels and tidal flat

Reference: Plamer, Andrew C.(Andrew Clennel),1938-Subsea Pipeline engineering, / Andrew C. Palmer and Roger A

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Semester –II

NAME2.4 5 (A) Marine Power Plant (Programme Elective-4)

Periods per week: 4 Examination: 70 Marks
Credits: 3 Sessionals : 30 Marks

1. Introduction: Classification of Power Plants, Comparison between land based and Marine Power Plants Performance Characteristics of Marine Power Plants, Fuel Consumption under varying conditions, Marine Power Plants layout.
2. Marine boilers: Marine Boilers of Fire Tube, Composite and water-tube boilers. Feed water treatment. Feed water supply systems and controls.
3. Marine steam turbines: Construction details, Compounded steam turbines for Marine applications, Operation and maintenance.
4. Marine gas turbines: Gas Turbine cycles for Marine applications, Recent trends and developments, Free piston engines, Combined Cycle Plants.
5. Nuclear power plants: Nuclear fission reaction, types of reactors, Fuels, moderators, Coolants, Control and safety rods, radiation hazards and shielding, Radioisotope applications, Radioactive Waste disposal, Nuclear Powered propulsion, Indian reactor developments.
6. Marine Refrigeration and Air Conditioning: Marine refrigeration systems- operation and maintenance-application in modern passenger ships, bulk carriers and refrigerated vessels. Air conditioning systems on board the ships-temperature and humidity control-comfort conditioning. Cabin and cargo ventilation- piping and ducting-insulating materials

Text books:

1) Marine Power Plants -- P.Akinov
2) Nuclear Engineering -- D.K.Singhal
3) Marine Engineering -- R.Harrington
4) Introduction to Marine Engineering -- D.A.Taylor.

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Semester –II

NAME 2. 5 (B) Advanced Fluid Mechanics (Programme Elective-4)

Periods/week : 4 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 3

Basics

Methods of Describing Fluid Motion, Kinematics of Fluid Motion -- the Eulerian picture, Kinematic transport theorem , Forces in the Fluid Law of Momentum Conservation , Relations between stress and rate-of-strain tensors Vorticity Theorem for a viscous fluid Rayleigh's Problem -- solid wall as a source of vorticity Scaling and similarity parameters

Low Viscous Flows

A thin fluid layer flowing down an incline Lubrication approximation for flow in a thin layer Stokes flow past a sphere Oseen's improvement for slow flow past a cylinder

High-Speed Flows and Boundary Layers

Flow of invisid and homogeneous fluids Viscous Flow at High Reynolds Numbers Two dimensional laminar jet

The effects of pressure gradient Karman's momentum integral approach Unsteady boundary layers

Rudiments of Hydrodynamic Instability

Rudiments of Hydrodynamic Instability Kelvin-Helmholtz Instability for continuous shear and stratification

Inviscid Instability mechanism of parallel flows Viscous Effects on the Instability of parallel flows

Textbooks:

Viscous Fluid Flow - White, John Wiley

Intermediate Fluid mechanics - Robert H Nunn - Hemisphere Publications

Boundary Layer Theory - Schlichting

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Semester –II

NAME 2. 5 (C) Fishing Vessel Technology (Programme Elective-4)

Periods/week : 4 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 3

Importance of fishing, Classification of fish for harvesting. Fishing methods- Purse seining, Drift netting, Gillnet fishing, Long line fishing. Pole and line fishing, Trawling, Harpooning.
Fishing Gear- Towed gear, Bottom trawling, side trawling, Towing arrangements, stern trawling operations and equipment, multiring trawling, Midwater trawling, Purse seining Types, Analysis of fishing nets.
Storing and preservation of fish on board a vessel, Fish hold arrangement. Insulation, icing and freezing. Refrigeration machinery.
Design of fishing vessels. Side trawlers, stern trawlers, purse seining. General arrangement, Layout and equipment on deck. Determination of main dimensions. Estimation of component weights. Development of lines. Estimation of resistance. Design of propellers for trawlers.
Machinery- main and auxiliary, Electrical systems, structural arrangements. Materials for the construction of fishing vessels.
Economics of fishing vessels. Estimation of initial and operation costs. The influences of size, speed, power, selling price, distance optimised fishing vessel design. Design and economics of simple low cost country fishing crafts.
References:
1. Design of Small Fishing Vessels by John Fyson
2. Fishing Boats of the World by Jan-Olof Traung

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Semester –II

NAME 2. 6 Audit Course-2
Periods/week : 3 Ses. : --- Exam : ----
Examination Theory: 3hrs.--- Credits: ---

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Semester –II

NAME 2. 7 CASD LAB
Periods/week : 3 Ses. : 50 Exam : 50
Examination Theory: 3hrs Credits: 2

1. Ship Structural Analysis using FEA Packages: Modelling, Meshing and solving using FEM packages. Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- Application of FEA packages in the analysis of ship components.
2. CASD (Computer Aided Ship Design)
3. Exposure to CASD packages like Rhino, NAPA, TRIBON, Shipflow etc:
4. Generation of ship hull parametric model using Modelling Softwares

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Semester –II

NAME 2. 8 Seminars
Periods/week : 3 Ses. : 50 Exam : 50
Examination Theory: 3hrs Credits: 2

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Semester –II

NAME 2. 9 Mini Project with Seminar
Periods/week : 3 Ses. : 50 Exam : 50
Examination Theory: 3hrs Credits: 2

M. Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)
Semester –III

NAME 3.1 (A) Experimental Hydrodynamics (Programme Elective 5)
Periods/week : 4 Ses. : 30 Exam : 70
Examination Theory: 3hrs Credits: 3

Requirement of ship model experiments, ITTC and it's role, Hydrodynamic test facilities, Dynamometry and instrumentation in model testing, Methodical series data, Statistical/ empirical method of resistance and powering estimation, Experimental techniques and methods for full scale predictions, Resistance, open water and propulsion experiments, Wake survey, Analysis of results, Cavitation experiments, Full scale sea trials.

N.B. The above course will mostly practical and tutorial oriented

M. Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)
Semester –III

NAME 3.1 (B) Marine Engineering-II (Programme Elective 5)

Periods/week : 4	Ses. : 30	Exam : 70
Examination Theory: 3hrs		Credits: 3

1. Engine room arrangements for different power plants – Functions of Auxiliary equipment – Bilge and ballast systems – Other Auxiliaries.
2. Piping – Piping fittings and valves – Control valves, materials and corrosion in pipes – Colorcodes – Steam traps, Drains and glands.
3. Pumping systems. General principles - Simple and duplex pumps – Rotary positive displacement pumps –– Centrifugal pumps – Axial flow pumps - Bilge , ballast & sanitary pumps – Boiler feed pumps – air pumps and Ejectors.
4. Centrifugal compressors – Working principles – Impeller and diffuser design.- Performance characteristics – Blade profiles.
5. Airflow compressors –Working principles – Types – Performance characters – Aerofoil theory – Blade design.
6. Condensers, Evaporators, Deaerators and purifiers - Auxiliary condensers – Evaporating plant – Distillation plant – Feed heaters deaerators oil purifiers – Self-changing purifiers.
7. Steering gear- Types Steam steering gear, Telemotor gear, Hand steering gear, Hydraulic systems, Electro hydraulic steering gear – Electrical steering gear.

Text Books:

1. The running and maintenance of marine Machinery - J Cowley.
2. Marine Auxiliary machinery - W.J Fox.
3. Marine Auxiliary machinery and systems - M Khetaguroo
4. Theory and design of steam and gas turbines - Lee.

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Semester –III

NAME 3.1 (C) Underwater Acoustics (Programme Elective 5)

Periods/week : 4	Ses. : 30	Exam : 70
Examination Theory: 3hrs		Credits: 3

IntroductionSound

Wave motion, Sound pressure, Reference intensity, Source level, Radiated power, Limitations to sonar power, Cavitation, Interaction, Changes to arrays, Projector sensitivity, Hydrophone sensitivity, Spectrum level, Sound in air and in sea water,

Arrays

Need for projector arrays, Need for hydrophone arrays, Beam patterns, Directivity of a dipole, The general line array, Shading, Shaded arrays: transmit source levels, Directivity index, Line array: beam pattern vs. steer angle, Broadside array: length and spacing, Beam pattern for a continuous line, DI of a simple dipole, DI of a line array, DI of a planar array, DI of a cylindrical array, DI formulae based for simple arrays, Conformal arrays, Spherical arrays, Volumetric arrays, Beam formers, Domes and arrays.

Propagation of Sound in the Sea

Propagation loss, Losses, Spreading losses, Absorption losses, Spherical spreading and absorption, Propagation in the real ocean, The speed of sound, Sound speed profiles, Deep sound channel, Reliable acoustic path, Surface duct propagation, Convergence zone propagation, Bottom bounce propagation, Propagation loss models, Ray theory and the Hodgson model, Hodgson example, Performance prediction, Multipath propagation

Target Strength

Definition, Formulae, Measurement, Dependence on pulse type and duration, TS of a sphere, TS of some simple shapes, TS of small targets, Mine target strength, Torpedo target strength, Submarine echoes, Beam aspect target strength, Bow aspect target strength, Submarine target strengths, Towed arrays, Target strength reduction, Practical values.

Noise in Sonar Systems

Sources of noise, Thermal noise, Noise from the sea, Noise from a vessel, the sonar environment, Self-noise Electrical noise, Machinery noise, Flow noise, Propeller noise, Variation with speed, Variation with frequency, Directivity, Self-noise and radiated noise, Addition of noise levels, Receiver noise factor, Noise factor of a sonar, Acceptable receiver noise level, Alternative calculation, Practical values

Reverberation

Sources of reverberation, Scattering and reflection, Boundary roughness, Classes of reverberation, Backscattering strength, Reverberation target strength, Volume reverberation, Boundary reverberation, Scattering layers, Volume scattering strength, Sea surface scattering strength, Bottom scattering strength, Variation with fi-equency, Reverberation under ice

The Sonar Equations

The basic sonar equation, The basic passive equation, The basic active equation, Detection threshold and detection index, Receiver operating characteristics, ROC curves,

Passive Sonar

Radiated noise, Radiated noise: source level, Nature of radiated noise, Practical values, Broadband and narrowband, Normalization, A Note on Swaths, Passive arrays, Passive aural, Passive displays, Formulae for detection threshold, Broadband square law detector, Broadband cross-correlator detector, Narrowband processor, Narrowband amplitude detector processor, Passive ranging, Triangulation, Vertical direct passive ranging, Horizontal direct passive ranging, Towed arrays, Bearing ambiguity, Self-noise,

Activesonar

Pulse types, Active sonar equations, Reverberation index, Reverberation and Target Echoes in the main lobe, and sidelobes, Range, pings and doppler shift, Reverberation rejection by CW pulses, Practical reverberation envelopes, Full- and half-beam processing, Beam forming, FM phase binning process, CW processing, Large aperture array, Detection performance, Noise and reverberation-limited detection ranges:, Ambiguity diagrams, Very long pulses, Operational degradation factor, Active displays, Unified detection and classification, Bandwidth, Beamwidth, CADAC, Levels of CADAC, CADAC and pulse features, Statistical analysis, Amplitude profiles, Multipath affects classification

Textbook: Sonar for Practicing Engineers – A.D. Waite - Third Edition – John Wiley

References:

1. Principles of Underwater Sound – (1983) Robert J Urick – Mc Graw Hill Publications
2. Understanding Active Noise Control C.H. Hansen
3. Underwater Acoustic Systems Rodney F.W. Coates
4. Underwater acoustics Leon Camp

M. Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)

Semester –III

NAME 3.3 Dissertation-I

Periods/week : ---	Ses. : ---	Exam : 100
Examination Theory: ---		Credits: 6

M. Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)

Semester –IV

NAME 4.1 Dissertation-II

Periods/week : ---	Ses. : ---	Exam : 100
Examination Theory: ---		Credits: 6