

BHARATHIARUNIVERSITY: COIMBATORE-641 046

B.Sc. MARINE SCIENCE

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

SCHEME OF EXAMINATION - CBCS PATTERN

PART	Course Title	Hrs/WEEK	EXAMINATION				CREDITS
			DURATION	CIA	UNI. EXAM	TOTAL	
	SEMESTER-I						
I	Language-I	6	3	25	75	100	4
II	English-I	6	3	25	75	100	4
III	Core-I-Physics -1	5	3	20	55	75	3
	Core-II-Marine Chemistry	5	3	20	55	75	3
	Allied-I-Marine Mathematics	6	3	25	75	100	4
	Core Practical – I - Physics Lab	6	3	20	30	50	2
IV	Environmental Studies #	2	3	-	50	50	2
	SEMESTER - II						
I	Language-II	6	3	25	75	100	4
II	English-II	6	3	25	75	100	4
III	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	6	3	20	30	50	2
IV	Value Education-Human Rights #	2	3	-	50	50	2
	SEMESTER - III						
III	Core-V-Behaviour of Materials	5	3	20	55	75	3
	Core-VI-Material Science and Metallurgy	5	3	20	55	75	3
	Core-VII- Basic Thermal Science	5	3	20	55	75	3
	Allied Paper-III- Marine Biology	6	3	25	75	100	4
IV	Skill Based I-Measurement and Instrumentation Lab	5	3	30	45	75	3
	Core Practical III – Behaviour of Materials Lab	6	3	20	30	50	2
IV	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						
III	Core-VIII-Basic Mechanics	5	3	20	55	75	3
III	Core-IX-Applied electrical and Electronics	6	3	20	55	75	3
III	Core-X-Applied Thermal Science	6	3	20	55	75	3
III	Allied-IV-Marine Geology	6	3	25	75	100	4
IV	Skill Based -II-Computer Practice Lab	5	3	30	45	75	3
III	Core Practical I V - Thermal Science Lab	6	3	20	30	50	2
IV	Tamil @ /Advanced Tamil # (or) Non Major Elective – II: General Awareness #	2	3		50	50	2
	SEMESTER - V						
III	Core-XI-Marine Electrical Science I	5	3	20	55	75	3
	Core-XII-Marine Electrical Science II	5	3	20	55	75	3

	Core-XIII-Marine Design and Drawing	5	3	20	55	75	3
	Core-XIV-Naval Architecture	5	3	20	55	75	3
	Core-XV-Marine Electronics	6	3	25	75	100	4
	Core Practical V-Analytical Chemistry of Sea Water	6	3	20	30	50	2
IV	Skill Based - III – Electrical Electronics And Microprocessor Lab	5	3	30	45	75	3
III	Minor Project*	--	--	--	--	100	4
	SEMESTER - VI						
III	Core-XVI-Marine Prime Mover	6	3	25	75	100	4
	Core-XVII-Marine Auxiliary Device	6	3	25	75	100	4
	Core-XVIII-Marine Machinery System Design	6	3	25	75	100	4
	Core-XIX-Ship's Advanced Fire Prevention and Control	6	3	25	75	100	4
	Core-XX-Marine Control and Automation	6	3	25	55	100	4
IV	Skill Based-IV- Marine Propulsions, Overhauling and Fire Fighting Lab	5	3	30	45	75	3
III	Core Practical VI – Marine Pollution Lab	6	3	20	30	50	2
III	Major Project *	--	--	--	--	100	4
V	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 - Forbe'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 Photometer - 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 – elemental & 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 CHEMISTY 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
4. Bachelor of Science (Marine) (CPOP-4 years) 2010-11

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:

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

SEMESTER: III

CORE – V -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.
2. Rajput.R.K. "Strength of Materials", 2nd Editio n, S. Chand & Co., New Delhi.

CORE - VI - MATERIAL SCIENCE AND METALLURGY

OBJECTIVE:

On successful completion of this course the students should have understood the structure of metals, crystal & lattice structures, the spread of atoms, their behavior and alloys.

UNIT I CRYSTAL STRUCTURES AND PHASE DIAGRAMS:

Simple cubic structure, BCC, FCC, HCP, Atomic packing factor, coordination number, Miller - Bravais space lattice system, single crystal, poly crystal, grain, allotropy and polymorphism, Bragg's law, simple problems, defects in crystalline solid - interstitial and impurity defects, edge and screw dislocation, low angle grain boundaries, grain size measurements

UNIT II DEFORMATION AND STRENGTHENING MECHANISM OF MATERIALS:

Deformation by slip, twinning, dislocation move - sources, elastic and elastic behavior, critically resolved shear stress, deformation in BCC, FCC and HCP materials, damping capacity and viscous deformation - Strengthening from grain boundaries, solid solution stringing, fine particles, fiber, point defects, Martensic strengthening, yield point phenomenon - deformation hardening, annealing, preferred orientation and directional properties.

UNIT III MECHANICAL; BEHAVIOUR AND TESTING OF MATERIALS:

Engineering and true stress - strain curves for different materials like mild steel, alloy steel, cast iron and rubber, proof stress, upper and lower yield stress, ductility measurements, different types of testing machines, compression test, various hardness tests and impact tests, codes and standards for different tests - Definition of fatigue, endurance limit and stress ratio S-N curves for ferrous and non-ferrous materials, stress concentration factor, fatigue failure and its prevention - Brittle ductile fracture, Griff's theory of brittle fracture toughness - Definition of creep - curve.

UNIT IV METALS ALLOYS AND MODERN MATERIALS:

Effects of alloying elements on properties of steel, carbon steel, low alloy steels, micro alloyed steel, stainless steels, tool steels and die steels, classification of cast iron, properties and their applications - Alloys of Al, Ti, Cu, Mg, Ni, Zn, and Pb - Properties and applications, bearing materials, brazing and soldering alloys. Shape memory alloy; inter metallic materials, functionally graded materials, composite and ceramic materials, properties and their applications.

UNIT V HEAT TREATMENT

Critical temperature on heating, annealing, spheroidizing, normalizing, hardening, isothermal transformation diagrams. CCT and TTT diagrams, martensic transformation, tempering, austempering and mar tempering, harden ability and its testing, simple problems, surface hardening processes, industrial application of different heat treatment processes.

TEXT BOOKS:

1. Gupta A.B - Material Science and Engineering- I Edition, Academic Scientific, Chennai, 1986.
2. Marc Andre Meyers and Krishnan Kumar Chawla, "Mechanical Behaviour of Materials", 3rd Edition, Prentice Hall, New Delhi, 1999

CORE VII - BASIC THERMAL SCIENCE

OBJECTIVE:

On successful completion of this course the students should have understood the laws of thermodynamics, the important concept of entropy, Carnot cycle and turbines.

UNIT I BASIC CONCEPTS OF THERMODYNAMICS:

Thermodynamics - systems, concepts of continuum, thermodynamic properties, equilibrium, processes, cycle, work, heat, temperature, Zeroth law of thermodynamics, First law of thermodynamics - applications to closed and open systems, internal energy, specific heats, enthalpy, steady and unsteady flow conditions.

UNIT II SECOND LAW OF THERMODYNAMICS AND ENTROPY

Statements, Reversibility, causes of irreversibility, Carnot cycle, reversed Carnot cycle, heat engines, refrigerators and heat pumps - Clausius inequality, entropy, principles of increase in entropy, Carnot theorem, available energy, availability

UNIT III WORKING FLUIDS & GAS POWER CYCLES:

Thermodynamics properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties, first law and second law analysis using and other substances, calculation of properties, first law and second law analysis using tables and charts, Gas power cycles - Carnot, Otto, Diesel, Brayton, Ericsson, Sterling, Lenoir, Atkinson Cycles.

UNIT IV STEAM AND VAPOUR CYCLES

Carnot cycle for Steam and ideal efficiency - Rankin Cycle with dry saturated, super heated steam. Modified Rankin- Reheat and regenerative cycles Binary vapour cycles. Feed pump working - Isentropic efficiency, Cycle efficiency, Work ratio. Reheating & Regenerating effect on thermal efficiency

UNIT V STEAM NOZZLES & TURBINES:

General flow analysis. Velocity at exit. Critical pressure ratio. Maximum mass flow - Convergent and Convergent - divergent nozzles. Isentropic flow - Effect of friction. Nozzle area at throat & exit. Problems of steam flow through nozzles - General principle of Impulse & Reaction turbines - Compounding of steam turbines - Pressure & Velocity compounding Stage efficiency, overall efficiency & re-heat factor. Multi-Stage Turbine with regenerative & reheat cycles. Maximum work output condition.

TEXT BOOKS:

1. P.K. Nag - Basic & Applied Thermodynamics - I Edition, Tata McGraw, New Delhi, 2002.
2. J.P. Holomon - Thermodynamics, 4th edition, McGraw-Hill book company, New York, 1988.

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

1. Use of precision measuring instruments like micrometer, Vernier, height and depth gauges, surface plate, etc.
2. Checking dimensions of a part using slip gauge
3. Use of sine bar for measuring angles and tapers
4. Measurement of tooth thickness by gear tooth Vernier
5. Calibration of dial gauge
6. Taper and bore measurement - using spheres. Testing
7. Squareness of a try square using slip gauges

INSTRUMENTATION LABORATORY

1. Pressure measuring devices
2. Pressure and vacuum gauge calibration
3. Temperature measuring devices like Platinum resistance thermometer
4. Thermocouple, radiation pyrometer, etc
5. Flow measuring devices like orifice meter, roto meter, etc.

COREPRACTICAL – III – BEHAVIOUR OF MATERIALS LAB

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 – BASIC MECHANICS

OBJECTIVE:

On completion of this course the students would be introduced to the basic concepts of mechanics viz. Force, Inertia, Friction, Velocity and the laws explaining them.

UNIT I STATICS OF PARTICLES

Introduction - Units and Dimensions - Laws of Mechanics - Vector - Vectorial representation of forces and moments - Vector operations - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS, FRICTION

Determination of areas and volumes - First moment of area and the centroid - second and product moments of plane area - parallel axis theorems and perpendicular axis theorems - polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia - Frictional force - Laws of Coulomb friction - simple contact friction - Rolling Resistance - Belt friction

UNIT IV DYNAMICS OF PARTICLES

Displacement, velocity and acceleration their relationship - Relative motion - Curvilinear motion - Newton's laws - Work - Energy Equation - Impulse and Momentum - Impact of elastic bodies.

UNIT V ELEMENTS OF RIGID BODY DYNAMICS

Translation and Rotation of Rigid bodies - Velocity and acceleration - General Plane motion moment of momentum equations - Rotation of rigid body - Work energy equation

TEXT BOOKS

1. Beer and Johnson- Vector Mechanics for Engineers -
Vol. 1 Statics and Vol.2 Dynamics- McGraw Hill International
2. Merriam, "Engineering Mechanics" Vol.1 and Vol. 2

CORE IX – APPLIED ELECTRICAL AND ELECTRONICS

OBJECTIVE:

On successful completion of this course the students should have understood current, power, energy, transformers, conductors and digital electronics.

UNIT I A.C AND D.C. CIRCUITS & MACHINES

Definition of current - potential - resistance, power, and energy - symbol and units (SI) - Ohm's law - Kirchhoff's laws - Alternating emf, average and rms values - form and peak factors, concept of phasor representation - AC circuits involving R,L, and C parameters - simple problems. Construction of DC Machines - Theory of operation of DC Generators - Characteristics of DC Generators - Operating principle of DC motors - Types of DC motors and their Characteristics - speed controls of DC motors.

UNIT II TRANSFORMERS & INDUCTION MACHINES

Principle of operation of transformers - Types - Equivalent circuit - efficiency - testing - all day efficiency - principle of operation of three phase transformers - transformer connections- Construction of single phase motors - Types of single phase motors - Double revolving field theory - Starting methods - Capacitor start capacitor run motors - shaded pole - Repulsion - construction - Types - Equivalent circuit

UNIT III ALTERNATOR & MEASUREMENTS

Principle of alternator - construction details - Types - Equation of induced EMF - Effect of power factor - Parallel operation - Torque equation - Synchronous condenser. Construction and principle of operation of moving coil and moving iron instruments (only voltmeters and ammeters) - dynamometer type wattmeter - Induction type energy meter.

UNIT IV SEMI CONDUCTORS AND TRANSISTORS

Bipolar junction transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A,B and C power amplifiers - Field Effect Transistor - SCR, Diac, Triac, UJT - characteristics and simple applications - application in temperature and motor speed control

UNIT V SIGNAL GENERATORS AND LINEARIC'S

Feed back Negative & Positive - RC phase shift, Hartley, Colpitt's, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators - DIGITAL ELECTRONICS: Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive or gate - Half and full adders

TEXT BOOKS

1. B.L. Theraja, Electrical Technology- vol. I & II, S.Chand & Co
2. Edward Hughes, Electrical and Electronics Technology, Pearson Education Limited

CORE – X – APPLIED THERMAL SCIENCE

OBJECTIVE:

On successful completion of this course the students should have understood the principles of heat transfer, refrigeration and air conditioning in general and in marine context.

UNIT I RECIPROCATING COMPRESSORS

Single stage Compressor-Ideal cycle for work transfer Mass flow, Volume flow, Free Air Delivery Effect of clearance and Volumetric Efficiency in single stage compressor Multi Stage compression neglecting clearance volume Condition for minimum work input and perfect inter cooling Tandem in line arrangements in compressors Air motors.

UNIT II BASIC REFRIGERATION & AIR CONDITIONING

Reversed Carnot Cycle- Vapour Compression Cycle Refrigerating Effect -Co efficient of Performance Cooling Capacity Refrigerants used in Marine application and their justification Rating of Refrigeration Plant Methods for improving COP Use of vapour tables -Applied Problems

UNIT III MARINE REFRIGERATING PLANTS

Typical Refrigerating plants with multiple compression & evaporation Heat pump cycles Refrigeration in liquefied gas carriers Applied problems

UNIT IV MARINE AIR CONDITIONING

Principles of air Conditioning Psychometric properties of air-Comfort conditions Control of humidity Air flow and A/C capacity Calculation for Ship plants

UNIT V BASIC PRINCIPLE OF HEAT TRANSFER

Conduction: Fourier law of conduction .One dimensional Heat diffusion Equation. Convection: Forced and free convection Radiation: Stefan-Boltzmann's equation. Law of radiation- problems Introduction to heat exchangers- Types of heat exchangers Design of Heat exchangers- LMTD & NTU method Double pipe, Shell and Tube type, Condenser & Evaporator

TEXT BOOKS:

1. Arora C.P “ Refrigeration & Air Conditioning” Sri E aswar Enterprise Chennai
2. Stoecker, Wilbert F.Jorold.W “ Refrigeration and Air Conditioning” Tata McGraw Hill

.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

UNIT II

Instruments used in marine geology. Beach and beach profile, variations in beach morphology and its significance – Nearshore geological processes: erosion, transportation and deposition - Sea bed minerals with emphasis on Indian ocean – Polymetallic nodules, phosphorites, carbonates, placer deposits and petroleum resources, gas hydrates

UNIT III

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 - 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, and hydrographic chart.

Reference Books:

1. Introductory oceanography (5th ed), 1988 Thurman, H. V., Merill 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 LAB – THERMAL SCIENCE LAB

THERMAL SCIENCE LAB

1. Flue gas analysis by Orsat apparatus - Test on Reciprocating compressor. C.O.P of a Refrigeration plant
2. Testing of fuels – calorific value, proximate analysis
3. Testing of fuels – Ultimate analysis, octane number ,cetane number. Testing of lubricants – flash point, fire point, pour point
4. Testing of lubricants – viscosity index, corrosion stability, carbon residue - Testing of lubricants –Mechanical stability, ash content
5. Performance test on IC Engine as per BIS specifications.

BOILER CHEMISTRY LABORATORY

1. To determine hardness content of the sample of oiler water in P.P.M in terms of CaCO_3 -
To determine Chloride Content of the sample of water in P.P.M in terms of CaCO_3
2. To determine Alkalinity due to Phenolphthalein, total Alk. And caustic Alk. Of the sample of water (in P.P.M)
3. To determine Phosphate Content of the sample of water
4. To determine dissolve Oxygen content of the sample of water. To determine sulphate content of given sample of wate.
5. To determine Ph.-value of the given sample of water - Boiler trial
6. Water Testing – Dissolved oxygen, total-dissolved solids, turbidity. Water Analysis (Fresh and sea water) – Chloride, sulphate, hardness
7. Sludge and scale deposit – Silica, volatile and non volatile suspended matter

SEMESTER V

CORE XI – MARINE ELECTRICAL SCIENCE– I

OBJECTIVE:

On successful completion of this course the students should have understood the principles of electrical measurements, transmission system and AC & DC principles.

UNIT I PRINCIPLES OF MEASUREMENT

Basic requirements of measuring instrument - Principles of indicating instruments - control and damping devices - Moving coil and moving iron instruments and their use of voltmeters and ammeters - Dynamometer type wattmeter - thermocouple type ammeter, voltmeters and wattmeter. Extension of instrument range.

UNIT II PRINCIPLES OF D.C. MACHINES AND GENERATORS

Principles of DC Machines - construction - winding and e.m.f equations - Armature reaction - commutation - brush shift - compensating winding - D.C generator - their characteristics - methods of excitation - parallel operation - performance equations.

UNIT III D.C. MOTOR

D.C. Motor - Their characteristics - starting and reversing - speed - torque equations - starters - speed control including electronic method of control - testing of D.C Machines for finding out the loses and efficiency - braking of D.C. Motor, Ward - Leonard control.

UNIT IV TRANSFORMERS

Transformers - Types and applications - operating principle - e.m.f equations - phase diagrams under no load and load conditions - leakage resistance - equivalent circuits - voltage regulation - losses and efficiency - open circuit and short circuit tests - parallel operation - three phase transformers - core and shell type - current and potential transformers - auto - transformers (single phase and three phase) - Effect of harmonics on transformers.

UNIT V TRANSMISSION SYSTEMS

Two wire and three wire D.C. Distribution - A.C Transmission - single and three phase - comparison of D.C and A.C. transmission - use of balancer - 2- wire, 3- wire A.C. Distribution - copper efficiency under different modes of distribution - one end fed and ring main distributor - fuses and its materials - D.C air circuit breaker - A.C. air circuit breakers.

TEXT BOOKS:

1. Hegers Edward, “ Electrical Technology”, 2nd edition, “ ELBS with DP Publications” USA, 1996.
2. I.J Nagrath and D.P. Kothari, “Basic Electrical Engineering” 2nd edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002

CORE XII – MARINE ELECTRICAL SCIENCE – II

OBJECTIVE:

On successful completion of this course the students should have understood the principles of induction, measurement, alternators and induction machines.

UNIT I ELECTRICAL MEASUREMENTS

Induction type energy meters-megger Single phase and three phase wattmeter for power measurement, Measurement of energy, speed, frequency and phase difference Measurement of resistance, inductance and capacitance by bridge method Magnetic method, Location of cable faults Transducers and its application in the measurement of pressure Etc Simple electronic measuring devices CRO,IC tester, signal generator, Timers etc.

UNIT II ALTERNATORS

Alternators, General arrangement, Construction of salient pole and cylindrical rotor types

Types of stator windings, e.m.f equation, Distribution and pitch factor Wave form of e.m.f generated, Rotating magnetic field, Armature reaction Voltage regulation, Load characteristics, open circuit and short circuit tests E.m.f and m.m.f methods, Parallel operation of alternators, KW and KVA Brushless alternator, Static excitation system.

UNIT III SYNCHRONOUS MOTORS

Principles of operation of 3-phase synchronous motor operation of infinite bus bars torque/angle characteristics Hunting, Methods of starting Merits and limits of synchronous motor over others.

UNIT IV INDUCTION MACHINES

Three phase induction motor Principles of operation and theory of action Slip speed, Rotor to stator relationship, Rotor frequency Rotor e.m.f and current, Torque/Slip characteristics Equivalent circuit relationship between rotor IR loss and rotor slip Starting torque and maximum running torque

UNIT V CONTROL OF INDUCTION MACHINES

Reversing, Speed control of induction motor, Starting of induction motor Method of starting, Direct on-line starters, star, delta starter Auto transformer starter, Starting of special high torque induction motors Single phase induction motor, Principles and operational characteristics Starting control, Constructional details, Failure & repairs of elect machines

TEXT BOOKS:

1. Hegers Edward - Electrical Technology - 2nd edition - ELBS with DP Publications USA, 1996.
2. I.J Nagrath and D.P. Kothari, "Basic Electrical Engineering" 2nd edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002

CORE XIII – MARINE DESIGN AND DRAWING

OBJECTIVE:

On successful completion of this course the students should have understood engineering design and drawing of consisting of materials, economics, aesthetic appeal considering working at sea with limitation.

UNIT I

Engineering Design: The design process, concepts, analysis, feasibility, Functional design, production designs. Selection of materials and manufacturing considerations in design. Economics, aesthetic appeal, initial and recurring costs, plans, drawings and manuals. Design with reference to repairs and reconditioning, specifically for working out at sea with its restrictions and limitations.

UNIT II

Types of Loading and Design Criteria: Strength, rigidity and deflection of machine elements stresses due to static loads, impact, loads, repeated loads, variable and cyclic loads, combined and reversible loads.

Stress concentration and design factors, fatigue strength, modes of failure, design stresses, factor of safety, theories of failure, wear, corrosion, design criteria, S-N curve Goodman and Soderberg equations.

UNIT III

Fasteners and Connections: Design of bolts and nuts, cotter and knuckle joints, keys. Design of welded joints, riveted joints, and pipe joints.

UNIT IV

Power Transmission Elements: Shafting with bending, twisting and axial loading based on strength and rigidity, rigid and flexible couplings.

Belt drives & hoists (Wire ropes).

UNIT V

Friction clutches and Brakes: Multiple plate clutches, cone clutch, centrifugal clutch blockbrakes, internally expanding shoe brakes, external band brakes, differential band brakes.

Text Books:

1. J.E.Shigley, "Mechanical Engineering Design", 1st metric edition, McGraw Hill, New Delhi, 1986.
2. VL Maleev, "Internal Combustion Engines", 2nd Edition, McGraw Hill book co., Singapore, 1987

CORE XVI – NAVAL ARCHITECTURE

OBJECTIVE:

On successful completion of this course the students should have understood the basic principles of floating, pressure exerted by the liquid, calculation involved in the stabilizing the ship.

UNIT I HYDROSTATICS

Pressure exerted by a liquid, load on an immersed plate, 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

Static 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 XV – MARINE ELECTRONICS

OBJECTIVE:

On successful completion of this course the students should have understood electronic themes of amplifier, converters, digital circuits, microprocessors

UNIT I

Operation Amplifier Theory: Concept of Differential Amplifiers - its use in DP AMPS, Linear Op amp circuits.

UNIT II

Digital Circuits: Logic Systems and Gates - Binary and BCD codes - Boolean algebra - Simplifications - Flip - flops- Counters- Registers and multiplexes - TTL & CMOS GATES: Digital integrated circuits- Semiconductor memories - ROM -RAM and PROM.

UNIT III

Converters ;(A-D and D-A): Analog to Digital and Digital to Analog Converters and their use in Data- Loggers - Electronic instruments: Cathode Ray Oscilloscope - digital Voltmeters and frequency meters-Multimeters- Vacuum Tube voltmeter and signal Generators - Q- Meters.

UNIT IV

Industrial Electronics: Power rectification - silicon control rectifier power control -Photoelectric devices – invertors - Satellite communication as applicable to GMDSS.

UNIT V

MICROPROCESSORS: 8085 Architecture- Programming - interfacing and control of motors - Temperature/ Speed control.

TEXT BOOKS:

1. Ramakant.A.Geakwad, “Linear integrated circuits”, 3rd edition, Prentice - Hall of India , New Delhi, 2001
2. Mavino Leach, “Digital principles and applications ”, 5th edition, Tata McGraw Hill - Publishing co., New Delhi, 1995

CORE PRACTICAL V – ANALYTICAL CHEMISTRY OF SEA WATER

UNIT – I

1. Estimation of Cu, Co and Pb in seawater by Flame AAS method
2. Estimation of Cu, Co and Pb in sediment samples by Flame AAS method
3. Estimation of Cu, Co and Pb in seaweeds by Flame AAS method
4. Estimation of Hg by using Hydride generator AAS

UNIT – II

1. Speciation of metals in sediments (Sequential extraction procedure)
2. Speciation of Manganese in sediments
3. Specification of Fe in sediments
4. Estimation of Cu and in water by Polarography method
5. Estimation of Pb and in water by Polarography method
6. Speciation of Chromium in waters by Polarography method

Reference Books:

1. A text book of qualitative Inorganic Analysis including Elementary Instrumental analysis by Vogel (1978). Published by the English Language book society.
- 2.. APHA. Standard methods for the examination of water and waste water analysis(1998).20th edition, Washington DC.
3. Methods of seawater analysis by Grosshoff (1983) .VerlagChemie, Weinheim.
4. Manual for geochemical analysis of marine sediments and suspended particulate matter by Loring and Rantala(1992). Earth Science Review.
5. Quantitative analysis by R. A. day and A.L. Underwood. Prentice-Hall of India, New Delhi, 2001.
6. Instrumental methods of Chemical analysis by G. W. Ewing (1976)

SKILL BASED SUBJECT III – ELECTRICAL, ELECTRONICS AND MICROPROCESSOR LAB

ELECTRICAL ENGINEERING LABORATORY

1. Load Test on D.C Shunt Motor.
2. Load Test on D.C. Series Motor.
3. O.C.C & Load characteristic of self / separately excited D.C. Generator
4. Parallel operation of D.C Shunt Generator
5. Speed con troll of D.C. Shunt Motor.
6. Load O.C. & S.C. test on single - phase transformer
7. Parallel operation of single - phase transformers.
8. Synchronization of 3 - phase alternator
9. Trouble shooting in Electric Motor and Transformers
10. Exercises in Power Wiring and earthing

ELECTRONICS LABORATORY

1. To study the volt - ampere characteristics of a high current semi conductor diode
2. To study the volt - ampere characteristics of a diode and Zener diode.
3. To study the half wave and full wave rectification circuit without and with filter circuit Transistor Designer test
4. Semiconductor devices characteristics test Digital & Linear Trainer
5. Arithmetic operations using 8085
6. Logical Operations using 8085
7. Array Operations 8085
8. Speed and Direction control of Stepper motor using 8085

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

CORE XVI – MARINE PRIME MOVERS

OBJECTIVE:

On successful completion of this course the students should have understood the functioning of marine engines, the concept of 2 stroke/4 stroke engines, the importance of lubricants and fuel.

UNIT I PERFORMANCE CHARACTERISTICS OF IC ENGINES

4Stroke & 2-Stroke cycle - Limitation in parameters, Timing diagrams of 2-Stroke & 4-Stroke engines, comparative study of slow speed, medium speed & high speed diesel engines - Suitability & requirements for various purposes. Mean piston speed, MCR & CSR ratings. Practical heat balance diagrams & Thermal efficiency.

UNIT II GENERAL DESCRIPTION OF MARINE DIESEL ENGINE

Constructional details of IC engines & Marine Diesel engines Components : Jackets & liners, Cylinder heads & fittings, pistons, cross heads, Connecting rods, crank shaft, bearings, Bed plates, A-frames, Welded construction for Bedplates & frames & Tie rods etc.

UNIT III SCAVENGING SYSTEM

Scavenging arrangements in 2- Stroke engines- Air changing & exhausting in 4-Stroke engines - Various types of scavenging in 2-Stroke engines. Uniflow loop and cross flow scavenging, their merits & demerits, Scavenge pumps for normally aspirated engines, under piston scavenging scavenge manifolds. Super Charging arrangements: Pulse & constant pressure type, merits & demerits in highly rated marine propulsion engines - Air movements inside the cylinders - Turbocharger & its details

UNIT IV FUELS

Liquid fuels - petroleum - Distillation process -effects of modern refining on residual fuel properties - fuel oil for marine diesel engines Testing & properties of fuel oils- Combustion of fuel- air for combustion -Combustion of hydro carbons Compression pressure ratio its effect on engines. Design aspects of combustion chamber. Control of NO_x, SO_x in Exhaust emission

UNIT V MARINE LUBRICATING OIL

Refining of crude petroleum & lubricating oils - friction-functions of lubricants-basic requirements-machine components-surface finish-slider bearings hydrostatic lubrication-boundary lubrication Elasto hydrodynamic lubrication -cylinder lubrication for large 2-Stroke engines- Crank case oil for large 2-Stroke engines- - air compressor cylinder oil - all-purpose oil- Refrigeration compressor crank case oil- Lubricating system for various engines - Monitoring engines through lubricating oil analysis reports.

TEXT BOOKS:

1. D.A Taylor, "Introduction to Marine Engineering" Butter Worth Heinemann
2. Wood Yard, Doug, "Pounder's marine Diesel Engines" Butter Worth Heinemann

CORE XVII – MARINE AUXILLIARY DEVICE

OBJECTIVE:

On successful completion of this course the student should have understood the need for pollution prevention and acquire knowledge of dry docking, deck machinery.

UNIT I POLLUTION PREVENTION

Oily water separators their construction and operation, use of coalescers, prevention of oil pollution Various international requirements, (MARPOL ACT), other shipboard equipments: incinerators. Sewage treatment plant, principle of operation, construction, maintenance, and fault finding analysis

UNIT II DECK MACHINERY

Various types of deck machinery used in ships e.g.-deck cranes winches & windless their requirements, Operation and maintenance - Hatch covers-different types of stabilizers- bow thrusters. Oil purification: Theory of oil purification, Principles of operation & construction of centrifuges for heavy oils. Blowers & Compressors: operational and constructional details of blowers and compressors used on board ships

UNIT III SHAFTING

Methods of shaft alignment, constructional details and working of thrust block. Intermediate shaft bearing Stern tube bearing - Oil and water lubricated stern tubes. Sealing glands. Stresses in tail end shaft, Intermediate shaft & thrust shaft

UNIT IV DRYDOCKING

Methods of dry-docking of ships, inspection and routine overhauling of underwater fitting and hull, Measurement of clearances and drops, removal & fitting of propellers and rubbers, Main and stern tubes, inspection and maintenance

UNIT V NOISE & VIBRATION

Elements of aerodynamics and hydrodynamics sound, noise sources on ships and noise suppressions techniques, noise level measurement, various modes of vibration in a ship (i.e. free forced, transverse, axial, torsion, their sources and effects). Resonance and critical speed, structure borne and air borne, vibration, anti vibration mountings of machineries, de tuners dampers with reference to torsion vibrations dampers, use of Torsion graphs

TEXT BOOKS:

1. D.W.Smith, "Marine Auxiliary Machinery," 6th Edition, Butter worths, London 1987.
2. H.D. McGeorge, "Marine Auxiliary Machinery", 7th Edition, Butter worth London, 2001

CORE XVIII – MARINE MACHINERY SYSTEM DESIGN

OBJECTIVE:

On successful completion of this course the students should have understood designs involved in marine machines, bearings, gears and valves.

UNIT I SLIDING CONTACT BEARINGS

Journal bearings, thrust bearings, friction in journal bearings, bearing loads, bearing design using various equations - Thermal equilibrium Rolling Contact bearings - load ratings, types of radial ball bearings, selection of bearings, lubrication of ball & roller bearings, methods of failure

UNIT II SPUR AND HELICAL GEARS

Basic design principles of spur gears, helical gears, dynamic tooth loads Design for strength and wear, Lewis and Buckingham equation. BEVEL AND WORM GEARS Basic design principles of bevel gears and worm gears, Lewis formula Thermal rating of worm gears.

UNIT III DESIGN OF IC ENGINE PARTS

Piston, connecting rod with bearings, crankshaft, flywheel and rocker arms

UNIT IV DESIGN OF COMPONENTS

Safety valve and reducing valves Crane hooks, lifting chains, Engine room E.O.T Crane

UNIT V DESIGN CRITERIA OF MARINE SYSTEM

Water cooling systems for diesel engines & steam plants, Lubricating oil systems for propulsion & auxiliary engines - Electro hydraulic steering gear system including rudder, rudderstock, tiller, rams - Marine diesel engine air starting system including air receiver, compressor & air starting valves - Marine diesel engine scavenge & exhaust systems - Marine diesel engines fuel injection system including fuel pumps & fuel injectors. Power transmission system including thrust blocks, intermediate shaft, steam turbine plants, and gas turbine plants

TEXT BOOKS:

1. Pandya & Shaw “Machine Design”- Charotar Publishing House
2. “Design and application in Diesel Engines” Sam Had Dad, Neil Watson- Ellis Horwood Ltd, London

CORE XIX – SHIP'S ADVANCED FIRE PREVENTION AND CONTROL

OBJECTIVE:

On successful completion of this course the students should have understood the important firefighting methods, equipment and their use.

UNIT I FIRE PROTECTION BUILT IN THE SHIPS

SOLAS Convention, requirements in respects of materials of construction and design of ships
Fire detection and extinction systems, fire test, escape means, electrical installation-ventilation system & venting system for tankers statutory requirements for firefighting systems and equipment on different vessels, fire doors & fire zones.

UNIT II DETECTION AND SAFETY SYSTEMS

Fire safety precautions on cargo ships, takers and passengers ships during working - Types of detectors, selection of fire detectors and alarm systems and their operational limits - Commissioning and periodic testing of sensors and detection systems - Description of various fitted on ships

UNIT III FIRE FIGHTING EQUIPMENT

Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, properties of chemicals used, water-mist fire suppression system-advantages of various fire extinguishing agents including vaporizing - fluids and their suitability for ship's use - Control of class A, B, C & class-D fires, combustion products & their effects on life safety.

UNIT IV FIRE CONTROL

Techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds gallery etc. fire fighting in port and dry dock - First aid, fire organization on ships, shipboard organization for fire and emergencies - combustion products and their effects on life safety, fire signal and muster fire drill. Leadership and duties, fire control plan - human behavior

UNIT V SPECIAL SAFETY MEASURES

Special safety measures for preventing, fighting fire in tankers, chemical carriers oil rings, supply vessels, and fire fighting ships, safe working practice with respect to fire on board ships and first aid for hazards arising from fire in ships.

TEXT BOOKS:

1. "Fire Abroad" by Frank Rush Brook- Son & Ferguson Ltd.
2. "Reed's Ship Construction for Marine Students" Vol. 5- Thomas Reed Publication

CORE XX – MARINE CONTROLL AND AUTOMATION

OBJECTIVE:

On successful completion of this course should have understood the need for control system and the automated operation of marine control systems

UNIT I CONTROL SYSTEM

Introduction to control terms, block diagrams for control systems, Open loop and closed feedback control, comparison of closed loop Feed forward control, feed forward modification Regulators and servomechanism, proportional plus integral plus derivative Use of various control modes.

UNIT II GRAPHICAL REPRESENTATION OF SIGNALS

Inputs of step, Ramp sinusoid, pulse and impulse, Exponential function etc. The dynamics of a simple servomechanism from angular position control The torque proportional to error, servo mechanism Technique for improving the general performance of servomechanism The frequency response test, series compensation using Nyquist diagram.

UNIT III PROCESS CONTROL SYSTEMS

Automatic closed loop process control system dynamic characteristics Dynamic characteristics of controller Electronic instrumentation for measurements and control analogue Basic concepts, analog computers, stimulation, uses, hybrid computers.

UNIT IV TRANSMISSION

Pneumatic and electric transmission, suitability for marine use Pneumatic and types of controller's hydraulic, electric and electronic controllers correcting units: diaphragm actuators, valve petitioners, piston actuators Electro pneumatic transducers, electro hydraulic and electric actuator control.

UNIT V APPLICATION OF CONTROLS ON SHIPS

Marine boiler, automatic combustion control, Air fuel ratio control, Feed water control single 2 & 3 elements type, steam pressure control Combustion chamber pressure control, fuel oil temperature control Jacket cooling water, fuel valve cooling water, piston cooling, scavenge air Fuel oil viscosity control of main machinery, Instruments for UMS Classification.

TEXTBOOKS:

1. D.A.Taylor, "Marine Control Practice- Butter Worth & Co-London
2. Leslie Jackson "Instrumentation and Control Systems" Thomas Reed pub. Ltd

SKILL BASED SUBJECT IV - MARINE PROPULSIONS, OVERHAULING AND FIRE FIGHTING 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 POLLUTION LAB

UNIT – I

1. Analysis of polluted water
2. Determination of dissolved oxygen
3. Determination of biochemical oxygen demand
4. Determination of chemical oxygen demand
5. Determination of hardness of water

UNIT – II

1. Determination of fluoride
2. Determination of hydrogen sulphide
3. Pre-concentration of water by solvent extraction method
4. Estimation of toxic heavy metals Zn
5. Estimation of toxic heavy metals Cd

Reference Books:

1. A practical hand book of sea water analysis, 1972 strickland, J.D.H. and parsons, T.R.
2. Marine chemistry (vol.1), 1972 – Martin, D.F.
3. APHA – Standard methods of the examination of water and waste water, 1985 – American Public Health Association, American water works association, Water Pollution Control Federation, New York.
4. Methods of seawater analysis, 1983 – Grasshoff, K., Ehrhardt, M and kremling, K. 5. A manual of chemical and biological methods of seawater analysis, 1972 – Parsons T.R. Mritz, Y and Lalli, C.H.

MAJOR PROJECT

All the students will undergo a 2-3 months summer placemen 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