B. Tech -IV Year- I Semester

Course code	Category	Course Title	Hours per week		Int Marks	Ext Marks	Total Marks	Credits
			L	P				
NM 4101	PE	Professional Elective III	4	0	30	70	100	3
NM 4102	PE	Professional Elective IV	4	0	30	70	100	3
NM 4103	PE	Professional Elective V	4	0	30	70	100	3
NM 4104	OE	Open Electives III	4	0	30	70	100	3
NM 4105	OE	Open Electives IV	4	0	30	70	100	3
NM 4106	HSS	Elective	4	0	30	70	100	3
NM 4107	SC	Advanced NAPA Lab	1	2	50	50	100	2
NM4108	INT	Internship-II			50	50	100	2
							Total credits	**22**

B. Tech -IV Year- II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
NM 4201	PROJ.	Project work	100	100	200	14
					Total credits	**14**

NM 4107 (SC) Advanced NAPA Practice

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

Course Objectives

- The objectives of the course are to provide training and provide hands on experience to the students on NAPA software for the purpose of hydrostatic calculations and resistance calculations

Course Outcomes

- At the end of the course, the student will be in a position to model a ship using the softare
- perform a detailed hydrostatic calculation
- Obtain the ship resistance

SYLLABUS

NAPA Main window features, Project Settings, Hull Modelling, Hydrostatic Calculations, Design Hydrostatics, Hydrostatics, Resistance, Report writing and explanation

PROFESSIONAL ELECTIVES:

I. INTRODUCTION TO OFFSHORE STRUCTURES

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

Course Objectives: This subject introduces students to basic naval architectural knowledge e.g. naval architectural terms, ship components and simple hydrostatics calculations. It also enables students to familiarize themselves with various offshore engineering sectors including basic knowledge on types of offshore structures and their functions

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

- Appreciate the shipbuilding industry
- Acquire the naval architectural principles and concepts
- Use the methods of numerical integration and quadrature
- Describe in detail a number of different offshore facility concepts, including the advantages and
- Disadvantages of each understand the various types of fixed and floating offshore platforms, including key design, fabrication
- And installation issues, as well as areas of applicability describe in detail a number of ships from recreational to naval, small to big, operating on or under the
- Sea acquire the basic knowledge of mooring systems and subsea technology

SYLLABUS

Fundamentals of physical oceanography, drilling technology, mooring systems, study of Environmental forces i.e. waves, wind, tides and current. Types of drilling rig suitability for particular applications. Drill ship- special equipment and operation of drilling rigs- supply crafts, structural arrangements, and semi-submersibles. Various types of offshore structures- jacket platforms, gravity platforms, complaint structures- guyed tower, tension leg platform etc. Structural systems used. Load calculation- wave, wind, current and functional loads, Soil structure interaction. Analysis of offshore structural components matrix methods-plane frame, grid and space frames. Introduction to dynamic analysis, transportation, launching and upending problems, preliminary design aspects of offshore structures. Safety and reliability of offshore structures.

REFERENCE BOOKS:

1. Hydrodynamics of Offshore Structures by S.K.Chakravarthy
2. Offshore Structural Engineering by Thomas H.Dawson
3. Mechanics of Wave Forces on Offshore Structures by Turgut Sarpkaya & M. Isaacson.

II. OCEAN STRUCTURES AND MATERIALS

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

Course Objectives: This subject introduces students to ocean structure knowledge e.g. naval architectural terms, ship components and simple hydrostatics calculations. It also enables students to familiarize themselves with various offshore engineering sectors including basic knowledge on types of offshore structures and materials

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

- Appreciate the knowledge on Oil and gas resources
- Acquire the Metal principles and concepts
- Use the methods of design and construction
- Describe in detail a number of different Materials facility concepts,

SYLLABUS

Brief introduction of ocean, Oil and gas resources. Near shore structures. Different types of ocean structures and systems (fixed, floating, semi-submersibles, submersibles, TLP s pipelines, intakes) for exploitation of oil and gas, minerals and energy.

Different materials for marine applications: Behavior of Metals, concrete and other Composite materials for marine environment. Principles of corrosion, properties and selection of materials, Non-destructive testing of materials and structures. Ocean pollution and its effect on ocean structures. Dredging and dredgers.

Brief outline of planning, design and construction. Regulation and codes of practices The environment and environmental forces. Structural analysis and principles of design Foundation and sea bed anchors. Towing, launching and installation.

References :

1. Ben C.Gerwick, Jr., Construction of Marine and Offshore Structures, CRC Press, New York, 2000

2. Reddy, D.V.and Arockiasamy, M., Editors, Offshore Structures, Vol.I and II, Krieger Publishing Company, Florida, 1991

3. Per Bruun, Port Engineering, Volume I and II, Gulf Publishing Company, 1989

III. FINITE ELEMENT ANALYSIS

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

Course Objective:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems

Course Outcomes: At the end of the course, a student will be able to

- CO1: apply direct stiffness, Rayleigh-Ritz, Galerkin method to solve engineering problems and outline the requirements for convergence.
- CO2: analyze linear 1D problems like bars and trusses; 2D structural problems using CST element and analyse the axi-symmetric problems with triangular elements.
- CO3: write shape functions for 4 and 8 node quadrilateral, 6 node triangle elements and apply numerical integration to solve; 1D and 2D; stiffness integrations.
- CO4: solve linear 2D structural beams and frames problems; 1Dheat conduction and convection heat transfer problems.
- CO5: evaluate the Eigenvalues and Eigenvectors for stepped bar and beam, explain nonlinear geometric and material non linearity

SYLLABUS

Fundamental Concepts: Introduction, Historical background, Outline of presentation, Stresses and Equilibrium, Boundary conditions, Strain-Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton's principle. Galerkin's method, Saint Venant's principle.

One-dimensional Problems: Introduction, Finite element modeling, Coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, in plane and Bending, problem modeling and boundary conditions.

Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, Higher-order elements. Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Text Book:

1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D.Belegundu (chapters 1 to 8 only).

References:

1. Introduction to Finite Element Method, by Abel & Desai.
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
4. Introduction to Finite Element Method, by J.N.Reddy.

IV. MARINE MANUFACTURING TECHNOLOGY

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

Course outcome: Introduce students to theory and operation of manufacturing including manufacturing processes and equipment overview, manufacturing design, production process and flow, materials, machine operations and logistics.

Course objective:

- Identify the different stages of a manufacturing process.
- Interpret the elements of the product design process.
- Identify the common machines used in a manufacturing process.
- Explain the operations and capabilities of machines used in manufacturing.
- Determine the operations used in finishing manufactured products.
- Explain the operations and capabilities of automated machines used in manufacturing.
- Interpret the functionality of base lining and documentation in a manufacturing process.
- Determine the main elements of quality assurance in a process.
- Identify characteristics of end product logistics.

SYLLABUS

Foundry: Foundry tools and appliances, layout – pattern types, materials, allowances, pattern making, moulding sands, types. Moulding methods, equipment for moulding, casting methods.

Lathe: Working principle, classification, specification, different operations on a lathe, methods of taper turning, cutting speed, feed, depth of cut, machining time and power required for cutting. Turret and capstan lathes.

Shaper and Planer (Elementary Treatment only): Principal parts, classification – quick return mechanisms, table feed mechanism working on shaper and planer, a comparison. Work holding devices.

Drilling and Boring Machines (Elementary Treatment only): Classification, specifications, cutting speed, feed, machining times, parts and description of boring machines, types.

Power Press: Operation, components, classification, selection, cutting dies, power requirements, power press operations, punching, blanking, deep drawing.

Linear and angular measurements: Micrometers, Slip gauges, Vernier and optical bevel Protractors, sine bar Angle gauges.

Comparators: Types, Mechanical, Electrical, Electronic comparators. Measurement of Straightness- flatness- square ness and symmetry- parallelism and circularity.

Metrology: Metrology of screw threads and Metrology of gears (Measurement of Pitch and tooth thickness only).

Grinding: Introduction-abrasives-grinding wheels, bonding processes, selection of grinding wheels-grinding machines-classification-honing-lapping, super-finishing, buffing, polishing, selection of process parameters.

Text Books:

1. Engineering Metrology by R.K. Jain
2. Production Technology by R.K. Jain and S.C. Gupta

References:

1. Production Technology by P.C. Sharma
2. Workshop Technology, Vol.1, 2&3 by W.A.J. Chapman
3. Machine Tools by Bhattacharya

V. FISHING VESSELS TECHNOLOGY

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

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 Books:

1. Design of Small Fishing Vessels by John Fyson

2. Fishing Boats of the World by Jan-Olof Traung

VI. MARINE HYDRODYNAMICS

Course Objectives: To provide students with a sufficient introduction to each of the topics of the course so that he/she will be able to understand the background of current literature in the hydrodynamics of marine vehicles, offshore engineering, and other ocean-related activities.

Course Outcomes: Students with ocean- and marine-related interest will develop the necessary theoretical and experimental background to keep up with existing literature and begin research on contemporary topics.

SYLLABUS

Small Amplitude Wave Theory Formulation and Solution: Review of hydrodynamics-Boundary Value Problems, summary of two-dimensional periodic water wave BVP, solution of linearized water wave BVP for a horizontal bottom, dispersion equation, engineering wave properties-water particle, kinematics of progressive waves, pressure field under a standard wave, partial standing waves, energy and energy propagation in progressive waves- principle of conservation of energy. Energy Flux.

Wave Forecasting: Generation of waves-theories of wave generation by Kelvin, Phillips, Milne, Jeffrey, Swerdrup and munk. Concept of fully developed sea, Characteristics of ocean waves, significant wave height and period, wave height variability, energy spectra of waves, simplified wave prediction models-SMB and PNJ. Methods, wave forecasting charts, effects of moving storms and variable wind speed and direction.

Wave Transformation and Wave statistics: Transformation of wave entering shallow water, shoaling of waves in shallow water, wave reflection, refraction and diffraction, combined refraction, diffraction, and wave breaking. Wave Height distribution-single wave train, wave groups, narrow banded spectra, Rayleigh's distribution, wave spectrum, directional wave spectrum-JONSWAP, PNJ and Bretschneider spectra.

Wave Forces: Wave forces on vertical cylindrical bodies due to non-breaking waves – Basic concepts, calculations of forces and moments, Transverse forces due to eddy shedding (Lift forces), selection of hydrodynamic force coefficient, C_d and C_m, calculation of forces and moments on groups of vertical and non-vertical cylindrical bodies due to breaking and non-breaking waves.

Text Book:

1. Shore Protection Manual, Vols. 1 & 2 by US army coastal engineering research center publication

Reference Books:

1. Water Wave Mechanics by Dean and Dlrymple

2. An introduction to Hydrodynamics and Water Waves by B. Le Mehaute

3. Estuary and Coastline Hydrodynamics by A.T. Ippen

VII. ADVANCED WELDING TECHNOLOGY

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

Introduction: Classification of welding and related processes. General conditions for welding, edge preparations, and design of welded joints, welding codes and symbols, weldability of metals and metallurgy in welding.
Plastic Welding: Forge Welding: Types, Forged joints etc. Resistance Welding: Principle, types, spot, seam, etc. Thermit welding.

Gas Welding: Principle, equipment, different gas flames, gas welding techniques, types of gas welding, oxy-acetylene, air-acetylene, and oxy-hydrogen welding etc.

Arc Welding: Principle and theory. Arc welding equipment, arc welding current and voltage, polarity of electrodes, angularity of electrodes, precautions in arc welding. Arc welding types, Carbon arc, metal arc, MIG, TIG etc.

Solid State Welding: Principle and types. Latest welding techniques, electron beam, laser beam, metal flame spraying etc. Under water welding (elementary treatment only). Related processes, oxy-acetylene cutting, arc cutting, brazing, soldering etc.

Welding of various Metals: Cast Iron, steel, non-ferrous metals, etc. Welding defects, inspection and testing-design for welding. Safety practices and training in welding and welding machines (elementary treatment).

Text Books:

1. Welding Engineering by R.L. Agrawal and Tahil Manghnani

2. A Text book of Welding Technology by O.P. Khanna

3. Welding Technology by N.K. Srinivasan

References:

1. Welding Engineering and Technology by R.S. Parmar
2. Welding and Welding Technology by Richard L. Little
3. Welding by A.C. Davies
4. Production Technology by R.K. Jain and S.C. Gupta
5. Elements of Workshop Technology, Vol.1 by S.K. Hajra Choudury
6. Welder Trade Theory by S.K. Singh

VIII. SEA KEEPING AND MANEUVERABILITY

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory : 3hrs. Credits: 3

Course outcomes:

- Apply the concepts of Static Equilibrium and Archimedes' Principle to the operation of a ship.
- Demonstrate the ability to assess the stability condition of a ship. Predict the effect of planned shipboard evolutions on ship stability.
- Understand the significance of damage to a ship which has compromised its watertight integrity. Use hydrostatics to make intelligent and safe choices to maintain a ship afloat and upright.
- Understand the structural arrangement of a ship, including the choice of materials and the stresses developed by loads encountered in its operating environment.
- Understand the different components that make up a ship's resistance and the manner in which the propulsion plant transmits its power to overcome those forces.
- Understand factors affecting the seakeeping and maneuverability of ships in a seaway.

Course objective:

This course is an introduction to the applied science of ship systems. The course describes ships and submarines and how they remain afloat from a design and application perspective. Included are topics in hydrostatics, ship stability and operability, materials, fluid dynamics and propulsion.

SYLLABUS

Introduction to sea keeping: Importance of sea keeping analysis. Behaviour of a ship in a seaway. Regular waves, Sinusoidal and trochoidal Theories.Chacteristics of waves; Sea surface. Analytical and statistical representations. Descriptive characterisation of the sea. Average and significant wave heights. Wave histogram. Characterisation by energy spectrum. Standard sea spectra. Beaufort scale.

Ship motions in regular waves: Surge, sway, heave, roll, pitch and yaw. Coupled and uncoupled motions. Equations of motion, inertial, damping, restoring and exciting forces and moments. Determination of the forces and moments. Tuning factor and Magnification factor. Added mass. Coupled heaving and pitching. Motions in shallow water.

Ship Motions in Irregular waves: Encounter spectrum. Response amplitude operators and their calculation by theory and experiment. Motion spectrum and statistical characteristics of motions in irregular waves.

Dynamic effects: Relative bow motion. Deck wetness and slamming. Added Resistance in waves. Added power. Power increase due to wind and waves. Loss of speed in a seaway. Loads due to motion. Wave loading and bending moments. Vertical and Rolling effects. Sea sickness

Stabilization of ship motions: Roll stabilizers- Bilge keels, Gyroscopic stabilizers, Movement of weight, Rudder action, Jet flaps, Stabilizing fins, Passive and Active tank stabilisers.

Pitch stabilization methods: Ship motion experiments. Generation of Regular and Irregular waves. Captive and free running model tests. Full scale Tests.Design considerations for sea keeping. Seakeeping criteria. ITTC Guidelines. Effect of design parameters and hull form on seakeeping.

Introduction to Manoeuvrability: Controlled and uncontrolled motions. Control Loop. Course keeping. Motion stability of ocean vehicles. Equations of motion. Hydrodynamic derivations. Stability criterion. Course changing. Tuning circle, zigzag and spiral manoeuvers. Heel while turning. Manoeuvering trials.

Control Surfaces: Control surface geometry. Rudders- types and characteristics. Effect of stall, aeration and cavitation.(Flow around rudder,Influence of ship- features on controls fired stability.) Design of rudders. Calculation of steering gear torque. Bending moment and stresses in rudder stock. Structural design of rudders. Other maneuvering devices. Maneuvering in restricted waters. Squat in shallow water. Bank suction effects- Interaction between ships. Theoretical determination of hydrodynamic derivatives of ship and control surfaces. Experimental determination of hydrodynamic derivatives. Estimation of maneuvering characteristics form hydrodynamic derivatives.

References:

1.Dynamics of Marine Vehicles by Rameshwar Bhattacharya.

2.Principles of Naval Architecture, Vol. III by Ed.V. Lewis

IX DYNAMICS OF OFFSHORE STRUCTURE

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

SYLLABUS

Dynamic perspective. Introduction to different types of ocean structures. Development of structural forms for deep and ultra deep waters. Basis of structural design of ocean structures. Environmental forces. Structural dynamics. Basics-SDOF systems Fundamentals of structural dynamics. Mathematical modelling of structural systems. Single Degree of Freedom (SDOF) systems. Characteristics of sing degree of freedom model – formulation of equation of motion. Free and Forced vibration of single degree of freedom systems. Undamped and damped systems.

Structures in the offshore environment - Description of typical offshore structures – Fixed-Compliant Floating - Solid fluid interaction parameters - Spring factor - Added mass and damping Response of offshore structures - Modelling of offshore structures – single and multi-degree freedom systems – effect of foundations

Structural action of ocean structures - Multi-Degree of freedom (MDOF) systems. Formulation of equation of motion - Influence coefficients - Eigen value problems. Dynamic matrix method. Dunkerley's method - Matrix iteration method - Stodla's method.Mode superposition. Mode truncation.Rayleigh-Ritz method.Damping.Rayleigh damping – Caughey damping. Application of dynamics. Fluid structure interaction (FSI).Perforated members. Articulated tower (AT).Freely moving structures - Stability of submerged and floating structures - Stability at small and large angles

Experimental Structural Dynamics. Experimental studies-free floating studies-free decay studies. Experimental investigation on perforated cylinders & perforated TLP model. Structural dynamics, introduction to stochastic dynamics of ocean structures. Motion analysis in random waves - Low frequency oscillation. Dynamic positioning.

Stochastic Dynamics – Introduction to Stochastic Dynamics of ocean structures. Fatigue Prediction. Random Environmental Processes – Response Spectrum.

References

1. Wilson, J. F., Dynamics of Offshore Structures, John Wiley, 2002.

2. Clauss, G, Lehmann, E &Ostergaard, C., Offshore structures - Vols 1 & 2, SpringerVerlag, 1992. 3. Chakraborti, S. K., Non Linear methods in Offshore Engineering, Elsevier SciencePubl, .2002. 4. Hooft, J. P., Advanced Dynamics of Marine Vehicles, John Wiley, 1982.

X. DESIGN OF SMALL CRAFTS

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4

Course objectives: provides a broad overview of craft design, construction and operation. The craft design process may be broken down broadly into two stages: Conceptual and/or preliminary design. The preliminary design process will normally take the form of a techno-economic appraisal, using a fundamental engineering economy approach.

Course outcome:

- demonstrate ability to critically, independently and creatively make the initial design of a ship for a certain transport scenario, taking into account relevant scientific, social, ethical, economic and environmental aspects, and international regulatory frameworks;
- give an account of the international shipping markets and the corresponding stakeholders, goods flow paths, and ship types;
- discuss the opportunities for seaborne transportation in a sustainable society and describe the shipping-related environmental problems and measures for tackling them;
- demonstrate ability to plan and carry out advanced engineering tasks within given frames using appropriate methods and to evaluate this work

SYLLABUS

Tugs and towing vessels: Types, stability requirements, Bollard pull, powering, Features of tow hook, Equipment. General arrangement, Special features of pusher tugs, Kort-nozzle, Voith-Schneider and Schottel propulsion in tugs. Design aspects.

Dredgers: Types of dredgers, Hydrostatics and stability considerations. Powering and dredging machinery and equipment. Disposal of dredged material. Design considerations.

High speed crafts: Their role in offshore and naval operations. Special features. Design considerations

Fishing vessels: Types of fishing vessels and fishing methods. Special features. Stability requirements and IMCO recommendations. General arrangement. Fishing gear and equipment. Preservation and processing of catch and by-products. Fishing vessel design.

Text Books:

1.Principles of Naval Architecture by Ed.V. Lewis

XI NAVAL VESSELS

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

SYLLABUS

Historical development of different types of naval vessels: Distinguishing features of warship types. Indigenous design and production of naval vessels. Mission requirements and constraints. Concept exploration and development of warship criteria. Determination of main dimensions. Volumes based and weight based criteria. Space allocation and general arrangement.

Design of Hull Form: Warship resistance data, Hydrodynamics of naval vessels. Propellers for warships. Design and construction. Propeller data for heavily loaded propellers. Hydrodynamic design methods. Stability criteria for warships. Damage survival considerations.

Main and auxiliary machinery in warships: Comparative methods of steam, diesel and gas turbine plants. Combined plants. Requirements of sea keeping and stability platform. Stabilisation systems. Special manoeuvring requirements for naval vessels.

Structural arrangements in naval ships: Structural design criteria and design procedures. Shock and methods to reduce its effects. Accommodation. Habitability standards. A/C requirements. Nuclear, bacteriological and chemical defense arrangements. Weapon systems. Guns torpedoes, depth chargers, mines and missiles. Radar and Sonar weapon control systems. Counter Measures.

Detailed study of some modern naval ships: Submarine: General description, pressure hull external structure, diving and surfacing systems. A/C and ventilation systems. Stability, equilibrium polygon. Distance when submerged and while on surface. Propulsion system. Rudder and hydroplanes. Nuclear submarines.

XII.ADVANCED SHIP THEORY

Course Objectives:

- The objectives of the course are
- Teach the student about the various hazards during the life of a marine engineer and the protection that should be provided against those Hazards
- Teach the students how to design a Ship Girder
- Teach the student how to design internal members like panel etc
- Teach the student about the internal and external factors of marine engineers life.

Course Outcomes

- At the end of the course the student will
- Be in a position to know about Various Hazards and protection and the environmental pollution aspects of ship's life
- Be capable of performing simple standard calculation for the ship girder,
- Be capable of structural Design of Stiffened plating, panels plating frameworks etc
- Know about the internal and external environmental aspects of the Ship Environment

SYLLABUS

Hazards and Protection - Flooding and collision Safety of Life at Sea (SOLAS), Abnormal Waves, Environmental Pollution

LO-1:

To explain Hazards and protection

The Ship Girder - Standard calculation for the ship girder, materials considerations,

Structural Design and Analysis - Stiffened plating, panels plating, frameworks, realistic assessment of structural elements, Fittings

LO-2:

To provide Design and Analysis of the ship girder

The Ship Environment and Human Factors - The external environment - sea, waves, climate, physical limitations, internal environment, motions, vibration and noise

LO-3:

To Explain Human Factors and Ship environment

Textbook

Basic Ship Theory by Rawson and Tupper – B&H

References

Muckle's Naval Architecture, by Eric Tupper – B&H

Principles of Naval Architecture – SNAME Publications

XIII. UNDER WATER ACOUSTICS

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

Introduction Sound

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,

Active sonar

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, Fulland 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

XIV. MARINE ENGINEERING -II

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

Engine room arrangements for different power plants – Functions of Auxiliary equipment – Bilge and ballast systems – Other Auxiliaries.

Piping – Piping fittings and valves – Control valves, materials and corrosion in pipes – Colorcodes – Steam traps, Drains and glands.

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. Centrifugal compressors – Working principles – Impeller and diffuser design.- Performance characteristics – Blade profiles.

Airflow compressors –Working principles – Types – Performance characters – Aerofoil theory – Blade design.

Condensers, Evaporators, Deaerators and purifiers - Auxiliary condensers – Evaporating plant – Distillation plant – Feed heaters deaerators oil purifiers – Self-changing purifiers.

Steering gear- Types of 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

XV.ADVANCED FLUID MECHANICS

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

Course Objectives: This course offers basic knowledge on fluid statics, dynamics and hydraulic machines. The objective of this course is to enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

Course Outcomes: The student will be able to:

- Identify importance of various fluid properties at rest and in transit.
- derive and apply general governing equations for various fluid flows
- Understand the concept of boundary layer theory and flow separation.
- Plot velocity and pressure profiles for any given fluid flow.
- evaluate the performance characteristics of hydraulic turbines and pumps

SYLLABUS

Fluid Kinematics & Fluid Dynamics: Stream line- Stream tube- Stream function- Potential function- Classification of flows- Steady, Unsteady, Uniform, Non-uniform, Laminar, Turbulent, Rotational, Irrotational flows, Vorticity and circulation- Conservation of mass- Equation of continuity, Conservation of momentum- Euler's equation, Conservation of energy- Bernoulli's equation and its applications- Vortex motion- Free and forced vortices- Basic solutions of ideal fluid flows- Flow net analysis.

One dimensional Viscous Flow: Couette flow- Plane Couette flow, Favourable pressure gradient and adverse pressure gradient- Flow through pipes- Hagen Poiseulle flow- Fannigs friction factor- Darcy's Weisbach friction factor- Loss of head due to friction in pipes- Laminar and turbulent regimes- Flow potential and flow resistance- Flow through branched pipes, Momentum equation- Forces due to pipe bends, Curved tubes, Sudden enlargement, Sudden contraction, flow through porous media- Darcy's equation. Two dimensional viscous flow: Navier -Stokes equations and solutions- Order of magnitude analysis- Boundary layer equations. **Laminar Boundary Layer:** Momentum integral equation- Flow over a flat plate- Displacement thickness, Momentum thickness and energy thickness.

Turbulent Boundary Layer: Laminar- Turbulent transition- Momentum equations and Reynold's stresses- Fully developed turbulent flow through a pipe- Turbulent boundary layer on a flat plate- Laminar sub-layer- Boundary layer separation and control.

Dimensional Analysis and Modeling Similitude: Fundamental and derived dimensions- Dimensionless groups- Buckingham p-theorem- Rayleigh method- Model testing- Types of similarity- Geometric, Kinematic and Dynamic similarities- Hydraulic diameter.

Compressible Fluid Flow: Thermodynamic relations- Continuity, Momentum and Energy equations- Velocity of sound in a compressible fluid- Mach number and its significance- Limits of incompressibility- Pressure field due to a moving source of disturbance- Propagation of pressure waves in a compressible fluids- Stagnation properties- Stagnation pressure, Temperature and density- Area velocity relationship for compressible flow- Flow of

compressible fluid through nozzles- Condition for maximum discharge through nozzles- Variation of mass flow with pressure ratio- Compressible flow through a venturimeter- Pitot static tube in a compressible flow.

Text Book:

Fluid Mechanics, by A.K.Mohanty, Prentice Hall of India Pvt.Ltd.

References:

1. Fluid Mechanics and Hydraulic Machines, by R.K.Bansal, Laxmi publications.
2. Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.
3. Fluid Mechanics and its Applications, by S.K.Gupta and A.K.Gupta, Tata McGraw Hill, New Delhi.
4. Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S.Chand & Co.
5. Fluid Mechanics by Kothandaraman and Rudramoorthy.

OPEN ELECTIVES:
I. INDUSTRIAL ELECTRONICS

Periods/week: 4 Ses. : 30 Exam: 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

Devices: Semi-conductor diode, Zenor diode - Transistor - Silicon control rectifier.

Rectifiers, Amplifiers, Oscillators, Cathode ray oscilloscope.

Industrial Applications: Poly-phase rectifiers - Control circuits - Motor speed control voltage control, Time delay relay circuits - Photo electric circuits.

Resistance welding, inducting heating - Dielectric heating.

Servomechanism: Open loop and closed loop systems (Elementary treatment only).

Introduction to Digital Electronics: Fundamentals of digital electronics, Number system and codes, Logic gates, Boolean algebra, Arithmetic - logic units, Flip-flops, Registers and counters, Memories: ROM, PROM, EPROM and RAM.

Introduction to Microprocessors: The Intel-8085 microprocessor; Architecture, Instruction set, Execution of instructions, Addressing structures, Timing and machine cycles of 8085 and programming I/O operations, Interrupts, Serial input and serial output, Programming the I/O ports, Programming the timer.

Text Books:

1. Industrial Electronics by Mithal (Khanna Publications).

2. Digital Computer Electronics - An Introduction to Micro Computer by Albert Paul Malvino, Tata McGraw-Hill Publishing Co. Ltd., New Delhi-2.

References:

1. Engineering Electronics by Ryder-McGraw Hill.

2. Micro Processors by Leventhal.

3. Industrial Electronics by Bhatacharya, Tata Mc-Graw Hill.

4. Industrial Electronics and Control by S.K. Bhatacharya and S. Chatarjee, 1995 Ed., Tata Mc-Graw Hill Pub. Co. Ltd.

II. NAPA /RHINO /EXACT FLAT LAB

III. MARINE INSTRUMENTATION AND CONTROL

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

SYLLABUS

Instrumentation: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain. pressure, flow, temperature and vibration.

Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement. Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.

Introduction: Control systems, Feedback and its effects. Transfer Function, Block Diagram and Signal Flow Graph: Impulse response and Transfer functions of linear systems, Block diagrams.

Mathematical Modeling of Physical Systems: Equations of electrical networks, Modeling of mechanical system elements, Equations of mechanical systems. State-variable Analysis of Linear Dynamic Systems: Matrix representation of state equations, State transition matrix, State transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values and eigen vectors.

Time-Domain Analysis of Control Systems: Typical test signals for the time response of control systems, Time- domain performance of control systems- The steady- state error, Time-domain performance of control systems- Stability of control systems- stability, Characteristic equation and the state transition matrix, Methods of determining stability of linear control systems, Routh- Hurwitz criterion.

Frequency-domain Analysis of Control Systems: Introduction, Nyquist stability criterion, Application of the Nyquist criterion, Stability of multi loop systems, Stability of linear control systems with time delays.

Text Books:

1. Automatic Control Systems, by Benjamin C. Kuo.

2. Mechanical Measurements, by R.S.Sirohi, H.G. Radha Krishna, Wiley Eastern, New Delhi.

References:

1. Experimental Methods for Engineers, by J.P.Holman, McGraw-Hill.

IV SHIP VIBRATION

Periods/Week : 5. Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 4

Course objective:

Presentation of the basic notions of the vibration theory and ship vibration. Definition of vibration problems and consideration of possibilities for their solutions. Reliable prediction of vibration level in the ship design stage. Review of vibration measurement procedures and vibration remedy

Course outcomes:

Upon completion of the course, students will be able to:

- understand basic principles of ship vibration.
- prepare input data for global hull-girder ship vibration analysis.
- apply analytical and numerical sollutions of free and forced global hull-girder vibration.
- apply FEM to ship vibration problems.
- understand problem of the fatigue of ship structural details and calculation procedures for estimation of the fatigue life

SYLLABUS

Introduction, Historical Review: The Structure Of Wooden Ships. Transition From Wood To Steel. The Structure Of Riveted Ships And Welded Ships. Riveting And Welding In Ship Building. Structural Changes From Riveted To Welded Ships. General Mid-Ship Section Structural Arrangements For Different Types Of Ships- General Cargo Ship, Oil Tanker-Single And Double Hull, Bulk Carrier, Container Ship, Tug, Trawler, Passenger Ship, Cross Channel Ferry.

Structural Parts And Functions And Classification Rules: Different Structural Elements-Keel, Transverse Frames, Longitudinal Frames, Web Frames, Vertical Keelson, Beams, Girders, Floors, Brackets, Pillars, Stem Bars, Stern Frames, Bulkhead Stiffeners, Platings Etc.-Their Structural Configuration, Design Features And Functional Aspects. Assembly Of Various Structural Elements Into The Structural Parts Of The Ship Such As Double Bottom Structure, Side Shell, Single Bottom Structure, Bulk Head Structure, Deck Structure, Aft-End Structure, Fore-End Structure, Super Structure Etc. Structural Design As Per Classification Society Rules. Use Of Relevant Standards In Structural Design.

Structural Design Of Bottom, Side Shell, Bulkhead, Deck, Fore-End, Aft-End Structures:

Bottom Structures, Structural Design Of Single Bottom And Double Bottom Structures, Their Structural Configuration And Determination Of Dimensions And Scantlings Of Stiffeners, Frames, Longitudinal, Inner And Outer Bottom Plating, Shell Plating And Framing-Layout Of Strakes, Spacing Of Framing, Shell Expansion Plan, Longitudinal And Transverse Frames, Ordinary And Web Frames, End Connections Of Frames, Bulk Heads-Structural Arrangement Of Bulk Heads, Longitudinal And Transverse Bulk Heads, Determination Of Scantlings And Sizes Of Structural Parts Of Bulkheads, Plating And Stiffening Of Bulk Heads, In Flat, Corrugated, Swaged And Non-Water Tight Bulk Heads, Connection Of Bulkheads With Side Shell, Decks Etc., Partial Bulk Heads.

Decks - Deck Plating, Subdivision Of Strakes And Structural Arrangements Of Longitudinal And Transverse Stiffeners. Determination Of Scantling, End-Connections Of Deck Stiffeners. Fore-End Structure-Stem Profiles, Plating And Stiffening Of The Fore End Structures, Panting Arrangement, Stem Design-Built Up Or Cast, Bulbous Bow Construction, Details Of Arrangements, Chain Locker, Hawse Pipes, Paint Stores, Forward Collision Bulkheads, Determination Of Scantlings.

Aft-End Structure-Stern Profiles, Plating And Stiffening Of Aft-End Structure, Stern Frame - Built Up Or Cast, Details Of Stern Tube, Bossings, Shaft Struts Etc. Different Types Of Rudder Configurations And Stern Fittings For These Rudder Types. Nozzles And Propeller Arrangements. Determination Of Structural Scantlings.

Structural Design Of Engine Room, Superstructure, Cargo Handling Arrangements, Hatches, Special Ships, Welded Structures And Computer Applications: Engine Room – Horizontal Subdivision Of Engine Room, Platforms, Decks, Shaft Tunnel And Recesses, Engine Casting, Foundations Of Diesel Engines, Turbines, Boilers, Auxiliary Machinery. Static And Dynamic Loads In Engine Room. Structural Design Of Engine Room And Determination Of Scantlings.

Superstructure – Structural Design And Details Of Openings, Expansion Joints Etc. Determination Of Scantlings, Construction And Design Of Cargo Handling Systems And Equipment – Loads On Derricks, Masts And Rigging. Determination Of Scantlings. Deck Cranes –Details Of Installation And Structural Arrangements Necessary.

Hatch Covers – Loads Acting On Hatch Covers, Various Types Of Hatch Covers And Their Structural Design.Structural Design Of Special Types Of Ships – Fishing Vessels, Tugs, Tankers, Dredgers, Icebreakers, And Submarines.

Stress Concentration And Fatigue In Ship Structures. Computer Applications In Structural Design. Various Methods Of Joining Structural Parts And Elements. Design Of Welded Structures. Problem Of Fracture In Welded Structures. Design And Strength Of Butt – Welds, Fillet Welds, Tee And Corner Joints, Bracketed Connections. Structural Fire Protection.

Hull Vibration Of Ships: Flexural Vibrations Of A Beam. Free And Forced Vibrations, Vibration Of Undammed Spring-Mass System, Damped Vibrations. The Exciting Forces On Hull Of Ships, Modes Of Hull Vibration. Calculation Of Hull Frequencies – Factors Influencing Frequency, Empirical Formulae For Hull Frequency Estimation. Analytical Methods For Calculation Of Hull Modes (Elementary Treatment Only). The Stodala's Interpolation Method.

Propeller Exciting Forces. Damping – Types Of Damping. Special Local Vibration Problems – Rudder Vibration, Cavitation, Stress And Vibration Levels, Human Reaction To Vibration.

General Methods Of Reducing Vibrations. Devices For Reducing Main Hull Vibration. Synchronising Devices For Twin – Screw Ships, Rotating Weight Neutralisers, Kurt Nozzles.

Reference Books:

1. Strength Of Ship Structures By W. Muckle
2. Ship Construction By D.J. Eyers
3. Principles Of Naval Architecture By Ed.V. Lewis
4. Ship Design And Construction By R.Taggart

V. CASD (COMPUTER AIDED SHIP DESIGN)

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

Course Objective: To acquaint and equip with the computer aided design and manufacturing of farm machinery with the help of CAD.

Course outcomes: Successful achievement of master level outcomes is required to receive a passing grade in the course. .

- Ability to create fully constrained solid models that can be quickly modified using standard software tools.
- Ability to use, identify and explain standard features in solid modeling including protrusions, revolutions, cutouts, and patterns
- Ability to use standard software tools to create engineering drawings, or other documents, to fully describe the geometries and dimensions of parts, as well as to document assemblies according to standard practice
- Ability to use standard software tools to create part assemblies and check for clearances.
- Ability to create the drawings of farm implements and their analysis.
- Ability to write the CNC part programming

SYLLABUS

Fundamentals of CAD - Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.

Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface- Transformation systems- windowing - clipping - 2D and 3D transformations - Linear transformation- Display files for 3D data - Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling.

Introduction to Finite Element Analysis - CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- CAD applications of FEM.
Database systems, structures, entity-relation models, Application to ship design, model manufacturing and testing, CAD applications in ship building, Computer aided manufacture, Numerical control, Part programming.

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover & E.W.Zimmer.
2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers.

References:

1. Computer Aided Design in Mechanical Engineering, by V.Rama Murthy.
2. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao.
3. Computer Aided Kinetics for Machine Design, by D.L.Ryan.
4. Computer Aided Design and Manufacturing, by C.B.Besant & C.W.K.Lui.
5. Computer-Aided Analysis & Design by S. Ghosal, Prentice Hall of India.
6. CAD/CAM/CIM by Radhakrishna, New age international.

VI. UNDER WATER ACOUSTICS

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

Introduction Sound

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,

Active sonar

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, Fulland 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

VII. SHIP CONSTRUCTION

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

Course Objective:

• To be well versed in how to apply various knowledge of architecture on ship operations.

• To Understand Ship Stability and Statically Stability

Course Outcome:

- CO 01: To understand the types of Ships
- CO 02: To understand the Stress and Strain in Ships in Still water and in Sea way
- CO 03: To understand the principle part of Ships
- CO 04: To understand the advantages of welding over riveting
- CO 05: To understand the concept of law of floatation
- CO 06: To understand the center of buoyancy and factors affecting the same
- CO 07: To understand the Transverse Statically stability
- CO 08: To understand the Equilibrium of Ship
- CO 09: To calculate of List while Loading, Discharging and/or shifting weights, Correction of List
- CO 10: To understand how to use of hydrostatic tables and curves as supplied to ships, Displacement/draft-curve and table, Light displacement& Load displacement

SYLLABUS

Introduction to ship building and materials used:

A typical ship construction program. Building berth. Building Dock. Multi-stage construction methods. Equipment used in building berths. Use of Goliath cranes. Floating Docks. Ship types. Shipyard layout. Classification societies, development and application of classification rules, role of statutory bodies. Materials for ship construction. Structural steels, special steels, non- ferrous steels, non-metallic materials, material properties and testing of materials. Joining methods of materials, non-destructive testing.

Storage and preparation of material and structural elements:

Material handling and storage, transport system in steel stockyard, material preparation

Devices- cleaning, marking processes. The cutting process, Mechanical cutting, thermal Cutting, optically and numerically controlled cutting, bending of rolled and built-up sections, Plate bending. Nesting of plates.

Fabrication of sub-assemblies, units and hull erection:

Process of prefabrication, welding in prefabrication and erection stages, sub-assemblies, flat Sections, panels- flat and curved, double bottom sections, side tank units, fore-end and aftend Structures, deck and bulkhead structures. Assembly of hull-units. Erection of hull-units On building berth/dock.

Ship structural components:

Functions and details of ship structural components, framing systems, single and double Bottom construction, shell and deck plating, bulkheads, pillars, girders and hatch-coaming, Machinery casings, super structures and deck- houses. Bow and stern Structures. Bossing and Struts, bilge keels and fenders.

Out Fitting, Welding, Testing And Trials And Launching:

Various components of outfitting, consisting of systems, equipment and fittings of hull, Machinery and electrical groups. Hull Preservation methods. Various outfitting methods. Advanced outfitting. Methods of welding, metallurgy of welding weld defects, distortion and Stresses in welds, testing of welds. Inspection and testing during various stages of ship Construction. Testing of structures and tanks. Bollard tests and sea trials. Details of launching Arrangements.

References:

1. Merchant Ship Construction by D. A. Taylor

2. Ship Construction by D.J. Eyres

3. Ship Design and Construction by R.Taggart

VIII.EXPERIMETAL HYDRODYNAMICS

Periods/week: 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

Course Objectives: To provide students with a sufficient introduction to each of the topics of the course so that he/she will be able to understand the background of current literature in the hydrodynamics of marine vehicles, offshore engineering, and other ocean-related activities.

Course Outcomes: Students with ocean- and marine-related interest will develop the necessary theoretical and experimental background to keep up with existing literature and begin research on contemporary topics.

SYLLABUS

Small Amplitude Wave Theory Formulation and Solution: Review of hydrodynamics-Boundary Value Problems, summary of two-dimensional periodic water wave BVP, solution of linearized water wave BVP for a horizontal bottom, dispersion equation, engineering wave properties-water particle, kinematics of progressive waves, pressure field under a standard wave, partial standing waves, energy and energy propagation in progressive waves- principle of conservation of energy. Energy Flux.

Wave Forecasting: Generation of waves-theories of wave generation by Kelvin, Phillips, Milne, Jeffrey, Swerdrup and munk. Concept of fully developed sea, Characteristics of ocean waves, significant wave height and period, wave height variability, energy spectra of waves, simplified wave prediction models-SMB and PNJ. Methods, wave forecasting charts, effects of moving storms and variable wind speed and direction.

Wave Transformation and Wave statistics: Transformation of wave entering shallow water, shoaling of waves in shallow water, wave reflection, refraction and diffraction, combined refraction, diffraction, and wave breaking. Wave Height distribution-single wave train, wave groups, narrow banded spectra, Rayleigh's distribution, wave spectrum, directional wave spectrum-JONSWAP, PNJ and Bretschneider spectra.

Wave Forces: Wave forces on vertical cylindrical bodies due to non-breaking waves – Basic concepts, calculations of forces and moments, Transverse forces due to eddy shedding (Lift forces), selection of hydrodynamic force coefficient, C_d and C_m, calculation of forces and moments on groups of vertical and non-vertical cylindrical bodies due to breaking and non-breaking waves.

Text Book:

1. Shore Protection Manual, Vols. 1 & 2 by US army coastal engineering research center publication

Reference Books:

1. Water Wave Mechanics by Dean and Dlrymple

2. An introduction to Hydrodynamics and Water Waves by B. Le Mehaute

3. Estuary and Coastline Hydrodynamics by A.T. Ippen

IX.MARINE POWER PLANT ENGINEERING

Periods/week: 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

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.

Marine boilers: Marine Boilers of Fire Tube, Composite and water-tube boilers. Feed water treatment. Feed water supply systems and controls.

Marine steam turbines: Construction details, Compounded steam turbines for Marine applications, Operation and maintenance.

Marine gas turbines: Gas Turbine cycles for Marine applications, Recent trends and developments, Free piston engines, Combined Cycle Plants.

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.

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

XI.MARINE ENGINEERING-I

Periods/week: 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

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.

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.

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.

Marine gas turbines – Practical cycles and shaft arrangements - Power turbine – Applications.

Marine Refrigeration – Cycles – Compressors, Condensers, Evaporators and thermostatic valves – Space coolers – Maintenance and Auxiliary equipment.

Marine Air-conditioning – cooling, Heating, Humidication process – Types of Air conditioning systems – Ducting controls.

Ventilation – Requirements and provision – Insulation protection of materials and maintenance.

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.

XII HYDRO DYNAMICS AND COMPUTATIONAL METHODS

Periods/week: 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

SYLLABUS

Introduction and Basic Numerical Methods: Introduction to CFD, Approximation and interpolation, Numerical integration, Finite difference approximations of derivatives

The Finite Volume Method for Model Problems: 1-D diffusion, Thomas algorithm for tri-diagonal systems, 1-D convection-diffusion, 2-D model problems

Modeling Navier Stokes Equations: Governing equations for fluid mechanics, Staggered grids, Pressure-velocity coupling – the SIMPLE algorithm, Steady flows, Unsteady flows, Implementation of boundary conditions Commercial CFD codes, Reynolds averaged Navier-Stokes (RANS) equations and turbulence modeling

Text Books: 1. Introduction to CFD the finite volume method by Malalasekera & Versfeeg
2. Computational FM and heat transfer by Anderson, Tennehill and Pletchen

HSS ELECTIVES

ORGANIZATIONAL BEHAVIOUR

Course Objectives:

1. To understand the basic concepts of organisational behaviour, its foundations and importance.
2. To enable students to have a basic perspective of Motivation and Motivation theories.
3. To acquaint the students about group behaviour in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

Course Outcomes:

1. Indentifying fundamental aspects of organizational dynamics.
2. Evaluate main theories of motivation and formulating suitable motivational strategies.
3. Analyze the behaviour of individuals and groups in organizations.
4. Understanding of Leadership theories and Leadership behaviour.
5. Apply relevant theories, concepts to address important Organizational Behaviour questions.

Syllabus

Organisational Behaviour : Concept of Organisation - Concept of Organisational Behaviour - Nature of Organisational Behaviour - Role of Organisational behaviour - Disciplines contributing to Organisational Behaviour.

Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation : Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

Organisational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

Organisational Change: Nature - Factors inOrganisational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books.

1.L.M.Prasad: Organisational Beaviour, Sultan Chand & Sons, New Delhi -110002
2.K. Aswathappa: Organisational Behaviour, Himalaya Publishing House, New Delhi

Reference Books.

1. Stephen Robbins: Organisational Behaviour, Pearsons Education, New Delhi.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives:

1. To familiarize the students with the concepts of Management.
2. To relate the concepts of Management with industrial organizations.
3. To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
4. To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

On completion of the course, the students will be able to:

1. Understand the roles, skills and functions of management.
2. Distinguish the different types of business organizations.
3. Identify the factors involved in Production Operations Management.
4. Diagnose organizational problems and take suitable decisions.
5. Establish good Human Resource Management practices.
6. Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

Syllabus

Basic Concepts of Management:
Management :- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;
Forms of Business Organizations: Introduction, **Types of Business organizations: Private Sector**- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations**; Public sector**- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship : Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

(1) Sharma,S.C, and Banga, T.R., **Industrial Organization & Engineering Economics**, Khanna Publishers, Delhi, 2000.
(2) Vasant Desai , **The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth),**HImalayan Publishing House, 2018.

Reference Books:

(1) Aryasri , A.R., **Management Science,** McGraw HIll Education (India Private Limited , New Delhi 2014.
(2) Sheela, P. , and Jagadeswara Rao, K., **Entrepreneurship**, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

OPERATIONS RESEARCH

Course Objectives:

- Formulate a real world problem as a mathematical programming model.
- Provide knowledge of optimization techniques and approaches.
- Understand and study inventory problems.
- Know the network models.
- Put on knowledge in solving replacement problems and different queueing models

Course Outcomes:

- Learned to translate a real-world problem into a mathematical formulation.
- Formulate and Solve Transportation, Assignment and sequencing problems.
- Resolve inventory problems.
- Able to solve maximum flow and shortest path problems.
- Capable to solve replacement problems and analyze queueing models.

SYLLABUS

Introduction: Definitions of Operations Research; Phases of Operations Research; Types of Operations Research models; applications, merits and demerits of Operations Research.

Allocation: Linear Programming problem formulation; Basic assumptions; Graphical solution; Simplex method; Artificial variable technique; Two phase method; Big M method; Duality principle; Primal and Dual relation.

Transportation: Formulation; Solution methods; Unbalanced transportation problems - North west corner rule; Least cost entry method; Vogel's approximation method; Optimal solution; degeneracy.

Assignment: Formulation; Variations in Assignment problem; Travelling salesman problem.

Sequencing: Sequencing of - n jobs through two machines; n jobs through three machines; n jobs through m machines; 2 jobs through m machines.

Inventory Control: Introduction; Types of Inventory; Inventory costs; Deterministic models - Economic order quantity (EOQ) and Economic Production Quantity (EPQ) with and without shortages; Quantity discounts; P system; Q system; Inventory control Techniques.

Network Analysis: Network definitions; Time estimates in network analysis; Labeling using Fulkerson's rule; Forward pass computations; Backward pass computations; Project management using Critical Path Method(CPM) and Programme Evaluation and Review Technique(PERT).

Replacement: Introduction, Replacement of items that deteriorate with time - Value of money unchanging and changing, Replacement of items that fail completely.

Queueing models: Introduction; Single channel poisson arrivals; Exponential service times; Unrestricted queue with infinite population and finite population models; Multi channel poisson arrivals; Exponential service times with infinite population and restricted queue.

Text Books:

1. Hamdy A Taha, "Operations Research- An Introduction" by TAHA , Prentice Hall, 2009.
2. F.S. Hiller, G.J. Liberman,B. Nag and P.Basu "Introduction To Operations Research, Mc Graw Hill Education(India), 2012.
3. S.D.Sharma, "Operations Research", Kedarnadh Ramnadh & Co.,2017

Reference Books:

1. R. Pannerselvam, "Operations Research", PHI..
2. Richard Bronson, Schaum's Series," Operations Research", Mc Graw Hill
3. N.V.S.Raju, "Operations Research- Theory and Practice" BS publications.
4. V.K. Kapoor, "Operations Research" Sultan Chand & Sons

Professional Electives:

I. Intro to Offshore structures
II. Ocean Structures & materials
III. FEA
IV. Marine Manufacturing Technology
V. Fishing Vessel Technology
VI. Marine Hydrodynamics
VII. Advanced Welding Technology
VIII. sea keeping and maneuverability
IX. Dynamics of Offshore Structures
X. Design of Small Crafts
XI. Naval Vessels
XII. Advanced Ship Theory
XIII. Under Water Acoustics
XIV. Marine Engineering II
XV. Advanced Fluid Mechanics

Open Electives:

I. Industrial Electronics
II. NAPA /Rhino /Exact Flat Lab
III. Marine Instrumentation and Control
IV. Ship Vibrations
V. CASD
VI. Underwater Acoustics
VII. Ship Construction
VIII. Experimental Hydrodynamics
IX. Marine Power plant Engineering
X. Sub Sea Piping
XI. Marine Engineering I
XII. Hydrodynamics and computational Methods

HSS Electives

I. Organization Behavior
II. Industrial management and Entrepreneur
III. Operations Research