NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

DEPARTMENT OF MARINE ENGINEERING

B.E. MARINE ENGINEERING PROGRAM

CURRICULUM & SYLLABUS

SEMESTER I

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR201	Communicative English & Sociology	4	0	0	4
2.	MA208	Mathematics – I	3	1	0	4
3.	MR202	Basic Thermodynamics	3	1	0	4
4.	EE225	Basic Electrical & Electronics Engineering	3	1	0	4
5.	MR203	Engineering Mechanics – I	3	1	0	4
6.	MR204	Workshop Technology	3	0	0	3
7.	MR205	Geometrical Drawing	1	2	0	3
PRACTICAL						
8.	EE282	Basic Electrical & Electronics Laboratory	0	1	2	2
9.	MR271	Workshop Practicals - I	0	0	6	3
TOTAL			20	7	8	31

MR201	COMMUNICATIVE ENGLISH & SOCIOLOGY	60 hrs.

AIM: This course is designed to enable the students to entrance their linguistic abilities in listening, reading, writing and speaking communicative English.

COMMUNICATIVE ENGLISH (30 Hrs.)

UNIT – 1 ENGLISH AND REMEDIAL GRAMMAR:

Revision of knowledge of Parts of speech, Tense, Narration, Analysis, Change of voices, Appropriate prepositions etc. **- 4 Hrs.**

WRITTEN COMMUNICATION

a) Formal and ordinary letters, formal invitations, letters to friends and relatives.
b) Official and semi-official letters. Application for appointment. Commercial letters, Letter to influence public opinion.
c) Notices, agenda & minutes writing.
d) Essay writing.
e) Writing factual reports, accidents and maintaining diary and log book.
f) Technical Report writing.
g) Summarizing/abstracting the main ideas of an unseen passage, given a working outline.
h) Stress marking and use of idioms and phrases. **– 12 Hrs.**

DEVELOPMENT OF SKILLS OF ORAL COMMUNICATION

Use of English in different situation with elementary phonetic drill

a) Speech training: Elocution, debating and extempore speech.
b) Group discussions and interviews.
c) Delivery of welcome address.
d) Use of Marine Vocabulary.

Selected tests to be conducted to test skill in comprehension and speech **- 8 Hrs.**

UNIT – 2 THEORY OF COMMUNICATION:

Communication and its importance, Means & barriers of communication – verbal & non verbal communication – Interpersonal communication – Communication gap and ways to reduce the communication gap. Means of communication on board ship, Means of communication between shore staff, office and ship staff. Need for good communication with friends & family. Leadership and communication **– 6 Hrs.**

SOCIOLOGY (30 Hrs.)

UNIT – 3 ETHICAL & SOCIAL VALUES

Ethics, values; Human spirit, moral values; Code of conduct, cultural advancement, Rationalism, Social values, Laws, Justice, Liberty, Equality & Fraternity. **– 4 Hrs.**

MODERN SOCIETY & INDIAN PROBLEMS

Social problems, Economic inequality: Education & cultural problems; Health, Unemployment, Criminal tendencies, Corruption, Labour problems, Social stratifications. Evolution & mobility; social Democracy, individual in Industrialised Societ; Historical Development of Technology; Industrial Revolution, Impact of Rationalisation and Automation on Industrial works; Technology & Society. Social & Economic problems of India. **-8 Hrs**.

UNIT – 4 POLITICAL INSTITUTIONS, SOCIETY & THE STATE:

Origin & nature of state, social contract theory. Nationality and Nation; Classification of state, Democracy, Party System, Public Opinion, Electorate, Dictatorship, Totalitarianism, Fascism, communism, Capitalism, Socialism, Democratic Socialism. The Constitution of India, Local Self-Government, International co-operation, UNO, India in World Affairs. **- 8 Hrs**.

UNIT – 5 INDUSTRIAL PSYCHOLOGY:

Aims, Motivation, Ethical & Social values in Human Relations; Environment, Safety, Pollution. Productivity & Efficiency Methods, Participative Management. Industrial Labour & Trade Unions in India – Problems, Principles of fixing minimum wage; Principles of Labour Legislation; Industrial Labour – Indian Scenario, Trade Union movement – Measures to improve; Recruitment and Training, Employment Exchange, Labour Legislation – Factory Act 1948, Workmen's Compensation Act 1923; ESI Act, Employees Provident Fund, Industrial Disputes Act, Minimum Wages Act. **– 10 Hrs.**

REFERENCE BOOKS:

ENGLISH

Communication Skills (Book 1)	- S.R. Inthira & V. Saraswati.
Spoken English for India	- R.K. Bansal & B. Harrison.
English language Books 1 & 2	- L. A. Hill, C.J. Daswani & C.T. Daswani (Oxford University Press 1975)
Written Communication	- Freeman & Sarah.
Business correspondence & Report writing	- R.C. Sharma and Krishnamohan.
Sea speak manual	- International Maritime Organisation
"Technical Communication English Skill for Engineers"	- Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2008.
Basic Communication Skill for Technology Second Edition	- Andrea J. Rutherford, Dearson Education, 2007

SOCIOLOGY

Sociology	- by Gidden, Anthony
Introduction to Sociology	- Bilton, Tony & others.

MA208	MATHEMATICS – I	60 hrs.

AIM: The course is aimed at developing basic mathematical skills that are imperative for effective understanding of Engineering subjects. The topics introduced will serve as a basic tool for specialized studies in engineering fields.

UNIT-I DIFFERENTIAL CALCULUS AND ITS APPLICATIONS

Review of prerequisites such as-Functions, limits, continuity, Uniform continuity and differentiability. Rolle's theorem, Mean value theorems and Taylor's theorem. Applications of Mean value theorems, Applications of derivatives-Rate measure, Error, Extreme, Curvature, Asymptotes Successive differentiation-Higher order derivates, nth order derivatives, standard results, nth order derivates, of rational functions and partial fractions, nth order derivative of the product of powers of sines and cosines **-12 hrs**

UNIT – II PARTIAL DIFFERENTIAL EQUATION AND ITS APPLICATIONS

Functions of several variables-Limit, continuity, Partial derivatives and their geometrical significance, Higher order partial derivatives, homogeneous functions, Euler's theorem, Maxima, Minima and Saddle points, constrained maxima or minima, Lagrange multipliers, exact differentials.

Calculus of Variations-The Brachistochrome problem, Euler-Lagrange development, applications of Euler's equation, several dependent variables, applications to discrete mechanics, the Isoperimetric problem. **-12 hrs**

UNIT – III INTEGRAL CALCULUS AND ITS APPLICATIONS

Properties of definite integrals, Fundamental theorem of integral calculus, applications of integrals to lengths of plane curve, volume and surface of revolution, Centre of gravity, Moment of inertia, Integration as limit of a sum, Beta function and gamma function, multiple integrals, differentiation under integral sign. **-12 hrs**

UNIT – IV VECTOR CALCULUS

Vector algebra, Scalar and vector products, orthonormal triad, scalar triple products, Linear dependence of vectors, other repeated products, identity of Lagrange, Reciprocal systems.

Vector calculus, vector functions of one variable and their derivatives, curves, arc length, tangent, curvature and torsion, Gradient of a scalar field, Divergence of a vector field, Curl of a vector filed, Directional derivatives. **-12 hrs**

UNIT –V Matrices and Analytic functions

Matrices and Determinants, matrix algebra, sub matrices, Rank of a matrix systems of n linear equations in n unknowns, Inverse of a matrix, Hermitian and Skew-Hermitian matrices, Unitary, orthogonal and normal matrices, Eigen values and Eigen vectors, Eigen values of Hermitian, Skew-Hermitian and Unitary matrices, Bilinear, Quadric, Hermitian and Skew-Hermitian forms, Real life applications.

Review of pre requisites of complex numbers, De-Moivre's theorem, complex variables, Limit, derivative, Analytic functions, Cauchy Rieman equations, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of an analytic functions, Taylor series and Laurent series. **-12 hrs**

REFERENCES:

1. Grewal. B.S. Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi 2004.
2. Bali, N.P. and NarayanaIyengar, N. CH. S., Engineering Mathematics, Laxmi Publications Pvt. Ltd., New Delhi, 2003.
3. Venkataraman, M.K. Engineering Mathematics, Vol-I & II Revised Enlarged Edition, The National Publishing Company, Chennai, 2004.
4. K.A. Stroud, Engineering Mathematics.

MR202	BASIC THERMODYNAMICS	60 hrs.

AIM: The course is aimed to impart basic Thermodynamics knowledge to the students. At the end of the course, the student should be able to understand and further study applied thermodynamics effectively.

UNIT 1

THERMODYNAMIC DEFINITIONS: Heat, Work, Energy, System, Boundary, Control Volume, working substance, Phase properties, phase diagrams, Point function, Path function, Reversible and Irreversible Process; p-V diagram for work transfer in reversible processes; Closed system and Open system; Steady Flow Process and Non-flow process; First law of Thermodynamics and its application to various processes; Steady-flow energy equation; Non-flow energy equation; Applied problems. **-12 hrs.**

UNIT 2

PROPERTIES OF GASES: Characteristic equation of state for a perfect Gas; Equation of state for real gas; Internal energy of a gas and Joule's law; Two specific Heats of a gas and relation between them. Different gas processes and Heat and work transfer in various gas process; Temperature-Entropy Diagram; Applied Problems. **- 12 hrs**.

UNIT 3

STEAM AND TWO PHASE SYSTEM: Phase; Equation of Steam; Temperature-Pressure diagrams; Triple Point; specific Enthalpy and Entropy, use of Steam Tables and Steam Charts; Pressure Volume and Enthalpy-Entropy diagrams; Internal Energy of vapours, super critical vapours; Non-flow proceses with steam; Applied Problems. **12 hrs**

UNIT 4

BOILERS AND EVAPORATORS: Boiler calculations; Boiler Thermal efficiency and equivalent evaporation of a Boiler; Basic calculations on the effect of condenser leakage and Impure feed, dissolved solids and scale in Boilers; Density of water and its control in

Boilers & Evaporators. Basic calculations on performance of single-effect, multi-effect and flash type Evaporators; Applied Problems. **- 12 Hrs**.

UNIT 5

IDEAL GAS CYCLES: Constant Volume cycle; Constant pressure cycle, Diesel cycle; Dual combustion cycle; 4-stroke & 2-stroke cycle; Criteria of Performance; compression ratio and Thermal efficiency; Indicator diagrams. Indicated power Brake power, Friction power, Mechanical efficiency, Specific fuel consumption; Energy Balance Applied Problems. **– 12 hrs**.

REFERENCES:

1. Applied Thermodynamics for Engineering Technologists T.D. Eastop & A. McConkey
2. Applied Thermodynamics J.B.O. Sneeden & S.V. Karr
3. Basic Engineering Thermodynamics Joel Rayner;
4. Heat Engines P.L. Ballaney
5. Thermodynamics – Applied to Heat Engines E. H. Lewitt
6. Heat & Thermodynamics Dittman

EE225	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	60 hrs.

AIM: The course is aimed at developing the basic Electrical and Electronic engineering knowledge that are imperative for effective understanding of electrical machines and electronics.

ELECTRICAL

UNIT-1

ELECTROSTATIC &ELECTROMAGNETIC CIRCUITS

Basic concept of electrical circuit, cells, electrostatics and electromagnetism, circuit laws and analysis, maximum power transfer and grouping of cells.

Laws of magnetic circuit, calculation of ampere-turns from B-H curve, hysteresis, magnetic leakage and fringing, simple magnetic circuit involving air-gaps. Self and mutual induction, energy stored in a magnetic field. **– 10 Hrs.**

UNIT-2

AC CIRCUITS

Alternating current and voltage, single phase a.c. circuits. Three phase circuits-balanced and unbalanced loads. Transient phenomena **- 8 Hrs.**

UNIT-3

MESUREMENT AND INSTRUMENTS

Basic requirements of a measuring instrument-deflection, control and damping devices, moving coil, moving iron, dynamometer and thermocouple type of ammeter, voltmeter and wattmeter-their construction and other details, extension of scales of a meter.

Single phase and three phase measurements of energy by wattmeters. Measurement of speed, frequency and Phase difference. Measurement of resistance, inductance and capacitance by Bridge Method. Magnetic measurement. Localization of cable faults. Transducers and its application in the measurement of pressure, flow, temperature etc. Simple electronic measuring devices, such as VTVM, CRO, IC tester, signal generator. Illumination and its measurement. **- 20 Hrs**.

ELECTRONICS:

UNIT-4

ELECTRON EMISSION

Electron Emission: Thermionic Emission, Photoelectric emission, Electric field emission and their application

Semi Conductors: What is semiconductor, Types of semi conductors, Electrical characteristics, Diffusion and Drift, Mobility, Varistors, Thermistors and Non Linear resistors. **– 10 Hrs**.

UNIT-5

SEMICONDUCTOR DEVICES AND ITS APPLICATIONS

Semi conductor & Diodes: Characteristics of diodes, Diode as a rectifier, Diode clamper and voltage doubler, Zener diodes, tunnel diodes, rectifiers & filters LEDs Transistors: The junction transistor and its basic characteristics, the transistor as a switch. The transistor as an amplifier. **– 12 Hrs**.

REFERENCES:

1. Electrical Engineering - Edward Huges
2. Basic Electronics, Volumes 1 to 7 by Harry Mileaf.
3. A text book of Electrotechnology, Volume 1, Basic Electrical Engineering by B.L. Theraja and A. K. Theraja
4. A text book of Electrotechnology, volume 2, AC and DC machines, by B.L. Theraja and A.K. Theraja.
5. A text book of Electrotechnology, Volume 4, Electronic Devices and circuits by B.L. Theraja and A. K. Theraja

MR203	ENGINEERING MECHANICS – I	60 hrs.

AIM: To impart a sound knowledge on the principles of Engineering Mechanics.

UNIT 1

VECTOR STATICS: Scalars and vectors. Moments and couple, couple moment – couple moment as a free vector, addition & subtraction of couple. Equilibrium and resultant of coplanar, concurrent and non-concurrent forces (analytical & graphical method) **- 8 Hrs.**

UNIT 2

Frame works. Free body diagrams. Trusses, Method of section, Joint to joint method and Bow's notations.

NON-COPLANAR FORCES: Three rectangular components of vectors. Equilibrium and resultant of vectors in space. **- 8 Hrs.**

UNIT 3

CENTROIDS: Centroids of areas, centroids of lines, centroids of volume, cencroids of volume, centroids of masses, centre of gravity, composite figures. .

Moment of Inertia: Moment of inertia of area. Transfer formula. Product of inertia and its transfer formula. Maximum and minimum moment of inertia. Mass moment of inertia and its transfer formula. Radius of gyration. **- 16 Hrs**.

UNIT 4

RECTILINEAR MOTION: Differential equation constant force.

Force as function of time and displacement. D'Alembert's principle of dynamic equilibrium. Linear momentum.

CURVILINEAR MOTION: Differential equation. Normal and tangential acceleration. Projectile, D'Alembert's principle. Angular momentum. **- 15 Hrs**.

UNIT 5

MOTION OF RIGID BODIES: Rotation about fixed axis. Rotation under constant moment Periodic motion, Work, Power and Energy.

VIRTUAL WORK AND MACHINES: Principle of virtual work. Ideal machines. Law of machines. Reversibility and irreversibility of lifting machines and its application to different types of lifting machines. **- 13 Hrs**.

REFERENCES:

1. Rajasekaran, S. Sankara Subramanian, G. 'Fundamentals of Engineering Mechanics' Vikas Publishing House Pvt. Ltd (2000)
2. Irving, H, Shames, Engineering Mechanics – Statics and Dynamics IV Edition – Pearson Education Asia Pvt. Ltd.
3. Hibbler. R.C., Engineering Mechanics, Vol-I Statics, Vol-II Dynamics, Pearson Education Asia Pvt. Ltd. (2000)
4. Elementary Mechanics of Machines – J. Hanna & R.C. Stephens.

MR204	WORKSHOP TECHNOLOGY	45 hrs.

AIM: To impart knowledge to the students about, common workshop tools, measuring techniques, overhauling of various types of valves and Machine and Machine process tools.

UNIT 1

COMMON WORKSHOP TOOLS: Description and uses of different types of calipers, straight edges, try squares, vices, hammers, chisels, scrapers, files, drills, reamers, tapers, V-Blocks, face plate, marking blocks, carpentry tools, pattern maker's tools, smithy tools and Moulding tools. Application of hand tools as chisel, file and saw.

MEASURING INSTRUMENTS & INSPECTION: Description and use of steel rule, Vernier's scale, Micro-meter, dial gauge, depth gauge, thread gauge, feeler gauge, wire

gauge, pattern maker's scale, taper gauge, snap gauge, plug gauge, optical methods of measurement, principles of interchangeability, limit system, use of limit gauge. **-9 Hrs**

UNIT 2

METAL CUTTING MACHINES: Kinematic analysis, specification, operation and inspection of the more important types of metal cutting machine tool including centre lathes, capstan and turret lathe, automatic lathes, drilling and boring machines, shaping slotting and planning machines, milling and broaching machines. **-9 Hrs**

UNIT 3

MACHINE PROCESS & MACHINE TOOLS: The geometry of cutting processes, chip formation cutting forces, stresses and power, friction of chip on tool. Generation and dissipation of heat in cutting. Standard nomenclature for cutting tools. Cutting speeds and feeds, estimation of machining time. The fundamental cutting process, geometrical control of the cutting edge. Turning, screw cutting and taper turning processes on centre lathe. **-9 Hrs**

UNIT 4

ABRASIVE PROCESS: grinding, honing and lapping by hand and machines. Shears and punches. Wood working machines. Principles of Jigs and fixtures, standardization.

FITTING AND OVERHAULING: Types of packing and joining materials and their uses, design considerations and construction of various types of valves and cocks, Reducing valves for steam and air. Bedding of bearings, marking of engine parts for fitting, machining operations, fitting of keys, cotters, etc. **-9 Hrs**

UNIT 5

SAFETY MEASURES: Sources of danger and methods of protection. Types of guards and safety devices, Factory act regulations.

WELDING: Welding equipment & applications, Electric Welding (AC & DC) spot welding. Gas welding, soldering & Brazing. Different welding and electrodes, solders & brazing fluxes. Defects in welding.
Safe working practices – personal protection equipment. **-9 Hrs**

REFERENCES:

1. Workshop Technology I & II – Hajra Choudhury
2. Workshop Technology – Khurmi
3. Workshop Technology – W.A.J. Chapman (Vol I & II)
4. H.M.T. Production Technology – TATA McGraw Hill, New Delhi.

MR205	GEOMETRICAL DRAWING	60 hrs.

AIM: To impart the knowledge to the students about good draughtsman ship, curves used in Engineering practice, and projection of solids.

UNIT 1

INTRODUCTION TO TECHNICAL DRAWING: Draughtsman ship, lettering, dimensioning, types of lines and correct use of drawing instruments, Construction of geometrical figures specially showing joining of straight lines and curves. . Projection of points and lines. **- 12 hrs.**

UNIT 2

CURVES USED IN ENGINEERING PRACTICE: Conic sections construction of ellipse, parabola and hyperbola by various methods. Drawing of spirals, involutes, cycloids, epi and hypocycloids, helixes. Detailed drawings of helical springs of round and rectangular sections Square thread formation in proper helical form **- 12 hrs**.

UNIT 3

PROJECTION OF SOLIDS: Axis perpendicular to a plane and axis parallel to both planes, axis parallel to one plane and inclined to the other, axis inclined to both planes. **– 12 hrs**.

UNIT 4

DEVELOPMENT OF SURFACE: Developing the surfaces of prisms. Pyramids and cones **– 12 hrs.**

UNIT 5

CURVES OF INTERSECTIONS:

Drawing the curves of intersection of cylinders to cylinders, cylinders to cones and other solids. **– 12 hrs**.

TEXT BOOK:

1. M.B. Shah and B.C. Rana, Engineering Drawing Pearson Education 2005.
2. N.D. Bhatt, Engineering Drawing Charotar Publishing House 46th Edition, 2006.

EE282	BASIC ELECTRICAL & ELECTRONICS LABORATORY	54 hrs.

ELECTRICAL LABORATORY:

a) Determination of equivalent resistance of the resistors when they are connected in
   i) Series,
   ii) Parallel &
   iii) Series-parallel.

   Measurement of armature resistance, shunt field resistance of a d.c. machine by ammeter and voltmeter method.

Determination of the resistance and the tolerance of the resistors having the colour sequences, using the standard resistors colour code.

Instruction with the help of Demonstration Boards the Display Models.
Preparation of wiring for i) Fan, ii) Florescent lamp
Measurement of Power using Watt meter.
Measurement of Energy (single and three phase) using suitable energy meter.
Measurement of the insulation resistance of an electrical machine and continuity test by the Megger.
Location of faults in electrical circuits. Testing of fuses.
For all practical the Instruments like Megger, equipment like motor and circuits like resistance fuses to be of kind that are actually found on onboard a modern ship.
b) Electrical symbols and how to read circuit diagram.
Making circuits of important system like starting of an induction motor (single & three phase)
Understanding malfunction in these systems and finding effects and reasons for same.
Maintenance and rectification of these faults.

ELECTRONICS LABORATORY:

Determination of the characteristics of Diode.
Determination of the characteristics of Triode.
To study the charging and discharging action of acapacitor.
To study the half wave and full wave rectification circuit without and with filter circuit.
To study the volt ampere characteristics of a high current semi conductor diode.
To study the volt ampere characteristics of a diode and zener diode.

MR271	WORKSHIP PRACTICALS - I	108 hrs.

Awareness of safety equipments in works.

Fitting shop: (Bench Work)

To make a square block from a round bar
(OR)
To make a hexagon block from a round bar
To make a Male – Female square fitting from 10 mm thick plate
To make a V – fitting from a 10 mm thick plate

Black Smithy Shop

Drawing down from round rod and bending to 90^o
To make a square head on a round rod (square head pin)
Bending 90^o from a round rod
To make a flat chisel of Hexagonal stem from a round rod
Tempering process of tools

Carpentry Shop

Make a wooden box with dovetail joint
Make a wooden plug for condenser tube
Make a cement box fresh water pipe

Miscellaneous

Two jobs that a student may be given as a project. Jobs to relate to onboard systems within the above mentioned fields.

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SEMESTER II

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR206	Seamanship, Elementary Navigation & Survival at sea	2	1	0	3
2.	MA209	Mathematics – II	3	1	0	4
3.	MR207	Applied Thermodynamics - I	3	1	0	4
4.	MR208	Strength of Materials – I	3	1	0	4
5.	CS208	Computer Science	3	0	0	3
6.	MR209	Engineering Mechanics – II	3	0	0	3
7.	MR210	Engineering & Machine Drawing	1	3	0	3
PRACTICAL						
8.	MR272	Applied Mechanics Laboratory	0	1	2	2
9.	MR273	Workshop Practicals – II	0	0	6	3
10.	CS275	Computer Laboratory - I	0	1	2	2
TOTAL			18	9	10	31

MR206	SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA	45 hrs.

AIM : To make students familiar with the duties of seaman, various types of ropes and knots, knowledge of Bridge equipments and about LSA.

UNIT 1

SEAMEN & THEIR DUTIES: Ship's Department, General ship knowledge and nautical terms like Poop-Deck, Forecastle, Bridge etc.

NAVIGATIONAL LIGHTS AND SIGNALS: Port and Starboard, forward and aft mast lights, Colours and Location. Look out, Precautions and Bad weather, Flags used on ships, Flag etiquette, Morse and Semaphore signaling, Sound signals. **- 6 hrs**.

UNIT 2

ROPE KNOTS AND MOORINGS: Types of knots. Practice of knot formation, Materials of ropes, Strength, Care and maintenance, use of mooring line, heaving line, Rat guards, Canvas and its use.

ANCHORS: Their use, Dropping and Weighing anchor, Cable stopper. - **6 Hrs.**

UNIT 3

NAVIGATION: General knowledge of principal Stars. Sextant, Navigation Compasses, Echo Sounder, Log and uses, barometer and weather classification, (3.M.T. and Zonal time, wireless Navigational Instruments, radar satellite-Navigation etc.

LIFE BOATS & LIFE RAFTS: Construction, equipment carried, carrying capacity. Davits and their operation, Launching of Life rafts (Inflatable type). Embarkation into lifeboat and Life raft. Survival pack, Stowage and securing arrangement. Rescue boat, immersion suit, Thermal Protective Aid. **-11 hrs**.

UNIT 4

ABANDON SHIP: Manning of lifeboat and life raft. Muster list, Radio and Alarm signals, Distress signal (S.O.S.). Distress Calls time and Radio frequency. Pyro-techniques.

SURVIVAL AT SEA: Survival difficulties and factors, equipment available, Duties of crew members, Initial action on boarding, Maintaining the craft. **- 10 Hrs.**

UNIT 5

INTRODUCTION OF: MARPOL Convention and its annexes, Regulatory Control towards environmental pollution at sea. Familiarisation with SOLAS, STCW conventions, ISPS code and other maritime codes & conventions.

PRACTICAL: Knots, bends and hitches, Ropes splice, Donning of Life jackets, Life boat drills. Lowering & hoisting of Life boats (model). **- 12 hrs**.

REFERENCES:

1. Seamanship	:	J. Dinger
2. Survival in Life Boat	:	Capt Purl
3. SOLAS	:	IMO
4. MARPOL	:	IMO
5. International light, shape & sound signals	:	W. Moore
6. Electronic navigation aids	:	G. Sonnenberg
7. Search and Rescue Manual	:	I.M.O. Publication
8. Mariner's Hand Book	:	H.M.S.O.

MA209	MATHEMATICS-II	60 hrs.

AIM : The **course** is aimed to understand higher mathematics useful in solving engineering problems.

UNIT – I

FOURIER SERIES AND ITS APPLICATIONS

Fourier Series and Integrals, Periodic Functions, Fourier Series and Euler's Formulae, Fourier Series for even & odd functions and functions having arbitrary period; Half-range Expansions. Applications of Fourier Series-Rectangular Pulse; Half-Wave Rectifier. Fourier Integral, Orthogonal Functions, Gibbs Phenomenon. **-12 hrs**

UNIT – II

LAPLACE TRANSFORMS

Laplace Transform, Inverse Transform, Linearity, Laplace Transforms of Derivatives & Integrals; Transformation of ordinary differential equati4n. Applications, shifting on the 's' and 't' axes; Convolutions, Partial fractions. **-12 hrs**

UNIT – III

DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS

Ordinary Differential Equations of First Orders, Basic Concepts, Geometrical considerations; Isoclines, Formation of Differential Equations, Separable Equation; Equations reducible to Separable Forms; Exact Differential Equations; Integrating Factors; Linear first order Differential Equations; Variation of Parameters; Picard's Iteration Method; Families of Curves; Orthogonal Trajectories; Applications to Electrical Circuits.

Ordinary Differential Equation of nth order; Solution of Homogeneous and non-homogeneous equation, Method of undetermined Co-4flcients.System of Ordinary Differential Equations, Phase Plane, Critical Points, Stability. **-12 hrs**

UNIT – IV

PROBABILITY AND RANDOM VARIABLES

Probability and Statistics; Concept of Probability; Random Experiments, Sample Space, Events; Axioms of Probability; Some important theorems on Probabi1ity; Mutually

exclusive events; Conditional Probability; Theorems on Conditional Probability; Independent Events; Bayes' Theorem; Problems and application on Combinatorial Analysis; Probability using Combinatorial Analysis.

Random variables; Discrete and continuous Probability distributions; Joint Probability distributions; 1ndependeit Random Variables; Conditional Distributions. Mathematical Expectations; Theorems on Mathematical Expectations; Variance and Standard Deviation; Standardized Random Variable; Moment generating functions; Characteristic functions; Variance for Joint Distributions, Co-variance; Correlation Co-efficient; Conditional Expectation; Variance & Moment; Chebyshev's inequality; La of large numbers; Percentiles. **-12 hrs**

UNIT – V

PROBABILITY DISTRIBUTIONS WITH APPLICATIONS

Special Probability Distributions-Binomial, Poisson; Normal and their Properties, Multinormal Distribution, Hyper-geometric Distribution, Uniform Distribution, Cauchy Distribution, Gamma Distribution, Beta Distribution, Square Distribution; t & f distribution; Geometric Distributions-Problems & Applications. **-12 hrs**

REFERENCES:

1. GRE WAL, B. S., Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi, 2004.
2. Bali, N.P. and NarayanaIyengar, N.CH.S., Engineeri4ig Mathematics, Laxmi Publications Pvt. Ltd, New Delhi, 2003.
3. Venkataraman M.K., Engineering Mathematics, Vol. I & II Revised Enlarged Edition, The National Publishing Company, Chennal, 2004.
4. K. A. Stroud, Engineering Mathematics.

MR207	APPLIED THERMODYNAMICS- I	60 hrs.

AIM: To understand the application of Thermodynamics in steam cycles, steam engines, reciprocating compressors.

UNIT 1

THE SECOND LAW OF THERMODYNAMICS: Different statements of the second Law of Thermodynamics. Carnots cycle, Thermodynamic Reversibility. Carnots Principle, Carnot's cycle for a gas, Deductions from Camot's cycle. Thermodynamic Temperature scale. Steam and Gas Processes on T-S and H-S charts, Entropy and Irreversibility. Applied problems. **-10 hrs**.

UNIT 2

STEAM CYCLE: Carnot cycle for steam and Ideal Efficiency. Rankine cycle with dry saturated steam and superheated steam. Feed Pump work. Rankine Efficiency, cycle

Efficiency, Isentropic Efficiency, work Ratio, Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency. Applied Problems. **- 12 hrs**.

UNIT 3

STEAM ENGINES: Modified Rankine cycle for steam Engines, Hypothetical Indicator Diagram. Mean Effective pressure and work transfer, Diagram Factor. Indicated power, Specific steam consumption. Indicated Thermal Efficiency. Efficiency Ratio, Engine Efficiency, Energy Balance, Compound steam Engines, Missing quantity. Applied problems. **- 8 hrs**.

UNIT 4

RECIPROCATING COMPRESSORS: Ideal cycle for compressors, work Transfer in single stage compressor, Mass and volume flow, Free Air Delivery, Effect of clearance and volumetric Efficiency in Single stage compressors, Multi-stage compression neglecting clearance and with clearance. Condition for Minimum work Input and Perfect Intercooling. Tandem and In-line arrangement in compressors. Rotary positive Displacement Types of compressors. Compressed air Motors. Applied Problems. **-14 hrs**.

UNIT 5

PROPERTIES OF MIXTURES OF GASES AND GAS & VAPOURS : Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric Analysis of Gas Mixtures, Gibb's-Dalton Law, Mean value of a Gas constant. Equivalent Molecular weight, Density, specific volume, specific Heat and Molar Heat capacity of gas mixture. Advanced problem on Adiabatic Mixing.

Air and Water vapour mixture, Specific Humidity, Relative Humidity, Dew point, unsaturated and saturated Air. Principle of Cooling Tower and Air Leakage Problem in surface condenser. **- 16 hrs**.

REFERENCES:

1. Applied Thermodynamics for Engineering Technologists : T.D.Eastop & A. McConkey.
2. Applied Thermodynamics : J. B. 0. Sneeden & S. V. Karr.
3. Basic Engineering Thermodynamics : Joel Rayner
4. Heat Engines : P. L. Ballaney
5. Thermodynamics — Applied to heat Engines : E. H. Lewitt
6. Heat and Thermodynamics : Mark W. Zemansky & Richard H. Dittman

MR208	STRENGTH OF MATERIALS-I	60 hrs.

AIM:

- To make the student learner, able to determine various stresses and strains in simple and composite members under external load, strength of simple connections and strain energy stored in members.
- To make the student learner able to design beams which can resist bending and shearing stresses and to teach the concept of principal stresses and maximum shear stresses.
- To teach the students to calculate the Shear force and Bending moment for the various types of statically determinate and indeterminate beams and the method of drawing the SFD and BMD.
- To make the student learner able to calculate the deflections caused by the application of loads and design of solid, hollow shafts, open coiled and closed coiled helical springs based on shear and bending.

UNIT 1

SIMPLE STRESSES AND STRAINS & STRAIN ENERGY: Concept of Stress and Strain and their relationship in deformable solids. Normal, shear and hydrostatic stresses and the corresponding strains. Poisson's Ratio and complementary shear stress. Relationship between three elastic constants. Uni-axial loading and deformations; Thermal Stress; Axial Stresses in composite materials.

Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience. **-14 hrs**.

UNIT 2

SHEARING FORCE AND BENDING MOMENT: Sign Convention, Relation between Intensity of Loading, Shearing Force and Bending Moment. Graphical construction of Bending Moment & Shear Force diagrams. **- 10 hrs**.

UNIT 3

THIN WALLED SHELLS & WELDED JOINTS: Stresses and Strains in thin Walled Shells subjected to internal pressure; Stresses and Strains in submersibles. Strengthening of Thin Walled Shells by wire or tape winding. Effect of temperature; Volumetric strain on capacity.

Strength of Welded Joints. Torsion effect on welded joint. **-13 hrs**.

UNIT 4

BENDING STRESS: Pure Bending, 2 moment of area, Stresses due to bending. Position of Neutral axis, Radius of Curvature, Combined bending and direct stress. Short Column with eccentric loading. Composite beams. Bending beyond the limit of proportionality.

-10 hrs.

UNIT 5

SHEAR & TORSION: Shear Stress and Shear Strain. Twisting of solid and hollow shafts, Stiffness and Strength. Power and Torque relation. Shafts with linear and compound shafts, Partial hollow shafts, Calculation for Coupling bolts, Torsion applied to closed coil springs, springs with axial load, Calculations for mean diameter Of springs, wire diameter & number of coils. Strain Energy in torsion. Plastic yielding of materials in Torsion. **- 13 hrs.**

REFERENCE:

1. Strength of Materials : G. H. Ryder
2. Strength of Materials : Stephen Timoshenko
3. Strength of Materials : R. K. Rajput
4. Strength of Materials : R. C. Stephens

CS208	COMPUTER SCIENCE	45 hrs.

AIM: To provide an awareness to Computing and Programming

OBJECTIVES:

- To enable the student to learn the major components of a computer system
- To Know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C and other languages, current in the field.

UNIT 1

INTRODUCTION TO COMPUTERS: Introduction - Characteristics of Computers - Evolution of Computers - Computer Generation - Classification of Computers - Basic Computer organization - Number systems. **-9 hrs**.

UNIT 2

COMPUTER SOFTWARE: Computer Software - Types of Software - Software Development Steps - Internet Evolution - Basic Internet Terminology - Getting connected to Internet Applications **-9 hrs**.

UNIT 3

PROBLEM SOLVING AND OFFICE AUTOMATION: Planning the Computer Program - Purpose - Algorithm - Flow Charts Pseudo code - Application Software Packages - Introduction to Office Packages (not detailed commands for examination). **-9 hrs**.

UNIT 4

INTRODUCTION TO C: Overview of C - Constants, Variables and Data Types - Operators and Expressions - Managing Input and Output operators - Decision Making - Branching and Looping. **-9 hrs**.

UNIT 5

FUNCTIONS AND POINTERS: Handling of Character Strings - User defined Functions - Definitions - Declarations - Call by reference - Call by value - Structures and Unions - Pointers - Arrays - The Preprocessor - Developing a C Program: Some Guidelines. **-9 hrs**.

HARDWARE INTRODUCTION: To understand, in general the hardware configurations. Elementary maintenance of Personal Computer – Hardware. (Not for Examination)

REFERENCES:

1. Ashok. N. Kamthane, "Computer Programming", Pearson Education (India) 2008.
2. Behrouz A. Forouzan and Richard F. Gilberg, "A Structured Programming Approach Using C", II
   Edition, Brooks - Cole Thomson Learning Publications,(2007).
3. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press.(2007)
4. Byron Gottfried, "Programming with C", 2 Edition, (Indian Adapted Edition), TMH Publications, (2006).
5. Stephen G. Kochan, "Programming in C", Third Edition, Pearson Education India (2005).
6. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education mc, (2005).
7. E. Balagurusamy, "Computing Fundamentals and C Programming", Tata McGraw-Hill Publishing company Limited, (2008).
8. S. Thamarai Selvi and R. Murugan, "C for All", Anuradha Publishers, (2008).

MR209	ENGINEERING MECHANICS-Il	45 hrs.

AIM: To enable the student to correlate the principles of friction, dynamics of rotation with application oriented studies.

UNIT 1

FRICTION: Static and Kinetic Friction. - Laws of Friction; Effort required to pull a body up or down an inclined plane. Friction in Square and V-threaded screws, friction in pivots and collars; Conical bearings and thrust bearings plates. Cone clutches and Centrifugal clutches. **-9 hrs**.

UNIT 2

DYNAMICS OF ROTATION : Dynamics of rotation particle and rotating bodies, velocity and acceleration in terms of path variables, cylindrical co-ordinates forces acting on a body having known motion; Torque equation; Work done by application of torque; Kinetic energy of rotation. Total Kinetic energy of a rolling wheel. **-9 hrs**.

UNIT 3

PERIODIC MOTION: simple Harmonic motion; Application of S.H.M. to masses and springs. Simple Pendulum and Compound Pendulum. **- 8 hrs.**

UNIT 4

GOVERNORS: Function of Governor; Comparison between a Governor and a fly wheel; Various types of Governors; Centrifugal and inertia types of Governors, Sensitiveness; Stability and Hunting of Governors; Governor effort and Power, Consideration of friction in Governors. **- 9 hrs**.

UNIT 5

DRIVES AND BRAKE: Belt and Rope drives; Open and Cross Belt drive; Belt dimensions; Ratio of belt tension; Modification for V-groove pulleys; Power of Belt drives and maximum power transmitted. Effect of Centrifugal tension; Creep in Belts; Different types of band brakes and block brakes. Dynamometers and their working principles; Absorption Dynamometer Band & Rope Brake Dynamometer, Hydraulic Dynamometer. **-10 hrs**.

REFERENCES:

1. Applied Mechanics : J. Hannah & MJ. Hillier
2. A text book of Engineering Mechanics : R.S. Khurmi
3. Engineering Mechanics : H. L Langhaar & A. P. Boresi

MR210	ENGINEERING & MACHINE DRAWING	60 hrs.

UNIT 1

ORTHOGRAPHIC PROJECTIONS: Orthographic Projection in 1st & 3rd angle projections of simple machine components from given isometric drawings; Drawing of third view from the given two views in Orthographic projections. Details of sectioning: Sectioning of components at the central axis; Part sectioning, Off-centre sectioning and Off-set sectioning; Simple assembly drawings with sectional views. **-15 hrs**.

UNIT 2

PICTORIAL PROJECTIONS: Isometric and oblique projections. Use of isometric scale. Isometric drawing of simple solids like prisms, Pyramids, cylinders and cones. Sectional views of simple machine components in isometric. **-12 hrs**.

UNIT 3

PROJECTION OF PORTS: Projection of Port and Openings in hollow cylinders. Parallel cut & radial cut ports; Rectangular & tapered ports in right cylinders; Tapered ports in tapered cylinders; Example of diesel cylinder liners; Steam piston valve liner and blow down cock. **-15 hrs**.

UNIT 4

THREAD FORMATION: V-threads and square thread details; Metric & BSP threads; General conventions for drawing of threads in engineering drawings. **-9 hrs**.

UNIT 5

NUTS, BOLTS & STUDS: Standard bolts, studs, nuts & tapped holes; Special bolts & screws e.g. tapped bolts, collar bolts and studs, pinching screws, cheese headed and round headed screws; Various types of locking arrangements of nuts. **-9 hrs**.

REFERENCES:

1. M. B. Shah and B.C. Rana, "Engineering Drawing ", Pearson Education, 2005.
2. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House 46th Edition, 2003.
3. H. G. Beck, "Reed's, Engineering Drawing for Marine Engineers - Volume II".
4. H. Barr & J.G. Holburn "MacGIBBON'S Pictorial Drawing Book for Marine Engineers"

MR272	APPLIED MECHANICS LABORATARY	45 hrs.

1. To verify the Principles of Moment with the help of -(a) Bell Crank Lever & (b) Moments of Stand.
2. To determine the magnitude and nature of forces acting on the different members of - (a) Wall Crank, (b) Shear Leg Apparatus, & (c) Derrick Crane.
3. To determine the reactions of a Loaded Beam.
4. To determine the co-efficient of friction between leather and metal in an inclined plane.
5. To prove that if a system of uniplanar forces are in equilibrium, the links respectively given in magnitude and direction taken in order, from a closed polygon.
6. If any number of forces acting at a point be such that they can be represented in magnitude, direction and sense by the sides of a closed polygon taken in order, then they shall be in equilibrium.
7. To prove in a frictionless simple machine that Mechanical Advantage is the same as the Velocity Ratio.
8. To find out the Mechanical Advantage, Velocity Ratio, Theoretical Effort, Efficiency, Friction, the Equation giving the relation between Load and Actual Efforts, and draw graphs with load as base for
   (i) Efficiency,
   (ii) Actual Effort,
   (iii) Mechanical Advantage and
   (iv) Friction for the following machines:

(a) Screw Jack;
(b) Worm and Worm Wheel;
(c) Compound Wheel and Axle;
(d) Single Purchase Crab and
(e) Double Purchase Crab.

9. To verify that the efficiency of a square thread is greater than that of V-thread.

10. To verify that - El x E2 E3
    Where- E1 = Efficiency of Simple Screw Jack;
    E2 = Efficiency of Worm Wheel; and
    E3 = Efficiency of Combined Screw Jack and Worm Wheel.

11. To determine the value of 'g' (acceleration due to gravity) by means of -
    (a) Atwoods Machine and (1) Fletcher's Trolley.
12. To determine the Moment of Inertia and Radius of Gyration of a Fly Wheel.

MR273	WORKSHOP PRACTICALS-II	90 hrs.

Machine Shop (Lathe Work):

Prepare a job piece which consist of following operations :
Straight Turning.
A Step Pulley.
Straight turning, under-cut with taper & threads.
Stepping down with knurling operation.
Taper turning and inside boring.
Making of hexagonal end with under-cut taper turning and thread cutting.

Welding Shop:

Half V-welding (from top face)
Full V-welding (from top face)
Double V-welding (on opposite faces)
Half U-welding (from top face)
Double U-welding (on opposite faces)
T-welding (on inner side)
T-welding (both inner sides)
T-welding (both outer sides)
L-welding (outside corner)
L-welding (inside corner)
Angular welding (both sides)

General Overhauling Work:

Dismantling, refitting and studying of various valves including return-type and non-return type valves.

Overhauling of a Globe Valve.
Dismantling, refitting and studying the operation of a Sluice Valve.
Overhauling of a Steam stop Valve.
Cutting of joints and packing for various uses.

Miscellaneous Work:

Two projects related to modern onboard systems under above mentioned workshops.

CS275	COMPUTER LABORATORY - I	30 hrs.

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table Creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing — Flow chart

b) Preparation of Spread Sheet

1. Chart — Line, XY, Bar and Pie.
2. Formula — Formula editor.
3. Spread sheet — inclusion of object, Picture and graphics, protecting the document and sheet.
5. Sorting and Import/Export Features

c) Simple C Programming*

1. Data Types, Expression Evaluation, Condition Statements.
2. Arrays
3. Structures and Unions
4. Functions

d) Modern Programming language used for ship systems.

e) Most popular programmes used for ship specific activities like inventory control.

[All topics which are taught in theoretical classes should also be discussed in the computer laboratory].

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

DEPARTMENT OF MARINE ENGINEERING

B.E. MARINE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER III

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MA210	Computational Mathematics	3	1	0	4
2.	EC224	Electronics	4	0	0	4
3.	MR211	Applied Thermodynamics - II	2	1	0	3
4.	MR212	Strength of Materials – II	3	1	0	4
5.	MR213	Mechanics of Machines - I	3	1	0	3
6.	MR214	Electrical Machines - I	3	1	0	4
7.	MR215	Marine Engineering Drawing	1	2	0	2
PRACTICAL						
8.	EC294	Electronics Laboratory	0	1	2	2
9.	CS283	Computer Laboratory - II	0	1	2	2
10.	MR274	Workshop Practicals – III	0	0	4	2
TOTAL			19	9	8	30

MA210	COMPUTATIONAL MATHEMATICS	60 Hrs.

AIM: To impart the knowledge to the students, on various computational methods.

UNIT – I

SAMPLING THEORY, CURVE FITTING, REGRESSION AND CORRELATION

Population and Sample, Sampling with and without replacement, Random Samples, Population parameters, sample statistics, samples mean, sampling distribution of means, sample variance, mean, variance and moments for grouped data.

Curve fitting, the method of least squares, the least squares line, least square line in terms of Sample variance and covariance, regression lines, regression coefficients, the least square parabola, multiple regression, standard error of estimate, linear correlation coefficient, Probabilistic interpretations of regression and correlation, interpretations of regression and correlation. **-12 hrs**

UNIT – II

DIGITAL MATHEMATICS, LOGIC CIRCUITS

Binary codes: Weighted and Non weighted Binary codes, Error detecting code, Error correcting codes, Alphanumeric codes. Basic logic gates: AND or NOT gates, combining logic gates, NAND, NOR, Exclusive-OR, Exclusive-NOR gates, converting gates with inverters.

Sum of products Boolean expressions, Product-of-sums Boolean expressions use of De Morgan's theorems, use of NAND logic, USE of NOR logic Numerical Analysis. **-12 hrs**

UNIT – III

THE CALCULUS OF FINITE DIFFERENCES - I

Differences of a function, Fundamental operators of the calculus of finite differences, Algebra of Finite Difference operators, Fundamental equations satisfied by Finite Difference operators, Difference tables, Derivative of a tabulated function, Intergal of a tabulated function, Summation formula. **-12 hrs**

UNIT – IV

THE CALCULUS OF FINITE DIFFERENCES - II

Difference equation with constant coefficients, Applications to oscillations of a chain of particles connected by strings and an electrical line with discontinuous leaks, Interpolation formulae, Newton's divided difference formula, Lagrange Interpolation formula, Forward & Backwards Gregory-Newton interpolation formulae, Stirling interpolation formula. **-12 hrs**

UNIT – V

COMPUTING

Design of efficient algorithms for problems like-factorial of a positive integer, Fibonacci sequence generation , Sin x, Cos x, ex series summation Linear search problem, Bubble sort problem, Merging Problem, Calculation of computational complexity. **-12 hrs**

REFERENCES:

1. Numerical Methods for Engineering & Scientific Computation – by Jain, M. K. Iyanger, S. R. K. Jain.
2. Numerical Methods for Engineers – by Chapra S. C. Canale R. P.
3. Grewal, B. S. Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi, 2004.

EC224	ELECTRONICS	60 Hrs.

AIM: To familiarize the student with the principles of operation of various electron devices so that he will be able to use these devices effectively.

UNIT – I

TRANSISTORS: The transistor as an amplifier, Stabilized biased circuits, Self biased and potentiometer biased, low and high frequency Respons4e, Response of Transistor Amplifiers, Effect of negative & positive feedback in transistor amplifier, JFET & MOSFETS, BJT, UJT.

Regulated Power Suppliers: Series Regulators, Shunt Regulators, PNM regulators, etc. **- 12 hrs**

UNIT – II

OSCILLATORS: Requirements for Oscillations, phase shift Oscillator, Wien Bridge Oscillator, Crystal Oscillators, Decoupling Filters.

TRANSISTOR POWER AMPLIFIER: Design theory, Basic Complementary symmetry, Practical complementary push-pull amplifier, Transistor. Phase inverter Relation between Maximum output power and load resistance and Transistor dissipation.

WAVE SHAPING AND SWITCHING: Clippling, Clamping, time base or Sweep Generator, Multivibrators & Schmitt Triggers.

OPERATION AMPLIFIER THEORY: Concept of Differential Amplifiers. Its use in DP-AMPS. Linear OP-amp circuits. **16 hrs**

UNIT – III

DIGITAL CIRCUITS: Logic systems and Gates. Binary and BCD codes, Boolean Algebra, Simplifications, Flip-flops; counters; Registers and Multiplexers.

CONVERTERS (A-D & D-A): Analog to Digital and Digital to Analog Convertors and their use in Data-Loggers. **10 hrs**

UNIT – IV

TTL & CMOS GATES: Digital Integrated Circuits, Semi-conductor Memories-ROM, RAM & PROM.

INDUSTRIAL ELECTRONICS: Power rectification, Silicon Control rectifier power control, Photo Electric Dev ices, Invertors. **10 hrs**

UNIT – V

COMMUNICATION: Modulation, Demodulation, AM/FM/PM Wireless, Radio Transmitters and Receivers, T-V Radar, Pulse Communication.

ELECTRONIC INSTRUMENTS: Cathode Ray Oscilloscope, Digital Voltmeters and frequency-meters, Multi-meters; Vacuum Tube voltmeter and signal Generators, Q-meters.

MICROPROCESSORS: 8085 Architecture – Programming – interfacing and Control of motors-Temperature/Speed control **12 hrs**

REFERENCES:

1. Power Electronics : P.S. Bhimbra
2. Digital Principles & Applications : Malvino Leach.
3. Microprocessors & Microcomputers : Ramesh Gaonkar.

MR211	APPLIED THERMODYNAMICS - II	45 Hrs.

UNIT 1

FUELS, COMBUSTION & DISSOCIATION: Definition of Fuel, combustion, Combustion equation, Analysis of the Products of combustion, stoichiometric combustion, Actual combustion, Excess Air, Mixture strength, Dissociation. Effect of Dissociation on I.C. Engines. **- 8 hrs**.

UNIT 2

GAS DYNAMICS: One dimensional steady flow of compressible fluids, Isentropic flow, Effect of friction, Flow through nozzles and Diffuser. Critical Condition, Mach number, Subsonic, Sonic and Supersonic flow. Flow of steam through Nozzles and Diffusers. **- 8 hrs.**

UNIT 3

STEAM TURBINES: General Principles of Impulse and Reaction Turbines – Velocity Diagrams for simple Impulse and Impulse-Reaction turbine. Compounding of Impulse turbine-Pressure and velocity compounding. Force on blades, work done by blades, Axial thrust, Blade or Diagram efficiency, Effect of friction on blades, Applied Problems **- 9 hrs**.

UNIT 4

REFRIGERATION: Reversed Carnot cycle, Vapour compression cycles, Refrigerating effect, Coefficient of Performance, cooling capacity, rating of a refrigerating plant, Methods of improving COP, Use of vapour tables, Applied Problems.

Typical Marine refrigerating plants with multiple compression and Evaporator system, Refrigeration in Liquefied gas carriers. **- 9 hrs**.

UNIT 5

TRANSMISSION OF HEAT: Fourier's Law of heat conduction. Thermal conductivity of insulating materials. Conduction through flat & cylindrical, spherical surfaces in series. Heat transfer from fluids to fluids through walls. Application of Heat transfer in

Marine Heat exchangers, like coolers, Heaters, Condensers. Pre-diction of convective Heat Transfer rates. Use of Non-dimensional groups.
Prandtl No. Nusselt No. Reynolds No. Stanton No. Grashof No. Graetz No. etc, Natural and Forced Convection. **- 11 hrs**.

REFERENCES:

1. Applied Thermodynamics for Engineering & Technologists T.D. Eastop & A. McConkey
2. Applied Thermodynamics J.B.O. Sneeden & S.V. Karr.
3. Basic Engineering Thermodynamics Joel Rayner.
4. Heat Engines P.L. Ballaney
5. Thermodynamics – Applied o heat Engines E. H. Lewitt.
6. Heat & Thermodynamsics Mark W. Zemansky & Richard H. Dittman

MR212	STRENGTH OF MATERIALS - II	60 Hrs.

AIM:

- To make the student learner, able to determine various stresses and strains in simple and composite members under external load, strength of simple connections and strain energy stored in members.
- To make the student learner able to design beams which can resist bending and shearing stresses and to teach the concept of principal stresses and maximum shear stresses.
- To teach the students to calculate the shear force and bending moment for the various types of statically determinate and indeterminate beams and the method of drawing the SFD and BMD.
- To make the student learner able to calculate the calculate the deflections caused by the application of loads and design of solid, hollow shafts, open coiled and closed helical springs based on shear and bending.

UNIT 1

DEFLECTION OF BEAMS: Strain energy due to bending. Application of impact. Deflection by integration, Macaulay's Method. Moment area method of deflection co-efficients. Deflection due to shear, Deflection by graphical method. Applied problems.

-15 hrs.

UNIT 2

BUILT –IN AND CONTINUOUS BEAMS: Moment-area method, built-in beam with central concentrated load, built-in beam with uniformly distributed load, with load not at center, Macaulay's method, Continuous beam, Claperyrons three moment theorem. Applied problems. **-12 hrs**.

UNIT 3

THIN CURVED BAR: Strain energy due to bending castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems. **- 6 hrs**.

THICK CYLINDERS: Thick cylinders, Lame's theory, compound cylinders, Solid shaft subjected to radial pressure, shrinkage allowance. Applied problems. **- 8 hrs**.

UNIT 4

STRUTS: Euler's theory and Euler's bucking load. Struts with both ends pin joined, both ends fixed, one end fixed and one end free, one end hinged. Pin joined strut with eccentric load, rankine-gordon formula. Applied problems. - **10 hrs**.

UNIT 5

COMPOUND STRESS AND STRAIN: Stresses on an oblique section, general two dimensional stress system, Materials subjected to direct & shear stresses, Principal plane & principal stresses. Strain on an oblique section. Determination of principal strains. Principal strains in 3-dimensions. Principal stresses determined from principal strains. Mohr's diagrams for stress, strain and strain rosette. Combined bending and twisting, Equivalent bending moment and torsion, shear, bending and torsion, theories of failure.

- 9 hrs.

REFERENCES:

1. Strength of materials G.H. Ryder
2. Strength of materials Stephen Timoshenko
3. Strength of materials R.K. Rajput

MR213	MECHANICS OF MACHINES - I	45 Hrs.

AIM: To impart the knowledge of velocity and acceleration of various kinematic linkages, cam profiles for different cam followers, various parameters of gears and gear train.

UNIT 1

TURNING MOMENT & FLYWEEL: Function of a flywheel. Crank effort diagrams. Fluctuation of speed and energy. Effect of centrifugal tension on flywheel, inertia torque and its effects on crank effort diagrams. **- 8 hrs**.

UNIT 2

KINEMATIC'S AND LINK-MECHANISMS: Relative motion between bodies moving in different planes. Instantaneous centre method; Rubbing velocities at pin joints. Graphical construction for relative velocity and acceleration in different link and sliding mechanisms. Analytical determination of velocity and acceleration. Forces in crank and connecting rods. Inertia force o link connecting rod etc. Effect of friction. **-11 hrs**.

UNIT 3

CAM: Types of cams and followers. Specified motion of followers. Uniform acceleration and deceleration, SHM. And uniform velocity Graphical construction of Cam-profile.

Analytical design procedure for cams with Straight flank, Curved flank,Circular flank with various types of followers spring force and reaction torque. In line cams and off center cams. **- 8 hrs**.

UNIT 4

SPUR GEARING: Various definition e.g. p.c.d., profile of gear teeth, module, path of contact, velocity of sliding, interference, Gear ratio and center distance of simple and compound gear trains.

TOOTHED GEARING: Types of gears, conditions for transmission of constant velocity ratio; methods of avoiding interference; Transmission of power by gear trains on parallel shafts; Rack and pinion, bevel gears, Worm and worm wheel, Spur gear Helical gears, Spiral gears; Epicyclic gear trains, acceleration of gear trains. **- 11 hrs**.

UNIT 5

GYROSCOPE: Gyroscopic couple, vector representation of torque and angular momentum, steady rectangular precession, vector treatment; Steady conical precession; Motion involving steady Precession; Application to ship's stabilization, reaction on gearbox bearings & other bearings. **- 7 hrs**.

REFERENCES:

1. Advanced Mechanics of machines – J.Hannah & R.C. Stephens
2. Theory of machines – P.L. Ballaney
3. Engineering Mechanics – S. Timoshenko & D.H. Young

MR214	ELECTRICAL MACHINES - I	60 Hrs.

AIM: To introduce the concept of operation and construction of DC machines and transformers.

UNIT-1

DIRECT CURRENT MACHINES

Principle of working, construction, winding, e.m.f. equation. Armature reaction, commutation, brush shift, compensating winding etc. **– 8 hrs.**

UNIT-2

DC GENERATOR

D.C. generator, their characteristics, methods of excitation, parallel operation, equalizer busbar, performance equations. **- 12 hrs**.

UNIT-3

DC 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 losses and efficiency, braking of D.C. motor. **- 12 hrs**.

UNIT-4

TRANSNISSION & DISTRIBUTION

D.C. & A.C. transmission and distribution-two wire and three wire D.C. system, use of balancer, A.C. transmission single phase and three phase, three wire and four wire distribution, comparison of D.C. & A.C. transmission, effect of voltage drop, copper utilization under different systems, single and double fed distributors, fuses, D.C. air circuit breaker, A.C. air and oil circuit breakers. **- 12 hrs**.

UNIT-5

TRANSFORMER

Transformers – Principle of action, e.m.f. equation, phasor diagrams for no load and load conditions, useful and leakage flux, leakage reactance, equivalent circuits, voltage regulation, losses and efficiency, open circuit and short circuit and short circuit tests, parallel operation, three phase transformer – core and shell type transformer, current and potential transformer, auto-transformer (single phase and 3 phases) **- 16 hrs**.

REFERENCE BOOKS:

1. Electrical Technology Hughes Edward
2. Electricity applied to Marine Engineering W. Laws
3. Electrical Power S. Uppal

MR215	MARINE ENGINEERING DRAWING	60 Hrs.

MACHINERY COMPONENTS DRAWING: Drawing of complete machine components in assembly (Orthographic to Orthographic and Isometric to Orthographic) with details like couplings, Glands, Return and Non-return valves, cocks & plugs.

- 30 hrs.

MARINE MACHINERY COMPONENTS & ASSEMBLY DRAWINGS: Assembly Drawing of Marine components in Orthographic projection from Isometric views eg. Bilge Suction Strainer Boxes, Ship's side discharge valve chest, cylinder relief valve, control valve, oil fuel strainer, Parallel slide stop valve, Ballast chest for oil or water, feed check valve, Gear pump, control valves, Boiler blow-down valves, Diesel Engines' rocker arms, cylinder liner, connecting rod with bearings, Full bore Boiler safety valve, Hydraulic Exhaust valve. (Minimum of 9 drawings to be completed in the class Remaining drawings to be given as home assignment) **- 30 hrs**.

REFERENCES:

1. MacGIBBON'S Pictorial Drawing Book for Marine Engineers H. Barr & J. G. Holburn
2. Reed's Engineering Drawing for Marine Engineers – Volume II H.G. Beck.

EC294	ELECTRONICS LABORATORY	36 Hrs.

To study the characteristics of Thermistor..
To study the Volt-Amphere characteristic of Field effect Transistor.
To study the characteristics of Silicon Controlled Rectifier.
To study the Transistor Bias stability.
To study the Transistor Feed Back Amplifier.
To study the Integrated Circuit operational Amplifier.
To study the Integrating, Differentiating Clamping and Clipping Circuit.
To study the Logic Training Board.
To study the speed control of a D.C. Motor by Thyristor.
Assembling electronic components as per given circuit on circuit board.
Study electronic PID controller.
Study PCB of High Temperature alarm system.
Study PCB of High level alarm system.
Study PCB of other alarm systems like heat, smoke, pressure, rpm.

CS283	COMPUTER LABORATORY - II	54 Hrs.

1. **UNIX COMMANDS**
   Study of Unix OS – Basic Shell Commands – Unix Editor.

2. **SHELL PROGRAMING**
   Simple shell program – Conditional Statements – Testing and Loops

3. **C PROGRAMMING ON UNIX**
   Dynamic Storage Allocation – Pointers – Functions – File Handling.

4. **MATLAB**
   a) Generation of periodic, exponential, sinusoidal, damped sinusoidal, step and impulse.
   b) Ramp signal using MATLAB in both discrete and analog form.
   c) Evaluation of convolution integral, Discrete Fourier transform for periodic and non periodic.
   d) Signals and simulation of difference equations using MATLAB.
   e) Cascade connection of second order system using MATLAB.
   f) Determination of Laplace Transform and inverse Laplace transform using MATLAB.
   g) Programs to implement structure union and function.

5. **OPERATING SYSTEM** presently in use in the Industry. Modern Engineering Programming Language.

MR274	WORKSHOP PRACTICALS - III	54 Hrs.

Study of workshop layout.
Steam & Exhaust line Tracing.
Feed & Condensate line Tracing for the steam Engine Plant.
Cooling Water & Fuel line Tracing for the steam Engine plant.
Smoke tube Boiler familarisation.
Globe valve overhauling.
Sluice valve overhauling.
Non-return Globe valve overhauling.
2 Way/3 Way cock overhauling.
Shaft Key making.
Thread cutting by Taps and Die.
Thread cutting by Lathe Machine.
Other important “jobs that may be introduced as per current trend to keep student abreast with latest.

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

DEPARTMENT OF MARINE ENGINEERING

B.E. MARINE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER IV

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR216	Ship Structure & Construction	4	0	0	4
2.	MR217	Marine Boilers & Steam Engineering	4	0	0	4
3.	MR218	Mechanics of Machines – II	2	1	0	3
4.	MR219	Electrical Machine - II	3	1	0	4
5.	MR220	Fluid Mechanics - I	3	1	0	4
6.	MR221	Marine Heat Engines & Marine Air Conditioning	3	1	0	4
7.	MR222	Practical Marine Automation	2	0	0	2
PRACTICAL						
8.	MR275	Heat & Boiler Chemical Laboratory	0	0	4	2
9.	MR276	Workshop Practicals - IV	0	0	4	2
10.	EI280	Control Engineering Laboratory	0	0	2	1
TOTAL			21	4	10	30

MR216	SHIP STRUCTURE & CONSTRUCTION	60hrs.

AIM: To impart the knowledge on construction of ships and ships terms and stresses in ships, primary and secondary girders used in ships.

UNIT-1

SHIPS TERMS: Various terms used in ship construction with reference to Ship's parameter eg. L.B.P., LOA, Moulded depth, Moulded draught, and other similar terms, General classification of Ships. .

STRESSES IN SHIP'S STRUCTURE: Bending, Shear, Hogging, Sagging, Racking, Pounding, Painting, etc., and Strength member to counteract the same.

SECTIONS AND MATERIAL USE: Type of section like Angles, Bulb Plates, Flanged beams used in ship construction. Welding techniques and machines for ships building process. Testing of welds. Fabricated components. **- 13 hrs**.

UNIT-2

BOTTOM & SIDE FRAMING: Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tank side brackets, Beam Knee, Web frame, etc.

SHELL & DECKS: Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, mid-ship Section of ships **- 13 hrs**.

UNIT-3

BULK HEADS & DEEP TANKS: Water tight bulkheads, Arrangements of plating and stiffeners Water tight sliding doors, water tight openings through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads.

FORE-END ARRANGEMENTS: Stem construction, arrangements to resist panting, panting stringers, Forepeak – Collision bulk heads, Bulbous bows. Anchor and cable arrangements

AFTER-END-ARRANGEMENTS: Types of sterns, Stern frame and rudder. Types of rudder, Supporting of rudder, Locking pintle, Bearing Pintle, Pallister bearing, Shaft tunnel, Tunnel bearing. **- 15 hrs**.

UNIT-4

LOADLINE AND TONNAGE: Definition of freeboard and various assigning conditions, List of closing appliances, Loadline Surveys, Tonnage regulations, calculation as per latest convention, details of markings permanently carved.

SHIPYARD PRACTICE: Layout of a shipyard, Mould loft fabrication of assembly, subassembly units in construction, role of Surveyors in construction of Ship; Keel laying, Launching, Sea trial. Use of computers in ship design with cost implication **- 9 hrs**.

UNIT-5.

SHIP TYPES: Tankers, bulk carriers, container ships, car carriers, LNG, LPG and chemical carriers, Lash ships, Passenger ships, Dredger, Tugs, etc – constructional details and requirements

OFFSHORE TECHNOLOGY: Drilling ships and platforms, supply/support Vessels-types and constructions, Dynamic positioning, Deep sea diving system.
SHIP SURVEYS: Survey rules, Functioning of ship classification Societies, Surveys during construction periodical surveys as per statutory regulations, harmonization of survey, retention/suspension of class of a ship, constructional features and rule guidelines for a merchant vessel as per SOLAS, Marpol regulations, IDB and IGC. .
Statutory Certificates and their validity, ships registration formalities, Intact Stability Criteria under damage conditions (constructional point of view in compliance with statutory regulations), enhanced. Survey requirements, HSSC, CAS. **- 10 hrs.**

REFERENCE:

1. Ship Construction REEDS Vol. – 5.
2. Ship construction Munro & Smith
3. D.J. Eyres "Ship construction", 4th Edition, Butter Worth – Heinemann, Oxford 1994
4. Merchant Ship Construction H.J. Pursey.
5. Merchant Ship Construction D.A. Taylor.
6. Principles of Naval Architecture – SNAME Publication.

MR217	MARINE BOILERS & STEAM ENGINEERING	60 hrs.

AIM: To impart the knowledge of Boiler & Boiler Mountings, steam turbines and steam engines to the students.

MARINE BOILERS (25 hrs.)

UNIT 1
SMOKE TUBE BOILERS: General Considerations governing the design of Boilers, Types of Marine Boilers, comparison of smoke tube and water tube boilers; Various types in Marine use, Principal dimensions and staying of flat surface of multi tubular cylindrical Boilers. Vertical Auxiliary Boilers.
WATER TUBE BOILERS: General description with sketches of principal types of boilers in Marine use, Super heater, Economizer, Air pre-heater & Steam Pre-heater; Circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control Attemperators and De-superheaters.
WASTE HEAT BOILERS: Waste heat recovery calculation, exhaust gas boiler. Scotch composite Boiler, Cochran exhaust gas and composite boiler, Spanner marine exhaust gas and Composite boiler. Forced water circulation boiler, Double evaporation Boilers.

– 10 hrs.

UNIT 2
BOILER MOUNTINGS: Safety Valves – Improved High lift, Full lift and full Bore type: gauge glass – Ordinary plate type and remote Indicator; Automatic feed regulator,

three element High & Low water level alarms, Main Steam stop valves, Retractable type soot blower etc.,

OPERATION, CARE & MAINTENANCE: Pre-commissioning procedures, steam raising and Operating procedures, Action in the event of shortage of water. Blowing down of boiler, Laying up a boiler; general maintenance, External and internal tube cleaning. Tube renewals, etc. maintenance, inspection and survey of boilers.

REFRACTORY: Purposes of refractory, types of refractory and reasons for failure;

OIL BURNING PROCESS: Procedure of Liquid fuel burning in open furnace. Various types of atomizer. Furnace arrangement for oil burning. Boiler control system i.e. master control, fuel control, air control and viscosity control.

TESTS ON BOILER: Destructive and Non destructive tests on plates, rivets, welded seams, classification societies requirements for boilers construction, Hydraulic tests. **- 15 hrs.**

MARINE STEAM ENGINEERING (35 hrs.)

UNIT 3

STEAM ENGINES: Multiple expansion Marine reciprocating engines & steam turbines. Description of different types of Steam turbines

LAYOUT OF PLANT: General layout of plant & description of a modern geared steam turbine installation including auxiliaries in Modern use;

CONSTRUCTIONAL DETAILS: Types of blades, method of fixing, solid built-up & drum rotor for impulse and reaction turbines, castings for HP and LP impulse and reaction turbines, diaphragms, nozzles glands, carbon glands labyrinth packing glands, main bearings and thrust bearings. **- 15 hrs**.

UNIT 4

LUBRICATION OF TURBINES: Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication – oil system and emergency lubrication arrangement.

REDUCTION GEARS: Reduction ratio, type of gear teeth, gear construction – various arrangement of marine gearing, gear defects, flexible coupling, quill shaft

CONDENSERS: Shapes and types of condensers, constructional details, location & method of securing, working principles, contraction and expansion allowance, leak test. Effect – change of temperature, circulating water quantity, change of main engine power, condenser surface. **- 8 hrs**.

UNIT 5

OPERATION AND MAINTENANCE: Turbine drain system, turbine gland steam, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls, emergency operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and fault finding

ALIGNMENT CHECKING: By bridge gauge and poker gauge, allowances for expansion, sliding foot, thrust bearing static and dynamic balancing.

SELECTION OF MATERIALS: Materials used in various components like blades, rotors, castings, sealing glands, gears etc & their justification **- 12 hrs**.

REFERENCES:

1. Marine Steam Boilers J.H. Milton.
2. Marine Boilers G.T.H. Flanagan.
3. Running & Maintenance of Marine Machinery I.M.E. Publication.
4. Steam Turbine Theory & Practice J. Kearton.
5. Boiler Plant Instrumentation Kent Gunn.
6. Boiler Control System David Lindsley.

MR218	MECHANICS OF MACHINES - II	45 hrs.

AIM: To impart the knowledge to the student on Balancing, Vibrations: Torsional, Forced and Transverse.

UNIT 1

BALANCING: Balancing of masses rotating in different planes, dynamic forces at bearings; Primary and Secondary balance of multi-cylinder in-line engines and configurations. Primary and secondary balance of multi-cylinder V-type engines and configurations. **- 11 hrs**.

UNIT 2

VIBRATION: Free Harmonic Vibrations, Linear motion of an elastic system, Angular motion of an elastic system. Differential equation of motion. Free vibration of springs in series and parallel. Simple and Compound Pendulums. Single and two degrees of freedom. **- 7 hrs**.

UNIT 3

TRANSVERSE VIBRATIONS OF BEAMS: Single concentrated load, effect of the mass of the beam, Energy method – several concentrated Loads, uniformly distributed load, Dunkerley's empirical method for several concentrated loads.

FORCED VIBRATIONS: Forced Linear and angular Vibrations, Periodic force transmitted to support, Periodic movement of the support.

WHIRLING OF SHAFTS: Whirling of shafts, critical speed, effect of slope of the disc, effect of end thrust. **- 11 hrs**.

UNIT 4

TORSIONAL VIBRATIONS: Single rotor system, rotor at end and rotor in the middle. Effect of inertia of shaft, Two rotor system, rotors at both ends and rotors at one end. Three rotor and multi rotor system. Torsionally equivalent shafts, Geared system **- 7 hrs**.

UNIT 5

DAMPED VIBRATIONS: Idea of Viscous and Coulomb damping, Linear and angular vibrations with viscous damping, Forced damped linear and angular Vibrations, Periodic movement of support.

FORCED DAMPED VIBRATION: To write differential equation of motion and find amplitude, frequency, etc. **- 9 hrs**.

REFERENCES:

1. Advanced Mechanics of Machines J. Hannah & R.C. Stephens.
2. Theory of Machines P.L. Ballaney.
3. Engineering Mechanics S. Timoshenko & D.H. Young.

MR219	ELECTRICAL MACHINE - II	60 hrs.

AIM: To impart the knowledge on AC motors and alternators.

UNIT-1
THREE PHASE INDUCTION MOTOR
Three phase induction motor – principle of operation and theory of action, slip speed, rotor to stator relationship, rotor frequency, rotor e.m.f. and current, equivalent circuit relationship between rotor IR loss and the rotor slip, torque/slip characteristics, starting torque and maximum running torque, reversing, speed control of induction motor, starting of induction motor, method of starting D.O.L, Star/Delta, Auto, Testing of motor, use of circle diagram. **-15 hrs**.

UNIT-2
SINGLE PHASE INDUCTION MOTOR
Single phase induction motor – principle and operational characteristics, starting control, constructional details. **- 8 hrs**.

UNIT-3
ALTERNATORS
Alternators-general arrangement of alternators, construction of salient pole and cylindrical-rotor types, types of stator windings, single and double layer windings, e.m.f. equation of an alternator, distribution and pitch factor, waveform of generated e.m.f., alternator on load, percentage regulation, internal voltage drop, production of rotating magnetic field, resultant magnetic field distribution, mathematical derivation of the rotating field condition, magneto motive force or ampere-turn waveform distribution, reversal of direction of rotation of rotating field. **- 16 hrs**.

UNIT-4
SYNCHRONOUS ALTERNATOR
Armature reaction in synchronous alternator, armature reactance, prediction of voltage regulation, open circuit test, short circuit test, synchronous impedance, torque/angle characteristics, infinite busbar, synchronizing current, torque and power hunting of phase swinging, parallel operation of alternators, a.c. generators in parallel-excitation control, throttle control, load sharing – KW and KVA **- 12 hrs**.

UNIT-5

SYNCHRONOUS MOTOR

Principle of action of three phase synchronous motor, effect of varying load and excitation, methods of starting, advantages and disadvantages of synchronous motor.

- 9 hrs.

REFERENCES:

1. Electrical Technology Hughes Edward.
2. Electric Motor drives Berde.
3. Electricity applied to Marine Engineering W. Laws.

MR220	FLUID MECHANICS - I	60 hrs.

AIM: To impart the knowledge of Fluid properties and effect of various forces acting on different places and surfaces, the Inviscid flow and real viscous flow.

UNIT 1

INTRODUCTION: Definition of Fluid. Different properties, i.e. Capillarity, Surface tension, viscosity, etc.

DIMENSIONAL ANALYSIS & DYNAMICAL SIMILARITY: Use of Dimensions for finding conversion factors; Dimensions of common quantities; Dimensions equations; Method of finding dimensionless groups; Geometrical and dynamical similarity, General principle; Dynamical similarity problems. **- 10 hrs**.

UNIT 2

HYDROSTATICS: Equilibrium of floating bodies; Fluid pressure; measurement of pressure; total thrust due to liquid pressure on immersed plane surface, curved surfaces, centre of pressure; total force and center of pressure on immersed surfaces such as tanks bulkheads, lock gates, manhole doors etc. **- 12 hrs**.

UNIT 3

FLUID IN MOTION: Energy of flowing fluid, pressure energy, potential energy, kinetic energy; total energy; Bernoulli's Equation for steady motion; Variation in pressure head along a pipe. Measurement of pipe flow rate by venturimeter, Discharge through a small orifice under a constant head; Coefficient of discharge for a small orifice, Experimental determination of orifice co-efficient. Power of a jet; Force exerted by a jet normal to a stationary or a moving flat vane; Jet inclined to a stationary or moving flat vane. **- 12 hrs**.

UNIT 4

FLOW THROUGH PIPES: Losses of energy in pipe lines; Losses due to sudden increase in pipe diameter, Losses due to sudden contraction in diameter, Friction losses, Shock losses, Derivation of darcey's and Chezy's formula; Parallel flow through pipes; transmission of power by pipe line; Condition for maximum power transmission. Time required to empty reservoirs of various shapes flow from one reservoir to the other reservoir; Inflow and Outflow. **- 12 hrs**.

UNIT 5

FLUID FRICTION, VISCOUS AND LAMINAR FLOW: Resistance co-efficient, variation of resistance co-efficient with Reynold's number; oiled bearings; Viscous flow; Flow between parallel planes; Critical velocity; Viscous flow in pipes, Power required for viscous flow.

VORTEX MOTION & RADIAL FLOW: Real & Ideal Fluid flow; steady & unsteady flow. Two dimensional flow theory, forced vortex, free vortex, Radial flow free spiral vortex, Compound Vortex. Illustrative problems related with centrifugal pumps and separators. **- 14 hrs**.

REFERENCES:

1. Hydraulics and fluid mechanics P.N. Modi & S.M. Seth.
2. Fluid Mechanics & Hydraulic Machines R.K. Rajput.
3. Fluid Mechanics (Part – I & Part – II) J.F. Douglas.
4. Fluid Mechanics & Hydraulic Machines R.K. Bansal.

MR221	MARINE HEAT ENGINES & MARINE AIR CONDITIONING	60 hrs.

AIM: To impart the knowledge on Steam Turbines, Power Plants and Nozzles and Basic Principles of Heat Transfer.

UNIT 1

STEAM TURBINES: Compounding of Steam Turbine – pressure compounding velocity compounding and pressure velocity compounding of Impulse turbines, conditions for maximum Energy transfer in above cases, Impulse-reaction and Parson's turbine. Degree of reaction, condition for maximum Energy transfer in Reaction turbines, Stage efficiency, overall efficiency and reheat factor, condition curve. **- 14 hrs.**

UNIT 2

VAPOUR POWER CYCLES: Carnot's cycle, Rankine cycle, Modified Rankine cycle, super heat cycle reheat cycle, regenerative cycle, Binary vapour cycle and its effect on Thermal Efficiency, Steam machinery plants, combined Steam & gas plant, calculations. **– 12 hrs.**

UNIT 3

GAS TURBINE PLANTS: Constant volume or Explosion cycle gas turbine plant, constant pressure cycle or Joule – Brayton cycle Gas turbine plant simple C-B-T cycle, condition for maximum work output and thermal efficiency in simple cycle, Methods of improvement of Thermal efficiency and work ratio of gas turbine plants. C-B-T-H cycle, complex cycles, closed cycle operation of Gas turbine plants, their merits and demerits. Total head or stagnation conditions. **- 10 hrs**.

UNIT 4

AXIAL FLOW COMPRESSOR: Principle of centrifugal compression and pressure rise in centrifugal compressor, change in Angular momentum. Pre-whirl and Pre-whirl vanes.

Mach number at inlet to a centrifugal compressor, slip and slip factor, multi-stage centrifugal compressor. **- 8 hrs**.

UNIT 5

MARINE REFRIGERATING AND A/C PLANTS: Typical marine refrigerating plants with multiple compression and Evaporator system. Heat pump cycles, refrigeration in liquefied gas carriers. Refer ships, refer containers. Applied Problems. Principle of Air conditioning, psychometric properties of air comfort conditions, control of humidity, Air flow and A.C. capacity calculation for ship plants. **- 16 hrs.**

REFERENCES:

1. Heat Engines P;L. Ballaney.
2. Thermodynamics applied to Heat Engines E.H. Lewitt.
3. Applied Thermodynamics for Engineering Technologists T.D. Eastop & McConkey.
4. Applied Thermodynamics J.B.O. Sneeden & S.V. Karr.
5. Tanker Safety Guide Liquefied Gas - International Chamber of Shipping.

MR222	PRACTICAL MARINE AUTOMATION	36 hrs.

AIM: To enable a student to acquire basic knowledge about ship board automation and be competent for operation and maintenance of control equipments.

UNIT 1

AUTOMATIC CONTROL THEORY: Process control, Feed back, Closed Loop and Open Loop control, Two step (On-Off) control, Modulating control, Off Set or Droop, Desired Value, Set value, Proportional Integral and Derivative control, Proportional Band, Split Range, Ratio and Cascade Control, System Response: Distance Velocity, Measurement and Transfer Lags. **- 6 hrs**.

UNIT 2

AUTOMATIC CONTROLLERS: Functions of pneumatic proportional, Integral and Derivative action controllers, Stacked type controllers, Controller adjustments, Relays **- 6 hrs.**

UNIT 3

CORRECTING UNITS AND SIGNAL TRANSMITTING DEVICES: General familiarization with Diaphragm actuators, Valve-positioners, Piston actuators, Electro-pneumatic transducers. Electro-hydraulic actuators and Electric actuator control valves. Flapper Nozzle, Electro Pneumatic Signal converter, Variable Inductance and capacitance transducer, Force Balance Transducer, Synchros. **- 8 hrs**.

UNIT 4

MEASURING DEVICES: Pressure, Temperature, Level and Flow measuring devices. Miscellaneous Instruments; Tachometers (electric and Mechanical), Salinity Indicator, Oil Water Monitor; Photo Electric Cells, Photo Conductive cells, Photo Voltaic Cells, Viscosity Sensors. **- 8 hrs**.

UNIT 5

APPLICATION OF CONTROLS ON SHIPS: Marine Boiler-Automatic combustion control, Air/fuel ratio control, Simple feed water proportional controller, steam pressure control, fuel oil temperature control, Temperature of lubricating oil, Jacket/piston cooling water and scavenge air, fuel oil viscosity control, Instrument for UMS classification, UMS automation & control. **- 8 hrs**.

REFERENCE:

1. Marine Control Practice - D.T. Taylor.

MR275	HEAT & BOILER CHEMICAL LABORATORY	72 hrs.

BOILER CHEMISTRY

1. To determine hardness content of the sample of boiler water in P.P.M. in terms of $CaCO_3$.
2. To determine Chloride content of the sample of water in P.P.M. in terms of $CaCO_3$.
3. To determine Alkalinity due to Phenolphthaline, total Alkalinity and Caustic Alkalinity of the sample of water (in P.P.M.)
4. To determine Phosphate Content of the sample of water.
5. To determine dissolved Oxygen content of the sample of water.
6. To determine Sulphate content of given sample of water.
7. To determine PH-Value of the given sample of water.
8. To determine total-dissolved solids, turbidity of a sample of water.
9. To determine Hydrazine content of boiler water.
10. Study sludges and scale deposit – Silica, volatile and non-volatile suspended matter.
11. Boiler water tests and kits as found in latest types of ships.

FUEL & LUBRICANT CHEMISTRY

1. To determine Absolute viscosity and Kinematic viscosity of Heavy oil, Diesel oil, Fresh Lubricating Oil & used Lubricating oil by Red Wood Viscometer.
2. To determine the Flash Point of a given sample of Fuel & Lubricating oil.
3. To determine water content of used Lubricating oil.
4. Conduct spot test for L.O. and analyse result.
5. To determine the percentage of CO_2, CO and Oxygen in the flue gases.
6. To determine the Calorific value of the fuel with the help of Bomb Calorimeter.

HEAT TRANSFER EXPERIMENTS

1. To determine the Thermal Conductivity of good conductors.

2. To determine the Thermal Conductivity of insulating materials.
3. Heat Transfer through Fins or Extended surface.
4. Heat Transfer through Forced Convection.

MR276	WORKSHOP PRACTICALS - IV	54 hrs.

Rectangular Block making by Shaping Machine.

Key Way making by Milling Machine.

Reciprocating Pump Overhauling.

Centrifugal Pump Overhauling.

Air Compressor Overhauling.

Water tube (Foster Wheeler) Boiler Familiarisation.

Machine Shop Job: Making a specimen for Tensile Test.

Double V Weld.

T-Weld (inner & Outer).

Pipe repair & Fabrication.

Diesel Engine Familiarisation & Overhauling.

Familiarisation with CNC & VMC machines.

Additional practicals to be included to help in understanding of modern day ship systems.

EI280	CONTROL ENGINEERING LABORATORY	18 hrs.

Study of Operation of control equipments:

Operation and utility of a 3 Term (P + I + D) Pneumatic controller for Temperature, Pressure, Flow and Level on SCADA unit.

Operation of Automatic Viscosity Controller.

Operation of boiler automatic controller.

Study hydraulic trainer unit to be familiar with hydraulic equipments.

Study Pneumatic equipments on Pneumatic trainer unit.

To study the functioning of a Mist Detector.

Study the operation of fire detection unit using Ionization chamber type detector.

Study of instruments under “measurement devices”.

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SEMESTER V

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR223	Material Science	3	0	0	3
2.	MR224	Management Science & Economics	4	0	0	4
3.	MR225	Marine Internal Combustion Engine - I	3	0	0	3
4.	MR226	Fluid Mechanics - II	2	1	0	3
5.	MR227	Marine Auxiliary Machines - I	2	1	0	4
6.	MR228	Naval Architecture - I	2	1	0	4
7.	MR229	Elementary Design & Drawing	0	3	0	2
PRACTICAL						
8.	MR277	Material Science Laboratory	0	1	2	2
9.	MR278	Mechanics & Fluid Laboratory	0	1	2	2
10.	MR279	Marine Power Plant Operation - I	0	1	2	2
TOTAL			16	9	6	29

MR223	MATERIAL SCIENCE	45 Hrs

AIM: To impart the knowledge of Metals and alloys, Heat treatment and various testing of Materials.

UNIT 1

STRUCTURE OF ATOM: Electrons and Bonding; wave mechanics and electronic behaviours; Electronic structure of atoms; Covalent bonding; Metallic Bonding; ionic bonding and Secondary bonding. Atomic packing-directionally and non-directionally bonded atoms; Crystal structure-Space lattices; Ionic and molecular crystals; Interfacing in crystals-Points; line, surface and volume imperfections; Non-crystalline solids; Elastomers; Long chain and molecular compounds and three dimensional net work.

- 8 hrs.

UNIT 2

METALS AND ALLOYS: Different types of iron and steel; their manufacture, properties and uses in industry. Alloys of iron and steel. Non-ferrous metals and alloys. Properties and uses Miscellaneous engineering materials; their properties and uses

MISCELLANEOUS ENGG. MATERIALS: Refractories, Insulating materials; Plastics and Rubber; PVC, Resins, Paints etc. Manufacture properties and selection for various engineering applications. Polyurethenefoam. **- 6 hrs.**

UNIT 3

Testing of Materials:

DESTRUCTIVE TESTS: Tensile Test; Compression Test; Hardness Test; Bend Test; Torsion Test & Impact Test. **Non-destructive Tests:** Magnetic Particle Test, Fluorescent Test; Ultrasonic Test, Radiography Test etc.

SOLID SOLUTION: Properties of solid solutions and alloys. Types of Binary alloys, Thermal Equilibrium diagrams, Cooling curves, Eutectic and peritectic alloys, Intermetallic compounds. Allotropy of Iron, Iron-carbon Equilibrium diagrams, T-T-T curve, Equilibrium diagrams for Ferrous and Non-ferrous metals and alloys. **-12 hrs**.

UNIT 4

HEAT TREATMENT: Heat treatment principles and processes and purposes for Ferrous and non-ferrous metals and alloys. Effect on structures and properties. Deformation and Fracture of materials in services.

FATIGUE & CREEP: Fatigue loading, Mechanisms of fatigue, fatigue curve, Fatigue tests. Design criteria in fatigue, Corrosion fatigue. Stress concentration. Creep phenomena and creep-resisting alloys. Creep curve. Short time and long time creep tests. Development of creep resisting alloys. **- 9 hrs**.

UNIT 5

CORROSION AND ITS PREVENTION: Mechanism of corrosion, Chemical corrosion, Electrochemical corrosion, Anodic and Cathodic protection, Forms of metallic coatings. Anodizing, Phosphating.

USE OF MATERIALS IN SHIPBOARD APPLICATION: Chromium, Cermaic, Titanium, PTFE in Shipboard systems. Characteristics of above materials.
Selection of Materials in Shipbuilding & Marine Engineering: Boilers, steam and gas turbine purifiers and Diesel engine components, pumping machinery, Components and other requirement for material test. **- 10 hrs**.

REFERENCES:

1. Metallurgy for Engineers - E.C. Rollason
2. Pounder's Marine Diesel Engines - Doug Woodyard.
3. Material Science - Hazra-Choudhury

MR224	MANAGEMENT SCIENCE & ECONOMICS	60Hrs

AIM: Introduction to Management, Finance, Production and Quality control, HRD etc.

MANAGEMENT SCIENCE
UNTI-I
INTRODUCTION TO MANAGEMENT PRINCIPLES & PRACTICE: Definition and objectives of sound management. Need for Sound Management Principles and Practice & Growth of Modern management thought, Management functions, Process Planning, Corporation/Long term & tactical strategy, Policy distribution, SWOT Analyses, Organizing – definition/illustrations, Staffing – manpower, planning, Directing – illustration, Controlling, parameters, application & Co-ordination; communication – efficient process model, communication & barriers, inter-personnel communication skill. Developing Organization Structure. Various types of organizational structures – Line/staff/matrix, centralization vs. decentralization of decision making, distinction between authority/responsibility/accountability, Basic principles of delegation/empowerment of employees; Authority & Responsibility. Boundaries of Authority. **- 10 hrs**.

UNIT – II
ACCOUNTING & FINANCE MANAGEMENT: Methods of Capital formation & Control of working capital, How to read balance sheet/Profit/Loss, Budgetary control & standard costing – Favourable/Adverse variances. Continuous & Discounted cash flow & project appraisal, Break even analysis, Cost benefit analysis, Methods of Depreciation Factory costing, Estimating, Balance Sheet, Financial & Physical ratios; Project & Budgetary control. **- 12 hrs**.

UNIT – III
PRODUCTION & OPERATIONS MANAGEMENT: Factors of production, Distinction between products & services, Types of production system viz. Jobbing/Lot/Mass. Functions of Production Planning and control, Product Development Principles, Standardization, Simplification & Specialization, Plant Layout, Product/Process, Logistics & Supply chain/management. Integrated material management – Functions of material planning, inventory control, safety stock/cycle

stock, purchase/stores performance, measurement parameters, standardization/codification, waste control. Introduction to Operations Research. Linear Programming , Distribution Methods, Network Technique in Management – Critical Path Method (CPM), Programme Evaluation & Review Technique (PERT). Resources Allocation & Loading smoothing, Operational Sales Forecasting; Works study, Job Evaluation & Merit Rating. Total Quality Management, Quality control, ISO 9000 series, Preventive/condition based Maintenance & spare management.

H.R.D.: The personnel Function, Selection & Recruitment, Role of Psychological Tests in Recruitments, Training of employees, Performance Appraisal & counseling, Reward system, Legal Requirements and Regulation of Working Condition, Employer's liabilities for Health and Safety, MBO, Leadership/Group Dynamics and Discipline, Motivation theories and Incentives, Maslow's hierarchy of needs theory, X & Y theory, Hertzberg's Hygienic and motivational theory, Elton Mayo's contribution. Problems of Accidents – Preventions, Fatigue, etc., Relation with Trade Union & workers Participation in Management. **- 14 hrs**.

UNIT - IV

ECONOMICS (A):

Importance of economics in Marine Engineering Study, Basic economic concepts and terms, Demand analysis, Supply analysis, Elasticity of Demand, Elasticity of supply.

Production function, Law of return, Economics of scale, Iso-product and Iso-cost, Cost-concepts, Cost-output relationship and cost curves in short period. Long period, Revenue – concept, Determination of price under free market and price control by Govt. Types of market, Factors governing extent of market, Pricing under perfect competition, Monopoly, Monopolistic competition and oligopoly.

Money: Types, Functions, Standard, Inflation:- Types, Causes. Commercial Banks – Functions, Functions of Central Banks. Features of Money and Capital market. National income concepts **- 12 hrs**.

UNIT - V

ECONOMICS (B):

Taxation - Direct and indirect, Govt. Budgets. Economic development, Growth, features of underdevelopment with reference to India. Globalization of Indian economics.

Difference between Domestic and foreign trade. Basis of International Trade:- Trade-theories. Free-Trade Vs Protection. Balance of payments – components, causes of deficit, steps to correct deficit. Exchange-Rates:- Types, determination, Devaluation of currency. Free-convertibility of currency with reference to Indian Rupee. Functions of I.M.F, World Bank, W.T.O.

Shopping Routs & Ports:- Major shipping routes & ports, Types, Problems, factors for good port. Major & Minor Ports of India, their location and importance. Deep-se fishing. Major sea-fishing zones, Off-shore oil producing zones. India's overseas Trade and Economic Importance with reference to Economic Zones. **- 12 hrs**.

REFERENCES:

1. Economics - Gangopadhyay
2. Modern Office Management - Mills, Standingford, Appleby

MR225	MARINE INTERNAL COMBUSTION ENGINE - I	45 Hrs

AIM: To develop knowledge in Marine Diesel Engine construction, fundamentals and latest developments.

UNIT-I

PERFORMANCE CHARACTERISTICS OF I.C. ENGINE: 4-stroke and 2-stroke cycle; Deviation from Ideal condition in actual engines; Limitation in parameters, Timing Diagrams of 2-stroke and 4-stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes Mean piston speed, M.C.R. & C.S.R. ratings. Practical heat balance diagrams and thermal efficiency. **- 8 hrs**.

UNIT-II

GENERAL DESCRIPTION OF I.C. ENGINES: Marine Diesel Engine of M.A.N – B&W., Sulzer make etc,. Constructional details of I.C. Engines; Principal components: Jackets and Liners, cylinder heads, Pistons, cross heads, connecting rods, bed plates, A-frames, Welded construction for bed plates & frames. Tie rods, hydraulic exhaust valves. **- 8 hrs.**

UNIT-III

SCAVENGING AND SUPERCHARGING SYSTEM: Scavenging arrangements in 2-stroke engines; Air charging and exhausting in 4-stroke engines; various types of scavenging in 2-stroke engines; uni-flow, loop, cross loop and reverse loop scavenging, their merits and demerits, scavenge pumps for normally aspirated engines; under piston scavenging, Scavenge manifolds.

SUPERCHARGING ARRANGEMENTS: Pulse and constant pressure type; their relative merits and demerits in highly rated Marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers **-10 hrs**.

UNIT -IV

COMBUSTION OF FUELS IN I.C. ENGINES: Grades of suitable fuels. Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, fuel injectors, and its details, ignition delay, after burning

Compression pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure, Design aspects of combustion chamber.

Control of NOX, SOX in Exhaust emission **- 9 hrs**.

UNIT-V

COOLING OF I.C. ENGINES: Various cooling media used; their merits and demerits, cooling of pistons, cylinder jackets & cylinder heads, bore cooling, coolant conveying mechanism and systems, maintenance of coolant and cooling system.

Safety and Prevention of mishaps in I.C. Engines: Causes and prevention of crank-case explosions, and scavenger fires. Detection of same and safety fittings provided to

prevent damage, Uptake fire, starting air line explosion. Thermal stresses Special features of I.C. Engines: Development of long-stroke Engines, Implication of stroke-bore ratio, Development in materials in construction and heat treatment of M.E. components.

-10 hrs.

REFERENCES:

1. Wood yard, Goug, "Pounder's Marine Diesel Engines". 8th Edition, Butter Worth Heinemann Publishing, London, 2001.
2. "Slow speed Diesel Engine" Institute of Marine Engineers.
3. S.H. Henshall, "Medium and High speed Diesel Engines for Marine Use:, 1st Edition, Institute of Marine Engineers, Mumbai 1996.
4. D.K. Sanyal, "Principle & Practive of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai, 1998.
5. "Marine Low speed Diesel Engine", Denis Griffiths.
6. "Lamb's Question and Answer on Marine Diesel Engine".
7. "Diesel Engine", A.J. Wharton.

MR226	FLUID MACHINES - II	45 Hrs

AIM: To develop knowledge about centrifugal pumps, reciprocating pumps and turbines.

UNIT 1

Advanced Dimensional Analysis: Non-dimensional performance characteristic of roto-dynamic machinery **- 5 hrs**.

UNIT 2

Reciprocating pumps and other positive displacement pumps: Various types, single and double acting, single and multi cylinder, co-efficient of discharge; Theoretical indicator diagrams; Effect of acceleration and friction; use of air vessel. **- 13 hrs**.

UNIT 3

Centrifugal Pump: Calculations of various heads; Losses and efficiency, work done per unit weight, Dimensions of impellers; velocity diagrams at inlet and exit, calculation for power input; torque on shafts, cavitation in centrifugal pumps. NPSH, specific head.

- 13 hrs.

UNIT 4

Pelton Wheel: efficiency and vane angles, vane speed and head lost in runner, specific speed; applied problems. **- 7 hrs**.

UNIT 5

Impulse and Reaction Turbines: Inward flow reaction turbine; efficiency and vane angles, vane speed and head lost in runner, specific speed; applied problems. **- 7 hrs**.

REFERENCES:

1. Hydraulics and Fluid Mechancis - P.N. Modi, S.M. Seth
2. Fluid Mechanics & Hydraulic Machines - R.K. Rajput
3. Fluid Mechanics (Part-I & Part-II) - J.F. Douglas

MR227	MARINE AUXILIARY MACHINERY - I	45 Hrs

AIM: To impart knowledge of Ship's Auxiliary Machines. The student will acquire knowledge of

- Ship's Engine room layout, piping systems & fittings.
- Various types of Pumps and its applications.
- Ship's Steering process.

UNIT I

Engine Room Layout: Layout of main and auxiliary machinery in engine rooms in different ships. Layout of pipe lines, pipe material, piping arrangement for steam, bilge, ballast and oil fuel systems, Lub. oil and cooling system lines with various fittings. Domestic fresh water and sea water hydrophore system. Colour code and safety fittings of bunkering procedure and in the pipe lines, etc. Bunkering procedure, precautions taken, line diagram for H.F.O & D.O. **- 9 hrs**.

UNIT II

Filters & Pumps Strainers and filters, types of marine filters, different types of filter materials, auto-clean and Duplex filters, static filters, micro filters. Priming and core maintenance of filters

Types of pumps for various requirements, their characteristics and application in ships. Centrifugal pumps, Gear Pumps, Screw Pumps and Reciprocating Pumps, Care and maintenance of pumps. Use & Care maintenance of pumps of various types. Hydraulic pumps & motors, line filters and systems. **- 9 hrs**.

UNIT III

Blowers, Compressors, Evaporators & Heat Exchangers: Operational and constructional details of blowers and compressors used on boar d ships. Uses of compressed air

Construction and operation of different types of evaporators. Fresh water generators and distillers. Reverse Osmosis process, conditioning arrangements of distilled water for drinking purpose.

Tubular and Plate type, reasons of corrosion, tube removal, plugging, and material used. **- 9 hrs**.

UNIT IV

Pollution Prevention, Oil Purification & Steering gears: STOKES law; static and turbo separators, Oily bilge separators, their construction and operation, use of coalescers, prevention of oil pollution and various International requirements. MARPOL convention, OLM & OCM,

Theory of oil purifications, various methods of oil purifications, Use of settling/service tanks & precautions taken before entering/cleaning tanks. Principles of operation and construction of different centrifuges for heavy fuel and lubricating oil like FOPX system, self desludging etc. uses of Homogenizers. ALCAP system, Importance of LO/FO testing, Method of testing etc.

Operation and constructional details of various types of steering machinery. Telemotor systems, transmitters and receivers Variable delivery pumps used in steering gears, axial and radial displacement types. Hunting action of steering gear. Emergency steering arrangement. Safematic steering gear with redundancy concept as per SOLAS. Care and maintenance of steering gear plants. **- 9 hrs**.

UNIT V

Shafting, Dry Docking & Other ship board equipments: Methods of shaft alignment, constructional details and working of Thrust blocks. Intermediate shaft bearing and Stern tube bearing. Oil water lubricated Stern tubes. Sealing glands, stresses I tail end, intermediate and thrust shafts.

Methods of dry docking of ships. Inspection and routine overhauling of underwater fittings and hull. Measurement of clearances and drops. Removal and fitting of propellers (with and without key).

Incinerators & MARPOL Annex – VI, Sewage treatment plant (MARPOL Annex – IV), Engine room crane, chain blocks, tackles, Anchor chain, its testing and survey requirements, different types of ship stabilizer. Bow Thrusters, Hull protection arrangements. **- 9 hrs**.

REFERENCES:

1. Marine Auxiliary Machinery - D.W. Smith
2. Marine Auxiliary Machinery - H.D. McGeorge
3. Marine Engineering Practice - IME Publication
4. Basic Marine Engineering - J.K. Dhar

MR228	NAVAL ARCHITECTURE – I	45 Hrs

AIM: To impart basic knowledge in Naval Architecture to students.

UNIT 1

Geometry of Ship and Hydrostatic Calculations: Ships lines, Density and relative density, Pressure exerted by a liquid, load on immersed plane, centre of pressure, Load diagram, Archimedes' principle, Displacement Calculation, Concept of DWT, GT and NT, Meaning of buoyancy, Tonnes per cm. Immersion, **– 9 hrs**.

UNIT 2

Draughts & Buoyancy: Co-efficient of forms, Wetted surface area, Similar figures, Wetted surface area of similar bodies, familiarization with hydrostatic curves of ships. First and Second moment of area, Simpson's rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rule, Tchebycheff's rule and their applications, Calculation of volume and centroid of volume, Calculation of WPA of ships. **– 9 hrs**.

UNIT 3

Transverse Stability of Ships:, Centre of gravity, Effect of addition and removal of masses, Effect of suspended masses, Transverse meta centre, Stable, unstable and neutral

equilibrium, Calculation of B.M., GM (Metacentric height), Statical stability at small angles of heel centre of buoyancy, righting lever, righting moment, Inclining experiment, Free surface effect, Stability at large angles of heel, angle of loll, curves of statical stability, dynamical stability, and Different Characteristic curves of Dynamic stability. ITTC formula, calculations of damaged stability. **– 9 hrs**.

UNIT 4

Longitude Stability and Trim: Longitudinal GM, MCT1, change of L.C.B. with change of trim, change of trim due to adding or deducting weights, change in draft & trim because of filling/flooding several tanks with different densities, change in draft due to change in density, Reserve buoyancy, effect of change in density of water, Effect of bilging amidship compartments, Flooding calculations, Floodable length curves, determination of floodable lengths, factors of subdivision, loss of stability due to grounding, Docking stability, Pressure on chocks. **– 9 hrs**.

UNIT 5

Resistance & Powering: Frictional, Residuary & Total resistance, model testing, calculation of frictional resistance, Froude's Law of comparison, Effective power calculations, Application of ITTC formula, ships co-relation factor (SCF), Admiralty co-efficient, Fuel Co-efficient and fuel consumption, Effect of viscosity. – 9 hrs.

REFERENCES:

1. Ship & Naval Architecture - R. Munro-Smith
2. Naval Architecture for Engineers - Reeds' Vol-6.
3. Introduction to Naval Architecture - Eric Tupper
4. Creative Naval Architecture - G.N. Hatch
5. Ship Construction - D.J. Eyers
6. Principles of Naval Architecture - SNAME Publications
7. Naval Architecture, Principles & Theory - B. Baxter
8. Naval Architecture for Marine Engineer - W. Muckle
9. Naval Architecture - Esic C. Tupper

MR229	ELEMENTARY DESIGN & DRAWING	54 Hrs

ELEMENTARY DESIGN (18 hrs.)

Procedure in Machine Design: Concepts of design, procedure & processes, Design synthesis, Ergonomic consideration in design, Feasibility, preliminary Design Alternative, Final Design alternative, Preliminary & Final plans & Drawings. - 2 hrs.

Use of standards in design, selection of preferred sizes, common useful Materials & manufacturing considerations in design. - 2 hrs.

Review of failure criteria in mechanical design, properties of materials, heat treatment processes, BIS system of designation of steels, Basis of good design, deformation, wear, corrosion. - 2 hrs.

Common useful materials & Manufacturing considerations in design. Failure criteria in Mechanical Design: Basis of good design. Failure of machine parts. Deformation, Wear, corrosion. - 2 hrs.

Machine Design: Strength consideration for design: Strength of Materials, Reliability, Influences of size, Stress concentration, Strength under combined stresses, Static loads, Impact loads, Repeated loads, Completely reversed loads, Static plus alternating loads, Cyclic & combined loads, Fatigue strength. Dynamic stresses. Selection of materials. Specification: Fit, Tolerance, finish-BIS. - 5 hrs.

Design & Drawing to specification for parts subjected to direct loads:
Fasteners: Bolts & Screws, Cotter & Knuckle Joints, Keys & couplings, Pipe Joints, Riveted & Welded Joints. Design of welded machine parts.

Power Transmission: Shafts & axles, Bearings, clutches & brakes, Belt drives, chain drives, Design & drawing of tooth gearing like spur & Bevel gears, Rack & Pinion, Worm & worm wheels, helical gears etc. - 5 hrs.

MARINE ENGINEERING DRAWING (36 hrs.)
Advanced Marine Machinery assembly Drawing:

Marine Diesel Pistons, 2-stroke & 4-stroke types, 4-Ram Steering Gear, Diesel Air starting Valve, Starting Air Pilot Valve, 4-stroke Diesel Piston and Rod, Automatic valve for Starting air system, Burner carrier, Quick closing sluice valve, Rudder Carrier Bearing, Reducing valve, Upper piston & rod, Telemotor receiver, Turbine flexible coupling, Fuel valve, Stern Tube & Tail shaft, Michell Thrust Block, Improved high lift safety valve. (Minimum of 9 drawings to be completed in the class. Remaining to be given as home assignment)

REFERENCES:

1. N.D. Bhatt, “Engineering Drawing”
2. H.G. Beck, “Reed’s Engineering Drawing for Marine Engineers”
3. H. Barr & J.G. Holburn, “Engineers MacGIBBON’S Pictorial Drawing Book for Marine”.

MR277	MATERIAL SCIENCE LABORATORY	54 Hrs

1. To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of Materials on Universal Testing Machine.
   i) UTS

ii) Yield Stress
iii) Young's Modulus
iv) Breaking Stress
v) Percentage Elongation
vi) Percentage reduction in area and
vii) Plotting of curveof Stress Vs Strain

2. To conduct IZODE impact test on impact testing machine and calculate value of energy absorbed.
3. Calculate Hardness of a material on Brinnel's Hardness Testing Machine.
4. Determination of behaviour of ductile materials when subjected to torsion and to obtain
   i) Maximum Torsion Stress
   ii) Modulus of Rigidity and
   iii) Plotting of curve of Angle of twist Vs Torque
5. To determine the Stiffness of spring for
   i) round wire and
   ii) Square section wire when subjected to compression.
6. To study grain structure of various ferrous & Non ferrous material under microscope.
7. To conduct Dye Penetrant Test for detection of crack in material.
8. To conduct Magnetic Particle test for crack detection.
9. To conduct flaw detection test by Ultrasonic Equipment.
10. To study behaviour of a material under a fatigue on fatigue testing Machine.
11. To prepare a report on use of material in ship building & Marine Engineering.

MR278	MECHANICS & FLUID LABORATORY	54 Hrs

To measure circular and linear displacements of cam and follower in case of

a) Plate cam-reciprocating follower.
b) Tangent cam-with roller oscillating follower and plot the displacement curves hence differentiate the velocity and accelerating curves.

To find the co-efficient of friction both for flat belt and V-belt with belf friction apparatus and hence find the slip.

Centrifugal clutch to demonstrate the process of power parameters of the Hartnell Governor.

a) Rotating masses
b) Spring Rate
c) Initial Spring Compression

Note the effects of varying the mass of the centre sleeve of the Porter Governor and compare the same with that of the Proell Governor.

To determine the characteristic curves of sleeve position against speed of rotation in case of:

a) Hartnell Governor
b) Porter Governor
c) Proell Governor

To determine the moment of inertia of different bodies by the Trifilar suspension by experiment and by calculation.

VIBRATIONS EXPERIMENTS

The following experiments in Vibrations are performed with **VIBLAB APPARATUS:**

To verity the relation $T = 2\pi\sqrt{(l/g)}$ in case of a simple pendulum and to plot the graph T vs L.

To verity the relation $T = 2\pi\sqrt{((K_2 + OG_2)/(g.OG))}$ in case of a compound pendulum, and find the radius of gyration and equivalent length of compound pendulum.

To determine the method of Torsional oscillation, the radius of gyration of a body, about the centre of gravity by using the relation, $T = 2\pi (K/a)\sqrt{(l/g)}$.

To verity the relation, $T = 2\pi\sqrt{(W/(K.g))}$ and plot a graph T_2 vs W.

Study of undamped natural vibrations of abeam pivoted at one end supported by tension spring at the other end.

To find out the natural frequency of a beam with and without load and to verity the Dunkerley's Rule.

Study of forced vibration for various amounts of damping of beam pivoted at one end and supported by tension spring at the other end and to plot a graph of amplitude factor vs frequency ratio. (Long. Vibration)

To study the forced vibrations for various amounts of damping and to plot a graph of amplitude factor vs frequency ratio (Lat. Vib.)

Experimentally prove the relation $T = 2\pi\sqrt{(I/Kt)}$ and study the relationship between the periodical time and shaft length.

FLUID MECHANICS EXPERIMENTS"

To determine the meter constant of the Venturimeter.

To determine the efficiency of a pelton wheel.

To determine the co-efficient of velocity of contraction and co-efficient of discharge of water through the various orifices.

To determine the friction co-efficient for the flow of water through a pipe.

To determine the GM (Metacentric Height) of floating body.

To determine the co-efficient of discharge through the various notches.

Study various types of impellers on a Board. Impellers of pumps for practical demonstration specially required for Design work.

MR279	MARINE POWER PLANT OPERATION - I	72 Hrs

Study of working of following Marine Equipments:

1. Cylinder liner of Marine Diesel Engine.
2. Piston of Large Marine Diesel Engine.
3. Cylinder Head.
4. Jerk type Fuel pump.
5. Sulzer/MAN-B&W fuel pump.
6. Sulzer/MAN-B&W air starting valve.
7. Fuel injector.
8. Cylinder relief valve.
9. Turbocharger.
10. Air Compressor.
11. Purifier.
12. Plate heat exchanger/Shell & tube heat exchanger.
13. 4 Ram & 2 Ram Steering gear.
14. Gear Box turbo alternator.
15. Thrust bearing.
16. Oily Water Separator.
17. Incinerator.
18. Any other Machinery found onboard a Modern Ship.

(Every student/cadet will study equipment and its working as per instruction sheet and draw sketches of the components where required, dismantling & assembling may be part of this practical training. Assessment will be done on student/cadet's understanding of the equipment)

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

DEPARTMENT OF MARINE ENGINEERING

B.E. MARINE ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER VI

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR230	Ship Fire Prevention & Control	3	1	0	4
2.	MR231	Marine Internal Combustion Engine - II	3	0	0	3
3.	MR232	Marine Electrical Technology	3	1	0	4
4.	MR233	Marine Auxiliary Machines - II	3	0	0	3
5.	MR234	Naval Architecture - II	3	1	0	4
6.	XX2E1	Elective - I	3	1	0	4
PRACTICAL						
7.	MR280	Fire Control & Life Saving Appliances Laboratory	0	1	2	2
8.	MR281	Marine Power Plant Operation - II	0	1	2	2
9.	MR282	Electrical Machines Laboratory	0	1	2	2
TOTAL			18	7	6	28

MR230	SHIP FIRE PREVENTION & CONTROL	60 hrs.

AIM: To provide sound knowledge of fire prevention and control to the students.

UNIT 1

Fire hazard aboard ships: Fire triangle, Fire Tetrahedron, Fire-Chemistry, spontaneous combustion, limits of inflammability. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. Control of Class A, B, C & D fires, Combustion products & their effects on life safety -10 hrs.

UNIT 2

Fire Protection rues in Ships' construction: SOLAS convention, requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire detection and extinction systems, fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements fire fighting systems and equipments on different vessels, fire doors & fire zones. - 10 hrs.

UNIT 3

Detection and Safety systems: Fire safety precautions on cargo ships and tankers during working. Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships. - 10 hrs.

UNIT 4

Fire Fighting Equipment: Fire pumps, hydrants and hoses, Couplings, nozzles and international shore connection, Construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships. Properties of Chemicals used, water-mist fire suppression system. Bulk Carbon di-oxide and inert gas systems. Fireman's outfit, its use and care. Maintenance, testing and recharging of appliances, Preparation, Fire appliance Survey. Breathing apparatus types, uses, principle. - 13 hrs.

UNIT 5

Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds galley, etc. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, Rescue operations from affected compartments. 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 behaviour, Special precautions for prevention/fighting fire in tankers, Chemical carriers, Gas carriers, Safe working practice. - 17 hrs.

REFERENCES:

1. Marine Engineering Practices - IME Publication

2. SOLAS - Bhanderkar Publication
3. Fire safety code book
4. Survey of Life saving appliances and fire fighting equipments - HMSO
5. Fire aboard - Frankrush Brook
6. Fire fighting abroad ships - M. G Stavitsky
7. Marine Electrical Technology - Fernandez

MR231	MARINE INTERNAL COMBUSTION ENGINE - II	45 hrs.

AIM: To make the students learn the concept and working of Marine Diesel engines.

UNIT-I

Forces and Stresses: Balancing, overloading, Different types of moments & couples, Different type of vibrations & its effects, A/F vibration, methods of vibration damping.

Fuel pumps and metering devices: Jerk and Common rail systems; fuel injection systems, Helical groove and spill valve type fuel pumps. System for burning heavy oil in slow and medium speed marine engine, V.I.T. & Electronic injection system.

- Effects of viscosity on liquid fuel combustion.
- Measuring equipment and its working principle.
- Necessity of variable fuel injection system
- Procedure of application on a modern slow speed long stroke engine.
- Necessity for adoption of fuel quality setting system.
- Incorporation of FQSL along with the V.I.T. system on the engine.

- 9 hrs.

UNIT -II

Maneuvering systems: Starting and reversing systems of different Marine Diesel engines with safety provisions. Action in emergency situation.

Indicator diagrams; and Power calculations: Construction details of indicator instrument. Study of different types of indicator cards, Significance of diagram Power calculations, fault detection, simple draw cards and out of Phase diagrams. Power balancing, Performance Characteristic curves, Test bed and Sea trials of diesel engines

- 9 hrs.

UNIT- III

Lubrication systems: Lubrication arrangement in diesel engines including Coolers & Filters, Cylinder-lubrication, Linear wear and preventive measures, Combinations of lubricating oil its effect and preventive measures.

- Improvements in Lubricating oils through use of additives. Types of additives
- Monitoring engines through lubricating oil analysis reports.

Medium Speed Engines: Different types of medium speed marine diesel engines, couplings, and reduction gear used in conjunction with medium speed Engine, Development in exhaust valve design, V-type engine details.

- Use of poor quality residual fuels and their consequences.
- Improvements in designs for higher power output.
- Fuels, combustion process – fundamentals.

- 10 hrs.

UNIT- IV

Gas Turbines: General constructional and Design features for marine plants, Materials of construction, Heat exchangers and Reheat arrangements, Comparison of free piston engine gasifiers and conventional air-stream combustion chambers.

Maintenance of Diesel Engines: Electronic Governor, Inspection and replacement of various component members such as Piston, Piston ring, X-head & other bearings, Cylinder Head, Liner, Bearings, Driving Chain and gears etc. Crankshaft deflection and alignment, Engine holding down arrangements, Tightening of tie bolts.

- 10 hrs.

UNIT -V

Trouble Shooting in Diesel Engines: Hot & Cold corrosion, Crankshaft web slip, X-head bearing Problems, microbial degradation in fuel & Lub. Oil.

Modern Trends in Development: Current engines (Sulzer RTA, B&W, CMC & SMC, SEMT, Pillstick) Intelligent engine (Camless concept), improvement in design for increased TBO, Nox – control of marine Diesel Engines.

All latest Technology incorporated in a modern propulsion Machinery Ships.

- 7 hrs.

REFERENCES:

1. Wood yard, Goug, "Pounder's Marine Diesel engine". 8th Edition, Butter Worth Heinemann Publishing, London, 2001.
2. "Slow speed Diesel Engine", Institute of Marine Engineer.
3. S.H. Henshall, "Medium and High speed Diesel Engines for Marine Use", 1st Edition, Institute of Marine Engineers, Mumbai, 1996.
4. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai 1988.
5. "Marine Low speed Diesel Engine", Denis Griffiths.
6. "Lamb's Question and Answer or Marine Diesel Engine".
7. "Diesel Engine", A.J. Wharton.

MR232	MARINE ELECTRICAL TECHNOLOGY	60 hrs

AIM: To develop skills in marine electrical technology including the knowledge of the regulations observed on board ship regarding electrical equipments wherever applicable.

UNIT-1

POWER GENERATION & ALTERNATIVE SOURCE OF POWER

Power generation: Merits & Demerits of A.C & D.C on board. Rules and regulations governing electrical machineries on ships, different alternator excitations – systems on board- (indirect, direct 'static excitations, brushless generator construction & operational diagram. automatic voltage regulator .

Alternative source of power: Emergency generator & different starting method including auto start, emergency batteries construction and its different types & duties , location of emergency power, different emergency loads, rules &regulations, emergency power, maintenance of emergency power source on board. Shore supply – specifications as per voltage/ frequency, precautions while taking shore supply. Navigation and signaling lights. - 14 hrs.

UNIT-2

DISTRIBUTION & MOTOR CONTROL

Distribution: Different electrical diagrams and their uses, electrical signals. Type of distributions, distribution network on board; main & emergency switch board, construction, different switch gear & protective devices, grounded and insulated neutral systems, precautions adopted in high voltage distribution system. Cables & temperature classifications.

Motor & control equipments: Types of marine motor, types of enclosures, protective devices on motors, motor characteristic curves, sequential starting (e.g. refrigerating plants, automatic fired boiler). - 12 hrs.

UNIT-3

MISCELLANEOUS MARINE ELECTRICAL EQUIPMENT

Miscellaneous marine electrical equipment alarm system : Engine room telegraph, rudder angle indicator, R.P.M & revolution counter, centralized salinity indicator, watertight door operation, alarm system (types, supply) on board's oxygen analyzer, high & low level arms, navigational lights, emergency radio operation, electrical deck auxiliaries. – 8 hrs.

UNIT-4

MAINTENANCE OF ELECTRICAL SYSTEMS

Maintenance of electrical systems , fault finding & repair : Types of faults & indications on generator, motor & distribution systems, different testing equipments & meters (multimeter/megger, clamp meter, etc.), salvaging a motor, detection of faults on electronic circuits & cards – indications & corrective arrangements, necessary precautions & care while fault finding and repair, preventative maintenance, periodic surveys, spares requirements. -10 hrs.

UNIT-5

SPECIAL ELECTRICAL & SAFE ELECTRICAL PRACTICES

Special electrical practice : Rules and regulations & operations of electro – hydraulic & electric steering gear, diesel – electric and turbo electric propulsion system, pod/ azipod drive unit , superconductivity applied in propulsion , turbo alternator, special electrical practice for oil , gas and chemical tankers (tanker classification, dangerous spaces, hazardous zones, temperature class), flame proof Ex 'd' and intrinsic safety Ex 'I' ,Ex 'e', and Ex 'n" equipments and their applications in zones, maintenance of Ex –protected apparatus.

Safe electrical practice : safe watching – keeping, points to check on electrical machineries, switch gears & equipments, microprocessor control and maintenance

electrical fire fighting, precautions against electric shock and related hazards. - 16 hrs.

REFERANCES:

1. Marine electrical practice – BOWIC
2. Electricity applied to Marine engineering - S.W. LAW
3. Marine electrical practice – G.O. WATSON
4. Practical marine electrical knowledge - DENNIS T. HALL
5. An introduction to electrical instrumentation - B.A. GREGORY

MR233	MARINE AUXILIARY MACHINERY -II	45 hrs

AIM: To impart sound knowledge about refrigeration and air conditioning, deck machinery and pollution prevention methods.

UNIT I

Refrigeration: Principles of refrigeration, overview of refrigeration cycles, different refrigeration systems, classifications of refrigerators, uses of refrigeration at sea, cryogenic technology- definition, temperature range, insulation.

Different refrigerants, chemical formula, desired properties (general, physical, chemical, thermodynamic) comparison, effect on environment, Montreal protocol, new refrigerants.

Design and construction of various components of refrigeration plants, i.e., compressor, condenser, evaporator, expansion v/vs, control & safety equipments.

Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant/ oil, purging of air, defrosting methods, trouble shooting.

Refrigeration of cargo holds, brine system and its operation & maintenance, methods of air circulation in holds, insulating materials , insulation , micro organism, dead and live cargo, factors affecting refrigerated cargo, container ship refrigeration, preparation for loading cargo, survey of refrigeration equipments.

Heat load calculations on refrigeration and air conditioning plant. – 11 hrs.

UNIT II

Air conditioning & Ventilation: Necessity on board ships, different systems, control of room air temperature, humidity, noise, dust and purity. Construction of duct & diffuser, fans, ventilation of accommodation, fire safety balancing of system.

Ventilation of engine room, pump room, CO_2 and battery rooms, air change requirements, design considerations, maintenance. – 8 hrs.

UNIT III

Noise and vibrations: Elements of aero dynamics and hydrodynamics sound, noise sources on ships and noise suppression techniques, noise level measurement. Various modes of vibration in a ship (i.e. free, forced, transverse, axial, torsional- 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 torsional vibrations dampers, use of torsi graphs. – 9 hrs.

UNIT IV

Fuels: Source of supply, study of primary fuels, coal, petroleum, natural gas, classification of fuels, treatment of fuels for combustion in marine I.C.E and steam plants. Residual fuels, emulsified fuels, merits and demerits of such fuel in marine engines. - 8 hrs.

UNIT V

Lubrication: Theories of lubrication, types of lubricants and their properties suitability of lubricants for various uses; solid and fluid lubricants. Additive oils and their specific use, Terminology used in lubrication systems. Loading pattern of various bearings in marine use and lubrication system adopted. Different types of bearings used for marine machineries. L.O analysis & monitoring engine through report - 9 hrs.

REFERENCES:

1. Marine engineering practice - IME Publication
2. Refrigeration at sea - J.R. STOT
3. Marine air conditioning - S.D. SRIVASTAVA
4. Advanced marine engineering - J.K. DHAR
5. General engineering knowledge – H.D. Mc GEORGE.

MR234	NAVAL ARCHITECTURE - II	60 hrs.

AIM: To impart knowledge to students in Naval Architecture to enable him understand strength and safety of ship.

UNIT-1.

Propulsion & propellers: Geometry of screw propellers & terminology, wake, apparent and real slip, thrust, relation between powers, relation between mean pressure and speed, thrust co-efficient (Kt), torque co- efficient (kq), advance co-efficient (j), propeller types, fixed pitch, variable pitch, ring propeller, kort nozzles, voith Schneider propeller, and propeller Theory - 14 hrs.

UNIT-2.

Blade element theory, law of similitude and model tests with propellers, propulsion tests, ship model correlation ship trials. – 10 hrs.

UNIT-3.

Rudder theory: Action of the rudder in turning a ship, force on rudder, torque on stock, calculation of force torque on non –rectangular rudder, angle of heel due to force torque on rudder , angle of heel when turning. Types of rudder, model experiments and turning trials, area and shape of rudder, position of rudder, stern rudders, bow rudders - 12 hrs.

UNIT-4.

Strength of ships: Curves of buoyancy and weight, curves of load, shearing force and bending moments, alternate methods, standard conditions, balancing ship on wave, approximation for max. Shearing force and bending moment, method of estimating B.M. &deflection. Longitudinal strength & bending, moment of inertia of section, section modulus & strength calculation, stresses on deck. Pressure on bulkhead - 12 hrs.

UNIT-5.

Motion of ship on waves: Theory of waves, trochoidal waves, relationship between line of orbit centres and the undisturbed surface, sinusoidal waves. Irregular wave pattern, wave spectra, wave amplitudes, rolling in unresisting media, rolling in resisting media, practical aspects of rolling, antorolling devices, forces caused by rolling and pitching, heavingandyawing. – 12 hrs.

REFERENCES:

1. Ship Naval Architecture – MUNRO-SMITH
2. Naval Architecture - W.MUCKLE
3. Ship Construction - D.T.TAYLOR
4. Naval Architecture for Engineers - REEDS' VOL-6

MR280	FIRE CONTROL & LIFE SAVING APPLIANCE LABORATORY	54 hrs.

Testing and operation of jet and spray type nozzles fire hoses.

Operation of emergency fire pump.

Operation, charging and maintenance of portable fire extinguishers

(a) CO_2 water type
(b) foam type
(c) dry powder type
(d) CO_2 extinguishers
(e)

Operation, use and functions of breathing apparatus.

(a) Self contained type.
(b) Bellow type.

Use of fireman's outfit

Study and operate total co2 flooding of engine room & cargo holds.

Operation of different types of fire detectors.

Study of working of life boat and provisions for life boat. use of life jackets.

Construction and operational details of life raft giving importance to manual and hydrostatic release device.

MR281	MARINE POWER PLANT OPERATION - II	54 hrs.

AIM: To develop skill of operation & maintenance of Marine Machinery among cadets.

(Note: The teacher-in-charge of the class will brief the cadets before starting an assignment and de-brief at the end).

Running of 2-stroke Diesel Engine (Coupled to Alternator): Methods of starting, running under different load conditions (load on the alternators), Watch keeping & recording of the temperatures, pressures on Different meters on the diesel engine instrument panel and switch board. Looking after the auxiliary machinery viz. Air compressor, Cooling water pump and Lub. Oil Pump.

Boiler Operation: i) Smoke Tube Boiler: Raising steam from cold condition up to its working pressure and maintaining the same while operating the Reciprocating engine and the auxiliary machinery, maintenance schedule for the smoke tube Boiler. Blowing of gauge glasses with precautions involved-necessity and procedure of cross blowing. Overhauling of mountings. Dismantling, overhauling and adjustment of High lift safety valve, studying the working of Boiler plant auxiliary machinery.

ii) To study the operation of the water tube boiler firing from cold condition, raising steam up to its working pressure and to maintain the same while operating the Steam Turbines and the auxiliary machinery, precautions involved during firing of boiler. Operation of steam super heater, water level indicators, high and low level alarms and other boiler mountings, Overhauling and adjusting of safety valves. Recording and controlling of various pressures & temperature on the instrument panel. Care of Boiler auxiliaries, feed water system and fuel system.

Running of Steam Reciprocation Engine/Turbine Engines: Warming up of the engine, Lubrication of moving parts and precautions involved. Starting of the engine, Reversing procedure. Running the engine at full power, performance monitoring.

Operation and Maintenance of Diesel Propulsion engine: Preparing the engine for operation, Running engine in ahead & astern directions, taking indicator cards, cutting out fuel pumps, opening up unit for maintenance, checking clearances of bearings.

Project Work – Every cadet will be required to make model of any machinery or part found onboard a ship or maritime industry. Working model would be appreciated.

MR282	ELECTRICAL MACHINES LABORATORY	54 hrs.

D.C. Machines:

To study and run a rotary converter under different conditions to record the generated voltage on D.C. side against variation of load.

A.C. Circuits and Machines:

To study the slip-torque characteristics of an induction motor and to find out the full load slip.
To study the different type of Motors, connect the motor to A.C. Supply, run the motor and obtain its speed load characteristics (The experimental multi-motor set).
To determine the regulation of a 3-phase alternator by synchronous impedance method.
To compute full load, input, output, torque, slip, power factor and efficiency of a 3-phase induction motor from circle diagram. Also to compare the results from the circle diagram with actual full load test on the motor.
Study operation of synchro transmeter and Repeater.
To determine the phase-sequence of 3-phase line by using resistance and capacitance in two ways.
To connect similar I-phase transformers in the following ways: (a) –Y, (b) Y-Y, (c) –Double Y, (d) –Double
Parallel operation of D.C. Shunt Generator.
Synchronising of a 3-phase Alternators.
Parallel operation of single-phase Transformers.
Study Pole changing motor for various speeds.
Determination of Characteristics of an A.C. Brushless Generator.
Determination of characteristics 2/4 pole single phase Induction Motor.
Variable frequency speed control of Induction Motor.
Overhauling of Induction Motor, and Star-Delta Starter.
Circuit breaker trainer (Study of Air circuit breaker)
To perform different types of Electrical Machines experiments (Preferably on scan drive system (TERCOSCAN)-Electrical Machine Tutor – Simulator) such as D.C. Machines, Induction Machine, Synchronous Machine and Transformer – mainly Motor generator characteristics, Control and Transformer tests to be performed – Monitoring & control to be studied with the help of a Personal Computer and different vector quantities seen in the oscilloscope.
Study of Electrical circuit diagrams of important systems individually and in totally

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SEMESTER VII

Sl. No.	Subject Code	SUBJECT	L	T	P	C
PRACTICAL						
1	MR283	On Board Training and Assessment	-	20	20	30
2	MR284	Voyage Report	-	4	8	8
3	MR285	Environmental Project	0	1	2	2
TOTAL			0	25	30	40

MR283	ON BOARD TRAINING & ASSESSMENT	6 Months

Training to be imparted as per TAR Book and assessment to be done as per TAR Book and Viva-voce at the institute.

Note: Cadets who are not able to be placed on board, may attend approved Marine workshop. A ship in Campus may provide similar facilities and as replacement of some of the onboard training and marine workshop training. Cadets will also make presentations of their training to the institute for assessment.

Enclosed: TAR (Training assessment & Record Book), for six month onboard training.

MR284	ENVIRAONMENTAL PROJECT	

Cadet has to prepare a report on pollution prevention measures available onboard and present for assessment by the institute.

Enclosed: TAR Book.

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SEMESTER VIII

Sl. No.	Subject Code	SUBJECT	L	T	P	C
THEORY						
1.	MR235	Ship Operation & Management	4	0	0	4
2.	MR236	Advanced Marine Control Engineering & Automation	4	0	0	4
3.	MR237	IMO & Maritime Conventions	3	0	0	3
4.	MR238	Advanced Marine Technology	3	1	0	4
5.	MR239	Engine Room Management	3	1	0	4
6.	MR2XX	Elective - II	3	1	0	4
7.	MR240	Marine Machinery & System Design	1	3	0	3
PRACTICAL						
8.	MR285	Simulator & Control Laboratory	0	1	2	2
9.	MR286	Technical Paper & Project	0	0	6	3
TOTAL			21	7	8	31

MR235	SHIP OPERATION & MANAGEMENT	60 hrs.

AIM: To teach the students about management of ships and impart knowledge on statutory regulation.

UNIT- I

Brief history of Shipping: Modern Shipping practice. Marine vehicles and cargo, care of cargo against damage. Development in Shipping and cargo handling Multimodal transportation, Factors affecting universal adoption. Liner and tramp shipping services. - 12 hrs.

UNIT- II

Conference systems: Organisation & concerns shippers council. Chartering, Charter parties. Theory of freight rates and fares. Rate fixation machinery and government control. Responsibilities of ship owners & charters. Tanker chartering. Freight rates & fares – various terms, influencing factors, market pricing. - 12 hrs.

UNIT- III

Bill of Lading: Function & Uniqueness & related problems. Carriage of goods by sea act. Cargo Surveys and protests.

Marine Insurance: Underwriting and loss adjusting principles applied to Marine cargo insurance. Hull/machinery policy, particular average. General average, P & I Clubs – making claims. - 12 hrs.

UNIT- IV

Shipping companies: Organizational structure, Restructuring on the basis of functional coherence, ship management companies. Turn around strategy for sick shipping companies. Ownerships of vessels, Shipping company and its administration.

Capitalization and finance. Characteristics, cost ratios & allied definition. Sources Financing package, Lender security, Relation between Insurance premium, & non-conformity/condition of class. Economics of new and second hand tonnage. Subsidies, procedure & implication of buying & Selling new/old vessels

Ship operations: Planning sailing schedules. Influencing factors, Unbalance in sea trade counter-action, Voyage estimation, Manning of ships, engagement & discharge of crew. Economic factors. - 12 hrs.

UNIT -V

Commercial Shipping Practice. Manning of ships. Engagement & discharge of crew. D.L.B. Seaman's welfare.

Merchant Shipping Act: Registration of ship, Ship's papers, Port procedures, Pilotage, Flags of convenience, flags of discrimination and their effects on shipping, Duties regarding pollution, Collision, Explosion, fire, etc. Vessels in distress, Shipping casualties penalities under Merchant Shipping Act.

Marine Faud : Genesis and prevention.

Indian Shipping : Current scenario and few case studies. - 12 hrs.

REFERENCES:

1. Shipping Practice - Stevens
2. Managing ships - John M. Downard
3. Advanced shipboard management - Capt. Dara E. Driver
4. Solas 1974 - IMO publications
5. Marpol 1973/78 - IMO publication
6. STCW -95 - IMO publications
7. Shipping management - G. Raguram
8. Ship operation & Management - Dr. K.V. Rao

MR236	ADVANCED MARINE CONTROL ENGINEERING & AUTOMATION	60 hrs.

AIM: To provide knowledge about automation and control engineering in ships.

UNIT I

Introduction to System Analysis: Formation of Mathematical Models to study System behavior considered in a mathematical sense using Differential Equation. *Flowchart for Automatic and Control System – Depiction and understanding of flowcharts, Symbols utilization and processes involved.* System description using mathematical terms for Mechanical, Electrical, Thermal and Liquid Level system, use of Laplace Transforms, Transfer Functions and Block Diagrams for solving control system problems. Use of D-Operators, Concept of stability. Routh & Hurtwiz stability criteria. Analysis of System Performance under dynamic or transient operating condition using Laplace Transformers. Performance characteristics. Nyquist stability criterion, System performance and compensation. - 16 hrs.

UNIT II

Automatic Controllers: Functions of a Proportional, Integral and derivative, Action Controllers, Stacked Type Electronic and Pulse type Controllers, Controller Adjustments, Relays On-Off/ Cut Off Switches, System analysis of all these control systems, formation of mathematical models and Programmable Logic Controllers. - 12 hrs.

UNIT III

Correcting Units: Detailed study of Diaphragm actuators, Valve-positioners, piston actuators, Electro-pneumatic transducers. Electro-hydraulic actuators and Electric actuator control valves. - 8 hrs.

UNIT IV

Signal Transmitting Devices: Flapper Nozzle, Electro Pneumatic signal converter, Electric signal transmission. Pneumatic, Types of Controllers: hydraulic, electric and electronic controllers for generation of control action, Variable Inductance and

capacitance transducer, Force Balance Transducer, Synchros. *Digital Sequential Control devices.* - 12 hrs.

UNIT V

Application of Controls on ships: Marine Boiler-Automatic Combustion control, Air/fuel ratio control, feed water control two and three element type, steam pressure control, combustion chamber pressure control, fuel oil temperature control, Control in Main Machinery units for Temperature of lubricating oil, jacket cooling water, fuel valve cooling water, piston-cooling water and scavenge air, fuel oil viscosity control, working of control system during Manoeuvring of Direct Reversing Diesel Engine Bridge control of main machinery. Instrument for UMS classification. - 12 hrs.

REFERENCES:

1. Control System for Technicians - G.T.Brayan (ELBS)
2. Instrumentation and control systems - Leslie Jackson
3. Engineering instrumentation and control - L.F.Adams
4. Instrumentation & Control Marine - G.T.Roy
5. Marine Control Practice - D.T. Taylor

MR237	IMO & MARITIME CONVENTIONS	45 hrs.

AIM: To impart knowledge about IMO and familiarization with requirements of maritime conventions

UNIT 1

Introduction: National, international bodies associated with Shipping. Statutory Bodies, State Administration, IMO, classification societies and other professional bodies.

Standards of Training, Certification and Watch-keeping for sea-farers-International Conference of 1978 and modifications under STCS 1995. Requirement of training & Competency for operational and management level, competency and training for crew, META manual of DGS, TAR Book for pre-sea and on-board training, Standards of training institutes, quality Management System for training institutes, training of trainers. - 10 hrs.

UNIT 2

Basic principles to be observed in keeping an engineering watch. Minimum requirement of training and competence for Ratings of Engine Room watch. Special requirement for engineer officers for Oil Tankers, Chemical Tankers and Gas Tankers. Details of operational guidance for In-charge of an engineering watch. - 8 hrs.

UNIT 3

Shipboard Applications- Regulations & Code 0f Practice; Ship design & equipment of Oil, Chemical & Gas Tankers; Ship operation, repair & maintenance; Emergency operations; Training of other personnel. Requirement of continued up-dating of

proficiency, Definition of flag state/port state. Port state control inspection, Implication of ship's detention. - 8 hrs.

UNIT 4

ISM Code: Statutory certificates and documents to be provided on board for safe trading of vessel and port state control inspection. Basic safety concept on board a merchant vessel & operational knowledge of the relevant IMO instruments like SOLAS, MARPOL, LOADLINE, TONNAGE, COLREG, STCW, ISPS with latest amendments, how above instruments are adopted under Explicit/Tacit acceptance procedures, Related conventions for the certificates, period of validity, involvement of ISM, issue of DOC/SMC and maintenance of SMC. ILO Maritime Labour Convention – 2006 and relevance to seafarers. *Toxic and other ill effects of cargoes on human and environment.* - 11 hrs.

UNIT 5

Survey of Ships: Statutory/Class surveys and certificates / documents obtained. Special/ intermediate / annual surveys for ocean going ships. Harmonisation of surveys, under water hull inspection. Issue of condition of class and implications. - 8 hrs.

REFERENCES:

1. STCW Convention - IMO Publication
2. META Manual - DGS, Govt of India
3. SOLAS, MARPOL 73/78 - IMO Publication
4. Others IMO Conventions - IMO Publication
5. Classification Societies & IACS

MR238	ADVANCED MARINE TECHNOLOGY	60 hrs.

AIM: To provide latest technology in ships to students

UNIT I

Study of LNG & LPG ships

Bridge Control Systems & UMS Operation:

Various controls of deck equipments including pneumatic and electronic equipments. Study reliquification plants & tandem operation. Study of structure of various types of tanks for LNG and LPG vessels. IG systems for gas tankers, glycol systems for cargo compressors, E-motor room, safety devices, study of compressors and safety devices. - 12 hrs.

UNIT II

Chemical Tankers: Classification, construction, pumps for chemicals, tank cleaning procedures, IG systems for Chemical tankers, Controls and safety devices associated with loading and discharging. - 12 hrs.

UNIT III

Oil Tankers: Types & classification, construction, COW operation, IG Systems, Pump arrangements and safety devices associated with loading and discharging. - 12 hrs.

UNIT IV

Car Carrier & Bulk Carrier: Construction, ventilation, Stability, Strength considerations, RO-RO arrangement.

Construction, Strength considerations w.r.t loading & discharging, Condition assessment system, Enhanced survey, safety considerations, stability considerations.

- 12 hrs.

UNIT V

Latest Engine Technology: Intelligent Engines, Condition monitoring, Common rail fuel injection w.r.t electronic fuel injection, Exhaust emission and control – design of engine, NOx Technical file, IAPP certificate. - 12 hrs.

REFERENCES:

1. Shipboard Operations - H.I.Lavery
2. Marine Diesel Engines - C.C.Pounder
3. Liquefied Gas Handling Principles on Ships and in terminals - McGuire & White
4. Tanker Safety Guide Liquefied Gas - International Chamber of Shipping
5. International Safety Guide for Oil Tankers and Terminals (ISGOTT) - International Chamber of Shipping

MR239	ENGINE ROOM MANAGEMENT	60 hrs.

AIM: To enable the student acquire knowledge for operation and maintenance of marine machinery and take care of engine room management.

UNIT 1

Preparation of Engine & Maintenance: Full knowledge of preparing Main Engine, A.E, Boiler, all auxiliary engines for sailing from port and port operation, All control systems (Pneumatic & Electronic) should be studied.

Preparing maintenance schedule for all machineries like Main Engine, Alternator, Compressor, Purifier, Evaporator, steering gear, electrical machinery and all other engine machineries, Overhauling procedure for various Aux. M/c., Bad weather precaution taken. - 14 hrs.

UNIT 2

Breakdown Operations & Spare parts Management: Preparation of engines for emergency operation, Emergency repair for engine room machineries, Emergency steering.

Preparing store inventory, Sending store requisition or ship, Maintenance of E.R. Stores, Just – In – Time (JIT) concept, ABC Analysis, Monitoring daily consumptions, Bunker estimates, Preparing bunker plan. - 10 hrs.

UNIT 3

Monitoring of engine performance & Management of engine room crew: Taking indicator cards and interpretation of card, trouble shooting from engine parameters like pressure & temperature and behavior like vibration and noise, crank case inspection, use of mist detector and other safety features.

Criteria for composing the engine room watch, Operation & Watch requirements, Fitness for duty, Protection for marine environment, Requirement for certification; minimum knowledge requirement for certification-theoretical, practical; Duties & responsibilities concerning safety & protection of environment, Requirements for watch keeping duties, Physical training & experience in watch-keeping routine; Main and aux. Machines, Pumping systems, Generating plant, Safety and emergency procedures, First aid - 14 hrs.

UNIT 4

Engineering watch (underway & Unsheltered anchorage): General, Taking over watch, Periodic checks of machinery, Engine Room Log, Preventive repair and maintenance; Bridge notification. Navigation in congested water and during restricted visibility, calling the attention of the Chief Engineer Officer, Watch-keeping personnel.

Conditions to be ensured. Watch-keeping (in Port-) Watch arrangements; Taking over the watch; Keeping a watch. Oil, Chemical & Gas Tankers-Principles, characteristics of Cargo; Toxicity hazards; Safety equipments; Protection of Personnel.

Pollution prevention methods. - 12 hrs.

UNIT 5

Deck machinery & Dry Docking: Various types of deck machinery used in ships e.g. Winches and Windlass and their requirements. Operation and maintenance. Deck Cranes. Hydraulic deck machinery; hydraulic motors, line filters and systems.

Planning, entering, docking, inspection, maintenance and repairs, Surveyors, certification. Undocking and report writing. - 10 hrs.

REFERENCES:

Question & Answers of Marine Diesel Engines - John Lamb.
Marine Electrical Practice - G.O.Watson
Marine Auxiliary Machines - D.W.Smith
Running & Maintenance of Marine Machinery - IME publication.

MR240	MARINE MACHINERY & SYSTEM DESIGN	60 hrs.

Design Considerations: Following design considerations are to be taken into consideration while designing marine machinery system: Manufacturing methods, Castings, Forgings, Fabrication & Plastic Moulding: Machining Tolerances, surface Finishes: Application to basic design principles in respect of Function, Available

materials, Production methods, Economics, Aesthetic appeal. Initial and Servicing costs, Analysis of force, Flow through an assembly and its effect on the design. Design with reference to Repairs and reconditioning specifically "at sea" work with its normal restrictions and limitations. - 3 hrs.

Marine Machinery Component Designs & Drawing: Design and Drawing of marine machinery components subject to combined bending, twisting and direct loading like Crankshafts, Propeller shafts etc., Design and Drawing of Flywheel, Piston, connecting rod, safety valves, Reducing valves, Compression & Torsion springs, Journal bearings, Thrust bearings etc. Design of lifting equipment e.g. Engine room overhead Crane, Globe & other valves Mechanical Pilot etc. - 9 hrs.

Advanced Design of Marine Systems Design & Drawing:
Power Transmission system including Thrust Blocks, Intermediate shaft and Tail-End Shaft
Water cooling systems including pumps, filters, Heat exchangers for Diesel and Steam engine plants.
Lubricating Oil systems including Pumps, Purifiers, Pressure by-pass valves.
Electro-hydraulic Steering gear system including Rudder, Rudder stock, Tiller arm, ram & cylinder.
Marine Diesel Engine Air starting systems including Air receivers, Compressors and Air starting valves.
Marine Diesel Engine Scavenge and Exhaust system.
Marine Diesel Engine Fuel Injection system including Fuel pumps and Fuel-injectors.
Design of Steam Turbine Plants.
Design of Gas Turbine Plants.
Life boat and it's launching device.
Refrigeration Plant.
Bulk CO_2 system.
Fire fighting system including emergency fire pump. - 42 hrs.

Note: Latest developments and IMO requirements are to be considered in each design project

Computer aided design: Analysis of stress, strain, vibration, thermal stress, deflection through method of Finite Element Analysis by use of various software like MSC NASTRAN, I-DEAS, AUTO-CAD, Pro-engineer. - 6 hrs.

REFERENCES:

1. Machine Design - Pandya & Shah
2. Marine Engineering - Harrington
3. IMO & Classification society Publications

MR285	SIMULATOR & CONTROL LABORATORY	54 hrs.

Engine Simulator Lab Exercise: Description of basic engine functions and their simulation introduced in Engine Room Simulator.
Manual engine operation from engine room station, Remote stations-i.e. control room and Navigation bridge. Safety and interlocks in UMS-ships and effect of malfunction of main engine auxiliaries. Trouble shooting of main engine and other auxiliary systems.

Training on Turbo Diesel Engine Software: Turbo Diesel's three modes of operation – standard mode of a four stroke, three cylinder medium speed marine engine.

Using Turbo Diesel the following experiments are to be performed:

1. To start and stop the engine.
2. To change engine's load and speed.
3. To change ambient operating conditions;
4. To simulate engine faults in varying degrees;
5. To mix different simulations;
6. To watch engine operation parameters;
7. To watch functions inside cylinders;
8. To simulate the engine sound which varies with speed;
9. To carry out maintenance and repairs;
10. To try out different maintenance strategies;
11. To print engine data
12. To use lesson facility. - 24 hrs.

Control Lab. Experiments:
Operation of Automatic Viscosity Controller and maintaining a specific viscosity of a given fuel.
Operation of an Automatic flow controller and measuring the flow from in a given pipe.
Operation and utility of a 3 Term (P+I+D) Pneumatic controller.
To study the functioning of a Mist Detector and checking the alarm when the Pre-set value is exceeded.
Study the operation of fire detection unit using Ionization chamber type detector.
Microprocessor controlled DC &AC machines,
Study of SCADA system and PLC.
Study Electronic governor for Main Engine & Generator Engine. - 14 hrs.

Combustion Simulator:
Study of engine combustion system in Combustion Simulator: To study various combustion problems, Effects of various combustion defects, trouble shooting, rectification of combustion defects, Cause, effect and rectification of combustion defects. Effect of quality and injection timings of fuel. VIT, super VIT and other modern methods for combustion control for achieving different objectives. - 16 hrs.

MR286	TECHNICAL PAPER & PROJECT	45 hrs.

Note: The cadets should write a technical paper under guidance of one faculty member of the institute. The paper will be assessed by a committee and the cadets will present the paper to another committee consisting of external assessors for evaluation, Final marks will be calculated from the both external and internal assessment.

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LIST OF ELECTIVES

SL. No.	Course Code	Course Title	L	T	P	C
1	MR2A1	Double Hull Tanker Vessels	3	1	0	4
2	MR2A2	Advanced Marine Heat Engines (Co-Cycles)	3	1	0	4
3	MR2A3	Environmental Science & Technology	3	1	0	4
4	MR2A4	Applied Hydraulics & Hydraulic Machinery	3	1	0	4
5	MR2A5	Transport & Logistic Management	3	1	0	4
6	MR2A6	Advanced Material Science & Surface Coating Engineering	3	1	0	4
7	MR2A7	Renewable Energy Sources & Applications	3	1	0	4

MR2A1	DOUBLE HULL TANKER VESSELS	60 hrs.

UNIT I

Orgin of double hull ships, their usefulness and superiority over conventional single skin ships, use of double hull tank ships for transport of different types of commodities, prevention of oil-spill and pollution of sea, IMO requirements, schedule for phasing out single hull tank vessels of different sizes. - 12 hrs.

UNIT II

Design considerations, main dimension, hull-weight estimate, double hull requirements, minimum depth of double bottom tank, wing tank width, clearance for inspection etc. maximum cargo tank size, capacity, effect of free surface, damage stability, hydrostatically balanced loading, sloshing loads, its elimination or minimization. - 12 hrs.

UNIT III

Structural design, non-uniform and uniform stress distribution, unidirectional (longitudinal) structural members, elimination of transverse structural members (except transverse bulkheads), minimization of structural discontinuities and stress concentration zones, use of steel of higher strength, resistance to grounding and collision, classification society requirements, access to inside and bottom spaces. - 12 hrs.

UNIT IV

Cargo handling system, use of submerged pumps, ordinary pumps of new independent pumps, cargo transfer system, assurance of quality of cargo oil, complete elimination of risk of admixture of different grades of oil, concealed pipe-lines, easy maintenance, inspection and cleaning, elimination of explosion risks. - 12 hrs.

UNIT V

Economic aspects, fast loading discharging of oil Cargo, quicker cleaning, ballasting and de-ballasting, larger number of trips per year. - 12 hrs.

REFERENCE:

1. Indian Register of Shipping Notes on Design of Double Hull Tankers
2. Lloyd Register of Shipping Notes on Design of Double Hull Tankers
3. “Ship Design”, SNAME

MR2A2	ADVANCED MARINE HEAT ENGINES (CO-CYCLES)	60 hrs.

UNIT 1

Complex Heat Engine Plants: Combined Steam Turbine and Diesel Engine cycles. Combined Steam Turbine and Gas Turbine cycles. Combined Gas Turbine and Diesel Engine cycles/plants. Different methods of improving the overall Thermal efficiency of

the entire plant. Design of the most optimum condition and combination of complex plants. Cascade Refrigeration plants. Free piston Gas Generators. - 14 hrs.

UNIT 2

Turbo Blowers and Turbo compressors: Compressor characteristics for Axial flow compressors and Centrifugal compressors. Stalling of compressors. Turbine characteristics. Matching of components like compressor and Turbine. Performance of different units in combination in single shaft arrangement. - 14 hrs.

UNIT 3

Combustion: Combustion of liquid fuels, atomization, Mixing, combustion curve and, Design of combustion chamber. Pre-mixing of gaseous fuels for combustion. - 10 hrs.

UNIT 4

Flame Stabilization: Different methods of flame stabilization, Spray of fuel, Stability of the flame. - 10 hrs.

UNIT 5

Heat Exchangers: Design of different types of compact Heat Exchangers for different applications, eg. Air pre-heater, Gas and oil heaters etc. - 12 hrs.

REFERENCE:

1. Reed's Marine Engineering Series, "Heat and Heat Engines", Thomas Reed Publications Ltd., 1983.

MR2A3	ENVIRONMENTAL SCIENCE & TECHNOLOGY	60 hrs.

UNIT 1

Basics of Environmental Science:

Concept of environment, definition, concept and scope of environmental science, environmental ethics, earth – man – environment, environment-civilization interface, genesis of global environmentalism.

Segments & Processes in the Environment:

Evolution of environment, physiochemical and biological factors in environment, Structure & composition of – atmosphere, hydrosphere, lithosphere and biosphere, Hydrological & Geochemical cycle, Geographical classification and zones, climate & weather. -12 hrs

UNIT 2

Principles of Ecology:

Tropic structure & energy flow, food web complexity & patterns, structure and function of forest and agricultural ecosystem, population ecology, community ecology, community structure & dynamics, Landscape ecology, landscape elements, landscape geometry, landscape sustainability, urban-industrial techno eco-systems. -8 hrs

UNIT 3

Biodiversity & Conservation Biology: Meaning of Biodiversity, levels of biodiversity, factors influencing local & regional biodiversity, hotspots of biodiversity. Global pattern of biodiversity, biodiversity conservation approaches, common aquatic and terrestrial flora & fauna in India and World (phytoplankton, Zooplankton, Macrophytes etc).

Environmental Microbiology: Fundamental of Microbiology – classification, growth and characteristics. Microbiology of water: Fresh water as a microbial growth supporter, common micro-organism, self purification of water, microbial pollution of water and assessment of pollution, D.O., BOD, COD, domestic waste & treatment, beneficial and pathogenic microbes in agriculture and their role in environment. -14 hrs

UNIT 4

Environmental Pollution and it's control:

Air Pollution: Natural and anthropogenic sources, primary & secondary pollutants, pollution from emissions of engines & CFC, HCFC, methods of monitoring air pollution, air quality criterion & standard, effects of air pollution, air pollution control – concept, devices and systems.

Water Pollution: Source of pollutants, surface water & ground water pollution, control of water pollution – recycling, industrial waste water control & management. Marine pollution – sources, effect, control.

Pollution from solid wastes, management of solid waste, biomedical waste, e-waste.

-14 hrs

UNIT 5

Environmental Audit:

Introduction to Environmental Impact Assessment (EIA), methodologies, official guidelines, techniques for EIA, concept and preparation of Environment Impact Statement (EIS). Environment Management Plan (EMP), environmental audit, guidelines and methodologies. Environmental laws and policies. Public liability insurance act 1991. MARPOL 73/78. -12 hrs

REFERENCE:

1. G.M. Master, "Introduction to Environmental Engineering & Science", Prentice Hall, New Delhi, 1997.
2. J.G. Henry and G.W. Heike, "Environmental Science & Engineering", Prentice Hall International Inc., New Jersy, 1996.
3. S.K. Dhameja, Environmental Engineering and Management, S. K. Kataria and Sons, New Delhi, 1999.
4. State of India's Environment – A Citizen's Report, Centre for Science and Environment and others, 1999.
5. Shyam Divan and Armin Rosancranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.

MR2A4	APPLIED HYDRAULICS & HYDRAULIC MACHINERY	60 hrs.

AIM: To provide in-depth knowledge about hydraulic machineries for general and shipboard application.

UNIT I

Hydraulic Transmission of Power:

Hydraulic Motors, Valves, Types of Hydrostatic drives. Types of Hydraulic Transmission Systems-Multimotor open-circuit Systems and closed-circuit systems. Applications of Hydraulic Transmission. Advantages and disadvantages of Hydrostatic transmission & fluid circuit. - 12 hrs.

UNIT II

Hydraulic pumps & motors:

Pumps: Design considerations, characteristics and calculations on Gear, Screw, Vane pumps of fixed and variable displacement types, Axial piston pumps of fixed and variable displacement types-Swash plate and Bent Axis Design; Radial piston pump.

Motors: Fixed or Variable displacement type, axial piston unit of Swash plate and bent axis design, fixed displacement axial piston unit of wobble plate design, Vane type.

- 12 hrs.

UNIT III

Rotodynamic Transmission:

Hydraulic Coupling, Torque converter and characteristics of hydraulic coupling Torque converter. Linear Transmission of Hydraulic Power. Hydraulic Rotary Actuator of parallel piston type and piston type with rack-pinion, crank lever mechanism.

Hydraulic Accumulators:

Various types-weight, spring or gas pressure loaded, different principles-piston, bladder of diaphragm type. Change of condition of the fluid in a loaded accumulator-Adiabatic, Isothermic, Polytropic. Flow graph, sizing, pressure setting and the economics. - 12 hrs.

UNIT IV

System components and functions:

Valves, Tank, Flexible hose, piping and fittings. Seal and packing, actuators, pipe couplings, Assembly of different hydraulic components without using piping, e.g. Vertical/Horizontal stacking, manifold block, etc. Different types of filters, instruments and control elements, e.g; Float switch, thermostat, pressure switch, etc. Different valves for pressure control, velocity and discharge control direction control, etc. Symbols of components along with hydraulic terms. Different control systems, hydraulic and pneumatic systems, Typical circuit for a pump set. - 12 hrs.

UNIT V

Shipboard application of hydraulic system:

Hydraulic Servo mechanisms. Servo valves, Valve operated servo mechanisms and pump control servo mechanisms. Hydraulic press, Jack, Accumulator, Hydraulic crane. - 12 hrs.

MR2A5	TRANSPORT & LOGISTIC MANAGEMENT	60 hrs.

AIM: To provide students with a state- of- the – art know how about the field of transport, logistic and the maritime industry.

Unit - 1.

Management principles & practices, Management information system, Human resource management. - 12 hrs.

Unit - 2.

Managerial economics, Financial accounting, Cost & Management accounting, International Financial Management. - 12 hrs.

Unit - 3.

International trade & commerce, International transport system, International transport law, Transport economics, import – export documentation & procedure, multimodal transport. Logistic & Operations Management. - 12 hrs.

Unit - 4.

Quantitative techniques, Operation research, Research Methodology, Strategic management, International marketing. - 12 hrs.

Unit - 5.

Port & Terminal management, Port Economics, Logistic & Supply Chain Management, Port Pricing & Finance, Port Marketing & Services. - 12 hrs.

MR2A6	ADVANCED MATERIAL SCIENCE & SURFACE COATING ENGINEERING	60 hrs.

UNIT 1

Material Structure: Details of material structure, structure property correlation, materials of construction, Micro and Macro examination of material, behavior of metals under fatigue, creep, corrosion, low temperature, high temperature, fracture mechanics and fracture toughness, role of residual ductility in corrosion fatigue. - 10 hrs.

UNIT 2

Material for ships: Metals, alloys and material used on ships (piston, cylinder liner & head, D.E valves, propeller, turbine blades, impeller, heat exchangers, chilling plants, LNG tanks, ship's hull. etc. Special polymeric material like PVC, Teflon, Polypropylene, etc. Super alloys like satellite and other hard facing material for ship's hull and other special application. Amorphous metallic coatings, metal-metalloid coatings Ni-P, Ni-P=B, Ni-P-B-Wc-Bc-Sic, Al_2O_3 etc. – 12 hrs.

UNIT 3

Heat treatment processes & Metallurgical aspect of Metals joining: Advanced heat treatments processes of steel based on T-T-T curves advanced steel making processes, Special steel for ship building, Advanced heat treatment processes for non-ferrous alloys.

Thermo-mechanical treatment and effect on material, soldering and brazing, metallurgical effect of welding; hot cracking, welding high tensile steel, welding cast iron, welding stainless steel, welding copper and it's alloys, welding brasses, welding bronzes and other alloys. - 14 hrs.

UNIT 4

Modern Material & Testing of Material: Discussion on recently developed material and study on them.

Advanced study tensile test, hardness test, notched bar test, various methods & machines foe tests. Non – destructive tests like penetrant test, magnetic particle test, ultrasonic test, radiographic test, Acoustic emission test (A.E.S), thermal Imaging test for welds.

- 12 hrs.

UNIT 5

Prevention of corrosion & Cracks: Non-metallic coatings (paints), anodic & cathodic protection, Impressed Current Cathodic Protection system,

Metallic coatings; thermal spray coating, plasma spray coating, Laser alloying, high energy surfacing processes, Ion-plating, plasma enhanced ionic deposition for marine application, Diffusion Coating and Surface modification for improving hull efficiency.

Prevention of static & dynamic stress corrosion cracking (S.C.C), cl.S.C.C. - 12 hrs.

REFERENCE:

1. Metallurgy for Engineers - E.C. Rollason English Language Book Society (ELBS)

MR2A7	RENEWABLE ENERGY SOURCES & APPLICATIONS	60 hrs.

Unit - 1

Principles of Renewable Energy:

Introduction, Fundamentals. Scientific Principles of Renewable Energy. Technical Implications, Social Implications.

Solar Radiation & Water Heating:

Introduction. Extra terrestrial Solar Radiation. Components of Radiation. Geometry of Earth & Sun. Geometry of the Collector. Solar Beam. Effects of Eastern Atmosphere. Measurement.

Estimation of Solar Radiation. Problems.

Introduction: Heat Balance. Unsheltered & Sheltered Heaters, Systems with Separate storage. Selective Surfaces. Evacuated collectors. Uses of Solar Heat. Air Heater. Space

Heating & Cooling. Water desalination. Solar Ponds. Solar Concentrators Electrical Power systems. Problems. - 14 hrs.

Unit - 2

Photo Voltaic Generation:

Silicon P-N Junction. Photo absorption. Solar Radiation Input. Photo voltaic Circuit Properties & Loads, Limit to Cell efficiency. Solar Cell Construction. Types & adaptation of Photo voltaic. Other types of Photo voltaics & thermoelectric Generation. Problems. - 8 hrs.

Unit - 3

Wind Power:

Introduction. Turbine Types & Terms. Linear Momentum & Basic Theory. Dynamic Matching. Stream Tube Theory, Characteristics of the Wind. Power Extraction by a Turbine, Electricity Generation. Mechanical Power. Total systems. Problems.

Wave Energy: Tidal Power:

Introduction. The cause of Tides. Enhancement of Tides. Tidal Flow Power. Tidal Range Power. World Range Power sites. Problems.

Ocean Thermal Energy Conversion:

Principles. Heat exchangers. Pumping Requirements. Other practical considerations. Problems. Hydro Power & Geothermal Energy.

Brief Review & Description. - 16 hrs.

Unit - 4

Energy storage & Distribution:

Importance of Energy Storage & Distribution. Biological Storage. Chemical Storage. Electrical Storage. Fuel Cells, Mechanical Storage. Distribution of Energy Problems. - 8 hrs.

Unit - 5

Bio mass & Biofuels:

Principles of using Biomass. Availability. Economics.

Introduction. Biofuel Classification, Thermochemical, Biochemical, Agrochemical. Biomass Production for energy framing, Energy framing-advantages & disadvantages. Geographical Distribution. Crop yield, Energy analysis. Direct combustion for heat. Domestic cooling & heating, Crop drying. Process heat & electricity.

Pyrolysis. Solid, Liquid, Gases,

Hydrogen Reduction. Acid & enzyme hydrolysis. Conversion of oil (coco) to Ester.

Methanol liquid Alcoholic fermentation. Directly from sugar cane sugar Beet. Starch crops. Cellulose. Ethanol fuel use. Ethanol production.

Anaerobic Digestion for Biogas-Basic process & energetics Digester sizing. Working Digesters. Agrochemical fuel Extraction-advantages & disadvantages. - 14 hrs.