



THE NEOTIA
UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

SCHOOL OF MARITIME STUDIES

SYLLABUS FOR FOUR YEAR MRE COURSE

Campus: Sarisha, Diamond Harbour Road,
24 Parganas (South),
West Bengal- 743368
India.
Phone No. 033-40084848
Web.: www.tnu.in

SEMESTER I

MSML/110	SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA- I	18 HRS
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AIM : To make students familiar with the duties of seaman, various types of ropes and knots, knowledge of Bridge equipments and about LSA.

Seamen & their duties: Ship's Department, General ship knowledge and nautical terms like Poop-Deck, Forecastle, Bridge. - 2 hrs

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. - 3 hrs

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. - 2 hrs

Anchors: Their use, Dropping and Weighing anchor, Cable stopper. - 2 hrs

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 - 9 hrs

REFERENCES:

1. Seamanship :J.Dinger
2. Survival in Life Boat : CaptPuri
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

SEMESTER I

MCE/111	COMMUNICATIVE ENGLISH SOCIOLOGY - I	36 HRS
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AIM: This course is designed to enable to students to entrance their linguistic abilities in listening, reading, writing and speaking communicative English. Adequate knowledge of English.

COMMUNICATIVE ENGLISH

Unit – 1, English & Remedial Grammar:

Revision of knowledge of Parts of speech, Tense, Narration, Analysis, Change of voices, Appropriate prepositions. - 12 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. - 12 hrs

Operation of all internal communication systems onboard

Unit – 3, Written Communication

- (a) Formal and ordinary letters, formal invitations, letters to friends and relative
- (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) Understand and use technical / engineering publications.
- (h) Summarizing / abstracting the main ideas of an unseen passage, given a working outline.
- (i) Stress marking and use of idioms and phrases. - 12 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 and 2	L. A. Hill, C.J.Daswani & C.T. Daswani. (Oxford University Press 1975)
Written communication	Freeman and Sarah.
Business correspondence	R. C. Sharma and Krishnamohan.
and report writing	
Sea Speak manual	International Maritime Organisation.
“Technical Communication English Skill for Engineers”,	Meenakshi Raman and Sangeetha Sharma,Oxford University press, 2008

SEMESTER - I

MMM/112	MATHEMATICS- I	72 HRS
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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 tools for specialised studies in Engineering fields.

Review of prerequisites such as-Functions, limits, continuity, Uniform continuity and differentiability. Indeterminate forms and L'Hospital's rule. - 2 hrs

Rolle's theorem, Mean value theorems and Taylor's theorem. Applications of Mean value theorems. - 4 hrs

Applications of derivatives- rate measure, Error, Extreme, Curvature, Asymptotes. - 4 hrs

Successive differentiation-Higher order derivatives, nth order derivatives, standard results, nth order derivatives of rational functions and partial fractions, nth order derivative of the product of powers of sines and cosines. Leibnitz' Theorem, Maclaurin's Theorem and std. Expansions. - 8 hrs

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. Curve tracing of cartesian and polar curves. - 12 hrs

Calculus of Variations-The Brachistochrone problem, Euler-Lagrange development, applications of Euler's equation, several dependent variables, applications to discrete mechanics, the Isoperimetric problem. - 8 hrs

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. Work done by variable forces mean values, RMS value of $\sin nx$ $1/\cos nx$, pappus and gulldinus theorem and its applications. Applications - Area volume, mass, centre of gravity of wire, lamina and solid. - 10 hrs

Vector algebra, Scalar and vector products, orthonormal triad, scalar triple products, Linear dependence of vectors, other repeated products, identity of Lagrange, Reciprocal systems. - 6 hrs

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 field, Directional derivatives. - 8 hrs

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. - 6 hrs

Review of pre requisites of complex numbers, De-Moivre's theorem, complex variables, Limit, derivative, Analytic functions, Cauchy Riemann equations, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of an analytic functions, Taylor series and Laurent series. - 4 hrs

REFERENCES:

1. GREWAL, B. S. Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi, 2004.
2. Bali, N.P. and Narayana Iyengar, 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.

SEMESTER - I

MBT/113	BASIC THERMODYNAMICS	54 HRS
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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.

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; Basic Problems. - 8 hrs

Properties of Pure Substances & 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 & Work Transfer in various Gas Process; Temperature-Entropy Diagram; Applied Problems. - 12 hrs

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 Processes with Steam; Applied Problems. - 12 hrs

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. - 10 hrs

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. Sneed & 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 |

MBEE/114	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	54 HRS
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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.

ELECTRICITY

Basic concept of electrical circuit, cells, electrostatics and electromagnetism, circuit laws and analysis, maximum power transfer and grouping of cells. - 6 hrs

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. - 8 hrs

Alternating current and voltage. Single phase a.c. circuits. Three phase circuits-balanced and unbalanced loads. Transient phenomena. - 8 hrs

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. - 7 hrs

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.

Simple electronics measuring devices, -such as VTVM, CRO, IC tester, signal generator.

- 7 hrs

Illumination and its measurement.

- 2 hrs

ELECTRONICS

Electron Emission: Thermionic Emission, Photoelectric emission, Electric field emission and their applications. - 4 hrs

Semi Conductors: What is semiconductor, Types of Semi Conductors, Electrical characteristics, Diffusion and Drift, Mobility, Varistors Thermistors and Non Linear Resistors. - 5 hrs

Semi Conductor & Diodes: Characteristics of diodes, Diode as a rectifier, Diode clamper and voltage doublers, Zener diodes, tunnel Diodes, Rectifiers & Filters LEDs. - 5 hrs

Transistors: The junction transistor and its basic characteristics, The transistor as a switch.

The transistor as an amplifier,

Signal generation – operating principles, applications - 2 hrs

Recommended Text:

1. Introduction to computer and communication (2006), TMH by D. Ravichandran.
2. 'Let Us C' 17th edition (September 2020), BPB Publications, By Yashwant Kanetkar.
3. Computer Fundamentals and Programming, Theraja, R, Oxford University Press.

REFERENCES:

1. Electrical Engineering - Edward Huges
2. Basic Electronics, volumes 1 to 7, by Harry Mileaf.
3. A text Book of Electro technology, volume 1, Basic Electrical Engineering, by B. L. Theraja and A. K. Theraja.
4. A text Book of Electro technology, volume 2, AC and DC machines, by B. L. Theraja and A. I. Theraja.
5. A text Book of Electro technology, volume 4, Electronic Devices and Circuits, by B. L. Theraja and A. K. Theraja.
6. Computer Fundamentals and Programming in C (2013), Oxford University Press; 2nd edition by Pradip Dey, Manas Ghosh.
7. Basics of Computer Science (2009) Cengage Learning, By Behrouz Forouzan, Firouz Maosharraf, Mostafavi.

SEMESTER - I

MMOM/115	ENGINEERING MECHANICS- I	54 HRS
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AIM: To impart a sound knowledge on the principles of Engineering Mechanics.

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), Lamis Theorem Frame-works. Free body diagrams. Trusses, Method of section, joint to joint method and Bow’s notations. - 6 hrs

Non-coplanar forces : Three rectangular components of vectors. Equilibrium and resultant of vectors in space. - 4 hrs

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. - 6 hrs

Centroids: Centroids of areas, Centroids of lines, Centroids of volume, Centroids of masses, Centre of gravity, Composite figures, Pappus Theorem - 8 hrs

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. - 10 hrs

Rectilinear motion: Differential equation. Constant force. - 4 hrs

Force as function of time and displacement. D’ Alambert’s principle of dynamic equilibrium. Linear momentum. - 4 hrs

Curvilinear motion: Differential equation. Normal and tangential acceleration. Projectile, D’Alembert’s principle. Angular momentum. - 6 hrs

Motion of rigid bodies: Rotation about fixed axis. Rotation under constant moment. Periodic motion, Work, power and energy. - 6 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. Hannah & R.C. Stephens

SEMESTER - I

MWT/116	WORKSHOP TECHNOLOGY	54 HRS
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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.

Common workshop Tools : Description and uses of different types of Calipers, Straight edges, Try squares, Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Tapes, 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. - 6 hrs

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 lathes, Automatic lathes, drilling and boring machines. Shaping slotting and planning machines, Milling and broaching machines. - 10 hrs

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. - 5 hrs

Abrasive process: Grinding, honing and lapping by hand and machines. Shears and punches. Wood working Machines. Principles of jigs and fixtures Standardization. - 5 hrs

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. - 6 hrs

Fitting and Overhauling: Types of packing and jointing 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, Pipe work. - 8 hrs

Safety Measures: Sources of danger and methods of protection. Types of guards and safety devices, Factory Act regulations. - 4 hrs

Welding: Welding Equipment & Applications, Electric welding (A.C & D.C.) spot welding. Gas welding. Soldering & Brazing. Different welding & Electrodes, Solders & Brazing Fluxes. Defects in welding
Safe working practices – Personal Protection Equipment - 10 hrs

REFERENCES:

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

SEMESTER - I

MGD/117	GEOMETRICAL DRAWING	72 HRS
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AIM: To impart the knowledge to the students about good draughts man ship, curves used in Engineering practice, and projection of solids.

Introduction to Technical Drawing: Draughts man ship, lettering, dimensioning, types of lines and correct use of drawing instruments, Construction of geometrical figures specially showing joining of straight lines and curves. - 18 hrs

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. Projection of points and lines. - 18 hrs

Projection of points, lines, planes, and solids: Projection of points and lines 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. - 18 hrs

Development of surface and curves of intersections: Developing the surface of prisms. Pyramids and cones and drawing the curves of intersection of cylinders to cylinders, cylinders to cones, and other solids. - 18 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, 2003.

SEMESTER - I

MBEEL/118	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY	54 HRS
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ELECTRICAL LABORATORY

- a) Determination of equivalent resistance of the resistors when they are connected in
- (i) Series,
 - (ii) Parallel
- And (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 and Display Models.
- Preparation of wiring for
- i) fan
 - ii) Florescent lamp
- Measurement of Power using Watt meter
- Measurement of energy (single and 3 phases) 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 practicals 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. - 35 hrs
- b) Electrical symbols and how to read circuit diagram.
- Making circuits of important system like starting of an induction motor (single phase & 3 phase)
- Understanding malfunction in these systems and finding effects and reasons for same.
- Maintenance and rectification of these faults. - 16 hrs

ELECTRONICS LABORATORY

- Determination of the characteristics of Diode .
- Determination of the characteristic of a Triode.
- To study the charging and discharging action of a capacitor.
- 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.
- Study of electronic symbols, interpretation of flow diagrams.
- Logic Circuits (Practical) : Basic Logic gates (Practical)

- 3 hrs

SEMESTER -

MWP/119	WORKSHOPS PRACTICALS- I	108 HRS
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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°

To make a square head on a round rod (Square Head Pin).

Bending 90° 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 freshwater pipe.

Miscellaneous

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

SEMESTER -

MIC/120	INDIAN CONSTITUTION	18 HRS
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Course Objective

1. To know about the development and historical background of Indian Constitution.
2. To know about the salient features of Indian Constitution.
3. To know about fundamental rights of Indian Constitution.
4. To know about the Welfare policies of the State.
5. To know about fundamental duties of the citizen as laid down in Indian Constitution.

Course Outcome

Learners will be aware of the fundamental law of the land which is the source of all the laws in India. Learners will be aware of fundamental rights guaranteed by Indian Constitution. Learners will be aware of directive principles of state policies, welfare policies of the State and how those policies can be implemented. Learners will get to know about fundamental duties of a citizen as laid down in Indian Constitution.

Course Contents

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|---|-------|
| 1. Salient features of the Indian Constitution | 3 HRS |
| 2. Preamble of the Constitution: Significance and Judicial Interpretation | 3 HRS |
| 3. Fundamental Rights: | |
| • Right to Equality, | |
| • Right to Freedom, | |
| • Right to Life and Personal Liberty, | |
| • Constitutional Safeguards against Arbitrary Arrest and Detention, | |
| • Right against Trafficking and bonded labours, | |
| • Freedom of Religion and Restrictions, | |
| • Constitutional Remedies to Enforce Fundamental Rights, | |
| • Public Interest Litigation. | 6 HRS |
| 4. Directive Principles of State Policy | 3 HRS |
| 5. Fundamental Duties | 3 HRS |

Recommended books

1. Jain M. P., Indian Constitutional Law, Wadhwa and Company, Nagpur, 5th edition (2007)
2. Pandey J. N., Constitutional Law of India, Central Law Agency, 44th edition (2007)
3. Granville Austin, Working A Democratic Constitution: A History of the Indian Experience, Oxford, (2000)
4. Durga Das Basu, Shorter Constitution of India, Vol. 1 & 2 14th edition Lexis NexisButterworthsWadhwa, Nagpur, (2009)

SEMESTER -

MCA/121	COMPUTER ARCHITECTURE	18 HRS
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8. Subject Name/Code: Computer Architecture

Section	Module name	Topics	Hours
Module-I	Input and Output devices	Lists the types of Input and Output devices. Explain different types of Input devices and their functions. Explain different types of Output devices and their functions.	5 hrs
Module-II	Computer Memory	Explain computer memory. Describe different types of computer memory. Describe Random Access Memory (RAM) and its types. Explain Read Only memory (ROM) and its types. Explain direct access memory and virtual memory.	5 hrs
Module-III	Logic Circuits	Logic gates and their application Explain basic logic gates. Explain the use of logic gates in digital circuits. Explain the use of multiplexers. Explain analog to digital and digital to analog converter.	5 hrs
Module-IV	Logic Circuits (Practical)	Basic Logic gates(Practical)	3 hrs

Recommended Text:

1. Introduction to computer and communication (2006), TMH by D. Ravichandran.
2. 'Let Us C' 17th edition (September 2020), BPB Publications, By Yashwant Kanetkar.
3. Computer Fundamentals and Programming, Theraja, R, Oxford University Press.

Reference:

1. Information Technology for management (2013), Tata McGraw Hill by Henry Lucas.
2. Computer Fundamentals and Programming in C (2013), Oxford University Press; 2nd edition by Pradip Dey, Manas Ghosh.
3. Basics of Computer Science (2009) Cengage Learning, By Behrouz Forouzan, Firouz Maosharrarf, Mostafavi.
4. Programming in ANSI C, 8/e (2019, McGraw Hill Education by E. Balagurusamy.

SEMESTER -

MAI/122	ARTIFICIAL INTELLIGENCE	18 HRS
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Subject Name/Code: Artificial Intelligence 15 Hrs

Section	Module Name	Topics	Hours
Module 1	Introduction to AI and specific learning Objective.	Definition of AI system, Explain what is AI, Examples, Strong and Weak AI, Narrow and General AI, Field of AI	03
Module 2	Search and Game Tree and problem solving.	General Learning Objective: Understand different approaches to AI problem solving like search and game tree, Game tree, Minimax principle to find optimal move, Assignment based on Game Tree(A very simple assignment without computer programming)	05
Module 3	Specific Learning Objectives:	Search and Problem Solving : Identify and Search Problems, State space, transitions and cost (Only basic search approach without any specific search algorithm),	03
Module 4	Uncertainty and AI General Learning Objective	Understand how AI deals with uncertainty using odds and probability and its application to Bayes rule Specific,	03
Module 5	Specific Learning Objectives:	Explain the following: Probability, Odds, and Converting odds to probability. Bayes rule: prior odds, likelihood ratio, posterior odds, Simple assignment on Bayes rule to calculate likelihood ratio and posterior odds, Naive Bayes Classification 4 D.	04

Recommended Text:

Artificial Intelligence – A modern approach by Stuart Russell and Peter Norvig (Prentice - Hall).

Reference:

1. <https://scikit-learn.org/stable/tutorial/index.html>.
2. https://scikit-learn.org/stable/auto_examples/index.html.
3. Ertel, W. (2018). Introduction to Artificial Intelligence. Germany: Springer International Publishing.

SEMESTER -

28.5	CREDIT MARKS
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SEMESTER-II

MCE/210	COMMUNICATIVE ENGLISH- II	36 HRS
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1. Reading & Comprehending with follow-up exercises

- 1.1 Reading & Comprehending (using Diagrams /Charts/ Display/Graphs)
- 1.2 Reading and Comprehending Domain-specific/ Scientific/Technical / Articles)

Writing gist/ precis / summary of articles, note-taking, vocabulary in context, short questions, matching headlines to paragraph, table completion, sentence completion.

2. Basic Writing Skills – Paragraph writing/ Report writing

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Articles
- 3.2 Prepositions

4. Writing Practices

- 4.1 Writing a memo / notice & agenda
- 4.2 Writing a page in a Diary
- 4.3 Writing an advert

REFERENCEBOOKS:

English

Communicationskills(Book1)

nEnglish forIndia

EnglishlanguageBooks1and2

Writtencommunication

Businesscorrespondence

R.C.Sharma

S.R.Inthira&V.Saraswati.Spoke

R.K.Bansal&B.Harrison.

L.A.Hill,C.J.Daswani&C.T.Daswani.

(OxfordUniversityPress 1975)

FreemanandSarah.

SEMESTER-II

MSML/211	SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA- II	27 HRS
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AIM: To make students familiar with the duties of seaman, various types of ropes and knots, knowledge of Bridge equipments and about LSA.

Seamen & their duties: Ship's Department, General ship knowledge and nautical terms like Poop-Deck, Forecastle, and Bridge. - 4hrs

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. -4hrs

Rope Knots and Moorings: Types of knots. Practice of knot formation, Materials of ropes, Strength, Care and maintenance, use of mooring line, heaving line, Ratguards, Canvas and its use. - 10 hrs

Anchors: Their use, Dropping and Weighing anchor, Cable stopper. - 4 hrs

Navigation: General knowledge of principal Stars. Sextant, Navigation Compasses, Echo Sounder, Loganduses, barometer and weather classification, G.M.T.and Zonal time, wireless Navigational Instruments, radar satellite - Navigation. - 5hrs

REFERENCES:

- | | |
|--|----------------------|
| 8. Seamanship | : J. Dinger |
| 9. Survival in Life Boat : | : Capt Puri |
| 10. SOLAS | : IMO |
| 11. MARPOL | : IMO |
| 12. International light, shape & sound signals | : W. Moore |
| 13. Electronic navigation aids | : G. Sonnenberg |
| 14. Search and Rescue Manual | : I.M.O. Publication |
| 15. Mariner's Hand Book | : H.M.S.O. |

SEMESTER-II

MMM/212	MATHEMATICS- II	54 HRS
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AIM: The course is aimed to understand higher mathematics useful in solving engineering problems

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. - 10 hrs

Laplace Transform, Inverse Transform, Linearity, Laplace Transforms of Derivatives & Integrals; Transformation of ordinary differential equation. Applications, shifting on the 's' and 't' axes; Convolutions, Partial fractions. - 10 hrs

Ordinary Differential Equations of First Order, 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. Cauchy's homogeneous linear differential equation and Legendre's equation Applications to deflection of beams, struts and columns. - 10 hrs

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

Probability and Statistics; Concept of Probability; Random Experiments, Sample Space, Events; Axioms of Probability; Some important Theorems on Probability; Mutually exclusive events; Conditional Probability; Theorems on Conditional Probability; Independent Events; Bayes' Theorem; Problems and application on Combinatorial Analysis; Probability using Combinatorial Analysis. - 8 hrs

Random variables and Probability distributions; Discrete and continuous Probability distributions; Joint Probability distributions; Independent Random Variables; Conditional Distributions. - 4 hrs

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; Law of large numbers; Percentiles; Special Probability Distributions-Binomial, Poisson; Normal and their Properties; Multi normal Distribution; Hyper-geometric Distribution; Uniform Distribution; Cauchy Distribution; Gamma Distribution; Beta Distribution; Square Distribution; t & f distribution; Geometric Distributions-Problems & Applications. - 8 hrs

REFERENCES:

1. GREWAL, B. S. Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi, 2004.
2. Bali, N.P. and Narayana Iyengar, 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

SEMESTER-II

MAT/213	APPLIED THERMODYNAMICS – I	72 HRS
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AIM: To understand the application of Thermodynamics in steam cycles, steam engines, reciprocating compressors.

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 Carnot's cycle. Thermodynamic Temperature scale. Steam and Gas Processes on T-S and H-S charts, Entropy and Irreversibility. Applied problems. - 10 hrs

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. - 14 hrs

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 prob. Applied lems. - 8 hrs

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. - 20 hrs

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. - 16 hrs

Air and Water vapour mixture, Specific Humidity, Relative Humidity, Dew point, unsaturated and saturated Air. Study of psychrometric chart, numerical based on psychrometry. - 4 hrs

REFERENCES:

- | | |
|---|---------------------------------------|
| 1. Applied Thermodynamics for Engineering | |
| 2. Technologists | T.D.Eastop & A. McConkey |
| 3. Applied Thermodynamics | J. B. O. Sneed & S. V. Karr. |
| 4. Basic Engineering Thermodynamics | Joel Rayner |
| 5. Heat Engines | P. L. Ballaney |
| 6. Thermodynamics – Applied to heat Engines | E. H. Lewitt |
| 7. Heat and Thermodynamics | Mark W. Zemansky & Richard H. Dittman |

SEMESTER-II

MSOM/214	STRENGTH OF MATERIALS- I	72 HRS
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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.

Simple Stresses and Strains: 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. - 10 hrs

Strain Energy in Simple Stresses: Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience. - 8 hrs

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

Thin Walled Shells: 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. - 10 hrs

Welded Joints: Strength of Welded Joints. Torsion effect on welded joint. - 6 hrs

Bending Stress: Pure Bending, 2^{nd} 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

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. - 18 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 |

SEMESTER-II

MCS/215	COMPUTER SCIENCE, PROGRAMMING & SECURITY	54 HRS
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AIM: To provide 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-I INTRODUCTION TO COMPUTERS

Introduction – Characteristics of Computers – Evolution of Computers – Computer Generations – Classification of Computers – Basic Computer organization – Number systems. - 3 hrs

UNIT-II COMPUTER SOFTWARE

Computer Software- Types of Software – Software Development Steps – Internet Evolution – Basic Internet Terminology – Getting connected to Internet Applications - 4 hrs

UNIT-III 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) - 7 hrs

UNIT-IV INTRODUCTION TO C

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making – Branching and Looping. -8 hrs

UNIT-V 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

UNIT-VI HARDWARE INTRODUCTION

To understand, in general the hardware configurations. Elementary maintenance of Personal Computer – Hardware -3 hrs

UNIT-VII Problem solving and office automation

Algorithm – Flow Charts – Pseudo code – Application Software - 5 hrs

UNIT-VIII Essential Terminologies:

CIA, Risks, Breaches, Threats, Attacks, Exploits. Open Source/ Free/ Trial Tools: nmap, zenmap, Port Scanners, Network scanners. - 1 hr

UNIT-IX Cryptography and Cryptanalysis

Introduction to Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec. Open Source/ Free/ Trial Tools: Implementation of Cryptographic techniques, OpenSSL, Hash Values Calculations MD5, SHA1, SHA256, - 3 hrs

SEMESTER-II

UNIT-X Cyber Security Vulnerabilities& Safe Guards

Internet and Cloud Computing & Security, Social Network sites security, Vulnerabilities-Overview, Vulnerabilities in software, System administration, Architectures of Complex Network, Open Access To Organizational Data, Weak Authentication, Authorization, Unprotected Broadband Communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access Control, IT Audit, Authentication.

– 4 hrs.

UNIT-XI Malware

Type and Explanation of Malware: Virus, Worms, Trojans, Robots, Adware's, Spywares, etc., OS Hardening: Process, Memory and Task Management, Windows Registry/ services another configuration. Malware Analysis: Open Source/ Free/ Trial Tools- Antivirus Protection, Anti Spywares, System tuning tools, Anti Phishing

- 4 hrs.

UNIT-XII Cyber Laws and Forensics

Introduction, Cyber Security Regulations, the INDIAN Cyberspace, National Cyber Security Policy 2013. Introduction to Cyber Forensics, Need of Cyber Forensics, Cyber Evidence, Documentation and Management Of Crime Sense, Image Capturing and its importance.

– 3 hrs.

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", 2nd Edition, (Indian Adapted Edition), TMH Publications, (2006).
- 5 E. Balagurusamy, "Computing Fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
- 6 Block chain: Blueprint for a new economy by Melanie Swan.
- 7 Block chain Revolution by Don and Alex Tapscott.
- 8 Cryptoassets by Chris Burniske and Jack Tatar.
- 9 The Basics of Bit coins and Block chains by Antony Lewis.
- 10 Block chain Technology Explained: The Ultimate Beginner's Guide by Alan T. Norman.
- 11 Block chain Technology for Industry 4.0, Springer.

SEMESTER-II

MMOM/216	ENGINEERING MECHANICS- II	54 HRS
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AIM: To enable the student to correlate the principles of friction, dynamics of rotation with application oriented studies.

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.
- 8 hrs

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.
- 8 hrs

Periodic Motion: simple Harmonic motion; Application of S.H.M. to masses and springs. Simple Pendulum and Compound Pendulum. Centrifugal Force and its application to conical pendulum, Unloaded Governor, Curved tracks and machine parts, stress in thin rim due to centrifugal action.
- 10 hrs

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.
- 18 hrs

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.
- 10 hrs

REFERENCES:

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

SEMESTER-II

MED/217	ENGINEERING AND MACHINE DRAWING	63 HRS
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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. - 16 hrs

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. - 11 hrs

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. - 18 hrs

Thread formation, Nuts, Bolts & Studs :: V-threads and square thread details; Metric & BSP threads; General conventions for drawing of threads in engineering drawings; 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. 18 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 "Mac GIBBON'S Pictorial Drawing Book for Marine Engineers"

SEMESTER-II

MAML/218	APPLIED MECHANICS LABORATORY	45 HRS
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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 AdvantageAnd (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- $E_1 \times E_2 = E_3$

Where-

E_1 = Efficiency of Simple Screw Jack;

E_2 = Efficiency of Worm Wheel; and

E_3 = 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 (b) Fletcher’s Trolley.
12. To determine the Moment of Inertia and Radius of Gyration of a Fly Wheel.

SEMESTER-II

MWP/219	WORKSHOP PRACTICALS – II	90 HRS
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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.

SEMESTER -

MCL/220	COMPUTER LABORATORY- I	18HRS
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- a) Introduction to Computers
- b) Magnetic Media and Multimedia application
- c) Utility programs for identifying disk problems and fixes.
- d) Word Processing
- e) Preparation of Spread Sheet
- f) Simple C Programming *
- g) Modern Programming language used for ship systems.
- h) Most popular programmes used for ship specific activities like inventory control.
- i) Installation and setup of multimedia application
- j) Backup management
- k) Computer Networking and its types
- l) Internet Technology

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

SEMESTER -

IOT/221	INTERNET OF THINGS	18 HRS
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Introduction: Architecture, Design principles, applications, Basic net working, IOT Fundamental: device, data Management, gateways, XaaS, Role of cloud in IOT. – 02 hrs

Element of IOT: Hardware components: Computing, communication, Input/output Interface. Software Components: Programming API's (using Arduino/Python/Node.js) for communication protocols, Bluetooth, zigBee, TCP. – 05 hrs.

Application Development of IOT: Implementation of Device integration, Data storage on Device-Data storage on local/cloud server, Device authentication and authorization. – 06 hrs.

Case studies on Marine Industry: IOT case studies on Marine industry automation, Marine Transportation System. - 05 hrs

REFERENCES:

1. Vijay Madiseti, Arshdeep Bahga, Internet of things, “A Hands on Approach”, University Press.
2. Dr.SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of things: A practical approach”, ETI Labs.
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use cases”, CRC Press
4. Jeeva Jose, “Internet of Things”, Khanna Publishing House, delhi.
5. Raj kamal, “Internet of Things: Architecture and Design”, Mc Graw Hill.

SEMESTER -

ML/222	MACHINE LEARNING	18 HRS
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Fundamentals of Machine Learning

The Introduction of Machine Learning, Types of Machine Learning Systems - 3 hrs

Machine learning landscape

Main challenges of Machine Learning (reference to bad algorithm and bad data); Fundamentals of Artificial Neural Network Architectures and Deep Learning -3 hrs

Marine applications of Machine Learning

Marine data predication, Marine equipment monitoring and maintenance, Fault detections of ship system and operations, Marine Engine systems condition based monitoring. Failure Mode and Effect Analysis (FMEA). - 3 hrs

Introduction to statistics & data science

Brief overview of Statistics and Linear Algebra. - 3 hrs

ML Models

Concept of Supervised and Unsupervised learning. Concept of Linear and Logistic Regression; Concept of Under fitting, Over fitting, Precision-Recall tradeoff. - 3 hrs

ML Algorithms

Concept of one of the algorithms: Support Vector Machine/ Neural Networks/ Decision Tree/ Random Forest. - 3 hrs

REFERENCES:

Recommended Text:

1. A first course in artificial intelligence by Deepak Khemani (McGraw Hill Education India).
2. Hands on Machine Learning: O'Reilly publication, 2019 edition. Author: Aurelien Geron
3. Machine Learning for Beginners; Oliver Theovald
4. ML- The Art and Science of Algorithms that make sense of data; Author: Peter Flach; Publisher: Cambridge

Reference:

1. <https://scikit-learn.org/stable/tutorial/index.html>.
2. https://scikit-learn.org/stable/auto_examples/index.html.
3. Müller, A. C., Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists.

SEMESTER -

MCFN/223	COMPUTER FUNDAMENTALS & NETWORKING	18 HRS
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a) Introduction to Computers

1. Introduction to Number system and mutual conversion.
2. Basic concept of bits, bytes and word in computer
3. Explain different types of number systems
4. Process of number system conversion
5. Describe the process of different types of number systems. - 01 hrs

b) Magnetic Media and Multimedia application

1. Care and storage of magnetic media.
2. Types of magnetic storage media.
3. Installation and setup of multimedia application
4. Explain the process of Backup management.
5. Various methods of handling and care of magnetic media. - 01 hrs

c) Utility programs for identifying disk problems and fixes.

1. Use of utility programs in OS.
2. Identify the disk problems and solved them with any utility program.
3. Describe how to fix disk problems using any utility programs. - 02 hrs

d) 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 - 2 hrs.

e) Preparation of Spread Sheet

- a. Chart – Line, XY, Bar and Pie.
- b. Formula – Formula editor.
- c. Spread sheet – inclusion of object, Picture and graphics, protecting the document and sheet.
5. Sorting and Import/Export Features - 2 hrs

f) Simple C Programming *

- a. Data Types, Expression Evaluation, Condition Statements.
- b. Arrays
- c. Structures and Unions
- d. Functions - 2 hrs.

g) Modern Programming language used for ship systems. - 2 hrs

h) Most popular programmes used for ship specific activities like inventory control. - 2 hrs

i) Installation and setup of multimedia application

1. Explain different types of multimedia applications and their installation.
2. Explain the uses of multimedia applications. - 01 hrs

SEMESTER -

j) Backup management

1. Definition and advantages of backup management.
2. Explain different types of backup management and their process and strategy. – 01 hrs

k) Computer Networking and its types

1. Describe the computer network.
2. Explain the different types of communication networks and their advantages. – 01 hrs

l) Internet Technology

1. Explain basic internet terminology.
2. Uses of modems.
3. Explain the application of the Internet and Intranet.
4. Differentiate Internet and Intranet. – 01 hrs

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

Recommended Text:

1. Computer Fundamentals and Programming, Theraja, R, Oxford University Press.

Reference:

1. Computer Fundamentals and Programming in C (2013), Oxford University Press; 2nd edition by Pradip Dey, Manas Ghosh.
2. Basics of Computer Science (2009) Cengage Learning, By Behrouz Forouzan, Firouz Maosharraf, Mostafavi.
3. Programming in ANSI C, 8/e (2019, McGraw Hill Education by E. Balagurusamy.

30	CREDIT MARKS
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SEMESTER -

MCE/310	COMMUNICATIVE ENGLISH- III	36 HRS
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1. Vocabulary Building – Exercised based on vocabulary

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Reading & Comprehending – Skimming, Scanning with follow-up exercises

- 2.1 Reading and Comprehending (Discussing reading strategies, reading notes and messages -Learning Global / Contextual / Inferential Comprehension)
- 2.3 Reading practice - Writing gist/ precis / summary of articles, note-taking, vocabulary in context, short questions & MCQ, matching headlines to paragraph, table completion, sentence completion.

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers

4. Nature and Style of sensible Writing

- 4.1 Describing
 - 4.2 Defining
 - 4.3 Classifying
 - 4.4 Providing examples or evidence
 - 4.5 Writing introduction and conclusion
- Writing practice- emails, business correspondence etc.

REFERENCEBOOKS:

English

Communicationskills(Book1)

nEnglish forIndia

EnglishlanguageBooks1and2

Writtencommunication

Businesscorrespondence

R.C.Sharma

S.R.Inthira&V.Saraswati.Spoke

R.K.Bansal&B.Harrison.

L.A.Hill,C.J.Daswani&C.T.Daswani.

(OxfordUniversityPress 1975)

FreemanandSarah.

SEMESTER III

MCM/311	COMPUTATIONAL MATHEMATICS	36 HRS
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AIM: To impart the knowledge to the students, on various computational methods.

Sampling Theory:

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. - 6 hrs

Curve Fitting, Regression and Correlation:

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. - 6 hrs

Digital Mathematics:

Binary codes: Weighted and Non weighted Binary codes, Error detecting codes, 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. - 6 hrs

Logic Circuits:

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. - 6 hrs

The Calculus of Finite Differences:

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, Integral of a tabulated function, Summation formula, 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 and backward Gregory-Newton interpolation formulae, Stirling interpolation formula. Numerical integration by various methods (Trapezoidal Rule, Simpson's Rule etc.), linear difference equation with constant coefficients. - 6 hrs

Computing:

Design of efficient algorithms for problems like-factorial of a positive integer, Fibonacci sequence generation, $\sin x$, $\cos x$, e^x series summation Linear search problem, Bubble sort Problem, Merging Problem, Calculation of computational complexity. -6 hrs

Recommended Text:

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.

MEM/312	ELECTRICAL MACHINE- I	72 HRS
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AIM: To impart the knowledge on AC motors and alternators.

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, including IGBT (Insulated Gate Bipolar Transistor) and Thyristor controls, starting of induction motor, method of starting D.O.L, Star/Delta, Auto, Testing of motor, use of circle diagram. Single phase induction motor – principle and operational characteristics, starting control, constructional details. - 36 hrs

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, magnetomotive force or ampere-turn waveform distribution, reversal of direction of rotation of rotating field. - 18 hrs

Synchronous alternator and motor

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, principle of action of three phase synchronous motor effect of varying load and excitation, methods of starting, advantages and disadvantages of synchronous motor. - 18 hrs

REFERENCES:

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

SEMESTER III

MAT/313	APPLIED THERMODYNAMICS – II	72 HRS
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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. - 10 hrs

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. - 10 hrs

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. - 14 hrs

Refrigeration: - Reversed Carnot cycle, Vapour compression cycles, Refrigerating Effect, Co-efficient of performance, cooling capacity, rating of a Refrigerating Plant, Methods of improving C.O.P. Use of Vapour Tables, Applied Problems. - 10 hrs

Typical Marine Refrigerating Plants with multiple compression and Evaporator system. Refrigeration in liquefied gas carriers. - 6 hrs

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 convection Heat Transfer rates. Use of Non-Dimensional Groups. - 14 hrs

Prandtl No. Nusselt No., Reynolds No., Stanton No., Grashof No, Graetz No., Natural and Forced Convection. - 8 hrs

REFERENCES:

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

SEMESTER III

MSOM/314	STRENGTH OF MATERIALS- II	72 HRS
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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.

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. - 12 hrs

Deflection of Beams: Strain energy due to bending. Application of impact. Deflection by integration, Macaulay's Method. Moment area Methods of deflection co-efficient. Deflection due to shear, Deflection by graphical method. Applied problems. - 15 hrs

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. - 15 hrs

Thin Curved bar: Strain energy due to bending Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems. - 10 hrs

Thick Cylinders: Thick cylinders, Lamé's theory, compound cylinders, solid shaft subjected to radial pressure, shrinkage allowance. Applied problems. - 10 hrs

Struts: Euler's theory and Euler's buckling 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

REFERENCES:

- | | |
|--------------------------|--------------------|
| 1. Strength of Materials | G. H. Ryder |
| 2. Strength of Materials | Stephen Timoshenko |
| 3. Strength of Materials | R. K. Rajput |

SEMESTER III

MMOM/315	MECHANICS OF MACHINES- I	54 HRS
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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 trains.

Turning Moment & Flywheel: 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. - 10 hrs

Kinematics' and Link-Mechanisms: Relative motion between bodies moving in different planes. Instantaneous center 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 on link connecting rods, Effect of friction. - 10 hrs

Cams: Types of cams and followers. Specified motion of followers. Uniform acceleration and deceleration, S.H.M. and uniform velocity Graphical construction of Cam-profile. - 5 hrs

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. - 5 hrs

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. - 6 hrs

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, Torque on gear trains, acceleration of gear trains. - 12 hrs

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 . -6 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

SEMESTER III

MSE/316	MANAGEMENT SCIENCE AND ECONOMICS	36 HRS
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AIM: Introduction to Management, Finance, Production and quality control, HRD.

MANAGEMENT SCIENCE: (36 hrs)

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, Organising – definition / illustrations, Staffing – manpower, planning, Directing - illustration, Controlling, parameters, application & Co-ordination; communication – efficient process model, communication & barriers, inter-personnel communication skill. Developing Organisation 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

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.

- 6 hrs

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. - 10 hrs

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 and Y theory Hertzberg's Hygienic and motivational theory, Elton Mayo's contribution. Problems of Accident – Preventions, Fatigue, Relation with Trade, Union & Workers Participation in Management. - 8 hrs

Ability to apply task & work load management – communication, team building, planning & co-ordination, personal assignments, time & resource constrains. Prioritization. Effective communication onboard & ashore.

- 2 hrs

REFERENCES:

1. Modern Office Management - Mills, Standingford, Appleby

SEMESTER III

MED/317	MARINE ENGINEERING DRAWING	63 HRS
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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 & plus, interpretation of machinery drawings and handbooks marine engineering drawing and design. The interpretation of piping, hydraulic and pneumatic diagrams. - 30 hrs

Marine Machinery Components & assembly drawings : Assembly Drawings of marine components in Orthographic projection from Isometric views e.g, 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)

Sample list drawings para 17 DGS Annex-II Air Inlet Valve, Automatic Valve - 33 hrs

REFERENCES:

1. Mac GIBBON'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

SEMESTER III

MMSL/318	MATERIAL SCIENCE LABORATORY	45 HRS
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1. To determine the behavior 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 Curve of- Stress vs Strain.
2. To conduct IZOD impact test on impact test 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 springs for
 - (a) round wire and
 - (b) 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 fatigue on Fatigue testing machine.
11. To prepare a report on use of material in shipbuilding & Marine Engineering.

SEMESTER

MWP/319	WORKSHOP PRACTICALS – III	45 HRS
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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 Familiarisation;
Globe Valve Overhauling;
Sluice Valve Overhauling;
Non-return Globe Valve Overhauling;
2 Way/ 3 Way Cock Overhauling;
Shaft Key Making
Thread cutting by Taps & Die;
Thread cutting by Lathe Machine.
Other important “jobs” that may be introduced as per current trend, to keep student abreast with latest.

SEMESTER		
MMS/320	MATERIAL SCIENCE	72 HRS

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

Structure of Atom: Electrons and Bonding; Wave Mechanics and electronic behaviors; 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 . - 12 hrs

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. - 6 hrs

Miscellaneous Engg. Materials: Refractories, Insulating materials; Plastics and Rubber; PVC, Resins, Adhesives and Bonding Plastics, Paints. Manufacture, properties and selection for various engineering applications. Poly-urethane-foam. - 6 hrs

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. - 6 hrs

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. - 14 hrs

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. - 8 hrs

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. - 6 hrs

Corrosion and its prevention: Mechanism of corrosion, Thermodynamics & kinetics of corrosion, Chemical corrosion, Electrochemical corrosion, Anodic and Cathodic protection, Forms of metallic coatings. Anodizing, Phosphating. - 6 hrs

Uses of materials in shipboard application: Chromium, Ceramic, Titanium, PTFE in Shipboard Systems. Characteristics of above materials. - 2 hrs

Selection of Materials in Shipbuilding & Marine Engineering: Boilers, Steam and Gas turbine, Purifiers and Diesel engine components, Pumping Machinery, Components and Piping System, Engine seating. Propellers and Rudders. Composition, strength value and other requirement for materials used. - 6 hrs

SEMESTER III

REFERENCES:

1. Metallurgy for Engineers - E. C. Rollason
English Language Book Society (ELBS)
2. Pounder's Marine Diesel Engines - Doug Woodyard
3. Material Science - Hazra – Choudhury

SEMESTER III

MSML/321	SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA - III	27 HRS
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AIM : To make students familiar with the duties of seaman, various types of ropes and knots, knowledge of Bridge equipments and about LSA.

Life boats & Life rafts: Construction, equipment carried, carrying capacity. Davits and their operation, Launching of Life rafts (Inflatable type). Embarkation into lifeboat and Liferaft. Survival pack, Stowage and securing arrangement. Rescue boat, immersion suit, Thermal Protective Aid - 8hrs

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. - 2hrs

Survival at Sea: Survival difficulties and factors, equipment available, Duties of crewmembers, Initial action on boarding, Maintaining the craft. - 2hrs

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, ill effects of cargo on human and environment. -6hrs

Practical: Knots, bends and hitches, Ropes splice, Donning of Life jackets, Life boat drills. Lowering & hoisting of Lifeboats (model). -7hrs

Rescue:

Method of Helicopter rescue, evaporation

Method of helicopter rescue, evacuation

- 2 hrs

REFERENCES:

- | | |
|---|----------------------|
| 1. Seamanship | : J. Dinger |
| 2. Survival in Life Boat : | : Capt Puri |
| 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 |

SEMESTER III

MSDA/323	Statistic and Data analysis using Python and R	18 HRS
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Python Programming: Introduction to Python, Characteristics of Python, Python interpreter/IDLE, Python IDE. Examples – I python, Py Charm, Jupyter, Spyder etc. – 02hrs

Python Basics : Basic input and output, syntax, keywords, writing and running program, variables and data types, operators and expressions – 02hrs

Control Flow : Statements: If statements, while statement, for statements, range function, break and continue statements, pass Statement, Demonstrate knowledge and understanding of defining and implementing functions in Python: defining function, function parameters/arguments, doc string, local and global variables, return statement. programming exercise on function. - 03 hrs

Data Structures: Lists, Tuples, Sets, Dictionaries, Sequences, array sequence data type operations – initialization, indexing, slicing, concatenation, multiplication, methods. - 02 hrs

Modules: Use of modules, import statements, accessing module variables and functions, Python Standard modules e, g, os, sys dir function programming exercise on modules - 02 hrs

File Handling: Open and close file, read, write and append mode, programming exercise on file handling. – 02 hrs

Introduction to Data Analysis and Measurement: Data and its importance, data sources, data products 1.5. Data analysis vs. data analytics. Categorical and numerical data, discrete and continuous data, levels of data measurement – nominal, ordinal, interval, and ratio - 02 hrs

Central Tendency Specific Learning Objectives : Arithmetic mean, population mean and sample mean, mean of grouped data, weighted average, median, median of grouped data, mode, mode of grouped data, percentile, calculation of pth percentile location e.g., 90th percentile, 50th percentile etc (Simple numerical on determining mean, median, mode and percentile) – 01 hrs

Dispersion Specific Learning Objectives: Variability, range, quartiles, interquartile range, deviation from the mean, mean absolute deviation, population variance, population standard deviation, sample variance, sample standard deviation, uses of standard deviation. (Simple numerical on above topics using data set comprising 3-4 numbers). – 02 hrs

Recommended Text:

1. A byte of Python by C H Swaroop <https://python.swaroopch.com/>.
2. Introduction to Statistics by David Lane <https://open.umn.edu/opentextbooks/textbooks/459>.
3. Introduction to R by W.N. Venables, D.M. Smith, et.al <https://cran.r-project.org/doc/manuals/r-release/Rintro>.

REFERENCES:

4. Numerical Methods for Engineering & Scientific Computation – by Jain , M. K. Iyanger, S. R. K. Jain
5. Numerical Methods for Engineers – By Chapra S. C., Canale R. P.
6. GREWAL, B. S. Higher Engineering Mathematics, 38th Edition, KhannaPublishers, Delhi, 2004.
7. Python Documentation: <https://docs.python.org/3/>.
8. Python Data Science Handbook by Jake Vander Plas ; <https://jakevdp.github.io/PythonDataScienceHandbook/>.
9. Adler. (2012). R in a Nutshell: A Desktop Quick Reference. United State: O'Reilly Media.
10. McKinney. (2013). Python for Data Analysis. Taiwan: O'Reilly Media, Incorporated.
11. Ripley, B. D., Venables, W. N. (1997). Modern Applied Statistics with S-PLUS. Springer Science Business Media New York.

SEMESTER III

31.5	CREDIT MARKS
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SEMESTER III

MCEL/410	COMMUNICATIVE ENGLISH LAB	63 HRS
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- 1. Honing 'Listening Skill' and its sub skills** through Language Lab Audio device
 - 1.1 TASKS based on listening – Listening for specific information / Listening for overall meaning and instructions
 - 1.2 Follow up exercises on Listening:Comprehension & Analysis of what has been listened to, paraphrasing- Pronunciation & Enunciation (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech

- 2. Honing 'Speaking Skill' using Language Lab Audio –Visual input;**
 - 2.1 Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone)
 - 2.2 Role Play
 - 2.3 Face-to-face with the interlocutor
 - 2.4 Short oral presentations
 - 2.5 Discussions in groups on a given topic
 - 2.6 Speaking in pairs and groups

REFERENCEBOOKS:

English

Communicationskills(Book1)

nEnglish forIndia

EnglishlanguageBooks1and2

Writtencommunication

Businesscorrespondence

R.C.Sharma

S.R.Inthira&V.Saraswati.Spoke

R.K.Bansal&B.Harrison.

L.A.Hill,C.J.Daswani&C.T.Daswani.
(OxfordUniversityPress 1975)

FreemanandSarah.

SEMESTER – IV

MSSC/411	SHIP STRUCTURE & CONSTRUCTION	72 HRS
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AIM: To impart the knowledge on construction of ships and ships terms and stresses in ships, primary and secondary girders used in ships.

Ships Terms: Various terms used in ship Construction with reference to Ship's parameter e.g. L.B.P., LOA, Moulded Depth, Moulded draught, Freeboard, rise of floor, flare, shear, rake and other similar terms, General Classification of Ships - 4 hrs

Stresses in ship's structure: Bending, Shear, Hogging, Sagging, Racking, Pounding, Painting, and Strength members to counteract the same. - 3 hrs

Sections and materials 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. - 8 hrs

Bottom & Side Framing: Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tankside brackets, Beam Knee, Web frame. - 8 hrs

Shell & Decks: Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, mid-ship Section of ships. - 8 hrs

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. - 8 hrs

Fore-End Arrangements: Stem construction, arrangements to resist panting, panting stringers, Forepeak – Collision bulk heads, Bulbous bows. Anchor and cable arrangements. Chain locker - 4 hrs

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 bearings. Aft peak tank - 8 hrs

Load line 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. Plimsol line - 4 hrs

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.

Ventilation arrangement for pump room in tankers and for holds and oil fuel tanks
Bridge team B/T, Plimsol line, Free Surface liquid on stability
Bilge piping system, Ballast piping, Sounding piping, Air piping - 5 hrs

Ship Types:

Tankers, bulk carriers, container ships, car carriers, LNG, LPG and chemical carriers, Lash ships, Passenger ships, Dredger, Tugs – constructional details and requirements. - 3 hrs

Offshore Technology:

Drilling Ships and Platforms, Supply/Support Vessels-types and constructions, Dynamic Positioning, Deep Sea diving system, fire fighting arrangement, Cable laying vessels. - 2 hrs

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, IBC and IGC codes. - 4 hrs

Statutory Certificates and their validity, Ships registration formalities, Intact Stability Criteria under damaged conditions (constructional point of view in compliance with statutory regulations), Enhanced Survey requirements, HSSC, CAS. - 3 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

SEMESTER IV

MBSE/412	MARINE BOILERS & STEAM ENGINEERING	72 HRS
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AIM: To impart the knowledge of Boiler & Boiler Mountings, steam turbines and steam engines to the students.

MARINE BOILERS - 30 hrs

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. - 5 hrs

Water Tube Boilers: General description with sketches of principal types of boilers in marine use, Superheater, Economizer, Air pre-heater & Steam pre-heater; Circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control, Attemperators and De-super heaters. - 5 hrs

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. - 4 hrs

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. - 7 hrs

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, maintenance, inspection and survey of boilers. - 3 hrs

Refractory: Purposes of refractory, types of refractory and reasons for failure. - 2 hrs

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. - 2 hrs

Tests on Boiler: Destructive and Non destructive tests on plates, rivets, welded seams, classification society's requirements for boilers construction, Hydraulic tests. - 2 hrs

MARINE STEAM ENGINEERING: - 42 hrs

Steam Engines: Multiple expansion marine reciprocating engines & steam turbines. Description of different types of steam turbines. - 5 hrs

Layout of Plant: General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use. - 4 hrs

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. - 8 hrs

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. - 2 hrs

Reduction Gears: Reduction ratio, type of gear teeth, gear construction – various arrangements of marine gearing, gear defects, flexible coupling, and quill shaft. - 4 hrs

Condensers: Shapes and types of condensers, constructional details, location & method of securing, working principles, contraction and expansion allowances, leak test. Effect – change of temperature, circulating water quantity, change of main engine power, condenser surface. - 4 hrs

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. - 10 hrs

Alignment checking: By bridge gauge and poker gauge, allowances for expansion, sliding foot, thrust bearing static and dynamic balancing. - 3 hrs

Selection of Materials: Materials used in various components like blades, rotors, castings, sealing glands, gears & their justification. - 2 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 |

MMOM/413	MECHANICS OF MACHINES- II	72 HRS
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AIM: To impart the knowledge to the student on Balancing, Vibrations : Torsional, forced and transverse.

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.
- 15 hrs

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.
- 10 hrs

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

Forced Vibrations: Forced Linear and angular Vibrations, Periodic force transmitted to support, Periodic movement of the support.
- 7 hrs

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.
- 8 hrs

Whirling of shafts-Whirling of shafts, critical speed, effect of slope of the disc, effect of end thrust.
- 7 hrs

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.
- 8 hrs

Forced Damped Vibrations: To write differential equation of motion and find amplitude, frequency.
- 10 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 |

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

ECONOMICS:

Importance of economics in Marine Engineering study, Basic economic concepts and terms, Demand analysis, Supply analysis, Elasticity of demand, Elasticity of supply. - 4 hrs

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. - 10 hrs

Money: - Types, Functions, Standard. Inflation: - Types, Causes. Commercial Banks – Functions, Functions of Central Banks. Features of Money and Capital market. National Income concepts. - 4 hrs

Taxation – Direct and Indirect, Govt. Budgets. Economic development, Growth, features of underdevelopment with reference to India. Globalisation of Indian economics. - 4 hrs

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. - 6 hrs

Shipping Routes & Ports: - Major Shipping Routes & Ports, Types, Problems, factors for good port. Major & Minor ports of India, their location and importance. Deep-sea fishing, Major sea-fishing zones, Off-shore oil producing zones. India's overseas Trade and Economic Importance with reference to Economic zones. - 8 hrs

REFERENCES:

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

MFM/415	FLUIDS MECHANICS – I	72 HRS
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AIM: To impart the knowledge of Fluid properties and effect of various forces acting on different places and surfaces, the In viscid flow and real viscous flow.

Introduction: Definition of Fluid. Different properties, i.e. Capillarity, Surface tension, viscosity. - 2 hrs

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. - 8 hrs

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. - 12 hrs

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; Co-efficient 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. Euler's formula, Pitot tube - 16 hrs

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. Surge Pressure. - 16 hrs

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. - 10 hrs

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. - 8 hrs

REFERENCES:

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

MEE/416	ELECTRONICS	72 HRS
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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.

Transistors: The transistor as an amplifier, Stabilized biased circuits, Self biased and potentiometer biased, low and high frequency Response, Response of Transistor Amplifiers, Effect of negative & positive feedback in transistor amplifier, JFET & MOSFETS, BJT, UJT. - 8 hrs

Regulated Power Suppliers: Series Regulators, Shunt Regulators, PNM regulators. - 5 hrs

Oscillators: Requirements for Oscillations phase shift Oscillator, Wien Bridge Oscillator, Crystal Oscillators, and Decoupling Filters. - 5 hrs

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. - 5 hrs

Wave Shaping and Switching: Clipping, Clamping, time base or Sweep Generator, Multi vibrators & Schmitt Triggers. - 5 hrs

Operation Amplifier Theory: Concept of Differential Amplifiers. Its use in DP-AMPS. Linear OP-amp circuits. - 5 hrs

Digital Circuits: Logic systems and Gates. Binary and BCD codes, Boolean Algebra, Simplifications, Flip-flops; Counters; Registers and Multiplexers. - 7 hrs

Converters (A-D and D-A): Analog to Digital and Digital to Analog Convertors and their use in Data-Loggers. - 7 hrs

TTL & CMOS GATES: Digital Integrated Circuits, Semi-conductor Memories-ROM, RAM and PROM. - 7 hrs

Industrial Electronics: Power rectification, Silicon Control rectifier power control, Photo-Electric Devices, Invertors. - 5 hrs

Communication: Modulation, Demodulation, AM/FM/PM Wireless, Radio Transmitters and Receivers, T-V Radar, Pulse Communication. - 7 hrs

Electronic Instruments : Cathode Ray Oscilloscope, Digital Voltmeters and frequency-meters, Multimeters; Vacuum Tube voltmeter and signal Generators, Signal generation – operating principle – application; signal generation as used on board ship like measuring and controlling various variables including rpm, pressure, flow, temperature level, strain. Q-meters. - 4 hrs

Microprocessors: 8085 Architecture – Programming – interfacing and Control of motors – Temperature / Speed control.

SEMESTER IV

Transistor as an amplifier, switch, oscillator, IC based timers, photo electric devices e.g. LED, LCD, 7 segment display, electron theory IC based generic (IC 555) & its application multi-vibrators, Tele communication system and service. - 2 hrs

REFERENCES:

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

SEMESTER IV

MCM/417	COMPUTATIONAL MATHEMATICS	18 HRS
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AIM: To impart the knowledge to the students, on various computational methods.

Sampling Theory:

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. - 2 hrs

Curve Fitting, Regression and Correlation:

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. - 4 hrs

Digital Mathematics:

Binary codes: Weighted and Non weighted Binary codes, Error detecting codes, 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. - 4 hrs

Logic Circuits:

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. -2 hrs

The Calculus of Finite Differences:

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, Integral of a tabulated function, Summation formula, 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 and backward Gregory-Newton interpolation formulae, Stirling interpolation formula. Numerical integration by various methods (Trapezoidal Rule, Simpson's Rule etc.), Linear difference equation with constant coefficients. - 6 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, KhannaPublishers, Delhi, 2004.

SEMESTER IV

MHBCL/418

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 a 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.

Industrial Chemistry; fundamental; acidity /alkalinity, corrosion

SEMESTER IV

MWP/419	WORKSHOP PRACTICALS - IV	45 HRS
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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.

SEMESTER V

MCEL/420	CONTROL ENGINEERING LABORATORY	27 HRS
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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”

SEMESTER V

MBEEL/422	ELECTRONICS LABORATORY	54 HRS
To study the characteristics of Thermistor.		- 06hrs
To study the volt-ampere characteristic of Field Effect Transistor.		- 06hrs
To study the characteristics of Silicon Controlled Rectifier.		- 06hrs
To study the Transistor Bias stability.		- 06hrs
To study the Transistor Feed Back Amplifier.		- 06hrs
To study the Integrated Circuit operational Amplifier.		- 06hrs
To study the Integrating, Differentiating Clamping and Clipping Circuit.		
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To study the Logic Training Board.		
To study the Speed control of a D.C. motor by Thyristor.		- 03hrs
Assembling electronic components as per given circuit on Circuit Board.		- 03hrs
Study electronic PID controller.		- 03hrs
Study PCB of High Temperature alarm system .		
Study PCB of High Level alarm system.		- 03hrs
Study PCB for other alarm systems like heat, smoke, pressure, rpm.		- 03hrs
Study of IC & LSIC		- 06hrs

31	CREDIT MARKS
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SEMESTER V

MCE/510	COMMUNICATIVE ENGLISH - IV	36 HRS
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AIM: This course is designed to enable students to enhance their linguistic abilities in listening, reading, writing and speaking communicative English. Adequate knowledge of English.

1. Reading & Comprehending – Follow-up exercises

1.1 Reading and understanding to describe, explain or summarise data, processes or events presented through charts, tables, graphs or diagrams

1.2 Reading and comprehending short/long news articles/blogs

Reading practice - Writing gist/ precis / summary of articles, note-taking, vocabulary in context, short questions & MCQ, matching headlines to paragraph, table completion, sentence completion.

2. Vocabulary – general and domain specific

2.1 Vocabulary – Standard Marine Communication Phrases

3. Identifying Common Errors

3.1 Finding errors in redundancies

3.2 Finding errors in clichés

4. Writing Practices

4.1 Writing application letters, CV/ Resume, complaint letters, letters of apology

4.2 Writing a Technical report

4.3 Domain specific writing

5. Use of Authentic Listening materials

5.1 Demonstrate attentive listening in different hypothetical situations - Critical thinking strategies for listening

5.2 Listening Comprehension - TASKS based on listening – Listening for specific information / Listening for overall meaning and instructions

6. Speaking Practice

6.1 Honing 'Conversation Skills' using Audio – Visual input

6.2 Classroom conversation in pairs / groups

REFERENCE BOOKS:

English

Communications skills (Book 1)

English for India

English language Books 1 and 2

Written communication

Business correspondence

R.C.Sharma

S.R.Inthira & V.Saraswati. Spoke

R.K.Bansal & B.Harrison.

L.A.Hill, C.J.Daswani & C.T.Daswani.

(Oxford University Press 1975)

Freeman and Sarah.

SEMESTER V

MEST/511	ENVIRONMENTAL SCIENCE & TECHNOLOGY	36 HRS
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Basics of environmental science:

Concept of environment, definition, concept and scope of environmental science, environmental ethics, earth – man –environment, environment-civilisation interface, genesis of global environmentalism. - 10 hrs

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 - 8 hrs

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 ecosystems . - 10 hrs

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). - 8 hrs

Reference Books:

1. Botkin, D.B.& Keller, E.A Environmental Science: Earth as a Living Planet, John Wiley, NY
2. College Botany, Vol. I, II & III- Gangulee, Kar and Das
3. Cunningham, W.P.& Cunningham, M.A., Environmental Science, Tata McGraw Hill. ND
4. Santra, S.C., Environmental Science
5. Maier, Pepper &Gerba, Environmental Microbiology.
6. Das, N.G., Statistical Methods (Volume 1 and 2)

SEMESTER V

MPA/512	ELECTRICAL MARINE AUTOMATION	36 HRS
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AIM: To enable a student to acquire basic knowledge about ship board automation and be competent for operation and maintenance of control equipments .

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

Automatic Controllers: Functions of a pneumatic Proportional, Integral and Derivative Action Controllers, Stacked Type Controllers, Controller Adjustments, Relays. - 6 hrs

Correcting Units: General familiarization with Diaphragm actuators, Valve-positioners, piston actuators, Electro-pneumatic transducers. Electro-hydraulic actuators and Electric actuator control valves - 6 hrs

Measuring Devices: Pressure, Temperature, Level and Flow measuring devices. Rpm, speed, torque, vibration, humidity and water control with calibration. Miscellaneous Instruments; Tachometers (Electric and Mechanical) , Salinity Indicator, Oil in Water Monitor: Photo Electric Cells, Photo Conductive Cells, Photo Voltaic Cells, Viscosity Sensors. - 6 hrs

Signal Transmitting Devices: Flapper Nozzle, Electro Pneumatic signal converter, Variable Inductance and capacitance transducer, Force Balance Transducer, Synchronos. - 4 hrs

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. - 6 hrs

Manipulator Element: Principles, Operation & Application, Electrical Servomotor, Hydraulic servomotor. - 2 hrs

REFERENCE:

1. Marine Control Practice - D.T. Taylor

MICE/513	MARINE INTERNAL COMBUSTION ENGINE- I	72 HRS
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AIM: To develop knowledge in marine diesel engines construction, fundamentals and latest developments.

Performance Characteristics of I.C. Engine: 4-Stroke and 2-Stroke cycles; 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. - 10 hrs

General Description of I.C. Engines: Marine Diesel Engine of M.A.N- B&W., Sulzer, make, 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. - 16 hrs

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. - 5 hrs

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. - 5 hrs

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. - 8 hrs

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. - 5 hrs

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. - 5 hrs

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. - 10 hrs

Special features of I.C. Engines: Development of long-stroke Engines, Implication of stroke-bore ratio, Development in materials in construction & heat treatment of M.E. components. - 8 hrs

SEMESTER V

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 & Practice 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.

SEMESTER V

MFM/514	FLUID MACHINES – II	54 HRS
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AIM : To develop knowledge about centrifugal pumps, reciprocating pumps and turbines.

Advanced Dimensional Analysis: Non-dimensional performance characteristic of rotodynamic machinery. - 6 hrs

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. - 16 hrs

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, Special head. - 16 hrs

Impulse and Reaction turbines : Pelton Wheel : Inward flow reaction turbine; Efficiency and vane angles, vane speed and head lost in runner, Specific speed; Applied problems. - 16 hrs

REFERENCES:

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

SEMESTER V

MAM/515	MARINE AUXILIARY MACHINERY – I	72 HRS
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AIM : To impart knowledge of Ship's Auxiliary Machines. The student will acquire knowledge of

- Ship's engine room layout, piping systems and fittings.
- Various types of Pumps and its applications.
- Ship's steering process.

Engine Room Layout : Lay out of main and auxiliary machinery in engine rooms in different ships.

- 2 hrs

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 and sea water hydrophore system. Colour code and safety fittings of bunkering procedure and in the pipe lines.

- 9 hrs

Bunkering procedure, precautions taken, Line diagram for H.F.O & D.O.

- 3 hrs

Filters: 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.

- 5 hrs

Pumps: 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. Automation and control of pumps & pumping systems.

- 8 hrs

Blowers and Compressors: Operational and constructional details of blowers and compressors used on board ships. Uses of compressed air. Air Bottles, Construction, mountings & associated system

- 5 hrs

Evaporators: Construction and Operation of different types of evaporators. Fresh Water generators and distillers. Reverse Osmosis process, Conditioning arrangements of distilled water for drinking purpose.

- 4 hrs

Heat Exchangers: tubular and plate type, reasons of corrosion, tube removal, plugging, and materials used.

- 4 hrs

Pollution Prevention: 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,

- 5 hrs

Oil Purification: 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 Uses of Homogenizers. ALCAP system, Importance of LO/FO testing, Method of testing.

- 7 hrs

Steering gears: 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. - 5 hrs

Shafting: 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 in Tail End, Intermediate and Thrust Shafts. - 5 hrs

Dry Docking: 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). - 4 hrs

Other Ship board equipments : 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. - 6 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

MNA/516	NAVAL ARCHITECTURE- I	72 HRS
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AIM: To impart basic knowledge in Naval architecture to students.

Geometry of Ship & Hydrostatic Calculations : Ships lines, Displacement Calculation, 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, Concept of DWT, GT and NT, Tonnes per Cm. Immersion, Co-efficient of forms, Wetted surface area, Similar figures, Centre of gravity, calculation of volume and centroid of volume, Calculation of WPA of ship. Co-efficient of forms, Familiarisation with hydrostatic curves of ship. - 12 hrs

Draught & Buoyancy: Meaning of buoyancy and reserve buoyancy. TPC, effect of change in density of water. Effect of bilging amidship compartments. Wetted surface area of Similar bodies, Centre of gravity, effect of addition and removal of masses, Effect of suspended mass. - 10 hrs

Transverse Stability of Ships: Statical stability at small angles of heel, Centre of gravity, centre of buoyancy, righting lever, righting moment , Transverse Metacentre. Stable, unstable and neutral equilibrium, Calculation of BM, GM (Metacentric height) , Inclining experiment, . Shift of centre of gravity due to addition or removal of mass, transverse movement of mass and effect , Free surface effect, Effect of suspended mass , Stability at large angles of heel, angle of loll, curves of statical stability, dynamical stability, Different Characteristic curves of Dynamic stability. ITTC formula. Calculations of damaged stability. IMO recommendation concerning ship stability - 20 hrs

Longitudinal Stability and trim: Longitudinal GM, MCTI , 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, Flooding calculations, Floodable length curves, determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability, Pressure on chocks. - 20 hrs

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. Theoretical knowledge of Naval Architecture and ship construction including damage control. - 10 hrs

REFERENCES:

- | | | |
|----|---|----------------------|
| 1. | Ship and 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 |

MEDD/517	ELEMENTARY DESIGN & DRAWING	45HRS
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ELEMETARY 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, Influence 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. Specifications: - Fit, tolerance, finish-BIS . - 5 hrs

Design & Drawing to specifications for parts subjected to direct loads:

Fasteners: Bolts & Screws, Cotter & knuckle joints, keys & couplings, Pipe joints, Riveted & welded joints. Design of Welded machine parts. - 2 hrs

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. - 3 hrs

MARINE ENGG. DRAWING: (27 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 Cross head & Guide shoe, Flow regulator, Gauge Glass (Plate type) Pedestal Bearing, Piston type, stop valve, Tunnel bearing ,Valve regulator (Minimum of 9 drawings to be completed in the class. Remaining to be given as home assignment)

1. Metallurgy for Engineers - E. C. Rollason
English Language Book Society (ELBS)
2. Pounder’s Marine Diesel Engines - Doug Woodyard
3. Material Science - Hazra – Choudhury

SEMESTER – V

MPPL/518	MARINE POWER PLANT OPERATION – I	54 HRS
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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.]

SEMESTER-V

MFL/519	MECHANICS & FLUID LABORATORY	45 HRS
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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 Belt friction apparatus and hence find the slip.

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

- i) Rotating masses
- ii) Spring Rate
- iii) 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 Proell Governor.

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

- i) Hartnell Governor
- ii) Porter Governor and
- iii) 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 verify the relation $T = 2\pi \sqrt{l/g}$ in case of a simple pendulum and to plot the graph T^2 Vs L .

To verify 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, $T = 2\pi \sqrt{(K/a) L/g}$

To verify the relation, $T = 2\pi \sqrt{W/Kg}$ and plot a graph T^2 Vs W .

Study of undamped natural vibrations of a beam 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 verify the Dunkerley's Rule.

Study of forced vibrations 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 'GM' (Metacentric Height) of a 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.

SEMESTER-V

FCLSL/520	FIRE CONTROL & LIFE SAVING APPLIANCE LABORATORY	36 HRS
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Testing and operation of Jet and spray type nozzles and fire hoses.

Operation of emergency fire pump .

Operation, charging and maintenance of portable fire extinguishers

- (a) CO2 water type
- (b) Foam type
- (c) Dry power type
- (d) CO2 extinguishers

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.

MEM/521	ELECTRICAL MACHINE- II	72 HRS
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AIM: To introduce the concept of operation and construction of DC machines and transformers.

Direct current machines:

Principle of working, construction, winding, e.m.f. equation. Armature reaction, commutation, brush shift, compensating winding. - 6 hrs

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

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. - 16 hrs

D.C. and 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. and 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. HV & LV switchgears - 8 hrs

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 & 3-phases). - 30 hrs

REFERENCE BOOKS:

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

31.5	CREDIT MARKS
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MHEAC/610	MARINE HEAT ENGINES & MARINE AIRCONDITIONING	72 HRS
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AIM: To impart the knowledge on Steam turbines, power plants and nozzles and basic principles of heat transfer.

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. - 16 hrs

Vapour Power cycles: Carnot's cycle, Rankine Cycle, Modified Rankine Cycle, superheat cycle, reheat cycle, regenerative cycle, Binary vapour cycle and its effect on Thermal Efficiency, Steam machinery plants, combined steam & gas plant. - 16 hrs

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. - 12 hrs

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

Marine Refrigerating and A.C. Plants: Typical marine Refrigerating plants with multiple compression and Evaporator system. Heat pump cycles, refrigeration in liquefied Gas carriers. Reefer ships, refer containers. - 10 hrs

Principle of Air conditioning, psychometric properties of air comfort conditions, control of humidity, Air flow and .A.C. Capacity calculation for ship plants. - 10 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 & A. McConkey |
| 4. Applied Thermodynamics | - J. B. O. Sneed & S. V. Karr. |
| 5. Tanker Safety Guide Liquefied Gas | - International Chamber of Shipping |

SFPC/611	SHIP FIRE PREVENTION & CONTROL	126 HRS
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AIM: To provide sound knowledge of fire prevention and control to the students.

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 & class D fires, Combustion products & their effects on life safety. - 26 hrs

Fire protection rules 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. - 26 hrs

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. - 26 hrs

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. **Fixed Fire installation on LPG & LNG** - 20 hrs

Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds galley. 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. - 22 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 abroadships - M . G Stavitsky
7. Marine Electrical Technology - Fernandez

MICE/612	MARINE INTERNAL COMBUSTION ENGINE- II	72 HRS
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AIM : To make the students learn the concept and working of Marine diesel engines

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

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. - 10 hrs

Maneuverings Systems: Starting and reversing systems of different Marine Diesel engines with safety provisions. Action in emergency situation. - 10 hrs

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. - 6 hrs

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. - 4 hrs

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. - 8 hrs

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. - 6 hrs

Automation in modern diesel engine plants: Remote operation, Alarm and fail safe system, Governors and their basic functions Constant speed and Overspeed governors. Constructional details and hunting of governor.

- Computerised monitoring and diagnostic applications in propulsion engines.
- Concept of intelligent engine .
- U.M.S. Operations of ships., minimum requirement of automation for UMS operation . - 6 hrs

SEMESTER VI

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. Crankshaft deflection and alignment, Engine holding down arrangements, Tightening of Tie bolts, - 10 hrs

Trouble Shooting in Diesel Engines: Hot & Cold Corrosion, Crankshaft web slip, X-head bearing problems, microbial degradation in fuel & lub oil. - 4 hrs

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. - 4 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 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, 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.

MET/613	MARINE ELECTRICAL TECHNOLOGY	72 HRS
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AIM: To develop skills in marine electrical technology including the knowledge of the regulations observed on board ships regarding electrical equipments wherever applicable.

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. - 7 hrs

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 & Regulation, 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 - 7 hrs

Distribution: Different electrical diagrams and their uses, electrical signals. Type of Distribution, 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 classification. - 5 hrs

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). - 7 hrs

Miscellaneous marine electrical equipment Alarm System: Engine Room Telegraph, Rudder Angle Indicator, R.P.M. & Revolution Counter, Centralised 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

Maintenance of Electrical Systems, Fault finding & Repair: Type of faults & indications on Generator, motor & distribution systems, Different Testing equipments & meters (multimeter / megger, clamp meter), 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 requirement. - 10 hrs

Special Electrical Practice: Rules and Regulations & operation 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. Electrical Survey requirements. - 18 hrs

Safe Electrical Practice: Safe watch-keeping, points to check on electrical machineries, Switch gears & equipments, microprocessor control and maintenance electrical fire fighting, precautions against electric shock and related hazards. - 8 hrs

SEMESTER-V

High voltage systems: Hazards & precautions required for operation of power system of above 1,000 V High voltage transformer. Design features of high voltage installations.

- 2 hrs

REFERENCES:

- | | |
|--|------------------|
| 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 |

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

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. - 4 hrs

Different refrigerants, chemical formula, desired properties (general, physical, chemical, thermodynamic) comparison, effect on environment, Montreal protocol, new refrigerants. - 4 hrs

Design and construction of various components of refrigeration plants, i.e, compressor, condenser, evaporator, expansion v/vs, control & safety equipments. - 6 hrs

Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant/oil, purging of air, defrosting methods, trouble shooting. - 6 hrs

Refrigeration of cargo holds, brine system and it's 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. - 6 hrs

Heat load calculation on refrigeration and air conditioning plant. - 2 hrs

Air conditioning: 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. - 6 hrs

Ventilation: Ventilation of engine room, pump room, CO₂ and battery rooms, air change requirements, design considerations, maintenance. - 2 hrs

Noise and Vibrations: Elements of aerodynamics 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 torsigraphs. - 10 hrs

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

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. - 18 hrs

REFERENCES:

1. Marine Engineering Practice - IME Publication
2. Refrigeration at Sea - J . R. Stot
3. Marine Airconditioning - S. D. Srivastava
4. Advanced Marine Engineering - J.K. Dhar
5. General Engineering Knowledge - H.D. McGeorge

SEMESTER-VI
ELECTIVE SUBJECTS

MNA/615	NAVAL ARCHITECTURE- II	72 HRS
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AIM: To impart knowledge to students in naval architecture to enable him understand strength and safety of ship .

Propulsion & Propellers : Geometry of screw Propeller & terminology, wake, apparent and real slip, Thrust, relation between powers, relation between mean pressure and speed, measurement of pitch, Cavitation, QPC, Efficiency of hull & propeller , Laws of similarity , thrust co-efficient (K_T) , Torque co-efficient (K_Q), Advance co-efficient (J) Propeller types, Fixed pitch, Variable Pitch, Ring propeller, Kort nozzles, Voith Schneider propeller, propeller theory. - 15 hrs

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

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. - 15 hrs

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. - 20 hrs

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, Antirolling devices, Forces caused by rolling and pitching, Heaving and Yawing. - 12 hrs

REFERENCES:

1. Ship 7 Naval Architecture - Munro – Smith
2. Naval Architecture - W. Muckle
3. Ship Construction - D.T. Taylor
4. Naval Architecture for Engineers - Reeds' Vol - 6

SEMESTER-VI
ELECTIVE SUBJECTS

MEP/616A	DOUBLE HULL TANKER VESSELS	36 HRS
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Origin 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. - 7 hrs

Design considerations, main dimension, hull-weight estimate, double hull requirements, minimum depth of double bottom tank, wing tank width, clearance for inspection. maximum cargo tank size, capacity, effect of fr surface, damage stability, hydrostatically balanced loading, sloshing loads, its elimination or minimization. - 9 hrs

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. - 9 hrs

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. - 7 hrs

Economic aspects, fast loading discharging of oil cargo, quicker cleaning, ballasting and deballasting, larger number of trips per year. - 4 hrs

REFERENCES:

1. Ship 7 Naval Architecture - Munro – Smith
2. Naval Architecture - W. Muckle
3. Ship Construction - D.T. Taylor
4. Naval Architecture for Engineers - Reeds' Vol - 6

SEMESTER-VI
ELECTIVE SUBJECTS

MEP/616B	ADVANCED MARINE HEAT ENGINES (CO-CYCLES)	36 HRS
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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. - 9 hrs

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. - 9 hrs

Combustion and Flame stabilization: Combustion of liquid Fuels, Atomisation, mixing, combustion curve and different methods of Flame stabilization, Design & combustion chamber. Spray of Fuel. Pre-mixing of Gaseous Fuels for combustion. Stability of the Flame. - 9 hrs

Design of different types of compact Heat Exchangers for different Applications, e.g. Air preheater, Gas and Oil Heaters. - 9 hrs

Text Books:

1. Reeds Marine Engineering Series, Heat and Heat Engines, Thomas Reed Publications Ltd., 1983
2. Gorla, Turbomachinery 1st Ed. Taylor and Francis, First Indian reprint 2011(Yesdee Publishing)
3. William Embleton, Leslie Jackson, Applied Heat For Marine Engineers, 4th Ed. Vol 3, Reeds London, 2011
4. KupanThulukkanam, Heat Exchanger Design Handbook, 1st Ed., CRC Press, 2000

References:

1. Turton, Principles of Turbomachinery, 2nd Ed. Springer, Reprint 2010, (Yesdee Publishing)
2. Eric, M. Smith, Advances in Thermal Design of Heat Exchangers, 1st Ed. Wiley Publishing, 2005
3. Ramesh K. Shah, Dusan P. Sekulic, Fundamentals of Heat Exchanger Design, 1st Ed. John Wiley and Sons, Inc., 2003

SEMESTER-VI
ELECTIVE SUBJECTS

MEP/616C	ENVIRONMENTAL SCIENCE & TECHNOLOGY	36 HRS
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Environmental microbiology:

Fundamentals of microbiology – classification, growth and characteristics. Microbiology of water : Fresh water as a microbial growth supporter, common microorganism, 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. - 10 hrs

Environmental Pollution & 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 : Sources 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. - 16 hrs

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.

- 10 hrs

Reference Books:

1. Botkin, D.B.& Keller, E.A Environmental Science: Earth as a Living Planet, John Weily, NY
2. College Botany, Vol. I, II & III- Gangulee, Kar and Das
3. Cunningham, W.P.& Cunningham, M.A., Environmental Science, Tata McGraw Hill. ND
4. Santra, S.C., Environmental Science
5. Maier, Pepper & Gerba, Environmental Microbiology.
6. Das, N.G., Statistical Methods (Volume 1 and 2)

MCE/617	COMMUNICATIVE ENGLISH- V	36 HRS
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AIM: This course is designed to enable to students to entrance their linguistic abilities in listening, reading, writing and speaking communicative English. Adequate knowledge of English.

1. Reading & Comprehending – Follow-up exercises

- 1.1 Reading and Comprehending domain specific articles
- 1.2 Reading and comprehending from charts, tables, graphs or diagrams
- 1.3 Reading and comprehending a variety of general articles

2. Writing Activities

- 2.1 Writing Formally & Informally
- 2.2 Abstract Writing
- 2.3 Domain Specific writing
- 2.4 Verbal Aptitude Practice

3. Listening Practice

- 3.1 Listening to authentic materials
- 3.2 Listening and comprehending with follow-up exercises

4. Speaking Practice

- 4.1 Conversational Dialogues
- 4.2 Sharing opinions and discussion
- 4.3 Impromptu Speech practice

REFERENCEBOOKS:

English

Communicationskills(Book1)

nEnglish forIndia

EnglishlanguageBooks1and2

Writtencommunication

Businesscorrespondence

S.R.Inthira&V.Saraswati.Spoke

R.K.Bansal&B.Harrison.

L.A.Hill,C.J.Daswani&C.T.Daswani.
(OxfordUniversityPress 1975)

FreemanandSarah.

R.C.Sharma

MPPL/618	MARINE POWER PLANT OPERATION – II	45 HRS
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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 superheater, water level indicators, high and low level alarms and other boiler mountings, Overhauling and adjusting of safety valves. Recording and controlling of various pressures & temp. 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.

Maintenance & Repair – Generator, switch board, electrical motor, starter, distribution system, transformer, distribution cable, DC, electrical system and equipment, battery system, automation control system.

MEML/619	ELECTRICAL MACHINES LABORATORY	45 HRS
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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 1-phase transformers in the following ways:

(a)-Y (b) Y-Y (c) –Double Y (d) –Double

Parallel operation of D.C. Shunt Generators.

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 totality.

Performance test for automation control devices and protective devices.

Calibrate & adjust transmitters and controllers, control system fault finding.

32.0	CREDIT MARKS
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SEMESTER-

MSOM/711	SHIP OPERATION AND MANAGEMENT	72 HRS
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AIM: To teach the students about management of ships and impart knowledge on statutory regulation.

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.

- 4 hrs

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.

- 4 hrs

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

- 6 hrs

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

- 10 hrs

Shipping Companies: Organisational 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.

- 10 hrs

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.

- 8 hrs

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

- 6 hrs

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

- 4 hrs

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. Vessels in distress. Shipping causalities penalties under Merchant Shipping Act.

Marine Fraud : Genesis and Prevention.

Indian Shipping : Current scenario and few case studies.

Marine conventions: 1) International convention on salvage 1989, Lloyds Standard Form of Salvage Agreement (LOF 2000)

2) Convention on limitation of liability of maritime claim 1976.

3) MLC (2006) /UNCLOS/WHO

- 20 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 |

AMCEA/712	ADVANCED MARINE CONTROL ENGINEERING, AUTOMATION	54 HRS
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AIM: To provide knowledge about automation and control engineering in ships.

Introduction to System Analysis: Formation of Mathematical Models to study System behaviour considered in a mathematical sense using Differential Equation. 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. Flowchart for automation & control system – depiction and understanding of flowchart, symbols utilisation and processes involved. Use of D- Operators, Concept of stability. Routh & Hurwitz stability criteria. Analysis of System Performance under dynamic or transient operating condition using Laplace Transforms. Performance characteristics. Nyquist stability criterion, System performance and compensation

- 10 hrs

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 V-I, I-V, P-I & I-P converters and Solve numerical problems on all above .

- 14 hrs

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

- 7 hrs

Signal Transmitting Devices: Flapper Nozzle, Electro Pneumatic signal converter, Electrical 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. Solving numerical problems on all above.

- 6 hrs

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.

- 8 hrs

Programmable Logic Controllers, Integrated automation control and monitoring (ICAMS), Computer programmable controller, Relay circuit unit, Digital sequential control devices, Control mechanism of PLC. Software version control – PLC, Micro-controllers, digital techniques.

- 9 hrs

– 3 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 |

IMOMC/713	IMO AND MARITIME CONVENTIONS	54 HRS
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AIM: To impart knowledge about IMO and familiarisation with requirements of maritime conventions

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, inspection of training institutes, training of trainers - 10 hrs

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. - 10 hrs

Shipboard Applications-Regulations & Code of 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. - 9 hrs

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. - 15 hrs

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. - 5 hrs

WHO:

Maritime Declaration of Health & the requirements of the International Health Regulation.

1. WHO's International Health Regulations 2005 (IHR)
2. International Medical Guide for Ships (IMGS)
3. IMO's Medical First Aid Guide (MFAG)
4. WHO's Guidelines for drinking water quality - 5 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

AMT/714	ADVANCED MARINE TECHNOLOGY	54 HRS
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AIM: To provide latest technology in ships to students

Bridge Control Systems & UMS Operation: - 6 hrs

Study of LNG & LPG ships: Various controls of deck equipments including pneumatic and electronic equipments. Study re-liquefaction 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

Chemical Tankers: Classification, construction, pumps for chemicals, tank cleaning procedures IG systems for Chemical Tankers, Controls and safety devices associated with loading and discharging. - 8 hrs

Oil Tankers: Types & classification, construction, COW operation, I.G Systems, Pump arrangements and safety devices associated with loading & discharging. - 8 hrs

Car Carrier: Construction, ventilation, Stability, Strength considerations, RO-RO arrangement. - 4 hrs

Bulk Carrier: Construction, Strength considerations w.r.t loading & discharging, Condition assessment system, Enhanced survey, safety considerations, stability considerations. - 4 hrs

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 |

MERM/715	ENGINE ROOM MANAGEMENT	72 HRS
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AIM: To enable the student acquire knowledge for operation and maintenance of marine machinery and take care of engine room management.

Engine room resource management, effective corrections, allocation of resources, planning & co-ordination, workload management, time & resource constrains. Personal relationship onboard ship, working in multi-cultural environment. - 2 hrs

Preparation of Engine: 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 thoroughly study. - 5 hrs

Maintenance: 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. - 5 hrs

Breakdown Operations: Preparation of engines for emergency operation. Emergency repair for engine room machineries. Emergency steering - 5 hrs

Spare parts Management : 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. - 5 hrs

Monitoring of engine performance : Taking indicator cards and interpretation of card, trouble shooting from engine parameters like pressure & temperature and behaviour like vibration and noise crank case inspection, use of mist detector and other safety features. - 5 hrs

Management of engine room crew: 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. - 5 hrs

Safe Engineering Watch Keeping

Routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system. Interpretation of functional tests on communication and control system. Maintenance of machinery space log book and the significance of readings taken. - 3 hrs

Engineering watch (underway): 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. - 5 hrs

Engineering Watch (Unsheltered anchorage): 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. - 5 hrs

Pollution prevention methods. - 5 hrs

Marine Environment: Marine Environmental awareness, marine ecology, seas & coastal areas, discharges to sea & their environmental impact, accidental & operational discharges, emissions to air from ships, other pollutants, proactive measures to control pollution & maintain environment.

Precautions to be taken to prevent pollution of Marine Environment: During Bunkering, loading / discharging oil cargo, tank cleaning, pumping out bilges & knowledge of construction & operation of oil pollution prevention equipment in Engine Room & on other specialized ships.

Responsibilities under the relevant requirements of the International Convention for the prevention of Pollution from ships – Annex-I, II, III, IV, V & VI.

Requirements & responsibilities under MARPOL, 73/78 (All Annexes, equipment requirements & their operations, documentation, including necessary record books), Ballast Water Management Convention 2004, Antifouling convention 2001, National Legislations of other countries like Oil Pollution Act 1990.

Environmental impact of accidental & operational discharges, emissions to air from ships, other pollutants, proactive measures to control pollution & maintain environment.

Emergency situations, actions to be taken for protecting & safe-guarding environment. - 6 hrs

Deck Machinery: Various types of deck machinery used in ships e.g. Winches and Wind lass and their requirements. Operation and maintenance. Deck Cranes. Hydraulic deck machinery; hydraulic motors, line filters and systems. - 4 hrs

Dry Docking: Planning, entering, docking, inspection, maintenance and repairs. Surveys, certification. Undocking and report writing. - 5 hrs
Safety requirement for working on ship board electrical system including isolation of all electrical plants. - 2 hrs

Safe working practices: Risk Assessment, personal protective equipment, Emergency procedure Entering Enclosed or confined spaces, permit to work systems, Lifting equipments, Hot work, Hazardous substances, Safety measures for safe working environmental and for using hand tools, machine tools, powered hand tools. - 3 hrs

Use of various types of sealants and packing's. - 2 hrs

REFERENCES:

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

MEP/716	ELECTIVE – III	72 HRS
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- ELECTIVE PAPER – III:**
- A) **ADVANCED HYDRAULICS & HYDRAULIC MACHINERY**
 B) **TRANSPORT & LOGISTIC MANAGEMENT**
 C) **ADVANCED MATERIAL SCIENCE & SURFACE COATING ENGINEERING**
 D) **RENEWABLE ENERGY SOURCES & APPLICATIONS**

MEP/716A	ADVANCED HYDRAULICS & HYDRAULIC MACHINERY	72 HRS
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AIM: To provide in-depth knowledge about hydraulic machineries for general and shipboard application .

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. - 15 hrs

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. - 15 hrs

Rotodynamic Transmission:-

Hydraulic Coupling, Torque converter and characteristics of hydraulic coupling and Torque Converter. Linear Transmission of Hydraulic Power. Hydraulic Rotary Actuator of parallel piston type and piston type with rack-pinion, crank lever mechanism. - 10 hrs

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. - 5 hrs

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. Different types of filters, instruments and control elements, e.g; Float switch, thermostat, pressure switch. Different valves for pressure control, velocity and discharge control direction control, Symbols of components along with various hydraulic terms. Different control systems, Hydraulic and Pneumatic systems, Typical circuit for a pump set. - 15 hrs

Shipboard application of hydraulic system :

Hydraulic Servo mechanisms. Servo valves, valve operated servo mechanisms and Pump controlled servo mechanisms. Hydraulic press, Jack, Accumulator, Hydraulic crane - 12 hrs

Text Books:

1.R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, ninth edition.

Reference Books:

1.P.N. Modi& S.N. Seth, Hydraulics & Fluid Mechanics, Rajsons Publications Pvt. Ltd, Twentieth Edition.

3. C.S.P. OJha, R.Berndtsson, and P.N. Chadramouli, "Engineering Fluid Mechanics" Oxford University Press, Dec. 2009.

4. P.N. Chanrdamouli, C.S.P.Ojha and K.M.Singh, "Hydraulic Machines" Oxford University Press, June 2010. 5. K Subramanya , "Flow through open channels" Tata McGraw Hill.

Source of reference; Online sources

1. <https://nptel.ac.in/course.html>

2. www.vlabs.ac.in

SEMESTER-VII
ELECTIVE SUBJECTS

MEP/716B	TRANSPORT & LOGISTIC MANAGEMENT	72 HRS
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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. - 10 hrs

Unit 2.

Managerial economics, Financial accounting, Cost & Management accounting, International financial management - 15 hrs

Unit 3.

International trade & commerce, International transport system, International transport law, Transport economics, import – export documentation & procedure, Multimodal transport . Logistic & Operations management. - 20 hrs

Unit 4.

Quantitative techniques, Operation research, Research Methodology, Strategic management, International marketing. - 15 hrs

Unit 5.

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

TEXTBOOKS:

1. T. N Chhabra, Principles of Management
2. Samuel C Certo And S. Trevis Certo, Modern Management

Reference Books:

1. L. M Prasad, Principles And Practices Of Management
2. Koontz, Essentials of Management.
3. Daft, R. L, Management.
4. Stephen P. Robins and Marry Coulter, Management.
5. Goldsby, T.J., D. Ivengar, and S. Rao 2014. The Definitive Guide to Transportation: Principles, Strategies, and Decisions for the Effective Flow of Goods and Services
6. Srinivasan, M., T. Stank, et al. 2013. Global Supply Chains: Evaluating Regions on an EPIC Framework – Economy, Politics, Infrastructure, and Competence
7. Watson, M. , S. Hoormann, et al. 2012. Supply Chain Network Design: Understanding the Optimization behind Supply Chain Design Projects

MEP/716C	ADVANCED MATERIAL SCIENCE & SURFACE COATING ENGINEERING	72 HRS
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Material Structure:

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

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,. Special polymeric material like PVC, Teflon, Polypropylene. 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, Al₂O₃ . - 15 hrs

Heat treatment processes:

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. - 10 hrs

Metallurgical aspect of Metal joining:

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. - 10 hrs

Testing of Material:

Advanced study tensile test, hardness test, notched bar test, various methods & machines for tests. Non –destructive tests like penetrant test, magnetic particle test, ultrasonic test, radiographic test, Accoustic emission test (A.E.S), thermal Imaging test for welds. - 10 hrs

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-implantation, 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

Modern Material :

Discussion on recently developed material and study on them. - 5 hrs

REFERENCE :

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

MEP/716D	RENEWABLE ENERGY SOURCES & APPLICATIONS	72 HRS
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Principles of Renewable Energy :

Introduction. Fundamentals. Scientific Principles of Renewable Energy. Technical Implications. Social Implications. - 10 hrs

Solar Radiation :

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. - 5 hrs

Solar Water Heating :

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. - 5 hrs

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.

- 10 hrs

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. - 10 hrs

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 - 10 hrs

Energy storage & Distribution:

Importance of Energy Storage & Distribution. Biological Storage. Chemical Storage. Heat Storage. Electrical Storage. Fuel Cells, Mechanical Storage. Distribution of Energy Problems. - 5 hrs

Bio mass :

Principles of using Biomass. Availability. Economics. - 5 hrs

Biofuels :

Introduction. Biofuel Classification, Thermochemical, Biochemical. Agrochemical. Biomass Production for energy farming, Energy farming-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.

- 12 hrs

TEXTBOOKS:

1. Renewable energy technologies - R. Ramesh, Narosa Publication.
2. Energy Technology – S. Rao, Parulkar

Reference Books:

1. Non-conventional Energy Systems – Mittal, Wheelers Publication.
2. Non-Conventional Sources of Energy- G.D.Rai, Khanna Publishers
3. Non-Conventional Sources of Energy- B. H. Khan, TMH Publication
4. Renewable Energy sources And Emerging Technologies, DP. Kothari, PHI.
5. Hand Book of Renewable Energy Technology, Ahmed F Zooba, R C Bansal World scientific.

SEMESTER-VII

MMSD/717	MARINE MACHINERY & SYSTEM DESIGN	72 HRS
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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.
- 5 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, Design and Drawing of Flywheel, Piston, connecting rod, safety valves, Reducing valves, Compression & Torsion springs, Journal bearings, Thrust bearings. Design of lifting equipment e.g. Engine room overhead Crane, Globe & other valves Mechanical Pilot.
- 15 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 CO₂ 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. - 10 hrs

REFERENCES:

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

SEMESTER -

MSCL/718	SIMULATORS & CONTROL LABORATORY	45HRS
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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 Diesel Engine operation & maintenance software: Different modes of operation – standard mode, Live run mode and Lesson mode of a four stroke, three cylinder medium speed marine engine.

Using 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 the cylinder;
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.

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 .

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.

Trouble shooting and restoration of electrical and electronic equipment and system.

Logical 6 step trouble shooting procedure.

**SEMESTER -
SEMESTER – VII**

MCE/719	COMMUNICATIVE ENGLISH - VI	54 HRS
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AIM:

To provide students ample practice and opportunities to listen, speak, read and write in English and gradually become more fluent and confident communicators and presenters in their professional life.

To provide latest technology in ship to students

1. Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non-Technical Passages
 2. Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions
 3. Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success
 4. Honing 'Speaking Skill' and its sub skills
- Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech

REFERENCE BOOKS:

English

Communications skills (Book 1)

English for India

English language Books 1 and 2

Written communication

Business correspondence

R.C.Sharma

S.R.Inthira & V.Saraswati. Spoke

R.K.Bansal & B.Harrison.

L.A.Hill, C.J.Daswani & C.T.Daswani.

(Oxford University Press 1975)

Freeman and Sarah.

SEMESTER -

IOT/720	INTERNET OF THINGS	18 HRS
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AIM: To provide latest technology in ships to students

Introduction:

Architecture, Design principles, applications, Basic networking, IOT Fundamental: device, data Management, gateways, XaaS, Role of cloud in IOT. – 03 hrs

Element of IOT:

Hardware components: Computing, communication, Input/output interface. Software Components: Programming API's (using Arduino/Python/Node.js) for communication protocols, Bluetooth, zigBee, TCP. – 06 hrs.

Application Development of IOT:

Implementation of Device integration, Data storage on Device- Data storage on local/cloud server, Device authentication and authorization. – 06 hrs.

Case studies on Marine Industry:

IOT case studies on Marine industry automation, Marine Transportation System. – 03 hrs.

REFERENCES:

1. Vijay Madiseti, Arshdeep Bahga, Internet of things, “ A Hands on Approach”, Unicersity Press.
2. Dr.SRN Reddy, Rachit Thukral and Manasi Mishra, “ Introduction to Internet of things: A practical approach”, ETI Labs.
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use cases”, CRC Press
4. Jeeva Jose, “Internet of Things”, Khanna Publishing House, delhi.
5. Raj kamal, “Internet of Things: Architecture and Design”, Mc Graw Hill.

SEMESTER -

MGS/721	GENDER SENSITISATION	18 HRS
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Gender Sensitization Training

Module	Subject Area	Duration	Expertise
Module 1	<u>Introduction of Gender Sensitization</u>	2	MARINE
1.1	Historical Perspective		
1.2	Early Medieval Period		
1.3	The Dawn of the 20 th Century – A New Beginning		
1.4	Women in Maritime History		
1.5	Women in Indian maritime		
1.6	Recent Statistics		
1.7	The Way Forward		
1.8	Importance of Gender Sensitization		
1.9	Benefits of a Gender-Sensitive Workplace		
1.10	Difference Between Gender Sensitivity and Non-Gender Sensitivity in a Workplace		
Module 2	<u>Gender and Sex</u>	2	SOCIOLOGY
2.1	Gender Stereotypes		
2.2	Gender		
2.3	How Gender Differences Develop		
2.4	Why is it Important to Understand the Difference between Gender and Sex?		
2.5	Why I Understanding this Distinction in Shipping Important?		
Module 3	<u>Gender Roles</u>	2	SOCIOLOGY
3.1	Gender Stereotypes		
3.2	Exercise – Biases of Participants		
3.3	Times then vs Times now		
3.4	How Gender Roles and Gender Stereotypes lead to Discrimination		
3.5	How Gender Roles Affect us		
3.6	How Times are Changing		
3.7	Looking at the person beyond Established Gender Roles		
3.8	Learnings and Insights		
		2	SOCIOLOGY /

SEMESTER -

<p>Module 4</p> <p>4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12</p>	<p><u>Discrimination and Safety of Women Seafarers</u></p> <p><u>Introduction</u> What Do Statistics Tell us? What is Gender Discrimination? Types of Gender Discrimination How Does Gender Inequality Affect Women? How do Women Deal with Discrimination and Adapt in the Workplace? Ways To Encourage Women to Be a part of Maritime Safety Concerns of Women Seafarers How Can this issue be dealt with? Organizations / Institutions Working for the Cause Laws against harassment in Maritime The Way Forward</p>		<p>PSYCHOLOGY</p>
<p>Module 5</p> <p>5.1 5.2 5.3 5.4 5.5 5.6 5.7</p>	<p><u>Gender Harassment</u></p> <p>Types of Harassment Power Dynamics and harassment Gender harassment in the Maritime Industry Consequences of harassment What Could be Done by Victims? Indian Laws against Psychological harassment What kind of Changes is Necessary to Promote a Culture of Gender Enquiry On board?</p>	<p align="center">1</p>	<p align="center">LEGAL</p>
<p>Module 6</p> <p>6.1 6.2 6.3 6.4 6.5</p>	<p><u>Digital Media : A Boon and Bane for Women at Sea</u></p> <p>The Boons and Banes of Internet and Digital Media Potential Threat of Cyber against Women Seafarers Prevention is Key Dos and Don'ts for male Seafarers Dos and Don'ts for Women Seafarers</p>	<p align="center">1</p>	<p align="center">MARINE</p>
<p>Module 7</p> <p>7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8 7.9 7.10</p>	<p><u>Legal Factors in Gender-Related Issues on board</u></p> <p>Introduction Global Recognition of Women Seafarers' Rights and Regulations for the same United nations for Seafarers Maritime labour Convention (2006) Indian Regulations for Women Seafarers Indian Constitutions and Gender Sensitivity Vishaka Guidelines Kudumbashree The DG SHIPPING GUIDELINES Notice No. 07 of 2019 Redressal of Complaints</p>	<p align="center">2</p>	<p align="center">MARINE</p>

SEMESTER -

<p>Module 8</p> <p>8.1 8.2 8.3 8.4 8.5 8.6 8.7 8.8 8.9 8.10 8.11 8.12 8.13 8.14 8.15 8.16</p>	<p><u>Physical and Mental Health in Women Seafarers</u></p> <p>Physical Health Premenstrual Syndrome (PMS) Premenstrual Dysphoric Disorder (PMDD) Menopause Symptoms of Menopause Physical Activity and Women Benefits of Physical Activity Reasons for Physical Inactivity in Women Appropriate Physical Activity for Women Barriers and Tips for Women to Overcome those barriers to Exercise Research article Effects of Gender Discriminations on Physical Health Physical Health in Women Seafarers Health Challenges Related to Work Psychological Issues in Women Seafarers Women's Mental Health: Some Facts</p>	<p align="center">2</p>	<p align="center">PSYCHOLOGY</p>
<p>Module 9</p> <p>9.1 9.2 9.3 9.4 9.5 9.6</p>	<p><u>Challenges Faced by Women Ratings On board</u></p> <p>Work Stereotypes Socio-Cultural background of Ratings Vocational Training Required for Ratings Accommodation of Ratings The Way Forward Importance of Findings solutions to the problems of Female Ratings</p>	<p align="center">1</p>	<p align="center">MARINE</p>
<p>Module 10</p> <p>10.1 10.2 10.3 10.4</p>	<p><u>Education Among Seafarers</u></p> <p>Current Scenario in the Seafaring Community Role of Family Area of Improvement Efforts Taken</p>	<p align="center">1</p>	<p align="center">MARINE</p>
<p>Module 11</p> <p>11.1 11.2 11.3 11.4 11.5 11.6 11.7 11.8 11.9 11.10 11.11</p>	<p><u>Gender-Sensitive Communication</u></p> <p>Using Gender-Sensitivity languages Body languages/ Communication at Sea Facial Expressions and Eye Contact Body Movements and Gestures Personal Distances Touch Understanding Body Language Understanding Differences in Communication across Cultures Do's and Don'ts while communicating with Women from different nationalities What to do When Faced with an Uncomfortable Situation? Things to Keep in Mind while communicating with the other Gender</p>	<p align="center">1</p>	<p align="center">COMMUNICATION</p>

SEMESTER -

Module 12	<u>Occupational Sexism</u>	1	MARINE
12.1	Male Domination and Sexism		
12.2	Society and Sexism		
12.3	Occupational Sexism in India		
12.4	Occupational Sexism in Maritime industry		
12.5	What The Industry Can Do		
12.6	What male Seafarers Can Do		
12.7	What Women Seafarers Can Do		

Reference Books:

1. Jane Pilcher & Imelda Whelehan :50 Key Concepts in Gender Studies, SAGE Publications, New Delhi
2. Bhasin, Kamla :What is Patriarchy?, Kali for Women, New Delhi
3. V. Geetha :Gender, STREE-SAMYA, Kolkata
4. V. Geetha :Patriarchy, STREE-SAMYA, Kolkata
5. Convention on the Elimination of All Forms of Discrimination against Women Adopted and opened for signature, ratification and accession by General Assembly resolution 34/180 of 18 December 1979 entry into force 3 September 1981, in accordance with article 27(1)
6. Declaration on the Elimination of Violence against Women Proclaimed by General Assembly resolution 48/104 of 20 December 1993

Links:

1. Understanding Gender - <https://youtu.be/MxhB16trdfg>
2. Basic concept of sex and gender, gender attributes & questions of identity (WS) - <https://youtu.be/k7GZ02hbiWQ>
3. Gender and Intersectionality theory - <https://youtu.be/JqdMLj6sYwo>
4. Patriarchy - <https://youtu.be/-ff9qsqaRg8>
5. Gender Sensitisation meaning - <https://youtu.be/BrfCAPfqpvk>
6. Gender Sensitisation: Issues and Challenges - <https://youtu.be/rECOSSt6yu4I>
7. Pitsattaki Gehraiyan - <https://youtu.be/R0C0ii4yBw8>
8. Mumkinhai/ It's Possible by Kamla Bhasin - <https://youtu.be/6tfPgVldJm4>
9. Understanding Gender with Kamla Bhasin - <https://youtu.be/y6WYBu7vuYY>.

SEMESTER -

MMHW/722	MENTAL HEALTH & WELL-BEING	18 HRS
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Mental Health and Hygiene
For Marine Engineering

1. Introduction to Mental Health and Hygiene	1 Hr
2. Importance of Mental Health and Hygiene	1 Hr
3. Techniques of Stress Management-1	1 Hr
4. Techniques of Stress Management-2	1 Hr
5. Symptoms of Common Psychological Disorder-1	1 Hr
6. Symptoms of Common Psychological Disorder-2	1 Hr
7. Symptoms of Common Psychological Disorder-3	1 Hr
8. Self-Administration of a Test	1 Hr
9. Interpretation of the Test	1 Hr
10. Emotional Intelligence-1	1 Hr
11. Emotional Intelligence-2	1 Hr
12. Techniques of Time Management-1	1 Hr
13. Techniques of Time Management-2	1 Hr
14. Motivation and Work-Life Pattern-1	1 Hr
15. Motivation and Work-Life Pattern-2	1 Hr
16. Conflict Resolution Techniques-1	1 Hr
17. Conflict Resolution Techniques-2	1 Hr
18. Self-Administration and Interpretation of a Test	1 Hr

REFERENCE BOOKS:

1. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.).
2. Carr, A. (2004). Positive Psychology: The science of happiness and human strength. UK: Routledge.
3. Forshaw, M. (2003). Advanced psychology: Health psychology. London: Hodder and Stoughton.
4. Hick, J.W. (2005). Fifty signs of Mental Health. A Guide to understanding mental health. Yale University Press.
5. Snyder, C.R., & Lopez, S.J. (2007). Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage.

Links:

1. Association Of Indian School Counselors and Allied Professionals (AISCAP) Central Board of Secondary Education, <http://cbse.nic.in/>
2. Common Emotional and Behavioural problems, Expressions India, (www.expressionsindia.org) Revised 2019
3. Press Information Bureau of India : <https://pib.gov.in/indexd.aspx>

SEMESTER -

4. National Book Trust: <https://www.nbtindia.gov.in/> • Adolescent Peer Educators' Orientation Course in Life Skills, Gender & Wellbeing, Training Manual for Peer Educators and Teacher Facilitators, Expressions India (Revised 2019)
5. Prerana Mohite, Namita Bhatt. "From Home to School: Mapping Children's Transition in the Indian Context", Research in Comparative and International Education, 2008
6. World Health Organization (1992). International statistical classification of diseases and related health problems (10th Ed.)
7. WHO website https://www.who.int/docs/default-source/coronaviruse/mental-healthconsiderations.pdf?sfvrsn=6d3578af_2
8. WHO/UNESCO/UNICEF: Comprehensive School Health Education; Suggested Guidelines For Action. World Health Organization. Geneva. 1992.

30	CREDIT MARKS
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- 01 IDENTIFYING & FAMILIARITY WITH DIESEL ENGINE PARTS
- 02 ENGINE DATA
- 03 ENGINE OPERATING PARAMETERS
- 04 PISTON & PISTON RINGS
- 05 PISTON & CONNECTING ROD, BEARINGS (TOP END & BOTTOM OR BIG END)
- 06 FUEL VALVE
- 07 VALVE GEAR
- 08 FUEL PUMP
- 09 ENGINE DATA, MEASUREMENT & CLEARANCE
- 10 CAMSHAFT
- 11 LUBRICATING OIL PUMP
- 12 FUEL OIL PRIMARY PUMP
- 13
 - a. CRANK SHAFT & BEARING
 - b. STARTING VALVE
 - c. CYLINDER UNIT
 - d. LUBRICATING OIL COOLER
 - e. ENGINE SYSTEMS
 - f. SPARE PARTS & GEAR
 - g. CRANKCASE RELIEF VALVE
 - h. FUEL OIL FILTER ASSEMBLY
 - C - SHIP GENERAL DATA, MAIN PROPULSION PLANT & AUXILIARY SYSTEMS
 - FAMILIARITY WITH SHIP GENERAL DATA
 - i. FAMILIARITY WITH SHIP GENERAL DATA
 - j. TECHNICAL DETAILS - DIESEL PROPULSION PLANT
 - k. TECHNICAL DETAILS - AUXILIARY SYSTEM
 - D - TWO STROKE DIESEL ENGINE
 - l. TWO STROKE DIESEL ENGINE
 - m. PISTON AND PISTON ROD
 - n. PISTON ROD STUFFING BOX
 - o. CYLINDER LINER AND COOLING JACKET
 - p. CYLINDER HEAD
 - q. CONNECTING ROD & CROSSHEAD
 - r. THRUST BLOCK
 - s. CHAIN DRIVE
 - t. TURBOCHARGER SYSTEM
 - u. EXHAUST VALVE AND GEAR
 - v. INDICATOR CARDS
 - w. RUNNING GEAR
 - x. SCAVENGE PORT & SCAVENGE
 - E - AIR COMPRESSOR
 - y. AIR COMPRESSOR
 - z. AIR COMPRESSOR SUCTION AND DELIVERY VALVE
 - aa. AIR COMPRESSOR MAINTENANCE SYSTEM
 - bb. AIR COMPRESSOR AIR COOLER
 - cc. AIR PRESSURE SAFETY VALVE & WATER JACKET SAFETY VALVE
 - F - OIL SEPARATOR

G - DRY DOCKING

- H - CENTRIFUGAL PUMP
- dd. COMPONENTS & PARTS
- ee. CENTRIFUGAL PUMP - TYPESI
 - SCREW PUMP
- ff. SCREW PUMP - USES, PARTS/COMPONENTSJ
 - FRESH WATER GENERATOR
- gg. FUNCTION, COMPONENTS
- hh. FRESH WATER GENERATOR FLOW DIAGRAMK
 - OILY BILGE SEPERATOR
- ii. FUNCTION
- jj. SYSTEM INSTALLATION ON SHIPL
 - SEWAGE TREATMENT PLANT
- kk. GENERAL ARRANGEMENTS, PLANT FLOW DIAGRAM
- M - TURBO CHARGER
- ll. FUNCTION, PARTS
- mm. AIR COOLER, BEARINGS
- N - GLOBE VALVE & GATE VALVE

- nn. COMPARISSION & COMPONENTS
 - O - PROPELLER & RUDDER
- oo. PROPELLER & RUDDER - FUNCTIONP
 - PIPING SYSTEM
- pp. PIPING SYSTEM - FUNCTIONS, MAINTENANCEQ
 - DECK MACHINERY
- qq. DECK MACHINERY - ANCHOR
- rr. DECK MACHINERY - WINDLASS
- ss. DECK MACHINERY - MOORING WINCHES
- tt. DECK MACHINERY - CARGO WINCHES/DECK CRANESR
 - MARINE INCINERATOR
- uu. FUNCTION & COMPONENTS S
 - MARINE REFRIGERATION
- vv. REFRIGERATION - PROVISION REFRIGERATION PLANTT
 - AUX. BOILER & MOUNTINGS
- ww. AUX. BOILER & MOUNTINGS
 - U - EXHAUST BOILER
- xx. EXHAUST BOILER V
 - STEERING GEAR
- yy. STEERING GEAR FUNCTION
 - W - HEAT EXCHANGER
- zz. HEAT EXCHANGER - FUNCTION, TYPES

- X - POWER GENERATION & DISTRIBUTION
 - aaa. GENERATORS
 - bbb. DISTRIBUTION
- Y - FIRE FIGHTING SYSTEM & APPLICATION
 - ccc. FIRE FIGHTING SYSTEM & APPLIANCES
- Z - ELECTRIC/ELECTRONICS/CONTROL - ENGINEERING
 - ddd. MAIN SWITCH BOARD/ENGINE CONTROL

78	ELECTRONIC INSTRUMENTS
79	
80	SEMICONDUCTORS, DIODES, TRANSISTORS, AMPLIFIERS & THYRISTOR
81	DETECTION OF CRACKS & DEALING WITH CRACKED PIECES

MENP/812	ENVIRONMENTAL PROJECT	54 HRS
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Cadet has to prepare a report on pollution prevention measures available on board and present for assessment by the institute.

MSYD/813	SHIP / YARD VISIT	72 HRS
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MTP/814	TECHNICAL PAPER AND PROJECT	54 HRS
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MGD/815	DEBATE/ GROUP DISCUSSION/ MOCK INTERVIEW	36 HRS
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G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD

Debates & Discussions

Presentations

Interviewing Skills

Interview Practice

Mock Interview Sessions

21.0	CREDIT MARKS
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