

BHARATHIAR UNIVERSITY: COIMBATORE-641 046

B.Sc. NAVAL ARCHITECTURE

(For the CCII students admitted from the academic year 2016-17 onwards)

SCHEME OF EXAMINATION – CBCS PATTERN

PART	Course Title	Instru hrs/ week	EXAMINATION				CREDITS
			Duration	CIA	Uni. Exam	Total	
	SEMESTER-I						
	Language-I	6	3	25	75	100	4
	English-I	6	3	25	75	100	4
	Core-I-Physics -I	5	3	20	55	75	3
	Core-II-Marine Chemistry - I	5	3	20	55	75	3
	Allied-I-Marine Mathematics - I	6	3	25	75	100	4
	Core Practical – I - Physics Lab	6	3	20	30	50	2
	Environmental Studies #	2	3	-	50	50	2
	SEMESTER - II						
	Language-II	6	3	25	75	100	4
	English-II	6	3	25	75	100	4
	Core-III-Physics - II	5	3	20	55	75	3
	Core- IV –Marine Chemistry - II	5	3	20	55	75	3
	Allied-II-Marine Mathematics - II	6	3	25	75	100	4
	Core Practical II – Marine Chemistry Lab	6	3	20	30	50	2
	Value Education - Human Rights #	2	3	-	50	50	2
	SEMESTER - III						
	Core-V- Introduction to Naval Architecture & Ship Building	5	3	20	55	75	3
	Core-VI- Behaviour of Materials	5	3	20	55	75	3
	Core-VII- Basic Ship Theory	5	3	20	55	75	3
	Allied Paper-III- Marine Biology	6	3	25	75	100	4
	Skill Based Subject -I-Measurement and Instrumentation Lab	5	3	30	45	75	3
	Core Practical III – Behaviour of Materials Lab	6	3	20	30	50	2
	Tamil @ / Advanced Tamil # (or)Non-Major Elective-I Yoga for Human Excellence # / Women's Rights # Constitution of India #	2	3	50		50	2
	SEMESTER - IV						
	Core-VIII- Fluid Mechanics	5	3	20	55	75	3
	Core-IX- Electrical Technology & Instrumentation	6	3	20	55	75	3
	Core-X- Stability of Ships	6	3	20	55	75	3
	Allied-IV-Marine Geology	6	3	25	75	100	4

Skill Based Subject-II-Computer Practice Lab	5	3	30	45	75	3
Core Practical IV – Electrical Engineering Lab	6	3	20	30	50	2
Tamil @ / Advanced Tamil # (or) Non-major Elective II: General Awareness #	2	3	50		50	2
SEMESTER - V						
Core-XI- Naval Architecture	5	3	20	55	75	3
Core-XII Structural Design of Ships - I	5	3	20	55	75	3
Core-XIII- Ship Dynamics	5	3	20	55	75	3
Core-XIV- Structural Design of Ships - II	5	3	20	55	75	3
Core-XV-Applied Thermodynamics	6	3	25	75	100	4
Skill Based Subject III – CAD/CAM Lab	5	3	30	45	75	3
Core Practical - V – Advanced Machine Tools Lab	6	3	20	30	50	2
Minor Project *	--	--	--	--	100	4
SEMESTER - VI						
Core-XVI-Electrical Systems on Ships and Shipyards	6	3	25	75	100	4
Core-XVII-Marine Engineering	6	3	25	75	100	4
Core-XVIII-Design of Machine Elements	6	3	25	75	100	4
Core-XIX-Ship Production Technology	6	3	25	75	100	4
Core-XX-Ship Repairing & Surveys	6	3	25	55	100	4
Skill Based Subject-IV- Marine Propulsions, Overhauling Lab and Fire Fighting Lab	5	3	30	45	75	3
Core Practical VI – Marine Systems and Mechanism Lab	6	3	20	30	50	2
Major Project *	--	--	--	--	100	4
Extension Activities @	--	--	50	--	50	2
TOTAL					3500	140

\$ Includes 25% / 40% continuous internal assessment marks for theory and practical papers respectively.

@ No University Examinations. Only Continuous Internal Assessment (CIA)

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* Project work/Internship: For Report 80% Marks & Viva-Voce 20% Marks

SEMESTER - I

CORE PAPER I – PHYSICS – I

OBJECTIVE:

On successful completion of this course the students should have understood the basics of matter and the guiding principles of physics with regard to heat, thermodynamics and optics.

UNIT I PROPERTIES OF MATTER

Elasticity -stress - strain diagram - factors affecting elasticity - twisting couple on a wire-shafts-Torsion pendulum - Depression of a cantilever - Young's modulus by cantilever - Uniform and non-uniform bending - I shape girders - production and measurement of high vacuum - rotary pump diffusion pump - Pirani Gauge - Penning gauge viscosity - Oswald viscometer - Comparison of viscosities.

UNIT II ACOUSTICS

Acoustics of buildings - Absorption coefficient - Intensity - Loudness - Reverberation time - Sabine's formula - Noise pollution - Noise control in a machine - Ultrasonic's - production - Magnetostriction and Piezoelectric methods - Applications of ultrasonic's in Engineering and medicine.

UNIT III HEAT AND THERMODYNAMICS

Thermal conductivity - Fourier's and Lee's Disc methods - radial flow of heat - Thermal conductivity of rubber and glass - Thermal insulation in buildings - Laws of Thermodynamics - Carnot's cycle as heat engine and refrigerator - Carnot's theorem - Ideal Otto and Diesel engines - Concept of entropy - Entropy - Temperature diagram of Carnot's cycle.

UNIT IV OPTICS

Photometry - Lummer - Brodhum photometer - Flicker Photo meter -Antireflection coating - Air wedge - Testing of flat surfaces – Interference – Theory – Interference in Thin films- Reflected and Transmitted Beam - Michelson's Interferometer and its applications – Photo elasticity and its applications.

UNIT V LASER & FIBRE OPTICS

Principle of lasers - laser characteristics - Ruby – Nd YAG, He-Ne, CO₂ and semiconductor lasers - propagation of light through optical fibers - types of optical fibers - Applications of optical fibers as optical waveguides and sensors.

TEXT BOOKS

1. Arumugam M “ Engineering Physics, Anuradha Agencies
2. Arumugam M “ Material Science” Anuradha Agencies
3. Text Book of Physics -BrijLall& N. Subramanyam
4. Bachelor of Science (Marine) (CPOP-4 years) 2010-11

CORE – II -MARINE CHEMISTRY-I

OBJECTIVE:

On completion of this paper the students should understand basics of marine chemistry and principles of electro chemistry, polymers, chemical thermodynamics and water treatment.

UNIT I ELECTRO CHEMISTRY

Types of electrodes and cells - Reversible and Irreversible cells - Nernst Equation - EMF measurements and its application - Electro motive Series - electro winning - Metallurgy - applications - sensors - electrochemical machining -metal processing - principles of chemical and electrochemical corrosion - corrosion control (Sacrificial anode and impressed current methods)

UNIT II WATER TREATMENT

Water quality parameters - definition and expression - estimation of hardness (EDTA - method) - alkalinity (titrimetry) - water softening (zeolite) - demineralization (ion-exchangers) - desalination - domestic water treatment

UNIT III POLYMERS

Monomer - functionality - degree of polymerization - classification based on source and applications - addition, condensation and co polymerization - mechanism of free - radical polymerization - thermoplastics and thermosetting plastics - processing of plastics - injection molding, blow molding and extrusion process - Commodity and engineering plastics - polymer blends and alloys - molding compounds - powder, DMC, SMC, liquid resin - composites - fibers ceramic - glass.

UNIT IV CHEMICAL THERMODYNAMICS

Definition of enthalpy, entropy, free energy and spontaneity - Maxwell relations - Gibb's - Helmholtz equation - Van'thoff equation - stoichiometry and energy balances in chemical reactions.

UNIT V DYNAMICS OF CHEMICAL PROCESS

Basic concepts - composite reactions (opposing, parallel and consecutive reactions) - collision theory - thermodynamic formulation of reaction rates – unimolecular reactions - chain reaction (stationary and non-stationary) enzyme kinetics - Michaelis - Menten equation.

TEXT BOOKS

1. Atkins P.W, "Physical Chemistry" EIBS, IV Edition
2. Dara S.S "A text book on Engineering chemistry", S. Chand & Co. New Delhi

ALLIED PAPER I - MARINE MATHEMATICS-I

OBJECTIVE:

On successful completion of this course the students should have understood the concepts of mathematics of matrices, analytical geometry and calculus.

UNIT I MATRICES

Characteristic equation - Eigen values and eigenvectors of a real matrix - Properties of Eigen values - Cayley - Hamilton theorem - Orthogonal matrices - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY:

Direction cosines and ratios - Angle between two lines - Equation of a plane - Equation of a straight line - Co - Planer lines - Shortest distance between skew lines - Sphere - Tangent plane - Plane section of a sphere - orthogonal spheres.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature - Cartesian and polar coordinates - Circle of curvature - Evolutes - Envelopes - properties of envelopes.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

Functions of two variables - Partial derivatives - Total differential - Differentiation of implicit functions - Taylor's expansion - Maxima and Minima - Constrained Maxima and Minima by Lagrangean Multiplier method.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS

Linear equations of second order with constant and variable coefficients - Homogeneous equation of Euler type - Method of variation of parameters.

TEXT BOOKS

1. Kreyszig.E, "Advanced Engineering Mathematics (8th edition)
2. Veerarajan. T, "Engineering Mathematics" Tata McGraw Hill- New Delhi
3. Grewal.B.S, "Higher Engineering Mathematics"- Khanna Publishers
4. Bachelor of Science (Marine) (CPOP-4 years) 2010-11

CORE PRACTICAL I

PHYSICS LAB

LIST OF EXPERIMENTS

1. Young's modulus by non - uniform bending
2. Young's Modulus – Uniform bending
3. Rigidity modulus and moment of inertia using Torsion Pendulum
4. Viscosity of a liquid by Poiseuille's method
5. Determination of Refractive Index by I-D curve
6. Wavelength determination using grating by Spectrometer
7. Thermal conductivity by Lee's disc.
8. Thickness of wire by Air wedge
9. Thermoe.m.f. measurement by potentiometer
10. Velocity sound in Air using Sona Meter

SEMESTER: II

CORE PAPER III - PHYSICS-II

OBJECTIVE:

On successful completion of this course the students should have understood the structure of materials, their properties like conduction and testing methods.

UNIT I ENGINEERING MATERIALS

Materials - Structure property relationship - Selection of materials for engineering - Advance modern materials - Crystal structure - Miller indices - density - Packing factor - Space lattices - X-ray diffraction.

UNIT II MECHANICAL PROPERTIES

Tensile - Compression - Hardness - Impact - fatigue - Creep and stress rupture - Comparative study of metals, ceramic, plastic and composite materials - Alloy - solid solution - Ferrous and Nonferrous system, phase changes Time - Temp. Transformation.

UNIT III CERAMICS & COMPOSITES

Modern ceramic materials - cermet - cutting tools - glass ceramics - fibers - composites - FRP - CRFP materials – Engineering Application - Composite Materials used as vibration damper, In IC engines as engine body, Industrial Tanks.

UNIT IV SEMI CONDUCTORS

Conductors – Semiconductors – Insulators – element al & compound semiconductor - Properties - Effect of temperature - Band gap energy - Hall effect - Different type of magnetic materials and their properties - Ferrites and insulators - Classification and their application - Optical materials LED / LCD Photo conducting materials - Optical properties and principles of testing.

UNIT V NON-DESTRUCTIVE TESTING

Liquid penetrant - Magnetic particle and Eddy current method - X-ray radiography - Fluoroscopy - Gamma ray - radiography - Ultrasonic scanning method - flaw detector – Thermography.

TEXT BOOKS

1. Arumugam M “ Engineering Physics, Anuradha Agencies
2. Arumugam M “ Material Science” Anuradha Agencies

CORE PAPER IV - MARINE CHEMISTRY-II

OBJECTIVE:

On successful completion of this course the students should have understood the chemistry of mass action, pollution aspects and protection methods.

UNIT I ORGANIC REACTIONS AND THERMO CHEMISTRY

Organic reactions and mechanism - law of mass action - industrial enthalpy balances - free energies of metallic compounds - Ellingham diagram - metallurgical and multi component equilibrium - phase rule of metallurgical reactions - refractory materials.

UNIT II EXTRACTIVE METTALLURGY AND ALLOYS

Ores - ore dressing - extraction processes - alloys - phase diagrams - heat treatment - non ferrous and special alloys - Powder metallurgy - Principles - compacting and sintering methods - applications.

UNIT III MARINE POLLUTION AND ENVIRONMENTAL PROTECTION

Water and oil pollution - sources and treatment - determination of BOD and COD, treatment of domestic sewage - types of industrial wastes - air pollution - green house effect - ozone depletion - acid rain - International standards for water and air quality - regulations - ship wasters and sewage treatment - Chemical Toxicology: Bio-chemical effects of Lead, Mercury, Carbon monoxide, Nitrogenoxides, Sulphur dioxide, Ozone and Cyanide.

UNIT IV SURFACE PROTECTION

Inorganic - surface conversion processes - anodizing, vitreous coating – Phosphating - Treatment of metal surfaces - Hot dipping - Electroplating - Cladding - organic coating –Paints - Ingredients and their functions - varnishes - Lacquers - Channels, Epoxy resin coating - Paints for marine use.

UNIT V CHEMISTRY OF EXPLOSIONS

Smoke bomb, rocket flares, rocket parachute and chemistry of pyrotechnics. Phase rule - definition - explanation of terms - examples - applications - one component and two component eutectic systems.

TEXT BOOKS

1. Jain P.C & Monika Jain, Engineering Chemistry, 4 Edition, Dhanpat Rai & Sons 1997 New Delhi, 2002
2. A.K. De., Environmental Chemistry, 2 Edition, Wiley Easter ltd, 1990
3. Bachelor of Science (Marine) (CPOP-4 years) 2010-11

ALLIED II - MARINE MATHEMATICS-II

OBJECTIVE:

On successful completion of this course the students should have understood the basic mathematics of integration, vector calculation and statistics.

UNIT I MULTIPLE INTEGRALS

Double integration in Cartesian and polar coordinates - Change of order of integration - Triple integration in Cartesian coordinates - Gamma and Beta functions

UNIT II ANALYTICAL FUNCTIONS

Cauchy Riemann equations - Properties of analytic functions - Determination of harmonic conjugate - Milne - Thomson's method - bilinear transformation

UNIT III COMPLEX INTEGRATION

Cauchy's theorem - Statement and application of Cauchy's integral formulae - Taylor's and Laurent's expansions - Singularities - Classification - Residues - Cauchy's residue theorem - Contour integration - Circular and Semi Circular contours (excluding poles on real axis)

UNIT IV VECTOR CALCULUS

Gradient, Divergence, Curl - Line, surface & volume integrals - Statements of Green's Gauss divergence and Stokes' theorems - Verifications and applications,

UNIT V STATISTICS

Moments - Coefficient of correlation - Lines of regression - Tests based on Normal and T distributions, for means and difference of means.

TEXT BOOKS

1. Kreyszig.E, “Advanced Engineering Mathematics (8th edition)
2. Veerarajan. T, “Engineering Mathematics” Tata McGraw Hill- New Delhi
3. Grewal.B.S, “Higher Engineering Mathematics”- Khanna Publishers

CORE PRACTICAL II - MARINE CHEMISTRY LAB

1. Preparation of Normal Solutions.
2. Test for alkalinity & Total alkalinity.
3. Water treatment testing - Chloride Test.
4. Cooling water test:
 - a. Nitrate Test
 - b. Chloride Test
 - c. PH Test.
5. Boiler water tests:
 - a. Alkalinity Test
 - b. Chloride Test.
 - c. PH Test.
6. Lubrication Oil testing:
 - a. Viscosity Test
 - b. Water Content Test.
 - c. Alkalinity Test
7. Fuel Testing:
 - a. Determination of flash & fire points of liquid fuel.
8. Titrations:
 - a. Determination of alkalinity of water sample.
 - b. Determination of acidity of water sample.
 - c. Determination of total, permanent & temporary hardness of water by EDTA method.
 - d. Comparison of the strength of two acids.

TEXT BOOK:

Engineering chemistry practical by Dr.C. Daniel Yesudian, 2004, Hitech Publications.

SEMESTER III

CORE V - INTRODUCTION TO NAVAL ARCHITECTURE& SHIP BUILDING

OBJECTIVE:

On successful completion of this course the students should have understood the history of ship building and the architecture of present times.

UNIT –I

Historical review - ancient types of vessels (rafts, boats, and ships) -Types of ships-terms and definitions, cargo ships, fishing vessels, factory ships, supply ships, Cable ships, ice breakers, research vessels, warships, hydrofoils, air cushion vehicles, small pleasure crafts (yachts, ketches, etc)

UNIT –II

Some physical fundamentals-Archimedes principle, laws of floatation stability and trim, forces acting on a ship - the ship's form-main dimensions, lines plan, coefficients

UNIT –III

The ship and her structural members-shipbuilding materials (properties, compositions), bottom structure, shell plating and framing, decks, hatches and hatch covers, superstructures, bulkheads, tanks, holds, fore and aft structure, stern and rudder.

UNIT –IV

Propulsion machinery-development of ship propulsion, general arrangement of propulsion plants, main engines - auxiliary machinery-power, auxiliary engines for ship systems operation, auxiliary engines for engine plant operation, steering gear.

UNIT –V

Outfitting-anchor, mooring and towing equipment, cargo handling equipment, rigging – Bridge - The control center of the ship-bridge arrangement and layout wheel house, navigation and communication equipments, methods of navigation, navigational lights

Text Books

1. Taggart; *Ship Design and Construction*, SNAME
2. D'Archangelo; *Ship Design and Construction*, SNAME. Eyres, D.J.; *Merchant Shipbuilding*
3. Taylor, D.A.; *Merchant Ship Construction*, Butterworths, London

Reference

1. *The Maritime Engineering Reference Book – A Guide to Ship Design, Construction and Operation*, Tony Molland, Butterworth-Heinemann, II008, ISBN: 978-0-7V06-8987-8
2. *Ship Knowledge - a modern encyclopedia*, Klaas van Dokkum, DOKMAR, ISBN 90-806IIIIII0-II-X

CORE – VI -BEHAVIOUR OF MATERIALS

OBJECTIVE:

On successful completion of this course the students should have understood the factors affecting materials under different kinds of load

UNIT I STRESS

Concept of Stress - Tensile and compressive stresses - Shear stress - Elastic limit - hooks law - Elastic constants and their relationship - Poisson's ratio - Generalized Hook's Law - Elongation of Simple and composite bars under external load - allowable stress - Factor of safety - Thermal stresses of Simple members - strength of simple connections for cotter joints and screwed joints, Resilience - Suddenly applied loads, strain gauges

UNIT II BEAMS

Stresses in beams - neutral axis - theory of simple bending - bending stresses in rectangular - I-sections and circular section beams. Bending stresses in composite section beams - Shear stresses in beams – rectangular - I-sections and circular sections - Stress components on a general plane and oblique plane - Principal stresses and Principal Planes - Maximum shear stresses and their plane

UNIT III SHEAR FORCE AND BENDING MOMENT

Bending moment - Shear force, BMD and SFD for statically determinate beams - cantilever - simply supports - over hanging beams - with or without applied moments, points of contra flexure. Statically indeterminate beams - BMD and SFD for fixed beams, propped cantilever beams and continuous beams - Theorem of three moments.

UNIT IV MOMENTS

Slope and deflection of Cantilever, overhanging and simply supported beams - Double integration method - Moment area method - problems with various types of load with or without applied moments and varying flexural rigidity (EI).
Torsion of solid and hollow circular shafts - Power transmitted by shafts - compound shafts - shafts subjected to both twisting and bending moment - Open coil and closed coil helical springs.

UNIT V COLUMNS AND STRUTS

Columns and struts - long and short columns - Euler's formula for long column - equivalent length - slenderness ratio - Eccentric loaded long and short columns - Rankine Gordon formula., use of Strut Formulae. Thin cylinders and thin spherical shells - under internal pressure - change in volume due to internal pressure. Thick cylinders - simple treatment of thick cylindrical walled pressure vessels

TEXT BOOKS:

1. S.Timoshenko, "Strength of Materials", 3rd Edit, CBS Publishers & Distributers, Delhi,1986.
Rajput. R.K. "Strength of Materials", 2nd Editio n, S. Chand & Co., New Delhi

CORE VII -BASIC SHIP THEORY

OBJECTIVE:

On successful completion of this course the students should have understood the basic ship building theories, calculation and drawing.

UNIT –I

Lines Plan - fairing process - table of offsets

UNIT –II

Integration rules -Trapezoidal rule; Simpson's rules (1-IV-1, 1-III-III-1 and V,8,-1 rule); 6 ordinate rule; Tchebycheff s rule; Areas, volumes and moments

UNIT –III

Bonjean calculations and curves, sectional area curves.-Hydrostatic calculations and curves

UNIT –IV

Buoyancy and weight of the ship.

UNIT –V

Watertight subdivision of ships - flooding calculation, Floodable length

Reference

1. *The Maritime Engineering Reference Book – A Guide to Ship Design, Construction and Operation*, Tony Molland, Butterworth-Heinemann, II008, ISBN: 978-0-7V06-8987-8
2. *Ship Knowledge - a modern encyclopedia*, Klaas van Dokkum, DOKMAR, ISBN 90-806IIIIII0-II-X
3. *Science in the Real World: Why Do Ships Float?* by Susan Markowitz Meredith, Chelsea Clubhouse II010, ISBN 978-1-60IV1III-IV66-7
4. *Principles of Naval Architecture Series: The Geometry of Ships* by John Letcher Edited by J. Randolph Paulling (II009), The Society of Naval Architects and Marine Engineers ISBN: 0-9III977III-67-1
5. Lewis,E.U.; *a Principles of Naval Architecture*°, (IInd Rev.), SNAME, New Jersey, U.S.A.

ALLIED III - MARINE BIOLOGY

OBJECTIVE:

On successful completion of this course the students should understand the origin and evolution of life and marine life processes.

UNIT – I

Introduction to marine biology – history, classification, theories, expeditions, hypothesis testing; Origin and evolution of life – life processes, abiogenesis, theories of natural selection, organic evolution, primordial soup hypothesis, organic molecules, chemical evolution, iron sulfide and black smoker's theory

UNIT – II

Marine and coastal environment – biological zonation, inter-tidal ecosystem (rocky - zonation pattern - physical and biological factors, sandy shores and protected sand flats - physical and biological factors, faunal composition and adaptations

UNIT III

Sea as a biological environment – physiological changes, regulators and conformers, scope for growth, temperature & metabolic rates, comparison among marine and terrestrial environment

UNIT – IV

Primary productivity – mechanism, light and dark reaction, intermediate products, factor affecting primary productivity, role of pigments, methods of assessment, biological pump and transformation of organic matter, vertical profile of primary productivity and SCM, turbulence and MLD.

UNIT – V

Secondary productivity - heterotrophic processes and pathways, herbivores and grazing, zooplankton sampling and constraints, biomass estimation, ontogenic and vertical migrations, mud bank formation, processes and fisheries

Reference Books:

1. Biological oceanography 1999 – Lalli, C.M.
2. Oceanography: The past, 1980 – Sears, M and Merimann D. (Eds).
3. Elements of ecology (3rd edn) 1982 – Tail, R.V.
4. An introduction to marine sciences, 1988 – Meadows, P.S. & Campbell, J.J.
5. Textbook of marine ecology, 1989 – Nair, N.B. &Thampy, D.M.

SKILL BASED SUBJECT – I

MEASUREMENT & INSTRUMENTATION LAB

MEASUREMENTS LABORATORY

Use of precision measuring instruments like micrometer, Vernier, height and depth gauges, surface plate, etc.

Checking dimensions of a part using slip gauge

Use of sine bar for measuring angles and tapers

Measurement of tooth thickness by gear tooth Vernier

Calibration of dial gauge

Taper and bore measurement - using spheres. Testing

Squareness of a try square using slip gauges

INSTRUMENTATION LABORATORY

Pressure measuring devices
Pressure and vacuum gauge calibration

Temperature measuring devices like Platinum resistance thermometer

Thermocouple, radiation pyrometer, etc

Flow measuring devices like orifice meter, roto meter, etc.

CORE PRACTICAL – III

BEHAVIOUR OF MATERIALS LAB

1. Tensions Test on M.S. Rod.
2. Compression Test - Bricks, concrete cubes.
3. Deflection Test - Bench type verification of Maxwell theorem.
4. Tension test on thin wire.
5. Hardness test on various machines.
6. Tests on wood - Tension, compression, bending, impact in work testing machine.
7. Tests on springs - Tension, compression.

APPLIED MECHANICS LAB

1. Impact test.
2. Double shear Test in U.T.M.
3. Load measurement using load indicator, load coils.
4. Fatigue test.
5. Strain measurement using Rosette strain gauge.

SEMESTER IV

CORE VIII - FLUID MECHANICS

OBJECTIVE:

On successful completion of this course the students should have understood the basic properties of fluids viz. density, specific gravity and the laws that govern them.

UNIT I

Introduction and basic concepts-properties of fluids-density, specific gravity, viscosity-Newtonian and non-Newtonian fluids - Fluid statics: pressure-variation of pressure-absolute and gauge pressure- Pascal's law, manometers- hydrostatic force -buoyancy and floatation- stability of submerged and floating bodies-metacentric height.

UNIT II

Euler's momentum equation-Bernoulli's equation and its limitations-momentum and energy correction factors-applications of Bernoulli's equation- orifice meter, pitot tube, orifices

UNIT III

Flow through pipes-laminar and turbulent flow in pipes-critical Reynold's number- Darcy Weisbach equation-hydraulic radius-power transmission through pipes-losses in pipes-pipes in series pipes in parallel-hydraulic gradient line - Open channel flow-Chezy's equation

UNIT IV

Fluid kinematics-Eulerian and Lagrangian approaches-classification of fluid flow-velocity and acceleration in fluid flow-continuity equation---Ideal fluids-rotational and irrotational flow-circulation and vorticity-potential function and stream function, basic flow fields- circulation-Magnus effect-Joukowski theorem.

UNIT V

Boundary layer-flow theory- boundary layer thickness-displacement, momentum and energy thickness-boundary layer separation-methods of controlling-wake-drag force on a rectangular plate-pressure drag-friction drag-total drag-streamlined body-bluff body lift and drag force on an aerofoil-characteristics-work done - Hagen-Poiseuille equation

Text Books

1. Yunus A. Cengel and John M. Cimbala, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
2. R.K.Rajput, *Fluid Mechanics*, S Chand and Company, New Delhi
3. Rajesh Kumar and Arun Mohan, *Fluid Mechanics*, Jyothis Publishers
4. Mody& Seth, *Fluid Mechanics& Hydraulic Machines*, Laxmi Publications, New Delhi

Reference Books

1. Douglas, *Fluid Mechanics*, Pearson Education, New Delhi
2. Shames I.H, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
3. D. S .Kumar , *Fluid Mechanics*, S. K. Kataria& Sons, New Delhi
4. Jagdishlal , *Fluid Mechanics & Hydraulics*, Metropolitan Book Co., New Delhi

CORE IX - ELECTRICAL TECHNOLOGY & INSTRUMENTATION

OBJECTIVE:

On successful completion of this course the students should have understood electrical concepts of Generators, alternators, motors and application of instrumentation in naval architecture

UNIT –I

D.C. Generator - O.C.C. – Condition for self excitation – field critical resistance – critical speed - Load characteristics of generators- Losses- power flow diagram- efficiency- condition for maximum efficiency- Application.

UNIT –II

D.C. Motors: Back emf – speed and torque equation- starting and speed control – testing of D.C. Motors – brake test – Swinburn’s test- Transformer – Emf equation – regulation- efficiency - Basic principle of III phase transformer - Applications

UNIT –III

Alternators - Type – emf equation (winding factor need not be derived) – synchronous impedance – regulation by emf and mmf method. Synchronous Motors - Three phase induction motor – torque equation – torque slip characteristics - single Phase motor

UNIT –IV

Introduction to Instrumentation- Classification of instruments, Standards and calibration, Errors,causes and corrective measures, Theoretical analysis of dynamic errors, First order system, Statistical analysis of data and errors

UNIT –V

Applications of Instrumentation to Naval architects: Measurements of Velocity, Acceleration and Torque measurements, classification and selection of transducers, Strain gauges - Pressure measurement,High pressure measurement, Vacuum gauges, Measurement of humidity and flow Hygrometer, dew point methods, anometers, Measurement of Liquid level using Gamma rays, float, ultrasonic methods etc

Text Books

1. Dr. P S Bimbira, *Electrical Machinery*, Khanna Publishers
2. J B Gupta, *Electrical Machines*, S K Kataria and Sons
3. Dr. P S Bimbira, *Power Electronics*, Khanna Publishers

Reference Books

1. Alexander Langsdorf A S: *Theory of AC Machinery*, Mc-Graw Hill
2. Say M G: *Performance and design of AC Machines*, ELBS

CORE X - STABILITY OF SHIPS

OBJECTIVE:

On successful completion of this course the students should understand the concepts behind the stability of ship and the mandatory government regulations.

UNIT –I

Potential energy and equilibrium - Stability of ships - C.O.B - C.O.B curve in lateral plane, metacenter, metacentric radius, metacentric height, metacentric curve, surface of flotation, curve of flotation, righting moment and lever - Moments due to wind, shift of cargo, passengers, accumulation of ice; Effect of superstructure on stability

UNIT –II

Transverse stability: - Form and weight stability – stability functions -Initial stability – GMO, GZ at small angles of inclinations, wall sided ships; Stability due to addition, removal and transference (horizontal, lateral and vertical) of weight, suspended weight and free surface of liquids; Stability while docking and grounding; Inclining experiment - Large angle stability -Diagram of statical stability (GZ-curve), characteristic of GZ-curve, static equilibrium criteria; Methods for calculating the GZ-curve (Krylov, Prohaska, etc.); Cross curves of stability; Dynamical stability – diagram of dynamical stability, dynamical stability criteria

UNIT –III

Longitudinal stability – trim, longitudinal metacenter, longitudinal centre of flotation, moment to change trim, trimming moment; trim calculations – addition, removal and transference of weight, change of density of water

UNIT –IV

Damage stability – deterministic and probabilistic approach.Stability in waves.

UNIT –V

Recommendations of classification societies and governmental authorities – Intact and damage stability rules.Practicals:– Cross curves of stability and Diagram of statical stability (Kryloff's method); Floodable length calculations

Reference

1. *Basic Ship Theory Vol I and II, Rawson and Tupper, Butterworth-Heinemann, II001, ISBN 0 7V06 VIII96 V*
2. *Contemporary Ideas on Ship Stability, edited by D. Vassalos et al II000, Elsevier Science Ltd, ISBN 0-08-0IVIII6VII-8*
3. *Ship Stability for Masters and Mates VE, DR Derret, Butterworth-Heinemann II001, ISBN 0 7V06 IV101 0*
4. *Ship Stability Notes And Examples, Kemp and Young II001, Butterworth-Heinemann, ISBN 0 7V06 IV8V0 III*

ALLIED IV – MARINE GEOLOGY

OBJECTIVE:

On successful completion of this course the students should have understood the geology of marine sea bed, sediments, basics of elucidation of earth structure, fossils etc.

UNIT – I

Sediment, sediment grade scale and analysis – Classification, composition, distribution and source of sediments with emphasis on nearshore areas – Surveying, sampling and laboratory techniques for the study of coastal and estuarine sediments – Analysis of sedimentological data and interpretation – Instruments used in marine geology. Beach and beach profile, variations in beach morphology and its significance – Nearshore geological processes: erosion, transportation and deposition.

UNIT – II

Sea bed minerals with emphasis on Indian ocean – Polymetallic nodules, phosphorites, carbonates, placer deposits and petroleum resources, gas hydrates – Fossilization process – Types of microfossils and classification, technique for paleoclimate reconstruction with respect to oxygen isotope studies, role of microfossils in paleo – oceanography, paleoclimate, marine archaeology petroleum exploration and monitoring marine pollution

UNIT – III

Structural Geology - Folds - parts of fold, nomenclature, types, causes; Faults - nomenclature, types; Joints. Minerals and their physical properties, Rocks - classification and properties. Ground water and saline water intrusion on the coastal plain and ground water.

UNIT – IV

Principles of geophysical methods: Gravity, magnetic and seismic – Elucidation of the structure of the earth using seismic model – Instruments used in marine geophysics. Hydrography – position fixing, depth measurement and sea bed mapping technique, side scan sonar, hydrographic chart.

Reference Books:

1. Introductory oceanography (5th ed), 1988 Thurman, H.V., Mercill Publ. Co, Ohio.
2. Oceanography (5th ed), 1990 – Grant Gross, M., Prentice Hall.
3. Coastal and estuarine sediment dynamics, 1986 – Dyer, K.R., John Wiley & Sons.
4. Beach processes and sedimentation, 1976 – Komar, P.D., Prentice Hall
5. Beaches and Coasts (2nd ed), 1972 – King, C.A.M., Edward Arnold

SKILL BASED SUBJECT II –COMPUTER PRACTICE LAB

1. MULTIUSER OPERATING SYSTEM & FUNDAMENTALS OF COMPUTERS AND OPERATING SYSTEMS

Unix: Introduction - basic commands - vi editor - filters - input/output redirection - piping - transfer of data between devices - shell scripts.

Evolution of Computers - Organization of Modern Digital Computers - Single user Operating System - Multitasking OS – GUI

2. FUNDAMENTALS OF NETWORKING & OFFICE AUTOMATION

Working on a network environment - accessing different machines from one node concept of E- mail – uses of internet

- a) Word Processing
- b) Data Base Management System
- c) Spread Sheet Package
- d) Presentation Software

3. HIGH LEVER LANGUAGE PROGRAMMING

C language: Introduction - operator - expressions - variables - input / output statements - control statements - functions arrays - points - structures - unions - file handling - case studies.

TEXT BOOKS

1. Stephen J. Kochen and Patrick h. Wood. ‘ Exploring the Unix System’, Techmedia, 1999.
2. Maurice J. Bach, ‘The design on Unix Operating Systems,’ Prentice Hall of India 1999.
3. Ramos,’Computer Networking Concepts’, Prentice Hall International, 1999.
4. Balagurusamy,’Programming in ANSI C’, Tata McGraw Hill, 1999.

CORE PRACTICAL IV
ELECTRICAL ENGINEERING LAB

1. Study of III-point and IV-point starters for D.C machines
2. OCC of self excited D.C machines – critical resistances of various speeds. Voltage built-up with a given field circuit resistance. Critical speed for a given field circuit resistance
3. OCC of separately excited D.C machines
4. Load test on shunt generator – deduce external, internal and armature characteristics.
5. Load test on compound generator
6. Swinburne's test on D.C machines
7. Brake test on D.C shunt motors and determination of characteristics.
8. Brake test on D.C series motors and determination of characteristics.
9. Brake test on D.C compound motors and determination of characteristics.
10. O.C and S.C tests on single phase transformers – calculation of performance using equivalent circuit – efficiency, regulation at unity, lagging and leading power factors.
11. Load test on single phase transformers.
12. Alternator regulation by emf and mmf methods
13. Study of starters for three phase induction motors
14. Load tests on three phase squirrel cage induction motors
15. Load tests on three phase slip ring induction motors
16. Load tests on single phase induction motors

References

1. Dr. P S Bimbra, *Electrical Machinery*, Khanna Publishers
2. R K Rajput, *A text book of Electrical Machines*, Laxmi publishers
3. A.P. Malvino, *Electronic Principles*– TMHF

SEMESTER V

CORE XI – NAVAL ARCHITECTURE

OBJECTIVE:

On successful completion of this course the students should have understood the basic principles of floating, pressure exerted by the liquid and stability of the ship

UNIT I HYDROSTATICS

Pressure exerted by a liquid, load on an immersed place, load, diagram, shearing force on bulkhead stiffeners, Archimedes' principle, displacement, T.P.C. immersion, coefficients of form, wetted surface area, similar figures, shearing force and bending moment - problems.

UNIT II GEOMETRY AND SHIP FORM CALCULATIONS

Ship lines, first and second moment of area, Simpson's first and second rules, application to area and volume, use of intermediate ordinates, trapezoidal rule, mean and mid - ordinate rule, Tchebycheff's rule and their applications, centre of gravity, effect of addition and removal of masses, effect of movement of mass and suspended masses - Problems

UNIT III TRANSVERSE STABILITY AND HEEL

Statical stability at small angles of heel, calculation of BM and Metacentric height, inclining experiment, free surface effect, stability at large angles of heel, curves of static stability, dynamic stability, angle of loss, stability of wall sided ship - Problems.

UNIT IV LONGITUDINAL STABILITY AND TRIM

Longitudinal BM, MCTI cm, change of trim, change of LCB with change of trim, alteration of trim due to adding or deducting weights, change in mean draught and end draughts due to density and due to bilging, flooding calculations, floodable lengths, factors, of sub division, loss of stability due to grounding - Problems.

UNIT V LAUNCHING AND DOCKING

Launching curves, construction of launching curves, ground ways, the dynamics of launching, strength and stability, sideways launching - Docking - Docking stability, pressure on chocks, load distribution, block behavior, strength of floating docks, stability during docking, ship lifts – Problems

Text Books:

1. Eric. Tupper, "Introduction to Naval Architecture." 3rd Edition, Butter worth - Heinemann, London, 2001.
2. G.N. Hatch, "Creative Naval Architecture", 1st Edition, Thomas Reed Publications, London, 1971.

CORE XII - STRUCTURAL DESIGN OF SHIPS - I

OBJECTIVE:

On successful completion of this course the students should have understood the shipping material, structures of bottom, decks, bulk heads etc., and design criteria

UNIT –I

Introduction Shipbuilding materials transition from wood to steel - shipbuilding quality steels - Joining techniques riveting, welding - Ship structural design concepts - structural analysis models, design criteria - steps in structural design procedure

UNIT –II

General structural arrangements of different types of ships - Ship structural systems Ship as stiffened plate structure framing systems, common stiffener sections, corrugated construction - Structural subsystems break up into bottom structure, side structure, deck structure, bulkhead structure, end structure, superstructure etc., - subassembly, stiffened panels and volume sections.

UNIT –III

Bottom structure and Side structure Bottom structure framing system, functions, single bottom and double bottom construction, structural components and scantlings, openings, cut outs, connection details, bilge keel; Side structure framing system, functions, structural components and scantlings.

UNIT –IV

Decks and Bulkheads Deck structure functions, framing system, structural components and scantlings, hatch ways, pillars, bulwarks, guard rails, fenders; Bulkhead structure type of bulkheads, functions, framing system, structural components and scantlings End structures Fore end structure functions, structural arrangements (panting), structural components & scantlings; Aft end structure functions, structural arrangements, structural components & scantlings; Structural connections compatibility, bottom & side, side & deck, bulkhead with deck, side & bottom.

Text Books

- I. *Basic Ship Theory Vol II, Rawson and Tupper, ButterworthHeinemann,II001, ISBN 0 7V06 VIII96 V*
- II. *Principles of Naval Architecture Series: Strength of Ships and Ocean Structures by Alaa Mansour and Don Liu, Edited by J. Randolph Paulling (II008), The Society of Naval Architects and Marine Engineers ISBN 09III977III66x*
- III. *Principles of Naval Architecture Series: Vibration by William S. Vorus Edited by J. Randolph Paulling (II010), The Society of Naval Architects and Marine Engineers, The Society of Naval Architects and Marine Engineers, ISBN: ISBN 97809III977III7V6*
- IV. *Practical Ship Design, DGM Watson, Elsevier Ocean Engineering Book Series II00II, ISBN: 0080IVII9998*
- V. *Marine Structural Design, II00III, Y Bai, Elsevier, ISBN: 0080IVIII9II176. Design of Ship Hull Structures A Practical Guide for Engineers, Yasuhisa Okumoto et al, Springer, ISBN: 978IIIVIV088IVIVIV6*

CORE XIII - SHIP DYNAMICS

OBJECTIVE:

On successful completion of this course the students should have understood the guiding factors of ship manouresw and the dynamics of design.

UNIT –I

Ocean Waves and Ships – Wind generated waves, regular wave theory, Types of Waves, Group Waves, Irregular Seaway, Concept and different types of spectra - Equations of Motion - Hydrodynamic Forces, Radiation Forces, ship wave encounter, Strip Theory

UNIT –II

Dynamic effects – Linear Superposition, Response Amplitudes - Pitch and Roll in Irregular Waves - Local and Relative Motions - shipping of green Water - Powering in waves, Wave Load - Ship Motion Control – Control of Roll – Passive Stabilisers - Active Stabilizers - Rudder Stabilisation, Control of Pitch

UNIT –III

Manoeuvring Fundamentals – the control loop, path keeping, equations of motion, linearized equations and control fixed stability indexes, model tests. Stability and control in the horizontal and vertical planes – definitive manoeuvres, turning trials. Control surface hydrodynamics – geometry of control surface (rudder), flow around rudder, aspect ratio, influence of hull shape on aspect ratio, influence of fixed structures.

UNIT –IV

Control surface design specification of requirements and constraints on rudder design, rudder location and orientation, number of rudders, type of rudders, geometric properties of rudder, maximum rudder deflection angle and deflection rate, rudder stock location - Experimental determination of hydrodynamic derivatives - IMO Rules and Recommendations -Trials

UNIT –V

Ship Dynamics and Design Aspects – Seakeeping performance criteria and ship seaway responses, factors affecting pitching, heaving and rolling, guidelines for design, Seakeeping features of high performance ships - Influence of ship features on controls fixed fin, propeller, hull, configuration - Controllability in the Ship Design Spiral, Effect of Hull Configuration on ControlsFixed Stability - Effect of Hull Configuration on Nonlinear and Linear Manoeuvres

Text Book

I. Lewis, E.U; 'Principles of Naval Architecture' (IInd Rev.) Vol. III, 1989, SNAME New York

II. Bhattacharyya..R; 'Dynamics of Marine vehicles', 1978, Wiley Inter Science, New York

Reference

I. Basic Ship Theory Vol II, Rawson and Tupper, ButterworthHeinemann,II001, ISBN 07V06 VIII96 V

II. Practical Ship Design, DGM Watson, Elsevier Ocean Engineering Book Series II00II,ISBN: 0080IVII9998

CORE XIV - STRUCTURAL DESIGN OF SHIPS—II

OBJECTIVE:

On completion of this course the students should have understood the design of engine rooms, cargo handling systems, life boatsetc.,

UNIT –I

Engine Room functions, general arrangement, engine casing, foundations, structural design of Engine rooms

UNIT –II

Superstructure and Deckhouses functions, structural arrangement, effectiveness of superstructure& deckhouse, structural design, opening and expansion joints

UNIT –III

Cargo handling equipment different cargo handling system, mast derrick system, loads on mastderrick system, design of mast derrick system, deck cranes.

UNIT –IV

Hatch Covers functions, load on hatch covers, statutory requirements, types of hatch covers, cleating & sealing arrangements, structural design of pontoon covers.

UNIT –V

Miscellaneous topics construction of life boats, submarine structure, chain locker, hawse pipe, rudder types & their construction, nozzles, stern tube & shaft bossing

Text Books

I. Basic Ship Theory Vol II, Rawson and Tupper, ButterworthHeinemann, 2001, ISBN 0 7V06 VIII96 V

II. Principles of Naval Architecture Series: Strength of Ships and Ocean Structures by Alaa Mansour and Don Liu, Edited by J. Randolph Paulling (II008), The Society of Naval Architects and Marine Engineers ISBN 09III977III66x

III. Principles of Naval Architecture Series: Vibration by William S. Vorus Edited by J. Randolph Paulling (II010), The Society of Naval Architects and Marine Engineers, The Society of Naval Architects and Marine Engineers, ISBN: ISBN 97809III977III7V6

IV. Practical Ship Design, DGM Watson, Elsevier Ocean Engineering Book Series II00II, ISBN: 0080IVII9998

CORE XV - APPLIED THERMODYNAMICS

OBJECTIVE:

On successful completion of this course the students should have understood the thermodynamic application to heat , gases and thermodynamic laws.

UNIT I

Thermodynamics Introduction:Basic definitions (System, Control volume, work, heat property, process etc.); Zeroth law of thermodynamics; Ideal gas equation of state - First law of thermodynamics - Second law of Thermodynamics - definition of entropy, change of entropy of an ideal gas - Pure substance Equilibrium diagram Ts,pV,pT,hs

UNIT II

Gas power cycles and I.C.Engines, Gas power cycles: Carnot cycle, Brayton cycle, Ericsson cycle, Sterling cycle etc.; Air standard cycles Otto Diesel, Dual and Joule cycle; Evaluation of thermal efficiency and mean effective pressure, Internal Combustion engine Classification of I.C. engines Principle of operation of spark Ignition and Compression Ignition engines both two stroke and four stroke

UNIT III

Steady state Heat Transfer, Modes of heat transfer and their mechanisms. Conduction Fourier's law of heat conduction Heat conduction through composite walls and cylinders Steady state heat convection Free and forced convection Definition of Nusselt, Reynolds, Prandtl and Grashoff's number and their significance. Radiative heat transfer Emissive Power Stephan Boltzman law Definition of black body, grey body

UNIT IV

Refrigeration Definition and purpose, Principle of operation of Simple vapour compression system - Vapour Absorption refrigeration system - Principle of operation of vapour absorption system like Aqua ammonia system, Electrolux system, Lithium Bromide Vapour absorption refrigeration system etc. Refrigerants, properties and requirements of common refrigerants Factors influencing selection of refrigerants

UNIT V

Air conditioning principles, Definition and purpose. Psychrometry psychrometric properties of air Psychrometric chart Adiabatic saturation. Psychrometric process. Summer and winter air conditioning

Text Books

1. P K Nag, *Engineering Thermodynamics*, Tata Mc Graw Hill Publishing Company Ltd. New Delhi II008.
- II. Ballaney, P.L.; *Thermal Engineering, Vol. I*, Khanna Publishers, New Delhi.
- III. James P. Todd & Herbert B. Ellis; *Applied Heat Transfer*, Herper & Row Publishers, New York.
- IV. Holman, J.P.; *Thermodynamics*, McGraw Hill International Student Edition

SKILL BASED SUBJECT III

CAD / CAM LAB

Solid Modeling

Creation of IIID models Wireframe, Surface and Solid modelling techniques using CAD packages Parametric

Modelling Drafting Generation of orthographic IID views from models Sectioning, Detailing – Exposure to Industrial components Application of Geometrical Dimensioning & Tolerance.

Assembly Design

Assembling of various machine parts and tolerance analysis, generation of IID drawings and bill of materials from assembly Mechanism Design synthesis and design of mechanisms animations exercises on various mechanisms like four bar chain, slider crank mechanism and its inversions System Design Schematic and non-schematic driven routing of pipes and tubes

Computer aided manufacturing

Part programming fundamentals manual part programming and computer aided part programming hands on training in computer controlled turning and milling operations tool path generation and simulation exercises on CNC lathe and machining centre/milling machines Generation of STL files and rapid prototyping of CAD models

Exercises

- 1) Modeling of machine parts, brackets using IID drawings
- 2) Modeling of surfaces using given master geometry
- 3) Parametric modeling of standard parts such as nuts, bolts, rivets, washers etc
- 4) Assembling of machine parts
- 5) Generation of manufacturing drawings from IIID models/assembly
- 6) Synthesis of four bar mechanism and its simulation using software packages
- 7) Synthesis of slider crank mechanism and its simulation using software packages
- 8) Schematic and non schematic routing of pipes/tubes
- 9) Manual/Computer aided part programming for turning and milling operations
- 10) Rapid prototyping of simple CAD models

Reference Books

1. CAD and Solid Modeling Software Packages CATIA VV, UNIGRAPHICS and PROE Manuals of Latest Version
- II. Ibrahim Zeid, R Sivasubrahmanian CAD/CAM: Theory & Practice *Tata McGraw Hill Education Private Limited, Delhi,*

CORE PRACTICAL V

ADVANCED MACHINE TOOLS LAB

List of Experiments

1. Study of precision tools used in machine tool laboratory: – Vernier caliper, micrometers, surface plates, surface gauges, gauge block, straight edges, dial gauge, plug and ring gauges, slip gauges, sine bar, care of tools and gauges.
2. Experiment on drilling machine: - drilling, boring, reaming and counter sinking – tapping – study of reamers and tapping.
3. Study and demonstration of N.C. machines:- CNC machines components - Point to point, straight cut and contouring positioning - incremental and absolute systems – open loop and closed loop systems – DDA integrator and interpolators - part programming fundamentals - manual programming – tape format – sequence number, preparatory functions, dimension words, speed word, feed word, tool world, miscellaneous functions – Computer aided part programming:- APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming, simulation and demonstration exercises involving plane taper and form turning etc.
4. Key way slotting, side & face milling of a rod to make square head - **1 practice.**
5. Vmm material removal by Shaping - **1 practice.**
6. CBR 16 mm, 10 mm deep - **1 practice.**
7. Surface grinding, cylindrical grinding and tool grinding - **1 practice.**

Besides to the skill development in performing the work, prepare the control charts and oral examination should also be carried out. Observation and record books are to be maintained.

The student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and University examination shall be carried out by the faculty members (lecturer and above).

TEXT BOOKS:

Acharkan. N., Machine Tool Design Vol. 1 to IV, MIR Publication.

REFERENCE BOOKS:

Chapman, Workshop Technology, Vol II, ELBS.

HMT, Production Technology, Tata McGraw Hill. YoramKoren, Numerical Control of Machine Tools, McGraw-Hill

MINOR PROJECT

All the students will undergo a 2-3 months summer placement training in any one of the organization related to the core subject. They shall choose an area of their choice in the training organization either suggested by the host guide or by the student himself or prepare a project/dissertation under the guidance of the host guide. The project will also be monitored by the faculty guide and suggest the improvements wherever required. The completed project will be submitted for assessment and for viva- voce duly certified

SEMESTER - VI

CORE XVI - ELECTRICAL SYSTEMS ON SHIPS & SHIPYARDS

OBJECTIVE:

On successful completion of this course the students should have understood the electrical system pertaining to shipping structure and shipyards.

UNIT I

Components of electrical system on board ships, Standard voltages, difference between marine and industrial circumstances - Electrical power generation on board ships Diesel generating sets - specification of generators - Capacity calculation of main power plant - emergency plant layout of IC engine driven & battery driven E.P.P. Switch gear for electrical system Fuses Switches relays contactors circuit breakers

UNIT II

Distribution systems: Ring and radial system - AC single phase & 3phase system DC systems Components of distribution system - MSB, SSB and DB single line layout - Rules governing the distribution system - Specification of transformers Specification of motors speed based and torque based motors DOL starter - Special regulation for installation of electrical system in steering system rectifiers - Installation rules

UNIT III

Electric propulsion advantages single line layout Control of propulsion motors. Light fittings different sources of light Types of light fittings lighting arrangements in engine room, accommodation place, weather deck etc. Navigation lights Installation rules for light fittings. Navigational equipments: Auto pilot, magnetic compass, Log, Echo sounder and radar rules satellite navigation RDF, Gyro Compass, LORAN Aerials fitted on board ships.

UNIT IV

Communication equipments: Modulation amplitude modulation, Frequency modulation, modulation index super heterodyne receiver Internal and external communication equipment. Installation rules Domestic equipment Engine room automation fire detection

UNIT V

Electrical system in shipyards: power factor improvement power tariff calculation essential regulations –main loads.

Text Books

I) Harrington L.Roy; *Marine Engineering, SNAME Publications*

II) Watson, G.O.; *Marine Electrical Practice*

III) Starr, A.T.; *Generation, Transmission and Utilisation of Electrical Power*

IV) Sonnenberg, G.J. & Newnen Butterworth; *Radar Electronic Navigation*

II) *Maritime Electrical Installations and Diesel Electric Propulsion, Alf Kåre Ådnanes, II00III, ABBMarine*

CORE XVII - MARINE ENGINEERING

OBJECTIVE:

On successful completion of this course the students should have understood the principles of propulsion and the various systems of propulsion including nuclear option.

UNIT –I

Main Propulsion Machinery 1 : Marine diesel engines general engine principles, Low speed and medium speed diesel engines, Fuels, fuel oil system, Scavenging and turbocharging. Starting and reversing systems, controls and safety devices, Lubrication, Lubricants and lub oil systems, cooling systems torque and power measurement. Marine boilers types

UNIT –II

Main Propulsion Machinery II: Marine Steam turbines Types of turbines, compounding reheat turbines, turbine construction, rotors, blades, casing, gland sealing, diagrams, nozzles, bearings etc. Lubrication systems, expansion arrangements, control, gearing operating procedure. Marine gas turbines fundamentals of G.T, Structure of gas turbines, gearing, operational features, controls, gearing, combined cycles.

UNIT –III

Special types : Nuclear propulsion physical principles of the operation of nuclear reactors use of nuclear propulsion on sea going vessels. Electric Propulsion, Dynamic Positioning, Automation of ship propulsion plants, Maintenance requirements and reliability of propulsion plants, Engine dynamics, torsional vibration of engine and shafting, axial shaft vibration, critical speeds engine rating, rating corrections, trial test etc.

UNIT –IV

Aux. systems Air compressors, boilers, heat exchangers, cooling, evaporators, distillers, waste heat recovery systems, hot water, drinking water, cooling water and seawater systems. Fuel systems, Ballast systems Sewage disposal, RO plant - Introduction to Marine pumps and piping types, materials, colour coding etc. Rudder and steering gear, anti-roll devices

UNIT –V

Considerations in Engine room arrangement, marine engineering considerations in ship design, design and selection considerations of marine machinery. Safety systems fire fighting equipment Instrumentation & control, watch keeping system UMS classes. Air compressors, heat exchangers and engine mounting, study of different types of marine engines available in the world market.

Text Book

I) Harrington; *Marine Engineering*, SNAME Publications

II) Pounder, C.C.; *Marine Diesel Engines*, Newnen Butterworths, London.

III) Khetagurov, M.; *Marine Auxiliary Machinery and Systems*, Peace Publishers, Moscow.

Reference

I) Taylor, D.A.; *Introduction to Marine Engineering*

CORE XVIII- DESIGN OF MACHINE ELEMENTS

OBJECTIVE:

On successful completion of this system the students should have understood the design of fundamentals machine parts i.e. joints, drive bearings etc.

UNIT –I

Fundamentals of machine design: definitions, design process, design principles, design criteria - Stresses in machine parts working stress, safe stress, factor of safety, endurance limits, fatigue - Factors Elastic springs classification and uses of springs allowable stresses and deflections design - For fluctuating loads

UNIT –II

Joints: Principles of force transmission; detachable joints - Non-detachable joints; welded, soldered and glued joints, riveted joints; strength of welded and riveted joints

UNIT –III

Drive elements: Shaft torsion and bending of shafts, design of shafts for strength and deflection, effect of key ways, crank shafts. Shaft couplings: Rigid coupling (flange and compression couplings) couplings with kinematics flexibility slip couplings fluid couplings.

UNIT –IV

Bearings: Slide bearings introduction to lubrication, hydrodynamic bearings, bearing materials, design of slide bearings. Roller bearing types, static & dynamic load, capacity, bearing life and selection of Bearings.

UNIT –V

Gears: Types (spur and parallel helical gears) and function of gears, strength of gear teeth, stresses and stress concentration in gears design of gears.

Text Book

- I) R.K.Jain, *Machine Design*, Khanna Publications, New Delhi.
- II) C.S, Sarma, Kamlesh Purohit, *Design of Machine Elements*, Prentice Hall of India Ltd , New Delhi
- III) M. F. Spotts, T. E. Shoup, *Design of Machine Elements*, Pearson Education.
- IV) V.B. Bhandari, *Design of Machine Elements*, McGraw Hill Book Company

CORE XIX - SHIP PRODUCTION TECHNOLOGY

OBJECTIVE:

On successful completion of this course the students should have understood the production system that is deployed in ship production and the use of statistical system like PERT/CPM to enhance productivity

UNIT –I

Production system - The systems approach -subsystems, comprehensive system model - the firm as a system

UNIT –II

Production design – application of the principles of design for production in shipbuilding – joining of parts, relations between structural design and prefabrication, simplifications in structural design (design for welding), and quality control.

UNIT –III

Process planning in shipbuilding: Planning for operations – interconnection between production design and process planning, production and process analysis, assembly charts, operation process charts, flow process charts; Process selection. Application of models for process planning, scheduling and control – Gantt charts, CPM & PERT, transportation models etc.; Special aspects of application of these in shipbuilding process, Decision of productive systems product line determination, product planning.

UNIT –IV

Operation planning and control production planning scheduling network models (PERT, CPM) quality control maintenance analysis Production Standards – production standards in several parts of the ship production process, work measurement systems, methods of man-hours determination, use of computers, correlation between size of series and needed man hours

UNIT –V

Quality Assurance and quality control activities in shipyards ; Problems of accuracy – tolerances, standards, measuring techniques (theodolite laser, etc

Text Book

- I. *Ship Production, IInd edition, 199V, Richard Lee, The Society of Naval Architects and Marine Engineers, ISBN 09III977IIIV70*
- II. *Shipbuilding Technology, V. K Dormidontov, MIR Publishers*
- III. *Elwood S.Buffa; Modern Production/Operations Management, Wiley Eastern Ltd.*
- IV. *Richard J. Hopeman; Production Concepts,Analysis, Control, III`d Edition, Charles E. Merril Publishing Co.*

CORE XX - SHIP REPAIRING & SURVEYS

OBJECTIVE:

On successful completion of this course the students should have understood the causes and repair of ships and marine survey.

UNIT –I

Repair of ship hull – Introduction; cause of wear and damage in ships hull: Comparison between different types of repair activities (Afloat, berthed, etc.); Repair of hull and other parts while afloat; docking plan replacement of hull plates and stiffeners, decks and bulkheads; repair of stem and stern frames and shaft bracket; NDT and X-ray tests; Testing for water tightness and hull continuity etc;

UNIT –II

Underwater welding – welding equipment; quality control and standards; degree of automation; Safety during repair – various operations involving risk; safety devices and plans; problems during docking; Ship repair facilities in a modern repair yard repair docks, machine shop, scaffolding; Subcontracting policies by shipyard in repair project, layout of repair yard.

UNIT –III

Various types of marine surveys. Roles and responsibilities of marine surveying agencies; Historical development of ship classification societies; Major activities of classification societies; rules and class notation; IACS and joint projects; Comparison of ship class rules by LRS and ABS

UNIT –IV

International Ship classification societies and UN agencies involved in marine and offshore activities. Activities of classification societies and surveying agencies bodies; Classification society – Design approval; construction survey; survey on operation, repair conversion. Industrial surveys, third party accreditation

UNIT –V

Statutory surveys – role of MMD. Activities of statutory bodies – MMD, Inspectorate of boats – design approval - construction inclination experiment, keel sighting, registration, surveys during – repair conversion and operation - Activities of other bodies – port authority; IWAI etc. - construction of warship - Cargo Survey dry, liquid and container.

Text Book

I. Witherby (IACS) General Cargo Ships, Guide lines for surveys Assessment and Repair fir Hull Structures

II. Witherby (IACS) Surveyors Guidance

Reference

1. Bulk Carriers, Guide lines for Surveys, Assessment and Repair of Hull structurers,IInd edition.

SKILL BASED SUBJECT IV

MARINE PROPULSIONS, OVERHAULING LAB AND FIREFIGHTING LAB

MARINE PROPULSION OVERHAULING LAB

(a) Main Routines:

1. Cleaning of Lubricating oil filters
2. Cleaning of Lubricating oil coolers.
3. Cleaning of Jacket water coolers.
4. Cleaning of Air coolers.
5. Crank case inspection.
6. Checking bearing clearances.
7. Main Engine over Hauling of cylinder heads and fittings.
8. Main Engine over hauling of fuel Injection pumps.
9. Cleaning of Turbo charger filters
10. Cleaning of fuel oil fillers.
11. Measurement of crank web deflection.

(b) Auxiliary Routines:

1. Over hauling of cylinder head and fittings.
2. Checking tappet clearances.
3. Overhauling of air coolers.
4. Over hauling of fuel injection pump.
5. Crank case inspection and checking of all bearing clearances.
6. Overhauling of crank case relief door.
7. Overhauling of Turbocharger
8. Cleaning of air coolers
9. Measurements of crank web deflection.

(c) FIRE FIGHTING LAB

1. Fire hazard aboard ships - inflammability, fire extinguishing use. Control of class A, B & C fires.
2. Fire protection built in ships, extinction systems and escape means

CORE PRACTICAL VI - MARINE SYSTEMS & MECHANISM LAB

Study on the marine systems such as

- a. Fresh water systems
- b. Sea water system
- c. Air-conditioning and ventilation system
- d. Accommodation system
- e. Fire fighting system

List of experiments

1. Test on reciprocating air compressor
2. Tests on blowers and rotary compressors
3. Free vibration analysis
4. Forced vibration analysis
5. Test on refrigeration equipment
6. Test on air conditioning unit
7. Determination of thermal conductivity of conducting and insulating materials
8. Heat flow through composite walls
9. Universal governor apparatus
10. Gyroscope
11. Friction in hydrodynamic bearings
12. Vortex tube

MAJOR PROJECT

All the students will undergo a 2-3 months summer placement training in any one of the organization related to the core subject. They shall choose an area of their choice in the training organization either suggested by the host guide or by the student himself or prepare a project/dissertation under the guidance of the host guide. The project will also be monitored by the faculty guide and suggest the improvements wherever required. The completed project will be submitted for assessment and for viva- voce duly certified