

SRI VENKATESWARA COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai)

SRIPERUMBUDUR TK.- 602 117



B.E. MARINE ENGINEERING

REGULATION – 2016

CURRICULUM AND SYLLABUS

(I - VIII Semesters)

(This course and syllabi are prescribed as per the directions of the Director General of Shipping, Government of India in compliance with STCW 2010)

SRI VENKATESWARA COLLEGE OF ENGINEERING
(An Autonomous Institution, Affiliated to Anna University, Chennai)
SRIPERUMBUDUR TK.- 602 117

REGULATION – 2016

B.E. MARINE ENGINEERING

CURRICULUM AND SYLLABUS (I - VIII Semesters)

(This course and syllabi are prescribed as per the directions of the Director General of Shipping, Government of India in compliance with STCW 2010)

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	HS16151	Technical English – I	3	1	0	4
2	MA16152	Mathematics for Marine Engineering – I	3	1	0	4
3	PH16151	Engineering Physics – I	3	0	0	3
4	CY16151	Chemistry for Marine Engineering	3	0	0	3
5	GE16151	Computer Programming	3	0	0	3
6	GE16152	Engineering Graphics	2	0	3	4
7	MR16101	Basics of Marine Engineering	3	0	0	3
PRACTICALS						
7	GE16161	Computer Practices Laboratory	0	0	3	2
8	GE16163	Physics and Chemistry Laboratory - I	0	0	2	1
9	MR16111	Marine Engineering Practices Laboratory	0	0	4	2
TOTAL			20	2	12	29

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	HS16252	Technical English for Marine Engineering	3	1	0	4
2	MA16252	Mathematics for Marine Engineering- II	3	1	0	4
3	PH16251	Engineering Physics – II	3	0	0	3
4	GE16251	Basic Electrical and Electronics Engineering	4	0	0	4
5	ME16251	Engineering Mechanics	3	1	0	4
6	MR16201	Marine Engineering Thermodynamics	3	0	0	3
PRACTICALS						
7	GE16261	Computer Aided Drafting and Modeling Laboratory	0	1	2	2
8	GE16262	Physics and Chemistry Laboratory - II	0	0	2	1
9	GE16263	Computer Programming Laboratory	0	1	2	2
10	MR16211	Workshop Fitting	0	0	4	2
TOTAL			19	5	10	29

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MA16351	Mathematics-III	3	1	0	4
2	MR16301	Marine Hydraulics And Fluid Machinery	3	0	0	3
3	MR16302	Seamanship, Elementary Navigation And Survival At Sea	3	0	0	3
4	MR16303	Marine Manufacturing Technology	3	0	0	3
5	MR16304	Marine Electrical Machines – I	3	1	0	4
6	MR16305	Marine Steam Engines	3	0	0	3
7	MR16306	Marine Machinery Drawing	1	0	4	3
PRACTICALS						
8	MR16311	Marine Hydraulics and Fluid Machinery Laboratory	0	0	3	2
9	MR16312	Welding Techniques, Lathe and Special Machine Shop	0	0	6	3
TOTAL			19	2	13	28

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MA16451	Computational Methods	3	1	0	4
2	MR16401	Mechanics Of Solids	3	1	0	4
3	MR16402	Marine Diesel Engines – I	3	1	0	4
4	MR16403	Marine Auxiliary Machinery – I	3	0	0	3
5	MR16404	Marine Refrigeration and Air Conditioning	3	0	0	3
6	MR16405	Engineering Materials, Metallurgy And Metrology	3	0	0	3
7	MR16406	Marine Boilers And Steam Turbines	3	0	0	3
PRACTICALS						
8	MR16411	Strength Of Materials and Applied Mechanics Laboratory	0	0	4	2
9	MR16412	Thermal Engineering and Boiler Chemistry Laboratory	0	0	4	2
TOTAL			21	3	8	28

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16501	Ship Construction	3	0	0	3
2	MR16502	Marine Diesel Engines - II	3	1	0	4
3	MR16503	Marine Auxiliary Machinery – II	3	1	0	4
4	MR16504	Marine Electrical Machines – II	3	0	0	3
5	MR16505	Marine Electronics	3	0	0	3
6		Elective - I	3	0	0	3
PRACTICALS						
7	MR16511	Measurement and Instrumentation Laboratory	0	0	4	2
8	MR16512	Marine Propulsion and Auxiliary Machineries Overhauling Laboratory	0	0	4	2
9	MR16513	Electrical and Electronics & Micro controller Laboratory	0	0	4	2
TOTAL			18	3	12	26

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16611	Marine Workshop Practical and Afloat Training	8hrs per day - 6 DAYS A WEEK 26 WEEKS AND 500 MARKS. SESSIONAL MARKS - 200 Report + viva 300			20

SEMESTER VII

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16701	Marine Systems and Machinery Design	2	2	0	4
2	MR16702	Marine Electrical Technology	3	0	0	3
3	GE16451	Environmental Science and Engineering (Common to all branches)	3	0	0	3
4	MR16703	Stability of Ships	3	1	0	4
5		Elective - II	3	0	0	3
6		Elective - III	3	0	0	3
PRACTICALS						
7	MR16711	Fire Fighting, Controls and Simulator Laboratory	0	0	4	2
8	MR16712	Computer Aided Marine Engineering Design and Analysis Laboratory	0	0	4	2
9	GE16661	Communication and Soft Skills Laboratory (Common to all branches)	0	0	4	2
TOTAL			17	3	12	26

SEMESTER VIII

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16801	Marine Vehicles Performance	3	1	0	4
2	MR16802	Ship Operational Management and IMO Requirements	3	0	0	3
3	MR16803	Marine Control Engineering and Automation	3	0	0	3
4	MR16804	Safety Precautions and Watch Keeping	3	0	0	3
5		Elective - IV	3	0	0	3
PRACTICALS						
6	MR16811	Project Work	0	0	12	6
TOTAL			21	1	12	22

Total Number of Credits : 208

ELECTIVE I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16001	Mechanics of Marine Machines	3	0	0	3
2	GE16701	Total Quality Management (Common to all branches except CE & BT)	3	0	0	3
3	MR16002	Nuclear Engineering	3	0	0	3
4	ME16011	Robotics (Common to AE, MR & ME)	3	0	0	3

ELECTIVE II & III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16003	Advanced Marine Heat Engines	3	0	0	3
2	MR16004	Ship Safety and Environmental Protection	3	0	0	3
3	MR16005	Ship's Fire Prevention and Control	3	0	0	3
4	MR16006	Special Duty Vessels and Type of Operations	3	0	0	3
5	ME16003	Renewable Sources of Energy (Common to AE, MR & ME)	3	0	0	3

ELECTIVE IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR16007	Double Hull Tankers	3	0	0	3
2	MR16008	Ship Recycling	3	0	0	3
3	MR16009	Marine Corrosion and Prevention	3	0	0	3
4	MR16010	Marine Propellers and Propulsion	3	0	0	3
5	MR16011	Supercharging and Scavenging in Marine Diesel Engines	3	0	0	3
6	GE16001	Professional Ethics (Common to all branches except CE & BT)	3	0	0	3
7	MR16012	Marine Engineering Practices	3	0	0	3

OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I**9 + 3**

Listening – Introducing learners to GIE – Types of listening – Listening to audio (verbal & sounds); Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading – Skimming a reading passage – Scanning for specific information – Note-making; Writing – Free writing on any given topic (My favourite place / Hobbies / School life, etc.) – Sentence completion – Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar – Prepositions – Reference words – Wh-questions – Tenses (Simple); Vocabulary – Word formation – Word expansion (root words / etymology); E-materials – Interactive exercises for Grammar & Vocabulary – Reading comprehension exercises – Listening to audio files and answering questions.

UNIT II**9 + 3**

Listening – Listening and responding to video lectures / talks; Speaking – Describing a simple process (filling a form, etc.) – Asking and answering questions – Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing – Biographical writing (place, people) – Process descriptions (general/specific) – Definitions – Recommendations – Instructions; Grammar – Use of imperatives - Subject-verb agreement; Vocabulary – Compound words – Word Association (connotation); E-materials – Interactive exercises for Grammar and Vocabulary – Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III**9 + 3**

Listening – Listening to specific task - focused audio tracks; Speaking – Role-play – Simulation – Group interaction – Speaking in formal situations (teachers, officials, foreigners); Reading – Reading and interpreting visual material; Writing – Jumbled sentences – Coherence and cohesion in writing – Channel conversion (flowchart into process) – Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar -Tenses (Past) - Use of sequence words - Adjectives; Vocabulary – Different forms and uses of words, Cause and effect words; E-materials – Interactive exercises for Grammar and Vocabulary – Excerpts from films related to the theme and follow up exercises – Pictures of flow charts and tables for interpretations.

UNIT IV**9 + 3**

Listening – Watching videos / documentaries and responding to questions based on them; Speaking – Responding to questions – Different forms of interviews – Speaking at different types of interviews; Reading – Making inference from the reading passage – Predicting the content of a reading passage; Writing – Interpreting visual materials (line graphs, pie charts etc.) – Essay writing – Different types of essays; Grammar – Adverbs – Tenses – future time reference; Vocabulary – Single word substitutes – Use of abbreviations and acronyms; E-materials – Interactive exercises for Grammar and Vocabulary – Sample interviews – film scenes -dialogue writing.

UNIT V**9 + 3**

Listening – Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking – Giving impromptu talks, Making presentations on given topics; Reading – Email communication – Reading the attachment files having a poem/joke/proverb – Sending their responses through email; Writing – Creative writing, Poster making; Grammar – Direct and indirect speech; Vocabulary – Lexical items (fixed / semi fixed expressions); E-materials – Interactive exercises for Grammar and Vocabulary – Sending emails with attachment – Audio / video excerpts of different accents – Interpreting posters.

TOTAL (L:45 + T:15) : 60 PERIODS**OUTCOMES:**

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
Listen/view and comprehend different spoken discourses/excerpts in different accents.

REFERENCES:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011
3. Goodale, Malcolm, Professional Presentations Video Pack: A Video Based Course (Cambridge University Press; Pap/Vhs edition 1998)
4. Downes, Colm, Cambridge English for Job-hunting, Cambridge University Press, New Delhi. 2008
5. Murphy, Raymond, Intermediate English Grammar with Answers, Cambridge University Press, 2000.
6. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006
7. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005.
8. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
9. Thomson, A.J. Practical English Grammar 1&2 Oxford 1986.

EXTENSIVE Reading (Not for Examination)

Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

OBJECTIVES:

- To provide the required knowledge on fundamentals of geometry integrals and integral calculus for engineering applications.

UNIT I THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT II DIFFERENTIAL CALCULUS 12

Differentiation of algebraic, circular, exponential and logarithmic functions, of products, quotient functions of a function and simple implicit functions. Successive differentiation- intro. And notation, nth order derivatives of standard functions, nth order derivatives using (a) trig. identities and standard functions (b) partial fractions, Leibnitz theorem, Maclaurin's Theorem, and standard expansions, Expansions using standard expansions, Taylor's theorem, Indeterminate forms and L'Hospital's rule, Curve tracing of Cartesian and polar curves.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Limits and continuity, Partial derivatives – definition, geometrical interpretation and rules of partial differentiation, Higher order partial derivatives, Homogeneous functions, Euler's theorem for homogenous functions – Total derivatives and chain rules, Differentiation of implicit functions and composite functions, Errors and approximations, Maxima and Minima, Method of Lagrangian multipliers.

UNIT IV INTEGRAL CALCULUS 12

Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under curve; volume of revolution; First moment of area and the position of a centroid of an area; Work done by variable forces; mean values, Root mean square values of $\sin nx$ and $\cos nx$. The rules of Guldinus. Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminas.

UNIT V MULTIPLE INTEGRALS 12

Double and triple integrals – Cartesian coordinates- Region of integration and change of order of integration, Spherical polar and cylindrical coordinates Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminas Applications- Area, Volume, Mass of wire, lamina and solid. Centre of Gravity of wire, lamina and solid. Moment of Inertia using multiple integrals.

TOTAL: 60 PERIODS

OUTCOMES:

- The basic concepts of analytical geometry and differential and integral calculus learnt by the students will be applied to marine engineering.

TEXT BOOKS:

1. Erwin Kreyszig, Advanced engineering mathematics, 8th Edition, John Wiley, 1999
2. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,2008.
3. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications Delhi, 2007.
4. William Embleton and Leslie Jackson, "Mathematics for Engineers Vol- I", 7th Edition, Reed"s Marine Engineering Serires, Thomas Reed Publications, 1997.

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques(qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer-thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd: YAG, CO₂, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:

- Working knowledge of fundamental physics and basic engineering principles to include advanced knowledge in one or more engineering disciplines
- The ability to formulate, conduct, analyzes, and interprets experiments in engineering physics
- To understand and to compute problems in Quantum Physics
- Use modern engineering physics techniques and tools
- To enhance knowledge about photonics and optical fiber communication system

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009.
2. Gasiorowicz, Stephen, Quantum Physics, John Wiley & Sons, 2000.
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
5. Pandey B.K., Chaturvedi.S. Engineering Physics, Cengage Learning India Pvt. Ltd, 2012.

OBJECTIVES:

On Completion of the course the Students are expected to

- Have a thorough knowledge of Boiler Chemistry and Feed Water Treatment methods.
- Have a knowledge of various Water Hardness analysis procedures
- Have a basic concept on Nano chemistry.

UNIT I WATER TECHNOLOGY**9**

Water and its impurities – Impurities in water – fresh water, sea water, distilled water impurities. Purpose of water treatment in boilers, scale formation and prevention.

UNIT II BOILER CHEMISTRY**9**

Boiler corrosion – fretting, pitting corrosion, corrosion fatigue, atoms and ions, electro chemical corrosion, hydrogen and hydroxyl ions, types and causes of corrosion and its control ; chemical and mechanical deaeration, methods of chemical deaeration, dezincification, stress corrosion.

UNIT III BOILER WATER TREATMENT**9**

Lime and Soda treatment, PH treatment, salinometer, use of litmus paper, test for partial, total alkalinity, chloride, sulphite, phosphate test, caustic soda treatment, condensate lime treatment. Desalination of water, reverse osmosis and electro dialysis, priming, foaming and control, effects of salts and gases in feed water

UNIT IV WATER HARDNESS ANALYSIS**9**

Hardness, units of hardness, estimation of hardness by EDTA method, treatment for hardness, total dissolved solids, dissolved oxygen test, use of coagulants, typical test valves for smoke and water tube boilers.

UNIT V ENERGY SOURCES AND NANOCHEMISTRY**9**

Introduction - Properties (Electrical, Mechanical and vibration) – carbon nano tubes -Applications in fuel cells, catalysis and use of gold nanoparticles - batteries –secondary batteries - alkaline batteries – lead acid, Ni – Cd and Li batteries, principles and applications of solar cells, fuel cells - Hydrogen and methanol.

TOTAL: 45 PERIODS**OUTCOMES:**

The knowledge gained on various aspects of water chemistry, energy sources and nanochemistry will provide a strong platform to understand concepts on these subjects for further learning.

TEXT BOOKS:

1. Jain.P.C. and Monika Jain, Engineering Chemistry, 4th Edition, Dhanpat Rai & Sons, New Delhi, 2002.
2. Milton and Leech , “Marine Boilers ”.Butter Worth Publishers, UK.

REFERENCES:

1. Uppal. M.M., A Text book of Engineering Chemistry, 7th Editions, Khanna Publishing, 1988. Water Treatment by J.D. Skelly Imarest Publication , London.
2. Reed's General Engineering Knowledge for Marine Engineers by Leslie Jackson and Thomas D. Morton.

OBJECTIVES:**The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION**8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS**10**

Problem formulation – Problem Solving - Introduction to ‘C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS**9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String-String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS**9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications

TEXT BOOKS:

1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

REFERENCES:

1. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

OBJECTIVES:

On Completion of the course the Students are expected to

- Have studied the renewable and Non-Renewable Energy Sources
- Have a good knowledge of working principle of 2 Stroke and 4 Stroke Marine IC Engines
- Have sound knowledge of Marine Refrigeration and Air- Conditioning Plant
- Have a Knowledge of Metal Forming and Joining Processes and various Power Transmission methods

UNIT I ENERGY RESOURCES AND POWER GENERATION 9

Renewable and Non-renewable resources – thermal, hydel, solar, wind, tidal, geothermal and nuclear – Indian energy scenario.

Power Plants - Steam, gas turbine, diesel, nuclear and hydel power plants – Layout, major components and working, Choice of the type of plant, Combined cycles, cogeneration, Importance of Energy storage, Environmental constraints of power generation using fossil fuels and nuclear energy.

Steam generators - Classification, working or Cochran, Babcock Wilcox, Lamont and Benson boilers, Principles and features of modern high pressure boiler – tower type boilers. (A separate study of boiler mountings and accessories are beyond the scope of this course).

UNIT II MARINE I.C. ENGINES 9

Classification, Working principles of petrol and diesel engines - two stroke and four stroke cycles, functions of main components, Carburetion - Single jet Carburetor, mixture strength, Ignition system of petrol engine, Fuel pump and injector of diesel engine, Cooling system – necessity, air and liquid cooling, optimum cooling, Lubrication system – purpose and methods of lubrication, lubrication oil classification and selection.

UNIT III MARINE REFRIGERATION & AIR CONDITIONING 9

Refrigeration – application and types, Vapour compression refrigeration system – working principles and features, working fluids.

Air conditioning – requirement of conditioned air, summer and winter air conditioning, layout of a typical window air conditioner, Thermoelectric cooling.

UNIT IV METAL FORMING, METAL JOINING PROCESSES 9

Metal forming – Principles of forging – mechanical power hammers – Hot and Cold forging processes – rolling, drawing and extrusion, Metal joining processes – flexible and permanent, Principles of welding – Fundamentals of arc welding, gas welding and gas cutting, Brazing and Soldering.

UNIT V POWER TRANSMISSION 9

Brief introduction to belt and rope drives. Simple and compound gear trains. Machine Tool Engineering - Main Components and functions of lathe, drilling, shaping, planning and milling machines. Introduction to CAD, CAM, CIM and ROBOT.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to identify the sources of renewable and nonrenewable energy towers.
- Ability to explain the working principles of 2 Stroke and 4 Stroke Marine Engines
- Ability to explain the working cycle of Refrigeration and Air- Conditioning used in marine
- Ability to explain different forming and metal forming processes.

TEXT BOOKS:

1. Taylor, Introduction to Marine engineering”, 2nd Edition, Butterworth Heinemann, London, 1999.
2. Shanmugam.G., Basic Mechanical Engineering 3rd Edition, TATA McGraw-Hill, New Delhi, Year 2000.

REFERENCES:

1. Venugopal K., Basic Mechanical Engineering, Fourth Edition, Anuradha Agencies, Chennai, Year 1994.
2. Duraivelu. K., Richard. S., Basic Mechanical Engineering, 2nd Edition, Dear Publication, Chennai, 2001.
3. Leslie Jackson and Thomas D. Morton, Reed’s General Engineering Knowledge for Marine Engineers.

OBJECTIVES:**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Stand alone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

PHYSICS LABORATORY – I**OBJECTIVES:**

To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS:

1. a) Determination of Wavelength, and particle size using Laser.
b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating.
4. Determination of thermal conductivity of a bad conductor – Lee’s Disc method.
5. Determination of Young’s modulus by Non uniform bending method.
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge.

OUTCOMES:

The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights.
6. Carey foster’s bridge set up (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - I**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

LIST OF EXPERIMENTS: (Any FIVE Experiments)

1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method
3. Determination of strength of given hydrochloric acid using pH meter
4. Determination of strength of acids in a mixture using conductivity meter.
5. Estimation of iron content of the water sample using spectrophotometer (phenanthroline / thiocyanate method).
6. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogels Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogels R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 10

Buildings:

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

- a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- b) Study of pipe connections requirements for pumps and turbines.
- c) Preparation of plumbing line sketches for water supply and sewage works.
- d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- a) Study of the joints in roofs, doors, windows and furniture.
- b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 20

Welding:

- a) Preparation of arc welding of butt joints, lap joints and tee joints.
- b) Gas welding practice

Basic Machining:

- a) Simple Turning and Taper turning
- b) Drilling Practice

Sheet Metal Work:

- a) Forming & Bending:
- b) Model making – Trays, funnels, etc.
- c) Different type of joints.

Machine assembly practice:

- a) Study of centrifugal pump
- b) Study of air conditioner

Fitting – Exercises – Preparation of square fitting and vee – fitting models

Smithy and Foundry:

- a) Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
- b) Foundry operations like mould preparation for gear and step cone pulley.

GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE 10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter
 2. Fluorescent lamp wiring.
 3. Stair case wiring
 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
 5. Measurement of energy using single phase energy meter.
 6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE 13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
 2. Study of logic gates AND, OR, EOR and NOT.
 3. Generation of Clock Signal.
 4. Soldering practice – Components Devices and Circuits –Using general purpose PCB.
 5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to fabricate plumbing and carpeting components.
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits.

SEMESTER-II

OBJECTIVES:

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.
- To understand and use technical and engineering publications

UNIT I

12

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix „self“ - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings and predicting the content – Reading advertisements and interpretation.
4. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

12

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, and complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III

12

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types - accident, survey, breakdown of machinery, Letter to superintendant reporting the defects, damage and repair of machinery; requirement of machinery spares, logistic and repair support on arrival at the harbour; monthly report on the condition of men and machinery. structure, data collection, content, form, recommendations.

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV**12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V**12**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS**LEARNING OUTCOMES:**

- Learners should be able to employ English effectively for all their communicative purposes, both formal and informal contexts.
- Learners should be able to deploy specific English (Marine Engineering) skills required for all their professional work.
- Learners should be able to write and publish their research articles in refereed journals, including the international journals.

REFERENCES:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai 2012.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011.
3. Goodale, Malcolm, Professional Presentations Video Pack: A Video Based Course Cambridge University Press; Pap/Vhs edition 1998.
4. Downes, Colm, Cambridge English for Job-hunting, Cambridge University Press, New Delhi, 2008.
5. Murphy, Raymond, Intermediate English Grammar with Answers, Cambridge University Press, 2000.
6. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi, 2006.
7. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi, 2005.
8. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
9. Thomson, A.J. Practical English Grammar 1&2 Oxford 1986.

WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com3>.
3. <https://owl.english.purdue.edu/owl/>
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

OBJECTIVES:

- To provide the required skill to apply the concepts of ordinary differential equations, vector calculus, complex variable and laplace transformation in marine engineering problems.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS – FIRST ORDER AND APPLICATIONS 12

Definition, order and degree, formation of differential equation. Solution of first order, first degree equations in variable separable form, homogeneous equations, other substitutions, Equations reducible to homogeneous and exact differential equations.

Equations reducible to exact Integration Factor, Linear differential equation of first order first degree, reducible to linear, Applications to electrical circuits and orthogonal trajectories.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS – HIGHER ORDER AND APPLICATIONS 12

Higher (nth) order linear differential equations - definition and complementary solution, Methods of obtaining PI, Method of variation of parameters, Method of undetermined coefficients, Cauchy's Homogeneous LDE and Legendre's equations, System of Ordinary Differential Equations Simultaneous equations in symmetrical form, Applications to deflection of beams, struts and columns. Applications to electrical circuits and coupled circuits

UNIT III VECTOR CALCULUS 12

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT IV ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w = z+c$, cz , $1/z$, and bilinear transformation.

UNIT V LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL :60 PERIODS

OUTCOMES:

- The basic and fundamental knowledge gained by the students in the application of ordinary differential equations vector fields and transformations will be applied by them in the process field related to marine engineering.

TEXT BOOKS:

1. Erwin Kreyszig, Advanced engineering mathematics, 7th Edition, Wiley India, 2007.
2. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, 3rd edition, Laxmi Publications Pvt Ltd., (2008).
3. Grewal. B.S, “Higher Engineering Mathematics”, 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company New Delhi, (2007).
2. Glyn James, “Advanced Engineering Mathematics”, 3rd Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K, “Advanced Engineering Mathematics”, 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS**9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS**9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors - direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS**9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS**9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – Ferro electricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS**9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Arumugam M., Materials Science. Anuradha publishers, 2010.
2. Pillai S.O., Solid State Physics. New Age International (P) Ltd., publishers, 2009.

REFERENCES:

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Pandey B.K., Chaturvedi.S. Engineering Physics, Cengage Learning India Pvt.Ltd, 2012.
4. Kittel, Charles, Introduction to Solid State Physics, JOHN WILEY ,India,2010.
5. Dekker, Adrianus J. Electrical Engineering Materials, Prentice-Hall Of India; 2002.

OBJECTIVES:

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and their applications.
- To explain the principles of digital electronics
- To impart knowledge of Communication Engineering.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MACHINES 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts).

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:

- To apply the fundamental laws governing electrical circuits and to describe the working of measuring instruments
- To identify the appropriate machine for a specific application based on the understanding of the construction and characteristics of electrical machines.
- To describe the fundamental behavior of different semiconductor devices and circuits.
- To apply the concepts of digital electronics in the synthesis of digital system.
- To recognize the type of signals, data transfer and be able to apply the concepts in various communication systems.

TEXT BOOKS:

1. Mittle V.N, Arvind Mittal “Basic Electrical Engineering”, Tata McGraw Hill(India), Second Edition,2013.
2. Sedha R.S., “A Text Book of Applied Electronics”, S. Chand & Co., 2014.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics Engineering”, Tata McGraw Hill, 2013.
2. I.J.Nagrath and D.P. Kothari, “Basic Electrical Engineering”, Tata McGraw Hill ((India), Third Edition, 2010.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 2010.
4. M.Morris Mano, “Digital Logic & Computer Engineering”,Printice Hall of India, 2004.
5. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, Fourth Edition,2007.

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES**12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES**12**

Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS**12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia – mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES**12**

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance - Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- Ability to analyse the forces in any structures.
- Ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 11th Edition, Tata McGraw-Hill Publishing company, New Delhi, 2015.
2. Vela Murali, “Engineering Mechanics”, Oxford University Press, 2010.

REFERENCES:

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
2. Kumar, K.L., “Engineering Mechanics”, 4th Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education 2005.
4. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, seventh edition, John Wiley & Sons, 2013.
5. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, student series, 1st Edition, Vikas Publishing House Pvt. Ltd., 2011.

OBJECTIVES:

- At the end of the study of this topic the students should have the knowledge on basic Thermodynamics and solve the problems on First and Second Law of Thermodynamics and Gas power cycles. Also should have the knowledge on fuel used in IC Engines and Combustion of Fuels.

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

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

UNIT II SECOND LAW OF THERMODYNAMICS 9

Thermodynamic systems – Second law of thermodynamics Statements & T-s diagrams, Reversibility, causes of irreversibility, Carnot theorem, Carnot cycle, reversed Carnot cycle, difference between heat engine, refrigerator, and heat pump. Clausius inequality, entropy, principles of increase in entropy, available energy.

UNIT III PROPERTIES OF PURE SUBSTANCES AND VAPOUR POWER CYCLES 9

Thermodynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties. Introduction – Rankine cycle, Rankine efficiency, Net work done, Modified Rankine cycle, Reheat cycle, Regenerative cycle.

UNIT IV GAS POWER CYCLES 9

Properties of ideal and real gases, gas laws. Air standard cycles– I.C Engines – Elementary principles and cycles of operation – Otto cycle, Diesel cycle, Dual cycle – Work done, power developed – Indicated and brake thermal efficiency, mechanical efficiency, overall efficiency – Heat balance - Gas turbine cycles – Brayton /Joule cycle.

UNIT V THERMODYNAMIC RELATIONS AND COMBUSTION OF FUELS 9

Exact differentials, T - ds equations, Maxwell relations, Clausius Claperon Equations, Joule-Thomson coefficients. Heat value of fuels, Combustion equations, Theoretical and excess air, Air fuel ratio and Exhaust gas analysis.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, students are expected

- To apply thermodynamic principles to mechanical and marine engineering applications.
- To apply mathematical fundamentals to study properties of steam, gas and gas mixtures

TEXT BOOKS:

1. Nag, P.K., "Basic and applied Thermodynamics", 2nd Edition, Tata McGraw-Hill Publishing Company Limited New Delhi, 2011.
2. Russel, "Engineering Thermodynamics", 1st Edition, Oxford University Press, 2007.
3. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition, Anuragam Publications, 2014.

REFERENCES:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
2. Wlliam Embleton obe., "Applied Heat for Engineers", Reed's Marine Engineering Series, Vol.3, Thomas Reed Publication, 4th edition, Reprint 2011.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd, 2013.

OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

- Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
- Drawing of a Title Block with necessary text and projection symbol.
- Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
- Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
- Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
- Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
- Drawing of a simple steel truss.
- Drawing sectional views of prism, pyramid, cylinder, cone, etc,
- Drawing isometric projection of simple objects.
- Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to use the software packers for drafting and modeling.
- ability to create 2D and 3D models of Engineering Components.

REFERENCES:

- George Omura and Brian C. Benton, “Mastering AutoCAD 2016 and AutoCAD LT 2016 : Autodesk Official press”, Wiley Publishers, 2015.
- Elise Moss, “Autodesk AutoCAD 2016 Fundamentals”, SDC Publications, 2015.
- James D. Bethune ,“Engineering Graphics with AutoCAD 2017”, PEACHPIT Press, 2016.
- Cheryl R. Shrock, Steve Heather, “Advanced AutoCAD 2016 Exercise Workbook”, Industrial Press, 2016.
- "CAD/CAM: Theory and Practice" by Ibrahim Zeid and Sivasubramanian R, Tata McGraw-Hill Education India, Jun 2009.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl. No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 Nos.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 Nos.

PHYSICS LABORATORY – II**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS (Any FIVE Experiments):

- Determination of Young's modulus by uniform bending method.
- Determination of band gap of a semiconductor.
- Determination of Coefficient of viscosity of a liquid –Poiseuille's method.
- Determination of Dispersive power of a prism – Spectrometer.
- Determination of thickness of a thin wire – Air wedge method.
- Determination of Rigidity modulus – Torsion pendulum.

OUTCOMES:

The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- Traveling microscope, meter scale, Knife edge, weights.
- Band gap experimental set up
- Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance.
- Spectrometer, prism, sodium vapour lamp.
- Air-wedge experimental set up.
- Torsion pendulum set up. (Vernier Caliper, Screw gauge, reading lens are required for most of the experiments).

CHEMISTRY LABORATORY - II**OBJECTIVES:**

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS:

- Determination of alkalinity in water sample.
- Determination of total, temporary & permanent hardness of water by EDTA method.
- Estimation of copper content of the given solution by EDTA method.
- Estimation of iron content of the given solution using potentiometer.
- Estimation of sodium present in water using flame photometer.
- Corrosion experiment – weight loss method.
- Conductometric precipitation titration using BaCl₂ and Na₂SO₄.
- Determination of CaO in Cement.

TOTAL: 30 PERIODS

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore,1994.
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980.

OBJECTIVES:**The student should be made to:**

- Be exposed to Unix shell commands.
- Be familiar with an editor on Unix.
- Learn to program in Shell script.
- Learn to write C programme for Unix platform.

LIST OF EXPERIMENTS:

1.	UNIX COMMANDS	15
	Study of Unix OS - Basic Shell Commands - Unix Editor	
2.	SHELL PROGRAMMING	15
	Simple Shell program - Conditional Statements - Testing and Loops	
3.	C PROGRAMMING ON UNIX	15
	Dynamic Storage Allocation-Pointers-Functions-File Handling	

TOTAL: 45 PERIODS**OUTCOMES:****At the end of this course, the student should be able to:**

- Use Shell commands
- Design of Implement Unix shell scripts Write and execute C programs on Unix

HARDWARE / SOFTWARE REQUIREMENTS FOR BATCH OF 30 STUDENTS**HARDWARE:**

1. 1 UNIX Clone Server
2. 33 Nodes (thin client or PCs)
3. Printer – 3 Nos

SOFTWARE:

1. OS – UNIX Clone (33 user license or License free Linux).
2. Compiler – C

OBJECTIVES:

- On Completion of the Course The Students are expected to have the Knowledge of Metal Cutting and Joining Process Tools and equipments used in Smithy, Carpentry, Fitting, Foundry, Welding and Sheet Metal.

LIST OF EXPERIMENTS:

- | | |
|---|----|
| 1. SHEET METAL | 20 |
| Fabrication of tray, cone etc. with sheet metal. | |
| 2. WELDING | 18 |
| 3. FITTING SHOP | 43 |
| Arc Welding of butt joint, Lap joint, Tee fillet etc. Demonstration of gas welding. | |
| Practice in chipping, filing, drilling – Making Vee, square and dove tail joints. | |

TOTAL: 60 PERIODS**OUTCOMES:**

- Ability to fabricate components using sheet metal.
- Ability to handle tools used in workshop
- Ability to use the welding process for forming
- Ability to make joint using fitting

SEMESTER-III

OBJECTIVES:

- To introduce Fourier series analysis that finds tremendous applications in engineering and also to analyze boundary value problems.
- To acquaint the student with Fourier transform techniques used to tackle problems in communication and heat transfer.
- To introduce the effective mathematical tools for the solutions of partial differential equations for linear and non-linear systems.
- To develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation – Linear homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS 12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity. Finite Fourier transforms, finite Fourier sine and cosine transforms.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction, long division method and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL (L: 45 + T: 15): 60 PERIODS

OUTCOMES:

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay. T.K and Ramanaiah. G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.

REFERENCES:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2011.
3. Veerarajan. T., "Transforms and Partial Differential Equation", Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.
4. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
5. Peter V.O' Neil, "Advanced Engineering Mathematics", Cengage Learning India pvt. Ltd. 7th Edition, New Delhi, 2012.

OBJECTIVES:

- To develop the theoretical and application skills of students in Marine Hydraulics and Fluid Machinery.

UNIT I FLUID STATICS 9

Properties of fluid – pressure head – Pascal’s law – absolute and gauge pressures – measurement of pressure – manometers (single, U-tube, differential), Mechanical gauges (bourdon gauge, dead weight gauge) – Temperature measurement (thermocouple, RTD) – Total force & Centre of pressure due to liquid pressure on immersed plane surfaces horizontal or vertical on a rectangular vertical plane surface, with one edge parallel to the surface of the liquid – Buoyancy and Floatation – Metacentric height – stability of floating and submerged bodies.

UNIT II FLUID KINEMATICS AND DYNAMICS 11

Kinematics: Types of fluid flow – Types of flow lines – rate of flow – continuity equation – circulation and vorticity, Types of motion of fluid particle.

Dynamics: Euler’s Equation of motion – Bernoulli’s equation – applications – venturimeter, orifice meter, pilot tube – impulse momentum equation – flow through an orifice – Torricelli’s theorem – Coefficient of velocity, contraction of area and discharge

UNIT III LAMINAR AND TURBULENT FLOWS 7

Reynold’s experiment – critical Reynolds number – Rotating Viscometer – Navier – stokes equations of motion – relation between shear stress and pressure gradient – flow of viscous fluid in circular pipes – Hagen poiseuille’s equation – turbulent flow – darcy weisbach equation – major and minor energy losses – pipes in series and parallel – power transmission through pipes – boundary layer – characteristics – thickness – total drag due to laminar and turbulent layer – boundary layer separation and its control.

UNIT IV PUMPS 9

Rotodynamic pumps – principles of dimensional analysis – Buckingham’s theorem important dimensionless numbers applicable to fluid mechanics – impact of jets – force exerted by a jet on flat, curved plates and pipe bends. Surge pressure and control – centrifugal pumps – some definitions – pump output and efficiencies – blade diagram – effect of vane angle – cavitation – constructional details, pump characteristics, multistage pumps. Vibration & noise in hydraulic pumps.

UNIT V HYDRAULIC TURBINES 9

Classification of hydraulic turbines – pelton turbines, velocity triangle – efficiencies – non dimensional numbers, working principle of the pelton wheel. Francis and Kaplan turbines – velocity triangles, efficiencies of the draft tubes, hydraulic turbine characteristics.

TOTAL: 45 PERIODS

OUTCOMES:

At the end the course the students are expected to have the knowledge of

- The Fluid properties and effect of various forces acting on different planes, surfaces and Pipes.
- The In-viscid flow and Real Viscous flow and their characteristics.
- The principles of theoretical aspect of pumps and hydraulic turbines fitted on board ships.

TEXT BOOKS:

1. Bruce, R.M., Donald, F.Y., Theodore, H.O., "Fundamentals Of Fluid Mechanics" 6th Edition, John Wiley & Sons (Asia) Pvt. Ltd. India, 2010
2. Joy, "Hydraulic Power Transmission In Marine Machinery", Marine Engineering Practice Vol-1, Part-07, IMarEST, London
3. Gupta, S.C., "Fluid Mechanics and Hydraulic Machines" 1st Ed. Pearson, 2011.
4. John F. Douglas, Janusz M. Gasiorek, John A. Swaffield and Lynne B. Jack, "Fluid Mechanics", 1st Ed. Pearson, Sixth Impression, 2011

REFERENCES:

1. Roberson, J.A. and Crowe C.T., "Engineering Fluid Mechanics", 6th Edition, John Wiley, 1999.
2. Anthony Esposito, "Fluid Power with Applications", 7th Ed. Pearson, 2015
3. R K Rajput, "Fluid Mechanics and Hydraulic Machines" 2nd revised Edition, S.Chand & Company Ltd., New Delhi, 2002
4. Dr.R.K.Bansal, "Fluid mechanics and Hydraulic Machines", 9th revised Edition, Lakshmi publication, 2010
5. Yunus A. Cengel, "Fluid mechanics fundamental and application", 2nd Edition, Mc Graw Hill, 2006

OBJECTIVES:

- To impart knowledge about Navigation and Operation of ship.
- To develop self confidence and skill for survival at sea.
- To impart knowledge about the organisation of a merchant ship
- To impart knowledge about various emergency in engine room

UNIT I SEAMAN & THEIR DUTIES 9

Ship's Department, General ship knowledge ad nautical terms like poop-deck forecastle, bridge etc. Deck equipment: winches, windlass, derricks cranes, gypsy, capstan, hatches and function. Navigation 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, sound signals.

UNIT II MOORING OPERATION 9

Anchors: their use, drooping and weighing anchor, cable stopper, cable locker. Operation of Mooring winches and safe working practices on mooring winches and windlass operation.

UNIT III NAVIGATION 7

General knowledge of principal stars. Sextant, Navigation compasses, echo sounder, GPS, GLONASS, log and uses, barometer and weather classification, G.M.T and Zonal time, wireless Navigational Instruments, radar satellite navigation etc.

UNIT IV SURVIVAL AT SEA & SURVIVAL EQUIPMENTS 11

Life buoy, EPRIB, SART, TPA, 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, Abandon ship: Manning of lifeboat and life raft. Muster list. Radio and alarm signals, Distress signals (S.O.S) Distress Calls time and Radio frequency. Pyro – techniques. Survival difficulties and factors, equipment available, duties of crew members, Initial action on boarding, maintaining the craft.

UNIT V DUTIES OF ENGINE ROOM PERSONNEL 9

Organization of engine room crew. Duties and responsibilities of engine room personnel. Various emergency situations and actions to be taken engine room crew. Safe working practices to be followed in E/R

TOTAL: 45 PERIODS**OUTCOMES:**

- On completion of the course the students can understand various navigational duties and usage of different navigational equipments
- On completion of the course the students can operate various life saving equipments like life boats and life rafts.
- On completion of the course the students can understand various duties to be performed in E/R.

TEXT BOOKS:

1. Graham Danton, "The theory and practice of seamanship", 11th Edition, Routledge, New York, USA 1996.
2. Capt. J. Dinger, "Seamanship Primer", 7th Edition, Bhandarkar Publications, Mumbai 1998.
3. Kemp & Young, "Seamanship Notes", Stanford Maritime limited, 1997.

REFERENCES:

1. A.N. Cockcroft, "Seamanship and Nautical knowledge", 27th Edition, Brown son & Ferguson Ltd., Glasgow 1997.

OBJECTIVES:

- To develop theoretical Knowledge of students on the process of manufacture of Marine Components.

UNIT I METAL JOINING PROCESSES 9

Classification plastic welding, fusion welding, solid phase welding and sub classification. Study of power sources, electrodes, processes and applications: SMAW, SAWM, GTAW, GMAW, PAW, electro gas welding and Electro Slag, resistance welding. Gas welding, oxy acetylene cutting, brazing and soldering. Under water welding. Advanced Welding Process -Plasma Arc welding, Cold Metal Transfer welding Defects and Inspection of welded joints.

UNIT II CASTING PROCESSES 9

Sand casting, pattern and core making, moulding process - sand properties, Gate cutting and allowances-melting furnaces – pit furnace and electric furnaces. Special casting processes – shell, investment, die casting – pressure and gravity types – squeeze casting - defects in casting - Plastic moulding – injection and blow moulding, and moulding – testing and inspection., Defects in casting

UNIT III FINISHING PROCESSES 9

Surface finishing processes: grinding processes, various types of grinders, work holding devices, grinding wheels and specification, selection of grinding wheels for specific applications – selection of cutting speed and work speed. Fine Finishing Process: Lapping, honing, and super finishing process , ship hull finishing.

UNIT IV METAL FORMING PROCESSES 9

Hot and cold working processes – rolling, forging, drawing and extrusion processes, bending, hot spinning, shearing, tube and wire drawing, cold forming, shot peening. Sheet metal working – blanking, piercing, punching, trimming, Bending – types of dies – progressive and compound dies. Shipbuilding Process – Plate Stocking, Surface Treatment and Cutting.

UNIT V MACHINING PROCESSES 9

Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning machining time and power required for cutting, Drilling - classification, specification, cutters speed feed and description of parts parts- boring machines- classification, principle, parts- specification. Milling - classification, principle, parts- specification-operations. CNC Machines

TOTAL: 45 PERIODS**OUTCOMES:****The students will be able**

- to know the different welding process and select the appropriate process for different applications
- to have the knowledge of different casting process and select the appropriate process for different applications.
- to select the Grinding Wheel and process based on the surface finish required.
- to have the depth understanding of various hot working and cold working process.
- to select the appropriate machines or machines tools for different requirements.

TEXT BOOKS:

1. Jeffus, Welding and Metal fabrication”,1st Ed. Cengage, Indian reprint 2012 (Yesdee Publishings Pvt. Ltd.).
2. Rao.P.N., “Manufacturing Technology, Metal Cutting and Machine Tools”, Tata McGraw-Hill, 2000.
3. Shan, H.S., “ Manufacturing processes”, Vol I, 1st Ed. Pearson, 2013.

REFERENCES:

1. Jain K.C. Agarwal, L.N. “Metal Cutting Science and Production Technology”,1st edition, Khanna Publishers, 1986.
2. Chapman W.A.J., “Workshop Technology”, Vol. II, Arnold Publishers.
3. H.M.T., “Production Technology”, Tata McGraw-Hill, New Delhi, 2000.
4. Serope Kalpakjian , Steven,R. Schmid, “Manufacturing Engineering and Technology,” 4th Ed. Pearson, 2011.
5. Timings, “ Fabrication and Welding Engineering“, Elsevier, Indian Reprint 2011, Yesdee Publishings Pvt. Ltd.
6. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2011.
7. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004.

OBJECTIVES:

- To expose the students to the Electrical equipments fitted on boards ships, the concepts of electrical measurements and electrical distribution systems.

UNIT I PRINCIPLES OF D.C. MACHINES AND GENERATORS 8+3

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

UNIT II D.C. MOTORS 8+3

D.C. Motor –their characteristics – starting and reversing – speed – torque equations – starters– speed control including electronic method of control – testing of D.C. machines for finding out the losses and efficiency – braking of D.C. motor, Ward-Leonard control. 37

UNIT III TRANSFORMERS 10+3

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

UNIT IV INSTRUMENTS AND TESTING 9+3

Basic requirements of measuring instrument-static and dynamic characteristics of measuring instruments – principles of indicating instruments – control and damping devices – moving coil and moving iron instruments and their use as voltmeters and ammeters – dynamometer type wattmeter – thermocouple type ammeter, voltmeters and wattmeter. extension of instrument range.

UNIT V DISTRIBUTION AND TRANSMISSION SYSTEMS 10+3

Two wire and three wire D.C. distribution – A.C. Transmission – single and three phase – comparison of D.C. and A.C. transmission – use of balancer – 2-wire, 3-wire and 4- wire A.C. distribution – one end fed and ring main distributor – fuses and its materials – D.C. air circuit breaker – A.C. air circuit breakers.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

At the end of the course the students are expected to have

- The knowledge about construction and operation of D.C. Machines in general and generators in particular
- To introduce the concepts about measurement practices and measuring instruments.
- To familiarize the students with the operation and control of D.C. motors.
- To study the construction and operation of transformer.
- To study the structure and functioning of transmission and distribution.

TEXT BOOKS:

1. Edmund GR Kraal, Stanley Buyers, Christopher Lavers, “Basic electrotechnology for marine engineers”, 4th Ed. Reeds Vol 06
2. Hughes Edward, “Electrical technology”, 2nd edition, “ELBS with DP Publications”, USA, 1996.
3. I.J Nagrath and D.P Kothari, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.
4. Bhag, S. Guru, Huseyin, R. Hiziroglu, “Electric Machinery and Transformers”, 3rd Ed. Oxford University Press, 2013.

REFERENCES:

1. Uppal S.L., “Electrical Power”, 13th Edition, Khanna publishers, Mumbai, 2002.
2. Berde M.S., ”Electric Motor Drives”, 1st Edition, Khanna Publishers, Mumbai, 1995.
3. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.
4. Gorti Ramamurthi, “ Handbook of Electrical Power Distribution”, 2nd Ed. Universities Press, 2009.

OBJECTIVES:

- At the end of the study on these topics the students should have the knowledge on Vapour power cycles, Steam nozzles, Steam Turbines. Also the students should have the knowledge on basic principles of heat transfer.

UNIT I Steam and Vapour Power Cycles 9

Carnot cycle for steam and ideal efficiency. Rankine cycle with dry, saturated and superheated steam. Reheat and Regenerative cycles. Binary vapour power cycles. Feed pump working. Isentropic efficiency, cycle efficiency, work ratio. Reheating and Regenerative feed heating and their effect on thermal efficiency.

UNIT II Marine Steam Engine 9

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 thermal efficiency. Energy balance, compound steam engines.

UNIT III Steam Nozzles 9

General flow analysis. Velocity at exit, critical pressure ratio and maximum mass flow. Convergent and convergent divergent nozzles isentropic flow. Effect of friction, nozzle area at the throat and exit. Problems of steam flow through nozzles.

UNIT IV Steam Turbines 9

General principle of Impulse and reaction turbines. Compounding of steam turbines – Pressure and Velocity compounding. Stage efficiency, Overall efficiency and re-heat factor. Condition for Maximum work output.

UNIT V Basic Principle of Heat Transfer 9

Qualitative treatment of heat transfer by conduction, convection and radiation, Laws of conduction and thermal conductance application to simple problems.

TOTAL: 45 PERIODS**OUTCOMES:**

On completion of this course, students are expected

- To know the theory of Vapour power cycles.
- To understand Reciprocating steam engines.
- To know the flow analysis of steam nozzles.
- To understand principle of steam turbine.
- To be familiar with the principles of heat transfer.

TEXT BOOKS:

1. Thomas, D. Morton, "Steam Engineering Knowledge for Marine Engineers", 3rd Ed. Reeds Vol 09, Adlard Coles Nautical, London
2. Coats, "Marine Steam Turbines", Marine Engineering Practice, Vol 1, Part 08, IMarEST, London
3. R.K.Rajput, "Thermal Engineering", Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2013
4. Marine Engineering Series, "Steam Turbines and Gearing", 1st Ed. Stanford Maritime limited, London, 1982

REFERENCES:

1. Gordon Rogers, Yon Mayhew, "Engineering Thermodynamics Work and Heat Transfer", 4th Ed. Pearson, 2011
2. Frank.P. Incropera, David P. DeWitt, Theodore L.Bergman, Adrine S.Lavine, Fundamentals of Heat and Mass Transfer, Sixth Edition, Wiley India, 2012.

OBJECTIVES:

- To make the students understand and practice Machine Drawing.

UNIT I EXPLANATION AND SKETCHING**3+6**

Dimensioning conventions of shafts, arcs, angles, holes, tapers, welded joints, threads and pipes conventional representation of metals and materials. Sectioning conventions, removed sections and revolved sections, parts not usually sectioned.

UNIT II LIMITS, FITS AND TOLERANCES**3+12**

Limits and tolerances, Surface Finish, Type of fits – description, hole basis system and shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades- simple problems, geometric tolerances

UNIT III RIVETS AND JOINTS**3+12**

Sketching screw-threads, screwed fastenings, rivets and riveted joints keep. cotter joints & pin joints.

UNIT IV MARINE MACHINERY PARTS**3+15**

Drawing of machine components in assembly - details like non-return valves, Universal coupling, connecting rod & bearings, Pedestal Bearing. Boiler mountings – full bore safety valve, gauge glass, Piston type stop valve.

UNIT V MARINE COMPONENT**3+15**

Assembly drawings, blue print of simple marine components - bilge strainer boxes, control valves, cylinder relief valves, Starting Air Valve.

TOTAL: 75 PERIODS**OUTCOMES:**

At the end of the course the students would have learnt

- The Method of sketching to Explain the Limits, Fits and Tolerances arcs etc., with respect to the Marine Machinery.
- To Sketch various joints and rivets and Valves.
- To draw Various parts of Marine Machinery and the general Marine components

TEXT BOOKS:

- MacGibbon“ “Pictorial Drawing Book for Marine Engineers-James”, 8th Edition, G.Holburn & John J. Seaton, James Munro & Company Limited, Engineering and Nautical Publishers, Mumbai, 1978.
- Beck, H.G., “Engineering Drawings for Marine Engineers”, 2nd Ed., Reeds Vol 11, Adlard Coles Nautical, London.
- N.D.Bhatt, “Machine Drawing”, 18th Edition, Charotar Publication, Mumbai, 2001.

REFERENCES:

- Gopalakrishna K.R., “Machine Drawing”, 17th Edition, Subhas Stores Books Corner, Bangalore, 2003.
- Gill P.S., “A text book on Machine Drawing”, S.K. Kataria & sons, Mumbai, 2000.
- Junnarkar,N.D., “Machine Drawing”,1st Ed. Pearson, 2004 Jindal, U.C., “Machine Drawing”, 1st Ed. Pearson, 2010.
- Jindal, U.C., “Machine Drawing”, 1st Ed. Pearson, 2010.

MR16311

L T P C

MARINE HYDRAULICS AND FLUID MACHINERY

LABORATORY

0 0 3 2

OBJECTIVES:

- To impart skill and knowledge on Fluid Mechanics and Fluid Machinery operation.

(A) FLUID MECHANICS LAB

20

Buoyancy Experiment – Metacentric Height for Cargo and War ship models. Fluid flow measurement using Pitot tube, Flow nozzle, Rotameter, Notches etc. Cd of Venturimeter and orifice-meter. Determination of frictional losses in pipes.

(B) FLUID MACHINERY LAB

25

Centrifugal pumps- Performance characteristics of a constant speed pump, specific speed. Performance characteristics of multistage pump. Characteristics of Impulse and Reaction Turbines. Specific speed and unit quantities. Positive displacement pumps. Performance characteristics of deep well pump, Jet pump, performance test on air compressor

TOTAL: 45 PERIODS

OUTCOMES:

- After completion of the Laboratory Experiments the students would have the skill to understand the flow behaviour of fluids
- Calculate the frictional losses and Cd of fluids when it passes through various obstructions
- Calculate the performance characteristics of hydraulic pumps and turbines and air compressor.

MR16312

**WELDING TECHNIQUES, LATHE AND SPECIAL
MACHINE SHOP**

L T P C

0 0 6 3

OBJECTIVES:

- To develop skill of the students in welding and machining techniques

WELDING TECHNIQUES

45

WELDING - Exercises in Electric Arc welding and Gas welding and Advanced Techniques like MIG and TIG Welding

Demo on Pulsed MIG and Cold Metal Transfer Welding

HAND TOOLS - Hand tools, sharpening, Powered hand tools, Measurements etc. Exercise involving above.

SHEET METAL WORKING - Simple Exercise like Tray, cone

PIPE WORK - Experiments involving thin pipes, Joining- 5 G and 6G welding, bending, welding and visual inspection.

LATHE & SPECIAL M/C SHOP

45

Lathe – Straight turning, Step turning, under cut, taper turning, knurling and thread cutting exercises. Shaping Machine – Making square from round rod and grooving exercises. Exercises on milling machine. Grinding: Exercises to the required accuracy on universal cylindrical grinder and surface grinder. Slotting Machine: Slotting and Key-way cutting.

TOTAL: 90 PERIODS

OUTCOMES:

At the end of this work shop training the students would have the skill:

- To carry out repair of Ship machinery and components by welding
- To do any kind of sheet metal works
- To make machine components using Lathes and Special machines such as milling, grinding and slotting machine.

SEMESTER-IV

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals - Newton's forward and backward difference formulae - Curve fitting by Principle of least squares – Fitting a straight line $y = ax + b$ and a second degree curve $y = ax^2 + bx + c$.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single Step methods - Taylor's series method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations, second order equations and simultaneous first order equations - Multi step methods - Milne's and Adams- Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL (L:45 + T:15): 60 PERIODS

OUTCOMES:

- The students will have a clear perception of the power of computational techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Iyengar. S.R.K., and Jain. R.K., "Numerical Methods", New Age International Publishers, New Delhi, 2012.
3. William Embleton OBE and Leslie Jackson, Reed's Mathematics for Engineers, Adlard Coles Nautical, London, 2011.(for Marine Engineers)

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley, India, 2007.
2. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
3. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
4. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.
5. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
6. Venkataraman. M.K. "Numerical Methods in Science and Engineering, National Publishers, 1995.
7. Kandasamy. K., Thilagavathy. K., and Gunavathi. K., "Numerical Methods", S. Chand & Company Ltd., New Delhi, 2008.

OBJECTIVES:

- To impart knowledge to the students about the Strength of Materials.

UNIT I CONCEPT OF STRESS**8+3**

Concept of stress- tensile and compressive stresses- shear stress- Elastic limit – Hooke's law- elastic constants and their relationship – Poisson's ratio – Generalized Hooke's law – elongation of simple and composite bars under external load – allowable stress – factor of safety- thermal stresses of simple members – strength of welded joints. Resilience-suddenly applied loads, strain gauges, Hydrostatic stress & corresponding strains.

UNIT II STRESSES IN BEAMS**9+3**

Stresses in beams – neutral axis- theory of simple bending- bending stresses in rectangular, I sections and circular section beams. Bending stresses in composite section beams. Strain energy due to bending. Shear stresses in beams – rectangular, I-sections and circular sections. stress components on a general plane and oblique plane - principal stresses and principal Planes, Maximum shear stresses and their planes- Mohr's Diagram for stress & strain

UNIT III BENDING MOMENT**10+3**

Bending moment-shear force, BMD and SFD for statically determinate beams- cantilever simply supported--overhanging beams- with or without applied moments, point of contra flexure. Statically indeterminate beam-BMD and SFD for continuous beams-clapeyron's theorem of three moments.

UNIT IV SLOPE, DEFLECTION AND TORSION**9+3**

Slope and deflection of Cantilever, overhanging and simply supported beams – Double integration method – Macalay's Method - Moment area method- problems with various types of load with or without applied moments and varying flexural rigidity (EI). Deflection due to shear, Deflection by graphical method.

Torsion of solid and hollow circular shafts – power transmitted by shafts – compound shafts - shafts subjected to both twisting and bending moment. Torsion applied to closely coiled springs, plastic yielding of materials in torsion. Torsion of shaft fitted with liner. Combined bending & twisting, equivalent bending & twisting moments, shear, bending & torsion, theories of failure- open coil and closed coil helical springs.

UNIT V COLUMNS, STRUTS, CYLINDERS AND PRESSURE VESSELS**9+3**

Columns and struts - long and short columns- Euler's formula for long column – equivalent length – slenderness ratio - Eccentric loaded long and short columns - Rankine Gordon formula, use of Strut formulae. Thin cylinders and thin spherical shells under internal pressure-change in volume due to internal pressure. Thick cylinders – simple treatment of thick cylindrical walled pressure vessels. Lamé's theory, compound cylinders. Thin curved bar, strain energy due to bending, Castiglione's theorem & its application to curved bar, strain energy due to twisting, applied problems.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of this course the students would have learnt

- The methods of determining various stresses and strains in simple and composite members under external load, strength of simple connections and strain energy stored in members.
- The concept of principal stresses and maximum shear stresses.
- To design beams which can resist bending and shearing stresses
- 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 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.
- To design a column and pressure vessel based on the different load condition

TEXT BOOKS:

1. James M Gere, “Mechanics of Materials”, 6th Edition, Cengage learning India pvt limited, Delhi, 2006.
2. Rajput. R.K. “Strength of Materials”, 5th Edition, S. Chand &Co., New Delhi, 2006.
3. Jindal, U.C., “Strength of Materials’, 1st Ed., Pearson, 2011

REFERENCES:

1. Bansal R.K, “ A textbook of Strength Of Materials”, 5th edition, Laxmi Publications (P) Ltd, New Delhi, 2010.
2. Beer Johnston, Dewolf Mazurek, “Mechanics of Materials”, 6th edition, McGraw Hill Education(India) Pvt.Ltd, New Delhi,2014.
3. Rattan S S, “ STRENGTH OF MATERIALS”, 2nd edition, McGraw Hill Education(India) Pvt.Ltd, New Delhi,2011.

OBJECTIVES:

- To provide knowledge to the students about Construction and working of slow speed operating marine diesel engines.

UNIT I FUEL TECHNOLOGY & COMBUSTION IN I.C. ENGINES 12

Liquid fuels – petroleum – distillation process – effects of modern refining on residual fuel properties – fuel oil for marine diesel engines – testing and properties of fuel oils – shore side and shipboard sampling and testing. Treatment of fuel for contaminants including microbiological infection. Combustion of fuel-air for combustion – combustion of hydro carbons (theoretical treatment). Control of NOX, SOX in Exhaust Emission.

UNIT II TYPES AND CHARACTERISTICS OF MARINE DIESEL ENGINES 9

Deviation from ideal condition in actual engines. General construction and working of Slow Speed and Medium Speed engines

Engine Cycles & Timing Diagrams. Mean Effective Pressure and Indicated Power: Mean Piston speed, M.C.R. & C.S.R. ratings. Study of heat balance diagram and thermal efficiency.

UNIT III STRUCTURAL ARRANGEMENT OF LARGE MARINE PROPULSION ENGINES. 15

Bed Plate-Construction-Engine chokes and holding down bolts arrangement. Construction of ‘A’ frames and cylinder blocks, Tie bolts, jack bolts. Construction of Piston- Piston rings-Clearances-Effect of improper clearances cross heads, connecting rods, crank shaft, bearings, Liner-Construction-Causes of liner wear-measurement of liner wear. Cylinder lubrication-construction of quills- Cylinder cover and mountings. –Construction of Cross head and bearings, connecting rod and bearings - Diaphragm and piston rod gland (Stuffing box)- Construction-method of checking clearances Construction and working of Fuel injection pumps-Jerk type and valve type (Sulzer engines), Fuel injectors

COOLING OF I.C. ENGINES:

Various cooling media, their merits and demerits, cooling of pistons, cylinder jackets & cylinder heads, bore cooling, coolant conveying mechanism and systems, maintenance of coolant and cooling system, cooling water: testing and treatment.

UNIT IV SCAVENGING SYSTEM 12

Methods of scavenging-types and methods of supercharging-super charging arrangements- their merits-demerits-under piston scavenging, turbocharging.

SUPERCHARGING ARRANGEMENTS

Pulse and constant pressure type; merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger construction and its details.

UNIT V CAMSHAFTS, CAMSHAFT DRIVE AND CRANK SHAFTS 12

Construction of camshaft and cams - gear drive-Chain drive-Roller chain construction-chain tensioning and replacing procedure-crank shaft-Types-Construction of various types-materials used-Crankshaft alignment-method of checking alignment-Crank shaft deflection-Purpose-Procedure of taking deflections and interpretation.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students are expected to have learnt,

- Fuel technology, combustion and characteristics of marine diesel engines.
- Construction of large two stroke marine engines
- Scavenging, supercharging and turbochargers construction.
- Camshaft chain drive construction and maintenance.

TEXT BOOKS:

1. D.A. Taylor, "Introduction to Marine Engineering", 2nd Edition, Butter worth – Heinemann, London, 1999.
2. Wood yard, Doug, "Pounder's Marine Diesel Engines", 7th Edition, Butter Worth Heinemann Publishing, London, 2001.
3. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai.

REFERENCES:

1. Engineering knowledge (Motor) Volume-I, Notes prepared By: Prof. K. Venkataraman. CEng, FIMarE, MIE.
2. Engineering knowledge (Motor) Volume-II, Notes prepared By: Prof. K. Venkataraman. CEng, FIMarE, MIE.
3. Marine diesel engine principle and practice-Notes prepared By: Prof. K. Venkataraman. CEng, FIMarE, MIE.

OBJECTIVES:

- To impart Knowledge on Ship's Auxiliary Machines.

UNIT I ENGINE ROOM LAYOUT, PIPING SYSTEMS AND FITTINGS 9

Layout of main and auxiliary machinery in Engine Rooms in different ships. Steam and condensate system, water hammering in pipes, Expansion joints in pipelines, Bilge – ballast, fuel oil bunkering and transfer system, bunkering procedure, precautions taken, fuel oil service system to main and auxiliary engines, lubricating oil and Engine cooling system to main and auxiliary engines, central cooling and central priming systems, control and service air system, domestic fresh water and sea water (Hydrophore) service system, drinking water system, fire main system.

UNIT II VALVES, COCKS , PACKING, JOINTS, FILTERS AND STAINERS 9

Straight way cocks, right angled cock, “T” cock, spherical cock, Boiler gauge glass cock (cylindrical cock). Globe valves, SDNR valve, swing check valve (storm valve), gate valves, butterfly valves, relief valves, quick closing valves, pressure reducing valves, control valves, change over valve chests, fuel oil transfer chest, valve actuators, steam traps.

Packings, Insulation of materials, Types, - Various applications. Seals – purpose of bearing seal, description and application of non rubbing seals and rubbing seals, simple felt seal, seals suitable for various peripheral speeds, V-ring seals, Lip seals.

Filtration, filter elements basket strainers, duplex strainers, edge type strainers, auto-kleen strainers, back flushing strainers, magnetic filter, rotary filters, fine filters.

UNIT III PUMPS 8

Types of pumps for various requirements – their characteristics, performance and application in ships – centrifugal pumps – gear pumps – screw pumps and reciprocating pumps – care and maintenance of pumps, operation of all pumping systems on board such as bilge, ballast and cargo pumping operations.

UNIT IV HEAT EXCHANGERS, EVAPORATORS AND DISTILLERS 9

Principle of surface heat transfer – description, contact heat transfer, construction of shell and tube type – flat plate type, single and double pass – lubricating oil coolers, fuel oil heaters, fresh water coolers, compressed air coolers, Main Engine charge air cooler, Fresh water heaters, steam condensers, evaporators and condensers in refrigeration system – materials used in all the above heat exchangers, expansion allowance – temperature controls effect of air in the system – maintenance.

Distillation of water, distilling equipment, problem of scale formation and method of controlling, methods of distillation, single effect and double effect shell type evaporator, low pressure vacuum type evaporator, flash evaporators, multiple effect evaporators-construction and operation salt water leaks and detection, reverse osmosis desalination plant, membranes, drinking water and treatment.

UNIT V STEERING SYSTEM

10

Hydraulic Telemotor system (Transmitter and receiver), Bypass valve – charging system, – hydraulic power unit – hunting gear heleshaw pump principle, construction and operation – pawl and ratchet mechanism, 2-ram and 4-ram steering gear – All electric steering gear, principle and operation – Hunting gear and emergency steering gear. Electro-hydraulic steering gear, Raphson and slide Actuators, Rotary vane steering gear – principle – construction – operation – safety features, relief, isolating and bypass valves, steering system regulations and testing – trouble shooting – rectification maintenance. Navigational safety of a ship – case history, cause and /or errors – how to avoid rudder restraining, general requirements – requirements for large tankers and gas carrier, additional requirements (electrical) definitions – controls – automatic system, general arrangement – rudder and pintle, rudder wear down – rudder carrier.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course the students will acquire knowledge of

- Ship's Engine Room Layout, Piping systems and fittings.
- Various types of Pumps and its applications.
- Construction details of Heat exchangers, Evaporators
- Ship's steering systems.

TEXT BOOKS:

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

REFERENCES:

1. H.D. McGeorge, "General Engineering Knowledge", 3rd edition, Butter worth – Heineman, London, 1991.
2. Vikram Gokhale, N. Nanda, "Advanced Marine Engineering Knowledge Vol. II", 2nd Edition, Engineer Enterprises, Mumbai, 2001.
3. Vikram Gokhale & N. Nanda, "Marine Engineering Knowledge for Junior Engineers, 3rd Edition, Engineer Enterprises, Mumbai, 1999.
4. T.B.Srinivasan, "Marine Machineries – Operation & Maintenance", 1st Edition, The Institute of Engineers, India.

OBJECTIVES:

- At the end of the study on these topics the students should have the knowledge on basic refrigeration and Air conditioning, Marine refrigeration plants & Refrigerated containers and their maintenance. Also the students should have the knowledge on Marine Air conditioning their components and their maintenance. In addition to this the students should also be aware of safe and efficient operation of these machineries.

UNIT I Basic Refrigeration and Air Conditioning 9

Reversed Carnot cycle – Vapour compression cycle – Refrigerating effect – Co-efficient of performance – Cooling capacity – Refrigerants used in marine practice and their justification - Rating of Refrigeration plant – Methods for improving C.O.P. – Use of Refrigerant tables and charts – Simple Problems.

UNIT II Marine Refrigerating Plants 9

Typical marine Refrigerating plants with multiple evaporator system – construction and operation, Safety measures in Refrigeration plants, Refrigerant Charging procedure. Refrigeration in Liquefied gas carriers, Marine Refrigerants and their desirable properties, ODP, GWP.

UNIT III Refrigerated Containers 9

Types of refrigerated Cargos, Identifying Reefer container, Air flow within reefer container, Power supply for reefer container, Importance of maintaining temperature, humidity, oxygen content in reefer container, Periodic maintenance of reefer container.

UNIT IV Marine Air Conditioning 9

Psychrometrics and Principles of Air conditioning – Comfort conditions - Typical marine Air Conditioning and Ventilation system – construction and working, Safe and efficient operation in UMS mode.

UNIT V HVAC Components 9

Refrigeration Compressors – types, construction – valves, L.P, H.P, Lubricating oil low pressure cut outs and compressor maintenance. Air blowers and ventilation systems components – maintenance. Refrigeration Condensers – types, construction and maintenance. Expansion valves – types, construction and maintenance.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, students are expected

- To know the theory behind Refrigeration process and use refrigeration of tables and charts.
- To understand construction and operation of Marine refrigeration plants.
- To recognize the importance of maintaining temperature, humidity and oxygen content in refrigerated Containers.
- To comprehend Psychrometrics and construction and working of typical marine Air conditioning plants.
- To know the components of HVAC systems and Marine refrigerants.

TEXT BOOKS:

1. Manohar Prasad, “Refrigeration and Air Conditioning”, 3rd Edition, New Age International (P) Ltd., Publishers, Chennai,2015
2. Arora C.P., “Refrigeration & Air Conditioning”, 3rd Edition, Tata McGraw-Hill, New Delhi, 2014.
3. J.R.Stott, “Refrigerating Machinery and Air Conditioning Plant”, Marine Engineering Practice, Vol-1 P Part-04, IMarEST, London,1998.

REFERENCES:

1. McGeorge.H.D, “Marine Auxiliary Machinery”, 7th Edition, Butterworth Heinemann, Woburn, USA, 2015.
2. D.A.Taylor, “Introduction to Marine Engineering”, Second Edition, Butterworth Heinemann, Woburn, USA, 2011.
3. C. Maheshwar, “Container Refrigeration”, First Edition, Witherby Seamanship International, Livingston, UK, 2008.

OBJECTIVES:

- To impart knowledge on the properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various Marine Engineering applications.
- To provide knowledge on various Metrological equipments available and the correct procedure to be adopted to measure the dimension of the components.

UNIT I FUNDAMENTALS OF METALLURGY 9

Basic metallurgy, metals and processes, properties of materials used in machinery on board ships - Metallurgy of steel and cast iron - iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure - Aluminium, copper and its alloys - Non-metallic materials – Polymers – types of polymer, Engineering Ceramics – Properties and applications of Al₂O₃, SiC Composites-Classifications- Matrix and reinforcement Materials- Applications of Composites- Nano composites. Applications of marine materials.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram - Hardenability, Jominy end quench test –Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening – precipitation hardening. Vacuum and Plasma hardening – Current trends, Thermo-mechanical treatments, elementary ideas on sintering

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning – Types of fracture – Failure modes - Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT IV MATERIAL PROCESSING AND TESTING OF JOINTS 9

Engineering processes used in construction and repair, Characteristics and limitations of process used for fabrication and repair. selection of materials in construction of equipment. Materials under load, self-secured joints, permanent joints, bonding plastics, adhesives and bonding, pipe work. Vibration tests. Destructive and non-destructive testing of materials – different methods

UNIT V BASICS OF METROLOGY AND MEASUREMENTS 9

Introduction to Metrology - Need - Elements - Work piece, Instruments -Persons - Environment - their effect on Precision and Accuracy -Errors -Errors in Measurements -Types, Control, Types of standards. Principles and Methods of straightness - Flatness measurement Optical Flat. Angular measuring instruments -Types -Autocollimator

TOTAL: 45 PERIODS**OUTCOMES:**

- At the end of the course the students are capable of knowing Properties of metals and non metals and uses, Various heat treatment processes, Metal Processing methods, testing of joints using destructive and non destructive methods
- At the end of the course the Students can demonstrate different measurement technologies

TEXT BOOKS:

1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 9th Indian Reprint 2013.
2. Parasihivamurthy, K.I., “Material Science and Metallurgy”, 1st Ed. Pearson, 2012.
3. Jain R.K. “Engineering Metrology”, Khanna Publishers,25th edition 2015.
4. Jindal,U.C., Atish Mozumder, “Material Science and Metallurgy”, 1st Ed. Pearson, Third Impression 2013.
5. Todd , “Selecting Material For Sea Water Systems”, Marine Engineering Practice,Vol-1, Part-10, IMarEST, London.

REFERENCES:

1. Eyres, D.J. “Ship Construction” 7th Edition,2015
2. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
3. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 6th edition 2015.
4. Book on Engineering knowledge general Vol-1.
5. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications,5th edition 2011.

OBJECTIVES:

- To provide knowledge to the students about Marine Boilers and marine steam turbines.

UNIT I MARINE BOILERS

9

Construction and working of Scotch Boiler, Cochran boiler. (Smoke tube boilers)

Water tube boilers: – Babcock Wilcox, Foster Wheeler – D-type, Double evaporation boilers.

Lamont exhaust gas boiler. Advantages of water tube boilers. Stresses in boilers.

UNIT II BOILER MOUNTINGS&FEED SYSTEM

9

Construction and working of Safety Valves: – Improved High Lift, Full lift and full Bore type:

Construction and working of Gauge glass: Tubular type, double plate type and I-gema remote

Indicator, Procedure for blowing through the gauge glass, feed check valve, Automatic feed

regulator, Main Steam stop valve, manhole door construction. **Feed system**-Open and close feed

system, construction of Condensers, hot well and cascade tank.

UNIT III COMBUSTION IN BOILERS

9

Theory of combustion in boilers, Construction of Various types of burners (Pressure jet, Blast jet,

Rotating cup type burners), excess air requirements and limitations, & furnace refractory materials.

boiler fuel system, Construction and operation of soot blowers.

UNIT IV OPERATION & MAINTENANCE OF BOILERS

9

Pre-commissioning procedures, boiler blowing down procedure, manhole door opening procedure,

tube renewals, Procedure for steam raising from cold, Boiler operating procedures, Action in the

event of shortage of water. Inspection and survey of boilers, safety valve over hauling and setting

procedure, accumulation pressure test and hydraulic pressure tests.

UNIT V MARINE STEAM TURBINES

9

Steam turbines – Working principle and Construction of Impulse and reaction turbines.

Construction of Condensers. Materials used in various components like blades, rotors, casings.

OPERATION AND MAINTENANCE OF TURBINES- control of speed and power of

propulsion, throttle valve control and nozzle control, emergency controls, emergency operation of

turbines, vibration in marine steam turbine, drain system, turbine gland system, warming through a

turbine plant. Turbine bearings lubrication system

TOTAL: 45 PERIODS**OUTCOMES:**

At the end the course the students are expected to have to have learnt

- Construction of various types of boilers.
- Combustion in boilers
- Operation and Maintenance of boilers.
- Operation and maintenance of marine steam turbines.

TEXT BOOKS:

- J.H. Milton & R.M. Leach, “Marine Steam Boilers”, 4th Edition, Butter worth, London, 1980
- GTH. Flanagan, “Marine Boilers” 3rd Edition, Butter worth, London, 2001.
- L.Jackson & T.D. Morton, “General Engineering Knowledge for Marine Engineers”, 4th Edition.

REFERENCES:

- Engineering knowledge (Motor) Volume-II, Notes prepared By: Prof. K. Venkataraman. CEng, FIMarE, MIE.

OBJECTIVES:

- To study the performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine
- To perform the tests on boiler feed water

LIST OF EXPERIMENTS:

THERMAL ENGINEERING LAB

- Performance test on steam turbine
- Determination of dryness fraction of steam using steam calorimeter
- Performance test on air blower
- Determination of C.O.P of refrigeration test rig
- Performance test on air conditioning test rig
- Determination of calorific value of liquid fuels
- Determination of Flash and Fire point of given oil
- Determination of viscosity of oil using redwoods viscometer
- Performance test on Diesel engine with AVL setup
- Heat balance test on Diesel engine.

BOILER CHEMISTRY LAB

- To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO_3 .
- To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO_3 .
- To determine Alkalinity due to Phenolphthaline, total Alk. and Caustic Alk. Of the sample of water (in P.P.M).
- To determine Phosphate Content of the sample of water.
- To determine dissolved Oxygen content of the sample of water.
- To determine sulphate content of given sample of water.
- To determine Ph-value of the given sample of water.
- Boiler trial.
- Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
- Water Analysis (Fresh and sea water)- Chloride, sulphate, hardness
- Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students are expected to have acquired the skill

- To perform various tests on engines
- To Analyse the results to understand the performance characteristics of engines
- To Perform Boiler water tests, Sea water and fresh water tests
- To Choose the best water, oils, fuels and lubricants based on the test results.

SEMESTER-V

OBJECTIVES:

- To impart knowledge to the students on Construction of ships.
- Ships terms and stresses in ships.
- Primary and Secondary girders used in ships.
- Fore-end and After-end arrangements.

UNIT I SHIP TERMS**9**

Various terms used in ship construction with reference to ship's parameter e.g. L.B.P.-Moulded Depth - Moulded draught etc. - General classification of ships. Stresses in Ship's structure: Hogging – Sagging – Racking – Pounding – Panting etc., and Strength members to counteract the same. Sections And Materials Use: Type of sections like angles – Bulb plates flanged beams used in ship construction – Process of welding. Riveting & Welding testing of welds – Fabricated components.

UNIT II BOTTOM & SIDE FRAMING**9**

Double bottoms, watertight floors solid and bracket floors – Longitudinal framing keels – side framing like tank side brackets – Beam knee – Web frame etc., Shell & Decks: Plating systems for shells – Deck plating & Deck Girders –discontinuities like hatches and other openings – supporting & closing arrangements –mid-ship section of ships. Bulkheads & Deep Tanks: watertight bulkheads – Arrangement of plating and stiffeners – watertight sliding doors – watertight openings through bulkheads for electric cables pipes and shafting – Deep tank for oil fuel or oil cargo corrugated bulkheads.

UNIT III FORE & AFT END ARRANGEMENTS**9**

Fore end arrangement, arrangements to resist pounding bulbous bow – Types of sterns stern frame and rudder – Types of rudder – Supporting of rudder – Locking pintle – Bearing pintle – Pallister, bearing shaft tunnel – Tunnel bearings.

UNIT IV FREE BOARD AND TONNAGE**9**

Definition of freeboard and various assigning conditions, Tonnage-regulations, calculation as per latest convention, Details of markings permanently craved. Plimsol line
Shipyard Practice - layout of a shipyard – Mould loft –Optical marking – Automatic plate cutting, Fabrication and assembly etc

UNIT V OFFSHORE TECHNOLOGY**9**

Drilling ships and Platforms – Supply vessels – fire fighting arrangement – Pipe laying ships – special auxiliary service ships. Ship Surveys :
Survey rules – Functions of ship classification – Societies – Surveys during construction – Periodical surveys for retention of class.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would have acquired the knowledge of

- Terms in ship construction - detailed understanding in riveting and welding
- Ship Floors/Framing Systems/Brackets/Girders
- Bulkheads and Deep Tanks
- Fore and Aft Arrangements
- Free board and Tonnage
- Drill Ships and Offshore Platforms

TEXT BOOKS:

1. D.J. Eyres, "Ship Construction", 7th Edition, Butter worth – Heinemann, Oxford, 1994
2. E.A. Stokoe, "Reed's Ship Construction for Marine Engineers", 5th Edition, Thomas Reed Publication, London, 2000.

REFERENCES:

1. A.J. Young, "Ship Construction sketch & Notes", 3rd Edition, Butter worth – Heinemann, London,1980.
2. H.J. Pursey, "Merchant Ship Construction", 7th Edition, Brown Son & Ferguson Ltd. GlasGow Great Britain, 1994.

OBJECTIVES:

- To make the students learn the concept and working of Marine Diesel Engines.

UNIT I MARINE LUBRICATION 12

Refining of crude oil-properties and testing of Lubricating Oil-hydrodynamic (fluid film) lubrication-hydrostatic lubrication- boundary lubrication, properties of crankcase oil of large two-stroke engines and trunk type piston engines, bearing lubrication system for large two-stroke engines–cylinder lubrication, construction of quills, bearing failures-Causes and remedies.

UNIT II MANOUVERING SYSTEMS, INDICATOR DIAGRAMS AND POWER CALCULATIONS 12

Starting and reversing systems of different Marine diesel engines with safety provisions. Construction and working of starting air valve and air distributor. Constructional details of indicator Instrument, significance of diagram, theoretical knowledge of power calculations, fault detection, simple draw cards and out of phase diagrams power calculation and power balancing.

UNIT III GOVERNERS, MEDIUM SPEED ENGINES 12

Governors-Mechanical, Hydraulic, Electrical and Electronic Governors. Construction of inline medium speed marine diesel engines piston, piston rings Cylinder, cylinder head and valves etc., V type engine details, Comparison of medium speed engines with large two stroke engines.

UNIT IV ENGINE SYSTEMS, GOVERNERS, FORCES AND STRESSES ON ENGINES. 12

Main engine lubrication system-cooling water system-Starting air and reversing system (Lost motion clutch) of large marine diesel engines with safety provisions. Forces and stresses acting on various components of I.C. Engine parts, different types of vibration & its effects on marine engines, balancing of engines.

UNIT V DEVELOPMENTS IN MARINE ENGINES 12

Comparison in construction of Sulzer RND& RTA engines, Common rail fuel injection system, Electronic injection systems, RT-FLEX Camshaft less intelligent engines MAN-BMW ME type-engines, improvement in design of exhaust valves, Alfa- lubrication for increased TBO.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the course the students will have knowledge of

- Marine fuel injection pumps and its applications.
- Manouvering systems of various marine diesel engines.
- Forces and stresses in slow speed and medium speed engines.
- Construction and operation of various Marine slow speed engines.

TEXT BOOKS:

1. C.C Pounder, "Marine Diesel Engines", 6th Edition, Butter worth – Heinemann, Scotland, 1995.
2. D.A. Taylor, "Introduction to Marine Engineering", 2nd Edition, Butter worth – Heinemann, London, 1996.
3. Christen Knak, "Diesel Motor Ships Engines and Machinery", 1st Edition, Marine Management Ltd., London, 1990.
4. John Lamb, "Marine Diesel Engines", 8th Edition, Butter worth – Heinemann, London, 1990.

REFERENCES:

1. S. H. Henshall, "Medium and High Speed Diesel Engines for Marine Use", 1st Edition, Institute of Marine Engineers, Mumbai, 1996.
2. A.B. Kane, "Marine Internal Combustion Engines", 1st Edition, Shroff Publishers & Distributors, Mumbai, 1984.
3. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai, 1998.
4. VL Maleev, "Internal Combustion Engines", 2nd edition, McGraw-Hill book co.,Singapore, 1987.
5. Wood yard, Doug, "Pounder"s Marine Diesel Engines", 7th Edition, Butter Worth Heinemann Publishing, London, 2001.

OBJECTIVES:

- To impart knowledge on the Working Principle of Marine Auxiliary Machineries

UNIT I OPERATION & MAINTENANCE 9

Operation, construction, maintenance of oil water separator both manual and automatic versions. Construction, operation, maintenance of incinerator and the of sewage plant.

UNIT II THEORY OF OIL PURIFICATION /AIR COMPRESSOR 9

Construction, operation, maintenance of fuel oil and lub oil purifiers, clarifiers together with self de sludge operation. Theory of air compression and uses of compressed air on board. Construction, operation, maintenance of main air compress and emergency air compressors. Types of bow thrusters, operation, maintenance of the same and Deck machinery, operation, maintenance of cargo winches, windless mooring winches. Safe working practices during operation and maintenance of machinery.

UNIT III METHODS OF SHAFT ALIGNMENT 9

Construction, operation, maintenance of - thrust block. - intermediate shaft. Construction, operation, maintenance stern tube and stern tube bearing both water cooled and oil cooled together with sealing glands .Stresses in shafting, i.e. intermediate shaft, thrust shaft and screw shaft.

UNIT IV DRY DOCKING 9

Preparation and procedure to dry docking vessel. Maintenance of hull, underwater fittings and machine maintenance and repairs during dry dock Removal and maintenance of rudder and propeller. Removal and maintenance of tail shaft and stern tube bearing. Methods of Docking eg. Slipways, Drydocks, Shiplift system etc., Safe working practices during drydock works.

UNIT V MAINTAINENCE AND REPAIR AT MANAGEMENT LEVEL, LEADERSHIP AND MANAGERIAL SKILLS 9

A) Theory of marine eng. Practice and maintenance of machinery, dealing with wear and tear, both electrical and mechanical., Alignment of components, temporary and permanent repairs. Detection of machinery malfunction and action to prevent damage.

B) Planned maintenance, preventive maintenance, condition monitoring, Principles of tribology, risk assessment, trials and safe working practices.

TOTAL: 45 PERIODS

OUTCOMES:

At The end of the course the students are expected to have the knowledge on

- The Construction, operation, maintenance of incinerator and sewage plant.
- The Construction, operation, maintenance of Oily water Separator and Purifiers
- The Construction operation, maintenance of sewage plant.
- Alignment of shafting system
- Dry docking of ships
- Maintenance and repair of Equipments , Machinery fitted in ships

TEXT BOOKS:

1. DW Smith "Marine Auxiliary Machinery", 6th edition, Butter Worths, London, 1987.
2. HDMcGeorge,"MarineAuxiliary Machinery"7thedition, Butter Worths, London, 2001.

REFERENCES:

1. D.K. Sanyal, " Principle and practices of Marine Diesel Engine" 2nd Edition, Bhandarkar Publication, Mumbai, 1998
2. MARPOL 73/78, IMO Publications, 2001.
3. Wood Yard , Doug, "Pounder"s Marine Diesel Engine" 7thedition, Butter Worths Heinemann Publications ,London 2001
4. " Pumping and Piping Diagram", IME publication
5. Heinz P. Bloch, Fred K. Geitner, "Machinery Component Maintenance and Repair" 3rd Ed. An imprint of Elsevier, 2010

OBJECTIVES:

- To expose the students to the concepts about Electricity production, measurements, cable faults and AC Machines used in Marine engineering.

UNIT I ELECTRICAL MEASUREMENTS AND CONTROL SYSTEM 8

Induction type energy meters-megger (Basic construction & principles of operation only).– Single phase and three phase wattmeter for power measurement – Measurement of energy, speed, frequency and phase difference – Measurement of resistance, inductance and capacitance by Bridge method – Magnetic measurement. Location of cable faults – transducers and its application in the measurement of pressure, flow, temperature, Torque, Humidity, Water content etc – simple electronic measuring devices – CRO, IC tester, Signal generator, Timers, Multi Tester, Clamp meter-Principle of operation and Application of Automatic control system-PID controller etc.,

UNIT II ALTERNATORS 11

Alternators – general arrangement – construction of salient pole and cylindrical rotor types – types of stator windings – e.m.f equation – distribution and pitch factor – waveform of e.m.f. generated – rotating magnetic field – armature reaction – voltage regulation – load characteristics – open circuit and short circuit tests – e.m.f and m.m.f. methods – parallel operation of alternators – KW and KVA sharing – Brushless alternator – static excitation system.

UNIT III SYNCHRONOUS MOTORS 5

Principle of operation of 3-phase synchronous motor. – operation of infinite bus bars torque/angle characteristics – hunting – methods of starting – merits and limits of synchronous motor over others.

UNIT IV INDUCTION MACHINES 12

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 rotor slip – torque/Slip characteristics – starting torque and maximum running torque-Effect of change in supply voltage on Torque-Induction generator.

UNIT V CONTROL OF INDUCTION MACHINES

Reversing – speed control of induction motor-Electronic methods of speed control of Induction Motor(IGBT,Thyristor) – starting of induction motor – method of starting – Direct on-line starters – Star – delta starter – auto-transformer starter – starting of special high torque induction motors – single phase induction motor – principle and operational characteristics – starting control – constructional details – Failure and repairs of electrical machines.

TOTAL: 45 PERIODS**OUTCOMES:**

After completing the course the students should have the knowledge of

- 1) The procedure for producing electricity on board ships through alternators and associated controls
- 2) To measure the power method of finding cable faults.
- 3) Design features of Alternators – their construction and operation.
- 4) Principles of operation and construction details of synchronous motors, induction machines
- 5) Speed control and trouble shooting in induction machines.

TEXT BOOKS:

1. Edmund GR Kraallavers , “Advanced Electo-technology For Marine Engineers”, 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London
2. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.
3. Ghosh, S., “Electrical Machines”, 2nd Edition., Pearson, 2012
4. IHerman, “Electrical Transformers and Rotating Machines”, 3rd Ed. Cengage, First Indian Reprint 2012(Yesdee Publishings Pvt. Ltd.).
5. IHerman, “Electrical Transformers and Rotating Machines”, 3rd Ed. Cengage, First Indian Reprint 2012(Yesdee Publishings Pvt. Ltd.).

REFERENCES:

1. Uppal S.L., “Electrical Power”, 13th Edition, Khanna publishers, Mumbai, 2002.
2. Berde, M.S., ”Electric Motor Drives”, 1st Edition, Khanna Publishers, Mumbai, 1995.
3. J. Nagrath and D.P. Kothari, “Basic Electrical Engineering”, 3rd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
4. Charles, I. Hubert, “Electric Machines”, 2nd Ed., Pearson, 2002

OBJECTIVES:

To make the students understand the Marine Electronics and its applications.

UNIT I INTRODUCTION TO LINEAR IC'S 9

Operation Amplifier -Basic information about op-amps – Ideal Operational Amplifier-Open and Closed loop configurations of Op-amp-Inverting ,Non inverting and Voltage Follower-Applications of op amp-Adder, Subtractor,Integrator, Differentiator.Comparator.

555 Timer-Introduction-Description of functional diagram-Applications

UNIT II DIGITAL CIRCUITS 9

Digital Circuits: Boolean postulates and laws - Boolean expression - Minimization of Boolean expressions-Log using K Map -Logic Gates -Combinational circuits-Adders,Subtractors and multiplexers-Sequential Circuits circuit Flip flops – Asynchronous and synchronous Counters – Memory Hierarchy different types of memory

UNIT III CONVERTERS AND MEASURING INSTRUMENTS 9

Converters; (A-D and D- A): Analog to Digital -Flash type ,Successive Approximation type-Digital to Analog Converters -weighted resistor type, R-2R Ladder type,

Electronic instruments: Cathode Ray Oscilloscope – Digital voltmeters – Multimeter – Signal Generators – Q - meters - Transducers for vibration, pressure, volume and velocity measurement. Measurement of V-I, I-V, P-I, I-P converters

UNIT IV INDUSTRIAL ELECTRONICS 9

Industrial Electronics: Power rectification-Half wave and Full wave rectifier – silicon control rectifier power control – Photoelectric devices – Photo diode, Phototransistor, Photo tubes,Photo multiplier, LED, LCD-Inverters-Satellite communication as applicable to GMDSS, GPS, INMARSAT.

UNIT V MICROCONTROLLERS 9

Microcontrollers: Architecture of 8051 – I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming- Interfacing of Stepper Motor and Basics of control mechanism of PLC

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students are expected to have learnt

- Amplifier Theory, Digital Circuits, Logic systems and Gates.
- Analog and Digital Converters and their applications
- Electronic Instruments and Micro controllers

Text books:

1. Ramakant.A. Gaekwad, "Linear integrated circuits", 3rd edition, Prentice –Hall India, New Delhi, 2001
2. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003
- 3.. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" 3nd Edition, Tata McGraw-Hill, 2nd Reprint 2013

REFERENCES:

- 1 Hofmann, "Global Positioning System", 5 Ed.,Springer, Indian reprint 2007 (Yesdee Publishing Pvt. Ltd.)
- 2 P.S.Bimbhra, "Power Electronics", 3rd edition, Khanna Publisher, New Delhi, 2001.
- 3 Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems:Using Assembly and C",Second Edition, Pearson education, 2011.
- 4 D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,2000.
- 5 Rashid, " Power Electronics Handbook",3rd Ed. Elsevier, Indian Reprint 2013(Yesdee Publishings Pvt. Ltd.)

OBJECTIVES:

- To impart knowledge on the use of Measuring Techniques, Measuring equipments and Instruments.

(A) MEASUREMENTS LABORATORY**35**

1. Use of precision measuring instruments like micrometer, vernier, height and depth gauges, surface plate, etc.
2. Checking dimensions of a part using slip gauge.
3. Use of sine bar for measuring angles and tapers.
4. Measurement of tooth thickness by gear tooth vernier.
5. Calibration of dial gauge.
6. Taper and bore measurement-using spheres / bore dial gauge/ Telescopic gauge.
7. Fundamental dimension of a gear using contour projector.
8. Testing squareness of a try square using slip gauges.
9. Checking straightness of a surface plate using autocollimator.
10. Measurement of angles between centre lines of holes drilled radially on a shaft.
11. Measurements of thread parameters using floating carriage micrometer.
12. Use of pneumatic comparator and mechanical comparator
13. Measurement of Tool nomenclature using: Tool Maker's Microscope
14. Measurement of Surface roughness using surf tester
15. Angle measurement using Bevel protector

(B) INSTRUMENTATION LABORATORY**25**

1. Pressure measuring devices-pressure and vacuum gauge calibration.
2. Temperature measuring devices like Platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
3. Speed measuring devices like tachometer, stroboscope, etc.
4. Force measuring devices, load cells and proving rings.
5. Torque measuring devices
6. Study and use of strain, displacement devices-strain gauge indicator, LVDT.
7. Study and use of velocity and acceleration-accelerometer.
8. Study and use of vibration devices-vibrometer.

TOTAL: 60 PERIODS**OUTCOMES:**

On completion of the experiments in this laboratory course the students will have the knowledge and skills in

- Using the Different types of measuring equipments instruments
- Method of measurements using the instruments

REFERENCES:

1. Lab manuals
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 25th edition 2015.
3. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 5th edition 2011.

MR16512

**MARINE PROPULSION AND AUXILIARY
MACHINERIES OVERHAULING LABORATORY**

L T P C

0 0 4 2

OBJECTIVES:

- To impart knowledge about the overhauling of equipments associated with Main Engines, Auxiliary engines and auxiliary machines.

MAINE ENGINE

1. Study of Lubricating Oil cooler
2. Study of Jacket water cooler
3. Study of Scavenge Air cooler
4. Study of crank case inspection and bearing clearance
5. Fuel Injection valve and pump
6. Starting air valve
7. Cylinder relief valve and indicator cock

AUXILIARY ENGINE

1. Study of Turbo charger
2. Study of cylinder head and fittings
3. Study of Fuel Injection pump

AUXILIARY MACHINES

1. Study of Lubricating oil screw pump
2. Study of S.W. centrifugal pump
3. Reciprocating Bilge pump
4. Study of Boiler safety valve and water level gauge glass
5. Study of 2 Ram hydraulic steering gear
6. Study of various valves, filters, oil separators, Incinerator, Heat exchangers etc.
7. Study of Boilers, cargo oil pump, F.W. generator
8. Study of Sewage treatment plant

TOTAL: 60 PERIODS

OUTCOMES:

- At the end of the course, the students are expected to have the ability to open, clean, repair and refit all the equipments associated with main engines.
- At the end of the course, the students are expected to have the ability to open, clean, repair and refit all the equipments associated with auxiliary engines.
- At the end of the course, the students are expected to have the ability to open, clean, repair and refit all the equipments associated with auxiliary machines.

TEXT BOOKS:

1. HDMcGeorge “Marine Auxiliary Machinery” Butterworths, London 7th edition
2. Introduction to Marine Engineering 2nd edition, DA Taylor
3. General engineering knowledge McGeorge 3rd edition
4. Lamb’s question and answers on marine diesel engine S Christensen
5. Diesel engines AJ Wharton 3rd edition

REFERENCES:

1. Instruction manual form the manufacturer of Alpha level centrifuges,
2. Instruction manual form the manufacturer of Sulzer

SEMESTER-VI

OBJECTIVES:

To impart knowledge, skill and to train the students to be able to perform as Engineer officer on board ships.

- The students are required to undergo Marine Workshop Training in DG Shipping approved Marine Engineering Workshop for a duration of 6 months. The training should be as per the Standard of Training Certification and Watch keeping for Seafarers (STCW 2010).

The field of training and with training has are as follows.

S.No.	Field of training	Period of training (Hrs.)
1.	Engine Room Machinery (Operation)	96
2.	Pumping Systems (Operation)	96
3.	All Onboard Machinery including Main, Auxiliary & Boilers (O'haul, Maintenance & Trouble Shooting)	720
4.	Marine Electrical Systems, Machinery & Equipments	144
5.	Electronics, Instrumentation & Control Engineering	96
6.	Ship Construction	48
Total		1200

The competency of the students are evaluated by the Marine Engineering Workshop and a report is sent to the college. During the training the students have to maintain a work diary. After completion of this training the students will be examined as follows:

a)Assessment on work diary (Internal)		200 Marks.
b)*(i) Written test for 1 hour. 10 questions		10 X 10 = 100 Marks
(ii) Viva voce		200 Marks

Total 500 Marks

* Valuation by both Internal and External Examiners.

TOTAL: 1200 HOURS

OUTCOMES:

On completion of the work shop training the students are expected to have acquired the sufficient knowledge

- In operation, maintenance, repair and refit of Marine machines viz. main engine, auxiliary engines,
- In operation, maintenance , repair and refit of Auxiliaries such as Compressors, Pumps, Steering gear, distillation plant, incinerator, sewage treatment plant etc.,
- In using hand tools, electrical and electronic equipments,
- In using Measuring and Testing Equipments for locating faults , malfunctions
- In repairing faults and malfunctions
- In operation, maintenance, repair and refit of Marine Electrical machines such as Alternators, Generators , Motors, Stabilizers
- Overhauling and maintenance of heat exchangers, oil separators, filters etc
- Of Fire fighting and Lifesaving Methods
- On maintenance of systems and controls

REFERENCES:

1. Original Equipment Manufacturers Manuals For On Board Equipments
2. Benedict, "Nontraditional Manufacturing Processes", 1st Ed. Taylor & Francis, Indian reprint 2011(Yesdee Publishings Pvt. Ltd.)
3. Bloch, "Machinery Component Maintenance and Repair", 3rd Ed. Elsevier, Indian Reprint 2010, (Yesdee Publishings Pvt. Ltd.)
4. Youssef, "Machining Technology", 1st Vol., Taylor & Francis, Indian Reprint 2012(Yesdee Publishings Pvt. Ltd.)
5. Parrlin, "Steering Gear" Marine Engineering Practice, Vol 1, Part 09, IMarEST, London
6. M.E.P., "Exhaust Emission From Combustion Machinery", Marine Engineering Practice, Vol 3, Part 20, IMarEST, London
7. Jones, "A Practical Guide To Marine Fuel Oil Handling," Marine Engineering Practice, Vol 3, Part 19, IMarEST, London
8. Henshall, "Marine Medium Speed Diesel Engines," Marine Engineering Practice, Vol 1, Part 03, IMarEST, London
9. Norris, "Prime Movers For Generation Of Electricity(A) Steam Turbines", Marine Engineering Practice, Vol 1, Part 02, IMarEST, London
10. Sterling, "Selection Installation & Maintenance Of Marine Compressors", Marine Engineering Practice, Vol 1, Part 01, IMarEST, London
10. Gopalakrishnan & Banerji, "Maintenance and Spare Parts Management", PHI Learning Pvt. Ltd., 2010
11. Mishra and Pathak, "Maintenance Engineering and Management," 2nd Ed. , PHI Learning Pvt. Ltd., 2012
12. Venkataraman, "Maintenance Engineering and Management," 1st Ed., PHI Learning Pvt. Ltd., 2010
13. Alan Rowen, Raymond Gardner, Jose Femenia, David Chapman, and Edwin Wiggins, "Introduction to Practical Marine Engineering", 1st Ed., SNAME, 2005
14. Roy L. Harrington, "Marine Engineering", 1st. Ed., SNAME, 1992
15. GTH. Flanagan, "Marine Boilers" 3rd Edition, Butter worth, London, 2001.
16. K.M.B. Donald, "Marine Steam Turbines", 1st Edition, Institute of Marine Engineers, London, 1977.
17. L.Jackson & T.D. Morton, "General Engineering Knowledge for Marine Engineers", 4th Edition, Thomas Reeds Publication, United Kingdom, 1986.
18. M.E.P., "Operation Of Machinery In Ships Steam Turbines, Boilers", Marine Engineering Practice, Vol 2, Part 15, IMarEST, London
19. Edmund GR Kraallavers, "Advanced Electo-technology For Marine Engineers", 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London
20. W.Laws, "Electricity Applied To Marine Engineering", 4th edition, The Institute Of Marine Engineers, London, 1998.

SEMESTER-VII

OBJECTIVES:

- To impart training and knowledge to the students about Marine Machinery system and Design.

UNIT I SLIDING AND ROLLING CONTACT BEARINGS 9+3

Journal bearings, thrust bearings, friction in journal bearings, bearing loads, bearing design using various equations. Thermal Equilibrium. Rolling bearing -Load ratings, types of radial ball bearings, selection of bearings, lubrication of ball and roller bearings, methods of failure.

UNIT II SPUR, HELICAL BEVEL AND WORM GEARS 9+3

Basic design principles of spur gears, helical gears, dynamic tooth loads, design for strength and wear. Basic design principles of bevel gears and worm gears. Lewis and Buckingham equations, thermal rating of worm gears.

UNIT III IC ENGINE PART 9+3

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

UNIT IV VALVES & LIFTING DEVICES 7+3

Valves, safety valves and reducing valves - crane hooks, lifting chains, chain blocks, E.O.T. Crane.

UNIT V DESIGN CRITERIA FOR MARINE SYSTEMS 11+3

Water cooling systems for diesel engines and steam plants. Lubricating oil systems for propulsion and auxiliary engines. Electro hydraulic steering gear system including rudder, rudderstock, tiller, rams. Marine Diesel Engine air starting system including air receiver, compressors and air starting valves. Marine Diesel Engine Scavenge and Exhaust systems. Marine diesel Engine fuel injection system including fuel pumps and fuel injectors. Power transmission system including thrust blocks, intermediate shaft and tail end shaft. Steam turbine plants. Gas turbine plants.

TOTAL: 60 PERIODS

OUTCOMES:

- On completion of the course the students will be able to understand the various considerations while designing various types of bearings.
- On completion of the course the students will be able to design a suitable gear drive for the given data.
- On completion of the course the students will be able to design various parts of marine IC Engine.
- On completion of the course the students will be able to design various valves, crane hooks, flanges etc.

TEXT BOOKS:

1. Jindal U.C. 'Machine Design' 1st Edition, Pearson 2010.
- 2.. A text book of Machine Design by RS Khurmi & JK Gupta 25th edition publishers S Chand

REFERENCES:

1. A Text book of machine design Mechanical Engineering Ed 9 Sharma PC & Agarwal DK by SK Kataria & Sons
2. Machine design data book Bhandari VB Tata Mcgraw 2014
3. Krishna Rao, T, "Design of Machine Elements " Ist edition Vol 2 IK International Publishing Pvt Ltd 2010
4. Machine design: Design of machine elements bJalaludeen Anuradha Agencies Ed 1 2015y

OBJECTIVES:

To develop skills of students in Marine Electrical Technology. The students will be imparted training in handling various electrical instruments to find out faults on various electrical equipments onboard ships and rectify such faults.

UNIT I POWER DISTRIBUTION AND REGULATIONS 9

The marine environment – Generators – Power supply commonly available – ships auxillary services – load analysis – electrical diagrams – active and passive safety measures – Do's and Don'ts – Electric shock – Requirements & Regulations – safe electrical equipments for hazardous areas – Indian Standards. High voltage installations, Systems of AC distribution – general concept – specific systems for ship's service – emergency power supply – shore supply – arrangement to ensure proper phase supply – remote switches to ventilating fans – fuel pumps – lubricating oil pumps and purifiers.

UNIT II INSTRUMENTATION AND SWITCHGEAR 9

Insulated & Earthed neutral systems – introduction – circuit faults – causes – prevention – detection and clearance – alternators. AVR – Panel instrumentation. Switchboards & Switchgear: Main and sub switchboard-Rating and Characteristics– instrumentation & controls – circuit breakers – fault protection devices – DC generator protection – alternator and system protection – protection through fuses – protection Discrimination -Motor Protection.

UNIT III CABLES AND LIGHTING SYSTEMS 9

Electrical Cables: conductors – Wire Sizes-Current Rating – testing-codes- Practical tips. Insulation – Insulation classes – Insulating Materials – Cable insulation & Sheath– Cable gland – Degrees of Protection. Lighting Systems: Introduction – Incandescent Lamps – Discharge lamps – Effect of voltage on lamp performance – Navigation & signal lights – Alarm Indication Systems: Fire alarms and Detection – Sequential starting and cut outs for an automatic fired boiler incorporating safety devices and combustion control equipments.

UNIT IV ELECTRICAL PROPULSION SYSTEMS 9

Propulsion Systems: Auxiliary propulsion systems – Layout and Optimizing storage space – Electrical Propulsion – Advantages & Disadvantages DC constant current systems – DC motor supplied from alternators – Turbo – electric propulsion – AC single speed and Induction motor drives – Fixed speed alternators – Cycloconverter device-Diesel Electric propulsion – Thruster and Water jet propulsion.

UNIT V AUXILIARIES AND MAINTENANCE 9

Batteries & Battery charging: Battery supplies – Lead-acid batteries – Electrical Characteristics – Nickel – Cadmium batteries – Sealed Ni-Cd batteries – Battery charging – Charging from AC and DC mains – Standby Emergency batteries – Voltage Regulators – Battery insulation & safety measures – First Aid treatment – Rotary generators. Maintenance & Troubleshooting- Maintenance of specific equipments – Recommended list of spares, tools & Accessories.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course the students are expected to have the knowledge of

- 1) Different Types of Electrical distribution Systems and Regulations.
- 2) Electrical Instruments and Switch Gear, location and rectification of various kinds of faults onboard ships.
- 3) Specification of cables and Type of Lighting systems.
- 4) Electrical propulsion systems, Maintenance and trouble shooting of electrical equipment's.

TEXT BOOKS:

1. Elstan.A. Fernandez., "Marine Electrical Technology", 9th Edition, "Shroff Publishers & Distributors Pvt. Ltd., Mumbai, 2017.
2. BOWIC C.T., Marine Electrical Practice, 5th Edition, "Butter Worth", London, 1981.
3. LAW S.W., "Electricity applied to Marine Engineering", 4th Edition, "The Institute of Marine Engineers", London, 1998.

REFERENCES:

1. Elstan.A. Fernandez., "Marine Electrical Technology", 1st Edition, "Sterling Book House",Mumbai, 2002.
2. Elstan.A. Fernandez., "Marine Electrical Technology", 9th Edition, "Shroff Publishers & Distributors Pvt. Ltd.,Mumbai, 2017.
3. Surinder Pal Bali," Electrical Technology Machines and Measurements", Vol II, 1st Ed. Pearson,2013
4. Surinder Pal Bali," Electrical Technology Machines and Measurements", Vol.I, 1st Ed. Pearson,2013

OBJECTIVES:

To study the nature and facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds. Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_x, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case

studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, „Introduction to Environmental Engineering and Science“, 2nd edition, Pearson Education, 2004 2. Benny Joseph, „Environmental Science and Engineering“, Tata McGraw Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi R.K. „Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards“, Vol. I and II, Enviro Media.

2. Cunningham W.P.Cooper., T.H. Gorhani, „Environmental Encyclopedia“, Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, „Environmental law“, Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan R, „Environmental Studies - From Crisis to Cure“, Oxford University Press, 2005

OBJECTIVES:

- To impart the Knowledge on the Basic Hydrostatics and Stability Calculations of Ships
- To impart the knowledge of Basic hydrostatics , Geometry of Ships
- To impart the knowledge of Calculations Viz. various coefficients,
- To impart the Knowledge of calculating the Area of wetted Surface , Volume etc.,
- To impart the Knowledge on Transverse Stability and Heel etc.,

UNIT I HYDROSTATICS 6+3

Density, relative density, pressure exerted by a liquid on an immersed plane, centre of pressure, load on immersed plane, load diagram, shearing forces on bulkhead stiffeners– problems.

UNIT II GEOMETRY AND SHIP FORM CALCULATION 6+3

Principle, Laws of floatation, displacement, tonne per cm immersion. Coefficients of form, wetted surface area, similar figures, shearing force and bending moment – problems.

UNIT III CALCULATION OF AREA, VOLUME, FIRST AND SECOND MOMENTS 9+3

Definition and regulation, Simpson's first rule and second rule, application to area and volume, use of intermediate ordinate rule, trapezoidal rule, mean and mid – ordinate rule, application of 5 + 8 – 1 Rule for area, application of Simpson's rule to first and second moments of area – Centre of gravity, effect of addition of mass, effect of movement of mass, effect of suspended mass – problems.

UNIT IV TRANSVERSE, STABILITY AND HEEL 12+3

Stability at small angles of heel, calculation of BM and metacentric height, metacentric diagram, inclining experiment, free surface effect, list and its corrections, stability at small angles, large angles of heel, curves of static stability, moments of Statical stability, dynamic stability, initial stability, angle of loll, stability of a wall sided ship –inclining experiment , problems. IMO recommendations concerning ship stability.

UNIT V LONGITUDINAL STABILITY 12+3

Longitudinal BM – MCT1 cm – Change of trim, change of LCB with change of trim, alteration of trim by adding or removing weights, mean draft, change in mean and end draft due to density and bilging – flooding calculation – floodable length – factor of subdivision –loss of stability due to grounding, partial loss of intact stability, problems- Knowledge of Trim and stress tables, diagrams and stress calculating equipment.

TOTAL: 60 PERIODS

OUTCOMES:

- At the end of this course students are expected to have adequate knowledge in
- Basic hydrostatics , Geometry of Ships
- Calculations Viz. various coefficients,
- Calculating the Area of wetted Surface , Volume etc.,
- Longitudinal Stability and Heel etc.,

TEXT BOOKS:

1. Stokoe, E.A., "Reeds Naval Architecture for Marine Engineers", 4th Edition, Thomas Reed Publications, London, 1982.
2. K.J. Rawson and E.C Tupper "Basic ship theory" volume – I & II – 5th edition butterworth and heine mann, London , 2001.

REFERENCES:

1. Rawson, K.J.Tupper E.C, "Basic Ship theory", 5th Edition, Butter worth – Heinemann, London, 2001.
2. G.N.Hatch, "Creative Naval Architecture", 1st Edition, Thomas Reed Publications, London, 1971.

OBJECTIVES:

- To impart Practical knowledge of fire fighting and control systems on board ship

MARINE FIRE FIGHTING LABORATORY

1. Fire hazard on board ships – inflammability, fire extinguishing use. Control of class A, B & C fires.
2. Fire protection built in ships, extinction systems..
3. System for tankers, statutory requirements for firefighting systems and equipments on different vessels.
4. Firefighting equipment: fire pumps, hydrants , hoses, couplings, nozzles and International
5. Shore connection, Construction, Operation and merits of different types of portable extinguishers.
6. Non-portable and fixed fire extinguishers, installation for ships.
7. Firemen outfit – it's use, care and maintenance. Recharging of portable extinguishers.
8. Fire Control: Action required and practical techniques adopted for extinguishing fires in
9. accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc.,
10. First aid, Fire organization on ships. Fire signal and muster.
11. Fire drill.

REFERENCES:

1. Laboratory Manual
2. D.G Shipping, Fire Fighting Appliances Rules (1969/1990), 3rd edition published by Bhandarakar Publications, Mumbai, 1996.
3. IMO. SOLAS (SAFETY of Life At Sea) 3rd edition, International Maritime Organization, London, UK 2001
4. Leslie Jackson, Reed's General Engineering Knowledge for Marine Engineers Vol 8., 4th Edition, Thomas Reed publication, Great Britain, 1986.
5. M.G. Stavitsky, V.I. Vostryakov, M.F.Kortunov, V.I. Martynenko & V.M. Sidoryok., "Fire Fighting Aboard ships Vol. I & Vol. II, Structural Design and Fire Extinguishing System", 1st edition,. Gulf publishing company, Houston, London, 1983.
6. Frank Rush Brook, "Fire Aboard", 3rd edition, Brown, son & Ferguson Ltd., Glassgow 1988.

HYDRAULIC AND PNEUMATIC CONTROL LABORATORY**Hydraulic Controls**

1. Symbols of Hydraulics
2. Hydraulic Power Pack
3. Double acting Cylinder Operation 4/3 Direct Control valve
4. Pilot operated check valve.
5. Speed control of cylinder with throttle valve.
6. To study the cracking pressure pilot operated check valve.
7. Meter-in-Circuit.
8. Meter - Out-Circuit
9. Bleed of Circuit
10. Direct operated relief valve.
11. Hydraulic motor operation.
12. Speed variation of hydraulic motor.
13. Sequence Circuit.

Pneumatic Controls

14. Symbols in Pneumatics.
15. Single acting cylinder with 3/2 Valve.
16. Quick exhaust Valve.
17. Time Delay circuit.
18. Impulse operation of single acting cylinder
19. Impulse operation of double acting cylinder

Electro Hydraulic and Pneumatic Controls

20. Pressure switch operation pneumatic system
21. Series connection of electro pneumatic Contacts
22. Parallel connection of electro pneumatic Contacts

TOTAL: 45 PERIODS

REFERENCES:

1. Laboratory manual.
2. Shanmuga Sundram, "Hydraulics and Pneumatics Controls", S. Chand group, 2006.

OUTCOMES:

On completion of this laboratory course the students are expected to have skills in

- Operating Different types of fixed and portable type of fire extinguishers
- Fighting different types of fire on board ships
- Refilling all types of fire extinguishers
- Operating different types of firefighting equipments Viz. fire pumps, hydrants and hoses, couplings, nozzles and International shore connection,
- First aid
- Operating Hydraulic and Pneumatic control , systems and components

OBJECTIVES:

- To develop skill to use software to create 3D models and assembly of Marine Machine Elements.
- To give exposure to software tools needed to analyze engineering problems.

List of Exercises**A. Modeling and Assembly**

- Study of capabilities of software for Modeling and Assembly
- Solid flat pulley
- Bearing
- V-Belt Pulley- three groove type
- Socket and Spigot joint
- Flange Coupling
- Universal coupling
- Knuckle joint
- Non-return valves
- Safety Valves

B. Analysis

- Introduction to Finite Element Analysis
- Stress and deflection analysis in beams with different support conditions.
- Stress analysis of a flat plate using Ansys
- Thermal stresses and heat transfer analysis of plates using Ansys
- Thermal stress analysis of cylindrical shells.

TOTAL: 60 PERIODS**OUTCOMES:**

- Upon completion of this course, the students can model and analyse experiments to meet real world system and evaluate the performance.

Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.
6. Learners to form team(s), select a module of external Industrial / Institutional interaction and prepare a short-thesis.

SEMESTER-VIII

OBJECTIVES:

- To impart Knowledge to students about Marine Vehicle Performance while sailing

UNIT I RESISTANCE**9+3**

Fluid flow, Types of resistance, frictional, residuary and total resistance, air, appendage, wave making, eddy and form resistances, model testing, propeller tests in open water, admiralty coefficient, fuel coefficient and consumption, sea trials, Form parameters and resistance – Problems.

UNIT II PROPELLER THEORY**9+3**

Types of propellers, apparent slip, real slip, wake, thrust, relation between powers and relation between mean problem and speed, measurement of pitch, cavitations, built and solid propellers, interaction between the ship and propeller, hull efficiency over all propulsive efficiency – problems.

UNIT III RUDDER THEORY**9+3**

Types of rudders, model experiments and turning trials, area and shape of rudder, position of rudder, bow rudders vs stern rudder, forces on rudder, torque on stock, angle of heel, due to force on rudder and angle of heel when turning – problems.

UNIT IV WAVE THEORY**9+3**

Theory of waves, regular waves, Trochoidal waves, relationship between line of orbit centers and the undisturbed surface, sinusoidal wave, Irregular wave pattern, wave spectra, wave amplitudes, Freak waves, rolling in unresisting media, rolling in resisting media, practical aspects of rolling. Anti rolling devices, forces caused by rolling, pitching, heaving and yawing.

UNIT V SHIP VIBRATION & NOISE**9+3**

Sources of ship vibration – Internal sources and external sources, Hull vibration, Engine vibration, vibration of shafting system, engine noise reduction, Ship response, Hull Girder vibration – Distribution of weights, Ship as a uniform beam, Types of Deformation, Modes and Nodes, Natural Frequency of Hull Girder, Fundamental Mode of Flexural Vibration, Uniform Beam Vibration Equation.

TOTAL: 60 PERIODS**OUTCOMES:**

On Completion of Course the Students are expected to have knowledge about,

- Ships Model Tests and Sea Trials .
- Various types of Propellers and Rudders
- Wave motions and the Ships Vibrations

TEXT BOOKS:

- K.J. Rawson and E.C. Tupper, “Basic Ship Theory” (Vol. II), 5th Edition, Butterworth Heinemann, London, 2001.
- Eric C. Tupper, “Introduction to Naval Architecture”, 3rd Edition, Butter worth – Heinemann, London, 2001.
- EA Stokoe, E.A, “Naval Architecture For Marine Engineers”, Vol.4, Reeds Publications, 2000
- Singiresu S. Rao, “Mechanical Vibrations”, Pearson, 4th Ed., Pearson, 2013
- John Carlton, “Marine Propellers and Propulsion”, Butterworth-Heinemann,2012

REFERENCES:

1. "Principles of Naval Architecture", SNAME Publication, 2000
2. R. Battacharjee. "Dynamics of Marine vehicles "SNAME Publication.
3. Srikant Bhawe, "Mechanical Vibrations", Pearson, 2010
4. Malcolm, J. Crocker, "Handbook of Noise and Vibration Control", John Wiley & Sons, 2007

OBJECTIVES:

- To teach the students about management of ships and impart knowledge on statutory regulations.

UNIT I STRUCTURE OF A SHIPPING COMPANY 9

Structure of a shipping company and functioning of its various departments, ownership of vessels, registration of ships, flags of convenience, IMO identification number.. Maritime Declarations of Health and the requirements of the International Health Regulations.

UNIT II COMMERCIAL SHIPPING PRACTICE 9

Planning sailing schedules and voyage estimates, liner and tramp shipping services, conference systems, chartering and charter parties, ship's papers for arrival and departure, port procedures, role of agents, theory of freight rates, bills of lading, , cargo surveys and note of protests, International labour organization (ILO) and Maritime Labour Convention,2006 COLREG 1972.

UNIT III MARINE INSURANCE 9

Underwriting and loss adjusting principles applied to Marine cargo insurance, hull / machinery policy, particular average, general average, P & I Clubs.

UNIT IV STATUTORY REGULATIONS 9

IMO Conventions, legislations, MARPOL acts and conventions, SOLAS 1974 and amendments, main objectives, overview of all chapters and articles with an emphasis on ISM and ISPS codes,.Maritime security policy,security responsibilities,vessel security assessment, security equipment,threat identification vessel security actions and security administration.Load Lines Convention 1966, Tonnage Convention 1969. Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo,Ballast Water Management.

UNIT V STCW 2010 9

International convention STCW 1978/95 for seafarers and STCW 2010, an overview of all sections, manning of ships, engagement and discharge of ship's crew, ship's articles, Merchant shipping act,Role of Maritime administration(DGS) and its functions: DGS Rules and MS Notices Port state control, PSC mandatory certificate check list, grounds for PSC inspection criteria for detention. Emergency Preparedness (Other than Emergencies in Engine room), drills and excercises,ERM(engine room resourse mamenagent). Energy Audit/Efficiency.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would have learnt about,

- Structure and functioning of a shipping company.
- Planning and estimating of a voyage besides executing the same.
- Marine Insurance as applicable to ship, cargo and crew.
- Statutory regulations applicable to shipping industry.
- Manning of ships, STCW and Port state control.
- Security Training with designated Security Duties as per STCW 2010

TEXT BOOKS:

1. E.F. Stevens & C.S.J. Butterfield “Shipping Practice” 11th Edition, Sterling Book House, Mumbai, 1999.
2. John.M.Downard, “Ship Management Series - Managing Ships”, I Edition, Fairplay Publications, Coulsdon, Surrey - 1990.
3. Capt.Dara E.Driver, “Advanced Shipboard Management”, I Edition, Rumar Publications, Mumbai, 1985.
4. Pinto, “Maritime Law”, Bhandarkar Publications, 1998

REFERENCES:

1. Nilima, M.Chanidiramani, “Carriage of goods by Sea and Multimodal Transport”, 1st Edition, Saptarang Publication, Mumbai, 1996.
2. SOLAS – 1974 - International Maritime Organisation Publications.
3. MARPOL – 1973/78 - International Maritime Organisation Publications.
4. STCW -2010 - International Maritime Organisation Publications.
5. G.Raghuram, “Shipping Management”, 1st Edition, Vasant J.Sheth Memorial Foundation, Delhi, 1992.
6. Gill, J.S., “Manual on Merchant Shipping Act, 1958”, 1st Ed., Bhandarkar Publications, 2003.
7. Industry Guidelines on Best Management Practices Vol. 3 (revised June 2010).
8. Advanced Marine Engineering knowledge Vol. IV Vikram Gokhale & N.Nanda, Engg Enterprisiers June 2011.
9. Advanced Marine Engineering knowledge Vol. V Vikram Gokhale & N.Nanda, Engg Enterprisiers July 2011.

OBJECTIVES:

- To provide knowledge about Automation and Controls fitted in ships.

UNIT I BASICS OF CONTROL SYSTEM 9

Terms used in control systems, open loop and closed loop control systems, comparison of closed and open loop, feedback and feed forward control systems, merits and demerits. Basic understanding of on-off control, proportional plus integral plus derivative controls. Block diagrams for control systems.

UNIT II CONTROL SIGNALS 9

Electronics: Basic application of semi conductors (Diodes as rectifiers) and transistor amplifiers. **Pneumatics:** Basic study, Nozzle-flapper, bellows, Position balance and force balance proportional controllers, relays, three term controller, pneumatic supply system.

Hydraulics: Basic study, open loop and closed loop hydraulic circuits, Hydraulic supply system.

UNIT III PROCESS AND KINETIC CONTROL 9

PROCESS CONTROL: Basic study of process control with examples, elements of control loop, control loop characteristics, control loop response, stability of process control systems, proportional, integral and derivative control actions. Multi-loop control systems such as Cascade control, Ratio control and Split range control.

KINETIC CONTROL: Basic study, servomechanism analysis, significance of step and ramp input. **Position control:** Ward Leonard all electric steering gear and Synchro servo mechanism. **Speed control.:** Speed control of D.C motors, Governors.

UNIT IV TRANSMISSION 9

Pneumatic and electric transmission - suitability for marine use. **Correcting Units-** Diaphragm actuators, Valve positioner, piston actuator, and Electro pneumatic transducers. Electro- hydraulic actuators, Electric actuator control valves.

UNIT V APPLICATION OF CONTROLS ON SHIPS 9

Marine Boiler - Automatic Combustion control, Air - Fuel ratio control, feed water control single, two and three-element type, steam pressure control, fuel oil temperature control, Control in main machinery units for temperature of lubricating oil, jacket cooling water, fuel oil viscosity control. Bridge control of main machinery, requirements for UMS classification.

APPLICATION OF COMPUTERS IN SHIPS: Basic concepts. Analog computers and Simulation. The use of Digital computers.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would have learnt,

- Basics of Control systems.
- Graphical representation of signals.
- Electrical, Electronics, Pneumatic and Hydraulic control systems.
- Design aspects of control systems on board ships.

TEXT BOOKS:

1. D.A. Taylor, "Marine Control Practice", 2nd Edition, Butter worth & Co (Publishers) Ltd., London, 1987.
2. Leslie Jackson, "Instrumentation and Control Systems", 3rd Edition, Thomas Reed Publication Ltd., London, 1992.
3. Bolton, "Control Systems", 1st Ed. Elsevier, Indian reprint 2011(Yesdee Publishing)
4. Smith, "Application Of Automatic Machinery And Alarm Equipment In Ships", Marine Engineering Practice, Vol 1,Part 06, IMarEST, London

REFERENCES:

1. L.F. Adams, "Engineering Instrumentation and Control", 1st Edition, English Language Book Society (ELBS), Hodder, Stoughton, Great Britain, 1984.
2. Peter Harriott, " Process Control", 26th reprint, Tata McGraw Hill Publishing Co. Ltd., 2005
3. Bhattacharya, S.K., "Control Sytem Engineering", 2nd Ed. ,Pearson, 2012
4. Sinclair, "Sensors and Transducers", 3rd Ed.Elsevier, Reprint 2011 (Yesdee Publishing)

OBJECTIVES:

- To impart knowledge to the students in Watch-keeping of Engine Room in various types of ships and to prepare for Class IV MOT Examinations.

UNIT I SAFE WATCH KEEPING 9

Definition of watch, operating principles, requirements of watch keeping, requirements of certification, duties of engineer officers – operation of engine room in general, log book writing – watch keeping under way – watch keeping at port – at unsheltered anchorage, fitness for duty, preparation of Diesel Engines for a long voyage – bad weather precautions, safe working practices – during overhauling at port, and during bad weather, change over from diesel oil to heavy oil and vice versa, entering enclosed or confined spaces, permit to work systems.

Trouble shooting during watch keeping: Emergency measures taken in case of –flooding of engine room, engine room bilge fire, general fire, blackout, Incase of any system failure or breakage of pipe lines, etc., rescue operations of injured persons.

UNIT II TROUBLE SHOOTING IN AUXILIARY MACHINERIES 9

Malfunctioning, partial or total failure of auxiliary machineries – such as, auxiliary engines, purifiers, heat exchangers, air compressors, reefer and air conditioning compressors and systems, boilers and accessories, soot blowing, fresh water generators, hydrophore tanks and systems, all pumps & systems.

Repairs and maintenance of propeller, rudder, drydocking methods, drydocking inspection and repair works.

UNIT III TROUBLE SHOOTING IN MAIN ENGINE 9

Trouble shooting related to various types of marine diesel engines and condition monitoring – causes, effects, remedies and prevention of engine not turning on Air and Fuel, knocking at TDC and BDC, black smoke in funnel, poor compression and combustion, early or advanced injection, turbocharger surging, scavenge fire, Air starting line explosion, crank case explosion, exhaust uptake fire, failure of bottom end bolts.

UNIT IV MAINTENANCE OF ENGINE COMPONENTS 9

Checking of holding down bolts, resin chocking – Tie-rods tensioning, checking and tightening of 2stroke and 4-stroke bottom end bolts.

Inspection and maintenance of crankshaft and cam shaft, dismantle inspection and reassemble of main bearings, cross head bearings & bottom end bearings, connecting rod, piston and piston assembly, stuffing box, cylinder head and all mountings, governor and over speed trip – checking of all clearances, adjustments, effect of improper clearances, prevention and rectification.

Cylinder liner and cylinder lubrication, thrust bearing, running gears inspection, engine alignment, chains drive adjustment and tensioning.

UNIT V TROUBLE SHOOTING AND MAINTENANCE OF ELECTRICAL MACHINERIES 9

Circuit testing, shore supply arrangement, maintenance of circuit breakers, transformers, electrical motors, navigational lights, batteries, starters, electrical equipments, maintenance of switchboard. Maintenance of electrical equipments in oil tankers, LNG / LPG carriers.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students are expected to have learnt,

- STCW standards of training, requirements of officers and ratings.
- Watch-keeping in various ships.
- Prevention, rectification and maintenance with respect to trouble shooting of machineries in the Engine Room.

TEXT BOOKS:

1. Vikram Gokhale & N.Nanda,” Marine Engineering Practice and Ship safety and Environmental protection”, 3rd Edition, Engge Enterprises Mumbai, 2002.
2. Sulzer brothers, “Sumitomo – Sulzer Diesel Engines”, Service Instruction for Sumitomo Sulzer Diesel Engines RND Sumitomo ship building & Machining co., Ltd., Japan.
3. Heinz P. Bloch, Fred K. Geitner, “Machinery Component Maintenance and Repair” 3rd Ed. An imprint of Elsevier, 2010

REFERENCES:

1. IME Manuals and Ship’s Marine Manuals.
2. Manual instruction for MAN Diesel Engine and spare parts, 1968.
3. Instruction Manual for Mitsui – B & W Diesel Engine data, Mitsui Engineering & Ship Building co., Mitsui B & W, 1976.
4. Manual De Maintenance & operation MAN type K.270 120E DMR.
5. Daihatsu Diesel Engine instruction book, Operation & maintenance manual for Daihatsu Diesel Engine Model – DV26, Model 6 PKT – TB-16.

MR16811 PROJECT WORK

OBJECTIVES:

To develop knowledge and skill in designing and fabricating a complete Engineering systems/machines /equipment and do experiments. To enhance the ability of students to analyse and conclude from the experimental data obtained

DETAILS

It is mandatory on the part of the students to do a project and submit a report containing not more than 100 pages. A project should be undertaken by not exceeding 4 students in a batch.

The project can be of working model, PC based training module and theoretical design and analysis. This will be evaluated by both Internal and External Examiners.

The projects will be done in the eighth semester and will be reviewed three times by project guide and HOD. The internal mark of 100, for this will be allotted by the guide.

The thesis work will be evaluated by both Internal and External Examiners for a maximum of 100

OUTCOMES:

On completion of the project work, the students would have the ability to

1. Design and fabricate any machinery/equipment/components
2. Conduct experiments
3. Provide alternative solutions to the malfunctioning/faulty equipments.

REFERENCES:

Books and Manuals on Design,fabrication,control which are relevant for the topic chosen

ELECTIVES

OBJECTIVES:

- To impart theoretical knowledge about mechanism of machinery, balancing and vibration of machines and associated system components and equipment

UNIT I MECHANISMS 9

Introduction – science of mechanisms – terms and definitions kinematic inversion – slider crank chain inversions – four bar chain inversions – Grashoff’s law–Determination of velocities and acceleration in mechanisms – relative motion method (graphical) for mechanisms having turning, sliding and rolling pair – Coriolis acceleration ,turning moment diagram and flywheel – applications in engine, punching presses.

UNIT II THEORY OF GEARING 9

Classification of gears, law of gearing, nomenclature – involutes as a gear tooth profile –lay out of an involute gear, producing gear tooth – interference and undercutting – minimum number of teeth to avoid interference, contact ratio, internal gears – cycloid tooth profiles – comparison of involutes and cycloidal tooth forms, Backlash of Marine Gearing.

UNIT III CONTROL MECHANISMS 9

Governors – gravity controlled and spring controlled – governor characteristics – governor effort and power - Gyroscopes – gyroscopic forces and couple – gyroscopic effects on the movement of air planes and ships.

UNIT IV BALANCING 9

Static and dynamic balancing – balancing of rotating masses – balancing of several masses in different planes – balancing of rotors, balancing machine, unbalance due to reciprocating parts – slider crank mechanism.

UNIT V VIBRATION 9

Periodic motion – non harmonic periodic motion – undamped free vibration – linear and torsion solution – natural frequency of single degree freedom system — Free vibrations with viscous damping of single degree freedom system and solution – logarithmic decrement. Forced vibration of single degree freedom system with damping — vibration isolation and transmissibility System with two degrees of freedom – shaft with two rotors - torsional vibration of major components in Ships - problems.

TOTAL: 45 PERIODS**OUTCOMES:**

At the completion of the course the students are expected to have Knowledge of

- Velocity and acceleration of various kinematic linkages
- Four bar and slider crank mechanisms using relative velocity method
- Turning moment diagrams and flywheel.
- Various parameters of gears.
- Governors and gyroscopes.
- Concept of balancing.

- Free and Forced Vibration of Single degree of freedom systems.

TEXT BOOKS:

1. Rattan S.S, „Theory of Machines“., Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.
2. Gordon John Roy, “Steam Turbines and Gearing Marine Engineering Series”, 1st Ed., Stanford Maritime limited, 1984
3. Sandhu Singh, “ Theory of Machines”, 3rd Ed., Pearson, 2012
4. Rao, J.S., and Dukkippatti, R.V., “Mechanism and machinery theory”, 2nd Edition, New age international, Mumbai, 1992.
5. Srikant Bhawe, “Mechanical Vibrations”, 1st Ed. Pearson, 2010

REFERENCES:

1. Shingley, J.E. & John Joseph Uivker, Jr., “Theory of Machines and Mechanisms”, 2nd Ed., McGraw – Hill International Editions, London, 1981.
2. Ghosh A. and Malik, A.M. “Theory of Mechanisms and machines”, 2nd Ed., Affiliated East – West Press Pvt. Ltd., New Delhi, 1988.
3. Francis. TSE. Ivan E-Morse Rolland T. Hinkle, “Mechanical Vibrations”, 2nd Ed., CBS Publishers and Distributed, India, 1983.
4. Thomson,W.T. and Dahleh,M.D., “Theory Of Vibration with Applications” 5th Ed., Pearson, 2005.
5. Grover.G.K., “Mechanical vibrations”, 7th Edition, Nem Chand & Bros, Roorkee, India, 2001.
6. Thomas Bevan, “Theory of Machines”, 1st Ed. Pearson, 2011.

OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, **Supplier Rating by Analytical Hierarchical Processing(AHP).**

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Industrial case studies on DFMEA and PFMEA.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000/TS16949 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOKS:

1. Dale H. Besterfield, et al., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

UNIT I FUNDAMENTALS OF ROBOT AND APPLICATIONS 6

Robot - Definition - Need for Robots - Robot Anatomy – Robot – configurations- Work Envelope –Wrist - Pitch, Roll, Yaw, Joint Notation scheme, Speed of Motion, Pay Load - Robot Drive Systems – Hydraulic-Pneumatic-Electric- Specifications- Industrial applications.

UNIT II END EFFECTORS AND ROBOT KINEMATICS 9

End Effectors-Grippers-Mechanical Grippers, Gripper Mechanisms, Magnetic Grippers, Vacuum Grippers-inflatable gripper; Internal and External Grippers; Gripper Selection and Design-Tools as End effectors- Gripper force analysis. Forward and Inverse Kinematics of Manipulators with two three degrees of freedom (DOF) in two dimensional space – four degrees of freedom in three dimensional space.

UNIT III SENSORS AND MACHINE VISION 12

Tactile Sensors – Touch Sensor – Force Sensors. Proximity and range sensors. Uses of sensors in robotics. Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, Resolvers, Optical Encoders, pneumatic Position Sensors, Triangulations Principles, Structured Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Compliance Sensors, Slip Sensors, Machine Vision – Functions of machine vision- Sensing and Digitizing Image Data - Imaging devices – Lighting Techniques - Image Processing and Analysis - Image Data Reduction – Segmentation- Feature Extraction -Object Recognition, Applications- Inspection, Identification, Visual Servoing and Navigation.

UNIT IV ROBOT PROGRAMMING AND ARTIFICIAL INTELLIGENCE 9

Lead through Programming, Robot program as a path in space- Motion Interpolation -Robot Programming Languages - Robot language structure -VAL Programming - Motion Commands, Sensor Commands, End Effector commands and simple Programs for pick-and-place task. Artificial intelligence – Goals of artificial intelligence – AI techniques – problem representation and problem solving – search techniques in problem solving.

UNIT V ROBOT CELL DESIGN AND ROBOT ECONOMICS 9

Robot cell layouts - Multiple Robots and machine interference -work cell design and control – Safety in Robotics. Implementation of Robots in Industries-Variou Steps; Economic Analysis of Robots - Pay Back Method - EUAC - Equivalent Uniform Annual Cost method.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.
2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

REFERENCES:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.

OBJECTIVES:

- To impart knowledge of Marine heat engine plants and their latest developments

UNIT I COMPLEX HEAT ENGINE PLANTS 9

Combined Steam Turbine and Diesel Engine Cycles. Combined steam Turbine and Gas Turbine cycles. Combined Gas Turbine and Diesel Engine cycles. Methods of improving the overall thermal efficiency of the entire plant.

UNIT II COMBUSTION OF LIQUID AND GASEOUS FUELS IN DIESEL ENGINES 9

Combustion of liquid fuels, atomization, mixing, pressure - crank angle diagram, types of combustion chambers used in diesel engines, Combustion of gaseous fuels. Introduction to simulation of engine processes.

UNIT III TURBO BLOWERS AND TURBO COMPRESSORS 9

Compressor and Turbine characteristics. Matching compressor and turbine. Stalling of compressors. Variable Geometry turbo chargers and twin turbo chargers

UNIT IV GAS TURBINES FOR MARINE PROPULSION 9

Advantages and disadvantages of gas turbine engines when used for Marine propulsion. Types of Gas turbine engines. Components and working of Gas turbine engines.

UNIT V RECENT TRENDS 9

Diesel Engines using LNG vapour camless intelligent Engines , CRDI, various methods of controlling NOx and SOx – Exhaust gas recirculation – water injection - selective cat reduction – variable injection timing.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to have knowledge on

- Various marine heat engine plants and methods of improving their efficiency
- Combustion of liquid and gaseous fuels in diesel engines
- Turbo blowers and turbo compressors and variable geometry turbochargers
- Types and working of Gas turbines used for marine propulsion
- Latest developments in engine plants and emission reduction technologies

TEXT BOOKS:

1. D.K. Sanyal, “Principle & Practice of Marine Diesel Engines”, 4th Edition, Bhandarkar Publication, Mumbai, 2010
2. Deven Aranha, “Marine Diesel Engines” Shroff Publishers And Distributors Pvt. Ltd, Mumbai, 2013

REFERENCES:

1. Wood yard, Doug, “Pounder’s Marine Diesel Engines and Gas turbines”, 9th Edition, Butter Worth Heinemann Publishing, London, 2014.
2. Journal papers on Marine Diesel engines
3. Websites of Engine manufacturers and turbocharger manufacturers

OUTCOMES:

At the end of the course the students would have acquired the knowledge of

- Precautions required for oil tanker operations and Prevention of oil pollution standards
- MARPOL 73/78 requirements and Safe Working Practices.
- Life Saving and Survival at Sea techniques.
- IMO, its conventions and statutory certificates of ships.
- To understand Personnel Management , Training and Emergency drills of ships

TEXT BOOKS:

1. STCW – 1995 Handbook

REFERENCES:

- 1 Bhandarkar V.K.“M & M Notices”, 1st Edition, Bhandarkar Publishers, Mumbai,1998.
.
- 2 International Maritime Organization, “SOLAS consolidated Edition 1997”, 2nd Edition,
Sterling Book House, Mumbai, 1997.
.
- 3 International Maritime Organization, “MARPOL 73/78 consolidated edition 1997”, 2nd
Edition, Sterling Book House, Mumbai, 1997.
.
- 4 R. H. B. Sturt, “The Collision Regulations”, 2nd Edition, Lloyd’s of London Press
Ltd., London, 1984.
.

OBJECTIVES:

- To provide knowledge and understanding of advanced Fire Prevention and Control to the students.

UNIT I FIRE PROTECTION BUILT IN SHIPS 9

Requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire test, escape means, electrical installations, ventilation system, fire doors & fire zones.

UNIT II DETECTION AND SAFETY SYSTEMS 9

Fire safety precautions on cargo ships, tankers and passenger ships during working. Types of detectors, selection of fire detectors, testing of detectors. Fire alarm system.

UNIT III FIRE FIGHTING EQUIPMENT 9

Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable extinguishers, and fixed fire installations on ships, water-mist fire suppression system. Advantages of various fire extinguishing agents. Control of class A, B, C & class D fires,

UNIT IV FIRE CONTROL 9

Fire fighting in port and dry dock. Procedure for reentry after putting off fire, Rescue operations from affected compartments. First aid, shipboard organization for fire and emergencies. Fire signal and muster. Fire drill. Leadership and duties, Fire control plan, human behavior.

UNIT V SAFETY MEASURES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will have learnt about,

- Fire protection, Detection and Safety systems in ships.
- Construction, Operation and Maintenance of Fixed and portable Fire Extinguishers in ships.
- Fire prevention and control in oil tankers, LPG / LNG carriers, Chemical tankers, oil rigs, supply vessels
- Operation of Fire fighting ships

TEXT BOOKS:

1. Frank Rush Brook, "Fire Aboard", 3rd Edition, Brown, son & Ferguson Ltd., Glasgow 1988.
2. Victory, "Fire Fighting Equipment And Its Use In Ships", Marine Engineering Practice, Vol 1, Part 05, IMarEST, London
3. M.G. Stavitsky, V.I. Vostryakov, M.F.Kortunov, V.I. Martynenko & V.M. Sidoryok., "Fire Fighting Aboard ships Vol. I & Vol. II, Structural Design and Fire Extinguishing System", 1st Ed. Gulf publishing company, Houston, London, 1983.

REFERENCES:

1. D.G. Shipping, Fire Fighting Appliances Rules (1969/1990), 3rd edition published by Bhandarkar Publications, Mumbai, 1996
2. IMO, SOLAS (Safety of Life At Sea) 3rd Edition, International Maritime Organization, London, UK, 2001.
3. Leslie Jackson, Reed's General Engineering Knowledge for Marine Engineers Vol.8, 4th Edition, Thomas Reed publication, Great Britain, 1986.
4. Gupta, R.S., "A Hand Book of Fire Technology", 2nd Ed., University Press, 2011

OBJECTIVES:

- To impart knowledge to the students about special duty ships operation and classification society regulations.

UNIT I INTRODUCTION 9

Need for special duty vessels with reference to development of trade and necessities of the trade. Operation of Bulk carriers – Bulk Grain and ore etc., – Coal Carriers – Oil, Products carriers & Gas Carriers – Container vessels.

UNIT II OIL TANKER CARGO OPERATIONS 9

Pipeline systems – Ring main – Direct Line – Combined – Free flow system – Stripping lines. Lining up pipe lines and cargo operations – loading & discharging –ballasting – precautions – ship / shore check list for safety– sources of ignition on – static electricity – precautions to prevent ignition due to static electricity cargo operations when not secured alongside – procedure if oil spill occurs – oil record books.

UNIT III OIL TANKERS ROUTINE OPERATIONS 9

Inert Gas system – principle – components of system, plant and distribution system – uses of inert gas during tanker operating cycle. Tank washing: Procedure – portable and fixed machines – tank washing with water –washing atmospheres – crude oil washing (COW) – advantages and disadvantages of COW – operating and safety procedures – gas freeing – pressure vacuum values – “Load on Top” system (LOT) regulations and operation – Segregated Ballast Tanks (SBT).

UNIT IV INTRINSICALLY DANGEROUS CARGOS 9

Dangerous goods – loaded in bulk – packaging – IMDG code – emergency procedures – „MS & M“ notices – general fire precautions, during loading / discharging, - fire fighting and detection system. Liquefied gas cargoes – regulations types of cargo and carriers – LPG and LNG – cargo handling equipments tank monitors, controls – operational procedures for loading and discharging of LPG/LNG cargoes – chemical cargoes regulations, operations – tank material and coatings – tank washing – cargo record book – equipment items precautions to be observed during cargo operations in port – fire protection – personnel protection.

UNIT V RULES AND REGULATIONS 9

Classification societies for hull, equipment and machineries of Cargo ships and oil tankers – requirements of various types of surveys and certification of Merchant Ships.

TOTAL: 45 PERIODS

OUTCOMES:

After the completion of the course the students will have learnt

- History of trade of special duty vessels.
- Cargo Operations of Oil tankers.
- About Inert Gas Systems and Tank Washing Operations of Tankers.
- Cargo Operations of Chemical tankers, LPG / LNG vessels.
- About rules of classification societies for Cargo Ships and Tankers.

TEXT BOOKS:

1. Lavery, "Ship board operation", 2nd Edition, Butter Worth- Heinemann, London, 1990.
2. V.K. Bhandarkar, "MS & M Notices to Mariners", 1st Edition, Bhandarkar Publications, Mumbai, 1998.
3. D.J. Eyres, "Ship Construction", 4th Edition, Butter worth – Heinemann, Oxford, 1994.

REFERENCES:

1. Indian Register of Shipping Part1 to Part7, "Rules and Regulations for the construction and classification of steel ships", 1st Edition, Indian Register of Shipping, Mumbai, 1999.
2. International of Maritime Organisation, "SOLAS consolidated Edition 1997", 2nd Edition, Sterling Book House, Mumbai, 1997.

OBJECTIVES:

- At the end of the course, the students are expected to identify the new methods and technologies for effective utilization of renewable and other non-conventional energy sources.

UNIT I SOLAR ENERGY 10

Introduction – Renewable vs non renewable sources of energy, Global, National and State energy scenario; Solar Radiation – Terminology, Measurements of Solar Radiation; Solar collectors - Flat Plate and Concentrating Collectors; Solar Applications - Direct Thermal Applications, Solar thermal Power Generation; Solar Cells - Fundamentals of Solar Photo Voltaic Cells, Classification, Characteristics, Power Generation & Applications; National Solar energy scenario – potential, installed, economics and environmental aspects.

UNIT II WIND ENERGY 8

Wind Energy – Wind data, site selection, power in wind, Betz criterion; Wind energy conversion – Principle, evolution of wind mills, Vertical and Horizontal axis wind mills, Construction and working, Performance, Safety and failure; National Wind energy scenario – potential, installed, economics and environmental aspects.

UNIT III BIO -ENERGY 9

Bioenergy – Introduction, energy crops, Biomass, Municipal & Industrial waste stream, ; Conversion techniques – Physical means, direct combustion, Thermo chemical and biochemical methods, Biomass gasifiers, Digesters, Ethanol production, Bio diesel; Cogeneration, Biomass Applications; National Bioenergy scenario – potential, economics and environmental aspects.

UNIT IV OTHER RENEWABLE ENERGY SOURCES 9

Tidal energy, Wave Energy, Ocean Thermal energy - Open and Closed OTEC Cycles, Geothermal Energy, Small Hydro energy and conversion techniques; National scenario – potential, economics and environmental aspects.

UNIT V OTHER NON-CONVENTIONAL ENERGY TECHNOLOGY 9

Hydrogen – Production & Storage; Fuel Cell – types, construction and working; Magento Hydro Dynamics, Thermo-electric and Thermionic power conversion.

TOTAL: 45 PERIODS**OUTCOMES:**

- Upon completion of this course, the students can be able to identify the method and technologies for effective utilization of renewable and other non-conventional energy sources.

TEXT BOOKS:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

REFERENCES:

1. Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.
3. Tiwari. G.N., "Solar Energy –Fundamentals Design, Modeling & Applications", Narosa Publishing House, New Delhi, 2002.
4. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985
6. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010
7. Chetan Singh Solanki, "Solar Photovoltaics, Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi

OBJECTIVES:

- To impart knowledge on the design features and utility of Double Hull Tankers
- Advantages and superiority of double hull tankers
- Design Consideration and Storage of Oil Space
- Structural design of double hull and oil handling devices
- Economic Aspect of Double Hull tankers

UNIT I INTRODUCTION 9

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.

UNIT II DESIGN 9

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

UNIT III STRUCTURAL ANALYSIS 9

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.

UNIT IV CARGO HANDLING SYSTEM 9

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 pipelines, easy maintenance, inspection and cleaning, elimination of explosion risks.

UNIT V ECONOMICAL OPERATIONS 9

Economical aspects, fast loading discharging or oil cargo, quicker cleaning, ballasting and de-ballasting, larger number of trips per year.

TOTAL: 45 PERIODS**OUTCOMES:**

At the end of the course the students would have acquired the knowledge of

- Advantages and superiority of double hull tankers Present
- Design Consideration and Storage of Oil Space
- Structural design of double hull and oil handling devices
- Economic Aspect of Double Hull tankers

TEXT BOOKS:

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

REFERENCES:

1. D.J. Eyres, "Ship Construction", 7th Edition, Butter worth – Heinemann, Oxford, 1994
2. E.A. Stokoe, "Reed's Ship Construction for Marine Engineers", 5th Edition, Thomas Reed Publication, London, 2000.

OBJECTIVES:

- To impart knowledge on the Ship Recycling
- Method of preparation and breaking of the Ships
- Hazards involved in while breaking the ships Method of controlling the same
- Types of Recycling and designing the ships Regulations in force for Recycling
- Ship Breaking Yards in INDIA

UNIT I SHIP LIFE CYCLE STAGES – INTRODUCTION 9

Various stages of life cycle of ships, Operations in life stages and effective management of the stages., Importance of ship recycling in life cycle stage management Definition of Ship Recycling - Relevance of Ship Recycling - Concept of sustainable development of the world, Factors contributing to the sustainable development , Role of maritime industrial sector , Statistics of global shipping and ship building

UNIT II SHIP BREAKING SAFE PRACTICES 9

Introduction on ship breaking, ‘Afloat method’, Dry dock method, type of components to be removed. Towing – Beaching – Preparation of diagram combustible and non- combustible - re usable materials and components, recovering metals, which are mixed with non-metal – metal cutting and scraping. Objective – definition of enclosed space – assessment of risk – authorization – authorization of entry – precautions – testing of atmosphere known unsafe space – additional precautions – hazardous cargo – fumigation – example of an enclosed space entry permit – potentially hazardous materials – hazardous wastes and substances.

UNIT III SHIP RECYCLING DOWNSTREAM 9

Recycled content, recycling plan, pollution prevention procedure for existing ships – Green passport – minimizing reducing waste generation, for new ships – minimizing hazardous substance, designing recyclable ships – minimizing waste generation.

UNIT IV REGULATION ON RECYCLING 9

MEPC 53, MEPC 54, MEPC 55, Basel convention, Role of Flag State, Port State recycling state – ILO, London Convention 1972/ 1996 Protocol, Shipping Industry. Ship recycling industry, interested stakeholder, and operational safety hazard conventions, recommended code of practice.

UNIT V SHIP BREAKING INDUSTRY 9

Ship breaking industry in India, present scenario, Gujarat Maritime Board, Gujarat Enviro protection and Infrastructure Ltd. Growth of Ship breaking industry – Alang Ship Breaking Yard – Role of pollution control board – Alang –Sosiya Ship breaking yard, Valanar Ship breaking yard. Hazards associated with ship breaking metallurgical & engineering consultant (India) finding.

TOTAL: 45 PERIODS**OUTCOMES:**

At the end of the course the students would have acquired the knowledge of

- Method of preparation and breaking of the Ships
- Knowledge about the Ship recycling technology
- Hazards involved in while breaking the ships Method of controlling the same
- Types of Recycling and designing the ships Regulations in force for Recycling
- Detailed layouts and breaking methods of Ship Breaking Yards in INDIA

TEXT BOOKS:

1. A guide for ship scrappers, tips for regulatory compliance, United States Environmental Protection Agency, Summer 2000.
2. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 8 October, 2005. 51
3. Rules and regulations in ship recycling Rule of various international and national agencies , IMO, UNEP (BASEL CONVENTION), EPACUSA), GMB (GUJARATH), ILO, DNV , Statutory Certificatess for Ship Recycling , Green passport and Green ship Role of NGOs (Green Peace foundation ,Ban Asbestos Network) Inventory list Safety matters/ requirements Chances of Environmental pollution ,effect on life / organisms at sea.

REFERENCES:

1. Purnen Misra, Anjana Mukharjee, Ship Recycling , A Hand book for mariners, Narosa Publicating, House, New Delhi, 2009

OBJECTIVES:

- To impart knowledge on the Type of corrosion and how this is being controlled in marine environment

UNIT I INTRODUCTION**11**

Atoms & Ions, PH value, Electrochemical corrosion, Mechanism of corrosion- Factors influencing corrosion-Electrochemical series, Galvanic series-Galvanic cell- chemical corrosion – Electrochemical corrosion–Direct chemical attack– Electro-Chemical attack – reason – Remedial measures. Various types of corrosion.

UNIT II HULL PLATE PREPARATION**9**

Plate preparation during building and repair periods -Atmospheric corrosion Mill scale – flame cleaning – Acid Pickling – Blast cleaning – causes of paint failure – shipboard preparations for painting – power wire brushing – power discing – air hammer – high pressure water blasting – sand blasting shot blasting.

UNIT III MODERN PAINT TYPES**9**

Basic composition of paint Alkyd – bitumen or pitch – chlorinated rubber – coaltar epoxy – Epoxy – oleoresinous – phenolic – polyurethane – primers – vinyl – self polishing copolymers – shipboard paint systems – underwater AF paints – boot top anti-corrosive paints – super structure paints.

UNIT IV CORROSION IN BOILER**7**

Effect of salts & Grease in feed water. Effect of corrosion while boiler is not in service – preservation to avoid corrosion. **CORROSION IN MARINE DIESEL ENGINES:** Corrosive wear of cylinder liners – Reasons and remedies – corrosion of Main Engine Jacket cooling spaces – Reasons and remedies – Corrosion in bearings.

UNIT V CORROSION AND ITS PREVENTION**9**

Anodic & cathodic protection. Anodic control protection- Forms of metallic coatings – anodizing – phosphating. Cathodic protection- sacrificial anodes, Impressed Current Cathodic protection. Design faults causing corrosion.

TOTAL: 45 PERIODS**OUTCOMES:**

1. At the end of the course the students will be able to understand the causes of corrosion and the methods adapted to prevent that in the marine industry from design onwards
2. At the end of the course the students will be able to demonstrate the various methods of preventing corrosion during the construction and operation of ships in the shipyards and during normal operation
3. At the end of the course the students can distinguish different types of paints available in the industry. They can appreciate different types of painting systems adapted in the marine industry
4. At the end of the course the students will be able to understand the corrosion mechanism in boilers and marine diesel engine cooling systems. Students shall have complete knowledge of preventive measures taken in the systems.

TEXT BOOKS:

1. Corrosion engineering 3rd edition Mars G by McGraw Hill 2010
- 2.. Corrosion, prevention and control Raj Baldev, Mudali, Kamatchi Narose publishing house 2009

REFERENCES:

1. Corrosion science and technology Mechanism , migration and monitoring by Mudali, Kamachi Narosa publishing house 2008
2. Introduction to metallic corrosion and its prevention Raj Narayan Oxford & IBM publishing
3. Marine engineering practice vol 2 Part II Corrosion for marine & offshore engineers 1st edition Rowlands JC

OBJECTIVES:

To impart knowledge on the Propeller, Geometry, Design, Performance and defects.

UNIT I PROPULSION SYSTEMS AND PROPELLER GEOMETRY 9

Fixed pitch propellers, Ducted propellers, Podded and azimuthing propulsors, Contrarotating propellers, Overlapping propellers, Tandem propellers, Controllable pitch propellers, Waterjet propulsion, Cycloidal propellers paddle wheels, Magneto hydro dynamic propulsion, Super conducting motors for marine propulsion.

Frames of references, Propeller reference lines, Pitch, Rake and skew, Propeller outlines and area, Propeller drawing methods Section geometry and definition, Blade thickness distribution and thickness fraction, Blade interference limits for controllable pitch propellers, Controllable pitch propeller off-design section geometry, Miscellaneous conventional propeller geometry terminology.

UNIT II PROPELLER MATERIALS & PROPELLER ENVIRONMENT 9

Density of water, Salinity, Water temperature, Viscosity, Vapour pressure, Dissolved gases in sea water, Surface tension, Weather, Silt and marine organisms. General and specific properties of Propeller materials, Mechanical properties and Test procedures.

UNIT III PROPELLER THEORY, CAVITATION & NOISE 9

Momentum theory – Ranking, R.E. Froude, Blade element theory – W. Froude, Propeller Theoretical development, Burrill's analysis procedure, Lerbs analysis method, Eckhardt and Morgan's design method, Lifting surface correction factors – Morgan, Lifting surface models, Lifting-line – lifting-surface hybrid models, Vortex lattice methods, Boundary element methods, Methods for specialist propulsors, Computational fluid dynamics methods. The basic physics of cavitation, Types of cavitation experienced by propellers, Cavitation considerations in design, Cavitation inception, Cavitation-induced damage, Cavitation testing of propellers, Analysis of measured pressure data from a cavitating propeller, Propeller – rudder interaction. Physics of underwater sound, Nature of propeller noise, Noise scaling relationships, Noise prediction and control, Transverse propulsion unit noise, Measurement of radiated noise.

UNIT IV PROPELLER-SHIP INTERACTION, SHIP RESISTANCE AND PROPULSION 9

Bearing forces, Hydrodynamic interaction, Froude's analysis procedure, Components of calm water resistance, Methods of resistance evaluation, Propulsive coefficients, The influence of rough water, Restricted water effects, High-speed hull form resistance, Air resistance.

UNIT V SERVICE PERFORMANCE, TOLERANCE AND MAINTENANCE 9

Effects of weather, Hull roughness and fouling, Hull drag reduction, Propeller roughness and fouling, Generalized equations for the roughness-induced power penalties in ship operation, Monitoring of ship performance. Full-scale trials: Power absorption measurements, Bollard pull trials, Propeller-induced hull surface pressure measurements, Cavitation observations

Propeller tolerances, Propeller inspection, Causes of propeller damage, Propeller repair, Welding and the extent of weld repairs, stress relief.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course the students are expected to have

- Knowledge on the Propeller, Geometry, Design, Performance and defects
- Awareness of various types of Propulsion systems, Propeller geometry
- Awareness of propeller theory , propeller operating environment
- Gained knowledge of interaction between hull and the propeller
- Knowledge of performance and maintenance of propellers

TEXT BOOKS:

1. John Carlton, Marine Propellers and Propulsion, (2nd Edition) published by Elsevier limited, 2007.

MR16011 SUPERCHARGING AND SCAVENGING IN MARINE DIESEL ENGINES L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge of supercharging and scavenging in Marine Diesel Engines

UNIT I Principles of Supercharging 9

Objectives - Effects on engine performance - Difference between supercharging and turbocharging – Thermodynamic and design considerations - Advantages and limitations.

UNIT II Principles of Scavenging 9

Importance of proper scavenging, scavenging efficiency, consequences of poor scavenging, scavenging methods in two stroke and four stroke marine diesel engines, induction swirl of air, scavenge space maintenance, scavenge fire causes and prevention

UNIT III Charging methods for large two stroke diesel engine 9

Peculiarities of large two stroke diesel engine, Types of turbocharger - construction and working – Surging causes and prevention – turbocharger cooling and lubrication – turbocharger maintenance – Auxiliary blower

UNIT IV Charging methods for four stroke diesel engine 9

Methods turbocharging of four stroke engines and their merits & demerits, Types of turbocharger for four stroke engines – construction and working, turbocharger maintenance, cooling and lubrication.

UNIT V Latest developments in Turbochargers 9

Role of turbochargers in engine emission control and engine performance, Two stage turbochargers, Variable Geometry Turbochargers, Hybrid turbochargers

TOTAL: 45 PERIODS

OUTCOMES:

on completion of this course the Students are expected to have

- concept of supercharging and turbocharging
- knowledge on scavenging and its importance
- understood charging methods for large two stroke diesel engines
- gained knowledge on charging methods for four stroke diesel engines
- awareness on the latest developments in turbochargers

TEXT BOOKS:

- 1.. D.K. Sanyal, “Principle & Practice of Marine Diesel Engines”, 4th Edition, Bhandarkar Publication, Mumbai, 2010
2. Deven Aranha, “Marine Diesel Engines”Shroff Publishers And Distributors Pvt. Ltd, Mumbai, 2013

REFERENCES:

1. Wood yard, Doug, “Pounder’s Marine Diesel Engines and Gas turbines”, 9th Edition, Butter Worth Heinemann Publishing, London, 2014.
2. Marine Diesel Engine and turbocharger manufacturer’s websites
3. Journal papers on turbochargers

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Stress and emotional management.

UNIT II ENGINEERING ETHICS 9

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics –Global warming- Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi,2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

OBJECTIVES:

- To make the students learn about overhauling and commissioning of marine engines and auxiliary machineries including electrical equipments.

UNIT I Main engine overhauling: 9

Safe working practices to be followed-Unit de-carbonising- Removal, inspection and re-fitting of Cylinder liner, Cross head bearing, bottom end bearing, Connecting rod and Main bearing -removal, inspection and re-fitting. Fuel injection pump over hauling (B&W and sulzer engines), timing checking adjusting and priming. Chain tensioning and renewal . Over hauling of Staring air valve, Fuel injector overhauling and testing, relief valve and Exhaust valve Turbochargers overhauling. Crank case and scavenge space inspection . Starting and stopping procedures of main engine prior to departure and arrival port, pre-hating of main engines. Action to be taken in the event of scavenge fire and crank case mist alarm.

UNIT II Auxiliary engines over hauling. 9

Unit decarbonising, Renewal of liners, checking crank pin and connecting rod for ovality, Bearings inspection and renewal, Tightening procedure of bottom end bolts, overhauling of fuel injection pumps and timing setting and adjustments, overhauling of cylinder heads and fittings including valves and valve gears, overhauling of air distributors, testing of safety cut-outs, tappet Clearance adjustments, crank case inspection and re-commissioning of auxiliary engines after complete overhauling. Safe working practices to be followed.

UNIT III Auxiliary machineries 9

Air compressors. Operating procedures, over hauling and commissioning. Pumps: Operating procedures for all types of pumps, over hauling and commissioning. Heat exchangers: Cleaning and over hauling procedures of plate type and tubular type heat exchangers. Refrigeration and air conditioning-Operating and charging procedure and routine maintenance.

UNIT IV Auxiliary machineries (continued) 9

Purifiers: Starting, stopping and de-slugging procedure, Method of opening, cleaning and boxing up of bowl assembly. Dismantling and assembly of horizontal and vertical shaft assembly. Action to be taken in the event of abnormal running- testing of alarms. Steering Testing and operating emergency steering prior to departure from port. sewage plant, Incinerator, fresh water generator. Oily water separator, bilge and ballast systems, fuel oil bunkering and transfer system: Operating procedure.

UNIT V Electrical machineries 9

Safe working practices to be followed, methods of synchronizing generators, switch board safety devices, procedure for testing open circuit, short circuit and earth faults, insulation testing procedure-overhauling procedure for alternators motors and circuit breakers, Main switch board cleaning procedure, method of giving shore connection during docking. Maintenance of batteries.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will have knowledge of

- Over hauling of main engines.
- Over hauling of auxiliary engines.
- Over hauling and operating procedures of auxiliary machineries.
- Over hauling of electrical machineries

TEXT BOOKS:

1. Marine Engineering Practice by Vikram Gokhale, N.Nanda

REFERENCES:

1. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai, 1998.
2. H.D. McGeorge, "Marine Auxillary Machinery", 7th Edition, Butter worth, London,2001.
3. John Lamb, "Marine Diesel Engines", 8th Edition, Butter worth – Heinemann, London, 1990.
4. C.C Pounder, "Marine Diesel Engines", 6th Edition, Butter worth – Heinemann, Scotland, 1995.
5. MARINE ELECTRICAL TECHNOLOGY byElstan.A.Fernandez,Shroff publications 4 Distributer Pvt.Ltd.,