B.E III/IV SEMESTER – I

Subject Code	COURSE	Periods (L/T/Lab)	Exam (hours)	Sessional Marks	Exam Marks	Total Marks	Credits
*NAM 311	Industrial Electronics	5	3	30	70	100	4
NAM 312	Fluid Mechanics	5	3	30	70	100	4
NAM 313	Ship Design - I	5	3	30	70	100	4
NAM 314	Marine Machinery – I	4	3	30	70	100	4
NAM 315	Resistance & Propulsion	5	3	30	70	100	4
NAM 316	Elective-I	5	3	30	70	100	4
# FE 01	Free Elective - I	4	3	30	70	100	4
* NAM 317	Soft Skills Lab	3		100			1
	TOTAL	**36**		**310**	**490**	**700**	**29**

*Common with Mechanical Engineering.
For other department students

B.E III/IV SEMESTER - II

Subject Code	COURSE	Periods (L/T/Lab)	Exam (hours)	Sessional Marks	Exam Marks	Total Marks	Credits
NAM 321	Manufacturing Technology	5	3	30	70	100	4
NAM322	Strength of Ships	5	3	30	70	100	4
NAM 323	Marine Hydrodynamics	5	3	30	70	100	4
NAM 324	Ship Design - II	5	3	30	70	100	4
NAM 325	Elective-II, Off-shore structures, Marine power plant engineering,	5	3	30	70	100	4
NAM 326	Ship Construction	5	3	30	70	100	4
NAM 327	Ship Drawing - III	6		100		100	4
	TOTAL	**36**		**280**	**420**	**700**	**28**

3 weeks Industrial training during summer vacation after 3rd year 2nd semester. Submission of report and presentation in 4th year 1st semester.

B.E. - III/IV NAVAL ARCHITECTURE
(I-SEMESTER)

*NAM 311 - INDUSTRIAL ELECTRONICS
(Common with Mechanical Engineering)

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

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

Rectifiers, Amplifiers, Osccillators, Cathode ray oscilloscope.

2. 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.

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

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

5. 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.

NAM 312 – FLUID MECHANICS

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

1. Basic Concepts and properties of fluids – pressure and its measurement – hydrostatic forces on surfaces .
2. Fluid kinematics: Description of fluid motion – Langrangian method – Eulerian Method. Types of fluid flow-steady and unsteady flows-uniform and non-uniform flows-one, two and three dimensional flows-rotational and irrotational flows-laminar and turbulent flows-compressible and incompressible flows.
   Types of flow lines-path line-stream line -stream tube- streak line – Rate of flow or discharge. Continuity equation. Continuity equation in Cartesian co-ordinates. Equation of continuity in polar co-ordinates. Circulation and vorticity. Velocity potential and stream function-velocity potential-stream function-relation between stream function and velocity potential. Flow nets-methods of drawing the flow nets-uses and limitations of flow nets
3. Fluid Dynamics:- Equations of Motion-Euler's Equation of Motion-Bernoulli's Equation from Euler's Equation-Application Bernoulli's Equation-Venturimeter , orifice meter and pitot-tube-the momentum Equation-Moment of Momentum equation-Free liquid jets.
4. Laminar and turbulent flow, and flow through pipes: Introduction, Reynolds experiment, flow of viscous fluid through circular pipes and between two parallel plates-loss of head due to friction in viscous flow- turbulent flow-frictional losses in pipe flow – expression for the loss of head due to friction in pipes and coefficient of friction in terms of shear stress- J Boussinesq expression for shear stress in turbulent flow- Reynolds's shear stress and Prandtl mixing length theory for turbulent shear stress-velocity distribution in turbulent flow in pipes-Hydro dynamically smooth and rough boundaries-velocity distribution for turbulent flow for smooth and rough pipes-loss of energy in pipes-All major and minor losses-loss of head energy due to friction –Hydrostatic gradient line(H.G.L) and Total energy line(T.E.L)-Flow through pipes in series, compound pipes, parallel pipes and branched pipes-Power transmission through pipes-Flow through nozzles-water hammer in pipes
5. Dimensional and Model Analysis: Dimensional Homogeneity – Methods of Dimensional Analysis – Rayleigh's Method- π-Theorem – Model Analysis – Similitude-Types of similarities – Dimensionless Numbers – Reynolds's numbers etc…- Model laws of similarity laws – model testing of partially submerged bodies.

6. Boundary Layer Flow: Laminar Boundary Layer- turbulent layer and Laminar sub-layer – Boundary layer thickness (δ) – displacement thickness (δ*) and momentum thickness – energy thickness (δ**) - Drag force on a flat plate due to boundary layer-Turbulent Boundary layer on a flat plate – analysis of turbulent boundary layer – total drag on a flat plate due to laminar and turbulent boundary layer – separation of boundary layer.
7. Forces on Submerged Bodies : Force exerted by a flowing fluid on a stationary body – Expression for Drag and lift – dimensional analysis of drag and lift- Drag on a

sphere – terminal velocity of a body – Development of lift on a circular cylinder – Magnus effect – Development of lift on an airfoil

8. Compressible flow – thermodynamic Relations – Basic equations of compressible flow – Velocity of sound or Pressure wave in a fluid etc..- Mach number- stagnation properties - Area velocity relationship for compressible flow – flow of compressible fluid through orifices and nozzles fitted to a large tank – Rate of flow is equal to sonic velocity and pitot-static tube in a compressible flow

Text Books: 1. Fluid Mechanics and Hydraulic Machines, by R.K. Bansal, Laxmi publications.

2. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, s. Chand & Co.

References: 1. foundations of fluid Mechanics, by Yuan, prentice Hall of India

2. Fluid Mechanics and its applications, by S.K. Gupta and A.K. Gupta, Tata McGraw Hill, New Delhi

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

NAM 313- Ship Design - I

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

1. **General Considerations and Introduction to Ship Design Methods:** Marketing, manufacturing and operational considerations in Ship design. Technological, economic and sociological factors and national priorities. Ship design as a science and as an art. Owner's requirements, shipyard production facilities and operational constraints to be considered in the design process. Introduction to ship design method using basic ship or parent ship types, ship design as an iterative process and stages of ship design. The design spiral, design ship categories such as dead weight carriers, capacity carriers, and linear dimension ships. Displacement and volume estimation. Dead weight-displacement ratio, components of dead weight and displacement, determination of main dimensions and form coefficients, use of computers in ship design process.

2. **Estimation Of Weight And Volume Components, Design Of Hull Form And Determination Of Stability And Other Criteria:**
Weight and capacity equations and their use in ship design. Use of cubic equation. Calculation of weight and volume components using parent ship data or other compiled data. Calculation of steel, wood, outfit and machinery weights, using formulas. Estimation of dead weight components, design of hull form from first principles. Sectional area curve. Design of load water line, sections, stem and stern profiles, other water lines and development of the lines plan., determination of position of the LCB. Preliminary estimation of power and propeller diameter. Preliminary check for rudder area. Use of series data such as BSRA series and Taylor's series. Calculation of stability, free board, trims capacity and tonnage. Stowage factors. Volume required for cargo fuel fresh water and Ballast.

3. **Determination of Engine Power and Selection of Main and Auxiliary Machinery:**
Calculation of engine power. Relation between resistance and engine power. Criteria for selection of main propulsion plant. Types of main propulsion plants and fuels-their advantages and disadvantages. Different types of power transmission and shafting systems used in ships. Selection of propeller. Propeller types and number and estimation of main propeller parameters, such as diameter, rpm, number of blades, blade area ratio etc. Determination of location, area and volume of engine room. Estimation of size of engine casing. Estimation of electrical power requirement in the ship and deck area and volume required for installation of generators and main switchboard. Functions of various other auxiliary machinery such as boilers, cargo pumps, fuel and lube oil pumps, separators, cooling systems etc.

4. **Cargo Systems and Cargo Handling Gear:** Introduction to various types of cargo systems and cargo handling gear used on board ships such as cranes, derricks, Sampson posts, pumping systems etc. Properties and requirements for carriage of different types of cargo. General cargo carriers, light and heavy bulk cargo carriers and ore carriers. Unitised cargo- pallets, containers, barges, etc. and specialised ships for their carriage. Wheeled cargoes. RO-RO ships and ferries. Liquid cargoes-oil tankers liquefied gas carriers and chemical tankers. Selection of cargo handling gear-arrangements for general, bulk, unitised and liquid cargoes. Piping arrangement for tankers.

5. **Important Design Features of Various Types of Ships and other Considerations:** General cargo carriers, container ships, oil tankers, passenger vessels, bulk carriers, fishing trawlers, tugs, dredgers, barges, ferries. Different types of hull forms, propulsion systems, main and auxiliary machinery, cargo handling systems and operational requirements suitable of the above mentioned ships. Other consideration in ship design such as water tight integrity, damage stability, manoeuvring and sea keeping criteria, propulsive efficiency, minimisation of hull vibrations, compartments and super structure design in different types of ships. Trimming calculations in various operating considerations. Ballasting arrangements and estimation of total ballast.

Reference Books:

1. Ship Design and Construction by R.Taggart
2. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
3. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

NAM 314 – MARINE MACHINERY - I

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

1. Marine and Special duty pumps: Details of pumps for marine purposes- condenser circulating pumps, condensate and drain pumps, air pumps, boiler feed pumps, Performance characteristics of Pumps, power pumps- rotary pumps. Ejectors and their purpose. Applications in Marine use. Details of construction.

2. Marine Piping: 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.

3. Marine systems: 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.

4. Cargo handling: 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**.**

Textbook:

1.Marine Auxiliary Machinery by W.J.Fox

References:

1.Marine Engineering by R.Harrington
2.Marine Auxiliary Machinery by D.W. Smith and Souchotte
3.Reed's General Engineering Knowledge for Marine Engineers
4. Material Handling by N.Rudenko
5. Principles of Naval Architecture by J.P. Comstock.

NAM 315 RESISTANCE AND PROPULSION

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

1. Introduction to resistance: Concept of resistance, flow of non-viscous and viscous fluids past submerged bodies and surface of ships. Introduction to important components of resistance such as frictional resistance, wave making resistance, eddy making resistance and air & wind resistance. Dimensional analysis, conditions of similarity, corresponding speeds of ship and model, Introduction to towing tank experiments and determination of ship resistance.

2. Viscous resistance and air & wind resistance: Froude's experiments with planks and plates, Reynold's experiments with pipes. Turbulence stimulation, friction lines, form resistance, boundary layer separation, effect of hull roughness, appendage drag, resistance in shallow water full scale tests and ship model correlation.

3. Wave resistance, estimation of total resistance and effective horsepower: Kelvin wave pattern, waves generated by ship, wave interference, Froude's method of resistance prediction. Resistance data presentation, estimation of total resistance and effective power, trail and service allowances. Aspects of hull form design. Statistical analysis of resistance data by regression.

4. Propeller Design and hull propeller interaction: Screw propeller terminology and geometry. Dimensional analysis and conditions of similarity. Propeller in open water. Propeller coefficients, hull- propeller interaction, wake and thrust deduction, hull efficiency, relative rotative efficiency, propulsive coefficient. Cavitation, fully cavitating propellers. Propeller design using methodical series data, design of free running propellers, propellers for tugs and trawlers. Elementary treatment including basic principles of momentum theory, blade element theory, lifting line theory and lifting surface theory of propeller. Design of propellers for a variable wake.

5. Ship Propulsion devices, prediction of ship's power and strength of propellers: Ship Propulsion devices and their historical development, water jet propulsion, controllable pitch propellers, vertical axis propellers, shrouded propellers, tandem and contra-rotating propellers and paddle-wheels, super conducting electric propulsion. Model propulsion experiments in towing tanks and Cavitation tunnels. Ship trails and service performance analysis, estimation of power based on model experiments and propeller design charts, use of $B\rho$- δ charts, Kt- Kq- J diagrams. Propeller blade strength methods of calculation, classification society rules, Propeller materials.

Reference Books:

1.Principles of Naval Architecture, Vol. II by Ed.V.Lewis.
2.Resistance and Propulsion of Ships by S.A.Harvald**.**
3.Marine Propellers and Propulsion by J.C.Carlton.

NAM 316 - ELECTIVE – I
(A) FINITE ELEMENT ANALYSIS

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

1. 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.

2. 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.

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

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

5. 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.

NAM 316 - ELECTIVE – I
(B) Computer Graphics

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

Representing and displaying images, Modifying and understanding images, Chaos, Attractors, and Fractals, Graphics primitives: lines, circles, ellipses, Polygons Rasterization & 2-D anti-aliasing, 2-D Transformations, 2-D Viewing, 2-D Clipping, Hierarchical modeling system , 3-D Transformations, 3-D Viewing pipeline 3-D Hierarchical Modeling system, 3-D object models, Splint curves & surfaces, Hidden surface removal, Z-buffer algorithm, Shading Midterm Exam (Oct 28) Illumination models, Rendering techniques, Texture-Mapping, Animation, Particle Systems, Behavioral Modeling, Radiosity & Ray-Tracing, Rendering 3-D data .

Textbooks:

1. Computer Graphics by Rogers and Rogers & Adams .
2. Graphics fundamentals by Shirley
3. l CG mathematics by Lengye.

References:

1. D. F. Rogers, Procedural Elements for Computer Graphics, 2nd Ed., McGraw-Hill, Boston, MA, 1998. (suggested text)
2. P. Shirley, Fundamentals of Computer Graphics, 1st ed, AK Peters Ltd, 2002. (suggested text)
3. Hearn, D., and M. P. Baker, Computer Graphics (C Version), 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 1997. (alternative text)
4. A. Watt, 3D Computer Graphics, 3rd Ed., Addison-Wesley, Reading, MA, 2000. (alternative text)
5. Foley, Van Dam, Feiner, Hughes, and Phillips, Introduction to Computer Graphics, Addison-Wesley, Reading, MA, 1994. (alternative text)
6. E. Lengyel, Mathematics for 3D Game Programming and Computer Graphics, 2nd ed., Charles River Media, 2003. (suggested graphics math text)
7. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Ed., McGraw-Hill, Boston, MA, 1990. (suggested graphics math text)
8. M. Mortenson, Mathematics for Computer Graphics Applications: An Introduction to the Mathematics and Geometry of Cad/Cam, Geometric Modeling, Scientific Visualization, and Other CG Applications, 2nd ed, Industrial Press, 1999. (alternative graphics math text)
9. P. Schnelder, D. Eberly, Geometric Tools for Computer Graphics (Morgan Kaufmann Series in Computer Graphics and Geometric Modeling), 1st ed, Morgan Kaufmann, 2002. (alternative graphics math text)
10. F. Dunn and I. Parberry, 3D Math Primer for Graphics and Game Development, 1st ed., Wordware Publishing, 2002. (alternative graphics math text)

NAM 316 - ELECTIVE – I
(C) WORK STUDY

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

1. Introduction to work study- Scientific management- Productivity. Advantages of work study to management, Supervisors and workers.

Method Study: Introduction- Significance of process charts. Critical Examination- Identification of key activities of exercises on process charts- String diagrams- Therbligs- Micro motion analysis- Memo motion films.

2. Principles of Motion Economy: Work place layout- Developing new method- Job survey report writing.

3. Work Measurement: Work measurement techniques- Rating- Measuring the job- Allowances- Standard time- Synthetic data- Analytical estimating- PMTS- Work factor- MTM.

Job Evaluation- Techniques of job evaluation- Merit rating- Incentive plans. Activity sampling- Its application

Text Books:
1. Introduction to Work Study-International Labour Organisation.
2. Elements of Work Study and Ergonomics, by Dalela Etal Standard Publications.

Reference:
Motion and Time Study, by Barnes, John Wiely.

NAM 316 - ELECTIVE –I
(D) MARINE REFRIGERATION AND AIR CONDITIONING

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

1. Thermodynamics: Thermodynamic principles and diagrams- properties of real fluids and refrigerants –change of phase-liquid and dilute solutions-mixture of liquids – steady flow processes with binary mixtures. Properties of ideal refrigerants. Types of commercial refrigerants- cycles of refrigeration- Air cycle and steam Jet refrigeration.

2. REFRIGERATION SYSTEMS: Vapor compression refrigeration-cycles-Multi-pressure systems- Refrigeration components like compressors, heat exchangers and expansion devices- Controls. Vapor Absorption system- Ammonia, Electrolux, Lithium bromide systems-Applications.

3. PSYCHROMETRY-DEFINITIONS: Evaporative cooling of air, dehumidification and other psychometric processes-representation on psychometric chart and calculations.

4. AIR CONDITIONING: Standards for marine Air conditioning-Types of air conditioning systems-Application of air conditioning systems in Cargo ships, refrigerated vessels, Passenger ships- Comfort and cargo air conditioning. Ventilation and ducting, Ship board ventilation- Engine room, Cargo holds accommodation and stores, ducting controls- Food preservation technology.

TEXT BOOKS:
1.Refrigeration and Air Conditioning by W.F.Stocker.
2.Refrigeration and Air Conditioning by P.L.Ballaney.

REFERENCE BOOKS:
1.Marine Engineering by R.L.Harington.
2. Marine Auxiliary Machinery by D.W.Smith.

FE 01 FREE ELECTIVE
(Offered to other branch students)

POWER PLANT ENGINEERING

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

Steam Power Plants: General Layout, Power plant cycles. Boilers: Construction and Heating surfaces. Mountings and accessories. High pressure and high duty forced circulation boilers land modern trends in Boiler design. Steam piping–fittings–logging.
Internal Combustion Power Plants: Types of engines for power generation, Super charging, Exhaust heating fuel tanks and oil supply systems. Air supply for starting, Modern trends and design in diesel engines, Performance of engines,
Gas Turbine and other Propelled Power Plants: Introduction – Gas turbine plant–Classification and comparison of different types of gas turbine power plants – Components and different arrangements of the gas turbine plants – Indian gas turbine power plants–Governing system of gas turbine plant–Marine, Aero and Rocket Propulsion power plants.
Hydro Electric Plants: Different types of plants. Selection of site. Low, medium and high head plants and pumped storage plants. General layout of the plant – Head works, Spillways, Canals, Tunnels, Governing, Lubrication, Penstock, Anchorages and relief valves, different types of surge tanks, intakes, Gates and Valves.
Nuclear Power Plants: Classification of reactors, Thermal utilization, Fuels, Fuel moderator and coolant, Control and safety rods, Special properties of structural materials required, Induced radio-activity, Gas cooled reactors, Radiation hazards and shielding, Radio active waste disposal.
Direct Energy Conversion: Solar Energy–Introduction, Solar radiation, Solar collectors, Energy storage. Wind Energy–Wind mills. Thermo Electric–MHD and other non conventional energy sources.

Text Books:
1. Power Station Engineering and Economy by Benhaedt G.A.Skrotzki, William A. Vopat, MGH Book , Inc.
2. Heat Engineering, I.T. Shvets et al, MIR Pub Moscow.
3. A Course in Power Plant Engineering, S.C.Arora & S.Domdundwar.

References:
1. Solar Power Engineering by B.S. Magal, TMGHPub Co..
2. Solar Energy by S.P. Sukhatme, T MGH pub. Co.
3. Modern Power Plant Engineering by Joel Weisman, Roy Eckart, PHI.
4. Atextbook of Power Plant Engineering by P.C. Sharma,S.K. Kataria&Sons, ND.
5. Fundamentals of Nuclear Power Engineering by D.K. Singhai,Khanna Pub.

*** NAM 317 SOFT SKILLS LABORATORY

Periods/week : 3 **Credits: 1**

(Common for all Branches of Engineering)

1. Basic Skills
    - Listening
    - Speaking
    - Reading
    - Writing

2. Non-Verbal
    - Grooming(Personal Appearance)
    - Using space
    - Body Language
    - Paralanguage

3. Basic Etiquette
    - Introducing
    - Conversation-Small Talk
    - Table Manners
    - Telephone/Cell phone manners

4. Goal setting
    - Immediate,Short term,Long term
    - Smart Goals
    - Strategies to achieve goals

5. Time-Management
    - Types of time
    - Identifying time wasters
    - Time Management Skills

6. Using Telephone
    - Making and receiving calls
    - Handling wrong numbers and unnecessary calls
    - Intonation
    - Enunciation

7. Leadership and Team Management
    - Qualities of good leader
    - Leadership styles
    - Decision Making
    - Problem Solving
    - Negotiation Skills
8. Assertiveness
    - Assertiveness and aggressiveness
    - Disagreement

- Openness and Expressiveness
- Self Concept
- Positive thinking

9. Group Discussion
   - Purpose(Intellectual ability,Creativity,Approach to a Problem, Solving,Tolerance,Qualities of a leader)
   - Group Behaviour
   - Analysing Performance

10. Job Interview
   - Identifying Job Openings.
   - Preparing a Resume (Basic,Functional,Specific).
   - Covering Letter(Solicited/Unsolicited)
   - Interview (Opening,Body-Answer Q,Close-Ask Q).
   - Types of questions.
   - Handling difficult Questions.

REFERENCE BOOKS:

1."*Technical Communication"* principal &practice by Meenakshi Raman and Sangeeta Sharma,Oxford University Press.
2."*Developing Communication Skills"* by Krishna Mohan & Meera Banerji,Macmillan Publishers.
3."*Technical writing"* Process and Product by Sharon J. gerson & Steven M . Gerson, Pearson Education Publishers.
4."*Technical Communication skills"* by Rizvi, Tata Mc Graw hill Publications.
5.***"The Oxford Guide to Writing and Speaking" by John Seely, Oxford University Press.***

B.E. - III/IV NAVAL ARCHITECTURE AND MARINE ENGINEERING
(II-SEMESTER)

NAM 321 – MANUFACTURING TECHNOLOGY

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

1. Foundry: Foundry tools and appliances, layout – pattern types, materials, allowances, pattern making, moulding sands, types. Moulding methods, equipment for moulding, casting methods.
2. 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.
3. 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.
4. Drilling and Boring Machines (Elementary Treatment only): Classification, specifications, cutting speed, feed, machining times, parts and description of boring machines, types.
5. Power Press: Operation, components, classification, selection, cutting dies, power requirements, power press operations, punching, blanking, deep drawing.
6. Linear and angular measurements: Micrometers, Slip gauges, Vernier and optical bevel Protractors, sine bar Angle gauges.
7. Comparators: Types, Mechanical, Electrical, Electronic comparators. Measurement of Straightness- flatness- square ness and symmetry- parallelism and circularity.
8. Metrology: Metrology of screw threads and Metrology of gears (Measurement of Pitch and tooth thickness only).
9. Grinding: Introduction-abrasives-grinding wheels, bonding processes, selection of grinding wheels-grinding machines-classification-honing-lapping, super-finishing, buffing, polishing, selection of process parameters.

Textbooks:
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

NAM 322 - STRENGTH OF SHIPS

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

1. Introduction to functions and analysis of ship structures: Functions of ship structure, the forces acting up on a ship at sea, static forces, dynamic forces. The distortion of ship's structure. Application of theory and experience. Limitations of the theory. Distinction between strength and stiffness of hull girder. Forces and moments acting on ship's structures in regular waves in head seas, and oblique seas. Nature of stresses in ship's hull when ship is floating in still water and on a wave. Modeling of ship's' structures including general remarks on structural strength. Three-dimensional analysis of a ship structures (elementary treatment only). Assumptions and simplification of longitudinal strength calculations. Introduction to the use of probability theory in the assessment of longitudinal strength.

2. Longitudinal strength of hull girder and ultimate strength: Modeling of ship hull Girder as a beam. Assumed form of wave systems. Conditions of Hogging and Sagging. The buoyancy curve. The weight curve. Distributions of dead weight items. The Load, shearing force and bending moment curves. Characteristics of shear force and bending moment curves. Still water bending moment, wave bending moment and total bending moment. Bending theory applied to ship structures and its limitations. Calculations of hull girder section modulus and hull deflection. Dynamic effects on loads acting on the hull due to ship motions and wave action such as slamming. Thermal effects on hull girder. Stresses in the inclined condition. Application of plastic theory to ship structures, stress-strain diagram, calculation of plastic neutral axis and plastic moment. Ultimate strength of a simply supported beam and a fixed ended beam. Ultimate longitudinal strength of a ship.

3. Transverse strength of hull girder and ship hull material: Transverse loads on ship's hull such as hydrostatic loads, weights, wave loads, racking, and torsion. Effect of hatches and other openings. Strain energy method, moment distribution method and comparison of the two methods, Influence of bracketed connections. Manufacture of steel. Requirement of ship building quality steels, high strength steels, Aluminum alloys and glass reinforced plastics.

4. Mechanical properties and chemical composition of structural materials: Testing of steels such as tensile test bend test and impact test. Brittle fracture. Steels for very low temperature applications.

5. Strength of bulk heads, decks and tank tops, foundations, super structure, deck houses and structural discontinuities and local strength problem: Types of bulkheads and loads on bulkheads. Strength analysis of bulkheads. Types of foundations- loads on foundations and Strength analysis. Generation of loads on superstructure. Factors affecting superstructure efficiency. Effective superstructure. Strength of Aluminum alloy superstructure. Strength analysis of decks and tank tops. Determination of scantlings of superstructure decks on the basis of simple bending theory. Strength of deckhouses, structural discontinuities such as holes in plates, notches in beams and girders, deck openings, ends of superstructure, ends of girders and other structural members. Stress concentration due to various structural discontinuities mentioned above. Applications of three-moment theorem to ship structures. Use of strain energy method for solution of bending moment problems and redundant structural problems.

6. Theory of thin plates, buckling of structures, composite construction, grillage analysis, calculation of scantlings as per rules: Thin plate theory and solution for different boundary conditions. Application of plain stress theory to ship structural problems. Case of a plate acted upon by a concentrated load; Buckling of plates. Influence of stiffeners (longitudinal and \ or transverse) on the buckling stress of ship's plating. Bending and membrane stresses in plates (application to bulkheads, shell plates etc.) Composite construction- Two materials with same elastic modulus. Two materials of different elastic Modulii. Bending of composite beam. Introduction to Grillage. Analysis of simple Grillage.

Scantling calculations according to the rules of classification societies.

REFERENCE BOOKS:

1. Ship Construction by D.J.Eyres Merchant Ship Construction by D.A.Taylor
2. Principles of Naval Architecture, Vol. II by Ed.V. Lewis.

NAM 323 - MARINE HYDRODYNAMICS

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

1. 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.

2. 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.

3. 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.

4. 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.

Textbook:

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

NAM 324 - SHIP DESIGN - II

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

1. General Arrangements of Ships: General arrangement of ships. Layout of main and other decks. Water tight subdivision of the ships hull. Disposition of bulk heads and decks. Allocation of cargo and machinery spaces. Bridge and navigation spaces. Arrangements of tanks for fuel oil, ballast water and other liquids. Engine room layout. Cargo handling arrangement, requirement for ships. Accommodation in ships. Design philosophy of accommodation spaces. Living spaces, commissionery spaces, spaces for dining, recreation and services. Access diagrams. Design of super structure and layout. General arrangement and deck layout of general cargo ship, bulk carrier, oil tanker, container ship, passenger ship, fishing trawler, ferry, tug and dredger.

2. Hull Fittings, Navigational aids and life saving appliances: Closing devices, water tight, weather tight, gas tight and non-water tight floors. Windows and portholes. Bulkhead openings, hull openings, cargo port, bow doors, stern ramps. Man holes and access doors.
Hatch covers-weather deck and between deck. Types of hatch covers-sliding, rolling and pontoon. Operating mechanisms. Arrangements for ensuring water tightness. Life saving equipment primary and secondary types and ship requirements. Navigational equipment. Bulwarks railings and awnings, gangway, gangplanks, and gangway adders. Masts and rigging, mast designs.

3. Auxiliary machinery and other Ship Systems: Ship auxiliaries and equipment.
Functions of auxiliary machinery and design requirements for location and installation.
Selection of components and space allocation for ship systems including electrical system,
Fuel and lubricating oil systems. Fresh water and sea water systems, Air conditioning,
ventilation, and refrigeration systems, anchoring and mooring gear,
Steering gear types and location, automation of ship systems and ship operation. Unmanned machinery spaces.

4. International and National regulatory Bodies: Safety and habitability. Impact of the regulatory bodies in ship design, IMO and classification societies, SOLAS, ILLC, ITTC, MMD. Prevention of marine pollution-MARPOL regulations. Free board assignment. Stability in various operating conditions, important features of maritime law of India - regulations regarding a/c, ventilation, noise, vibrations. Survival after damage. Carriage of dangerous goods. Collision prevention.
Ship design organisation and design consideration for special ships and use of computers: Evolution of design philosophy. Changes effected over the years. The "Titatanic Disaster" and impact.
Design features of special types of ships- ice breakers, refrigerated cargo carriers, liquefied gas carriers, aircraft carriers, Ro-RO vessels, SWATH vessels, luxury passenger ships and high speed ships.
Double hull structures for tankers. Hatch coverless containers. Offshore supply vessels, deep sea fishing vessels, use of computers in design of general arrangement and systems. Trends of future developments. Aesthetic considerations in ship design.

Reference Books:

1. Ship Design and Construction by R.Taggart
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

NAM 325- ELECTIVE –II
(A) MARINE POWER PLANT ENGINEERING

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

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.

NAM 23I NTRODUCTION TO OFFSHORE STRUCTURES
Elective - II (B) NAM 325

Module 1

Types of offshore structures and conceptual development - Analytical models for jacket structures - Materials and their behaviour under static and dynamic loads - Statutory regulations - Allowable stresses - Various design methods and Code Provisions - Design specification of API, DNV, Lloyd's and other classification societies - Construction of jacket and gravity platforms

Module 2

Operational loads - Environmental loads due to wind, wave, current and buoyancy - Morison's Equation - Maximum wave force on offshore structure - Concept of Return waves - Principles of Static and dynamic analyses of fixed platforms - Use of approximate methods - Design of structural elements.

Module 3

Introduction to tubular joints - Possible modes of failure - Eccentric connections and offset connections - Cylindrical and rectangular structural members – In plane and multi plane connections - Parameters of in-plane tubular joints - Kuang's formulae - Elastic stress distribution - Punching shear Stress - Overlapping braces - Stress concentration - Chord collapse and ring stiffener spacing - Stiffened tubes - External hydrostatic pressure - Fatigue of tubular joints - Fatigue behaviour - S-N curves - Palmgren-Miner cumulative damage rule - Design of tubular joints as per API Code

Module 4

Analysis of offshore structures.- Fatigue analysis, inplace analysis, loadout analysis, launch analysis, transportation analysis

Module 5

Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online corrosion monitoring - Corrosion fatigue.

References

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API., 2000.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
4. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
5. Reddy, D. V & Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
7. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
8.Offshore pipelines by B. Gou, S. Song, J. Chacko and A. Ghalambor,Â GPP Publishers,2006

NAM 325 – ELECTIVE –I I
(C) Ocean Structures and Materials

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

1. 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.

2. 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.

3.. 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

NAM 325 - ELECTIVE –I I
(D) OPERATIONS RESEARCH

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4
(Common with Mechanical (with Marine Engg. Electives))

1. Development: Definition, Characteristics and phase of Scientific Method, Types of models. General methods for solving operations research models.

2. Allocation: Introduction to linear programming formulation, graphical solution, Simplex method, Artificial variable technique, Duality theory and Dual simplex method.

3. Transportation Problem: Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution, Variations i.e., Non-square (m*n) matrix restrictions.

4. Sequencing: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines, problems with n-jobs and m-machines, graphic solutions. Travelling salesman problem.

5. Waiting lines: Single channel Poisson arrivals, Exponential service times, Unrestricted queue with infinite population and finite population models; Single channel Poisson arrivals, Exponential service times with infinite population and restricted queue.

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

7. Theory of games: Introduction, Two-person zero-sum games, The Maximum -Minimax principle, Games without saddle points - Mixed Strategies, 2xn and mx2 Games - Graphical solutions, Dominance property, Use of L.P. to games, Algebraic solutions to rectangular games.

8. Inventory: Introduction, inventory costs, Independent demand systems: Deterministic models - Fixed order size systems - Economic order quantity (EOQ) - Single items, back ordering, Quantity discounts (all units quantity discounts), Batch - type production systems: Economic production quantity - Single items, Economic production quantity multiple items. Fixed order interval systems: Economic order interval (EOI) - Single items, Economic order interval (EOI) - Multiple items.

9. Network Analysis: Network definitions, Minimum spanning tree algorithm, Shortest root problem, Maximum flow model. Elements of project scheduling by CPM and PERT.

Text Books:

1. Operation Research, by TAHA (PHI)
2. Operations Research Methods and Problems, by M.Sasiene, A.Yespal and L.Friedman.(John Wiely)
3. Operation Research by S.D.Sharma.(Kedarnadh Ramnadh & Co.,)
4. Operation Research by R.Pannerselvam, (PHI)

NAM 326 - SHIP CONSTRUCTION

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

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 4**.**Ship Building Technology. By J.H.Dixon

NAE 327 - SHIP DRAWING - II

Periods/week : 6 Ses. : 100
Credits: 4

Resistance: Resistance, powering and propulsion calculations, propeller design and drawing, rudder design and drawing.
Practical: Resistance calculations using Guldhammer and Harvald method, and plotting of resistance and propulsion curves. Propeller design and drawing, rudder design and drawing.
Strength of Ships: Strength of ships and structural design based on longitudinal strength and transverse strength calculations. Midship section design and drawing, derrick design and drawing, drawing of trochoidal wave and sine wave. Use and application of classification rules. Bulkhead design and drawing. Deck design and drawing.
Practical: Drawing of shell expansion plan, mid ship section, steel weight calculations, longitudinal strength calculations, transverse strength calculations, derrick design.

INDUSTRIAL TRAINING

3 weeks Industrial training during summer vacation after 3rd year 2nd semester. Submission of report and presentation in 4th year 1st semester.