SRI VENKATESWARA COLLEGE OF ENGINEERING
(An Autonomous Institution, Affiliated to Anna University, Chennai)
SRIPERUMBUDUR TK - 602 117
REGULATION – 2018
B.E. - MARINE ENGINEERING
Choice Based Credit System
I-VIII Semesters CURRICULUM

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

SEMESTER I

SNO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	HS18151	Communicative English ***(Common to all branches)***	HS	3	3	0	0	3	Nil	F
2.	MA18152	Mathematics for Marine Engineering- I	BS	4	3	1	0	4	Nil	F
3.	PH18151	Engineering Physics ***(Common to all branches)***	BS	3	3	0	0	3	Nil	F
4.	CY18152	Chemistry for Marine Engineering	BS	3	3	0	0	3	Nil	F
5.	EE18151	Basic Electrical and Electronics Engineering *(Common to* ***AE,BT,CE,CS,IT,MR & ME)***	ES	3	3	0	0	3	Nil	F
6.	GE18151	Engineering Drawing ***(Common to all branches)***	ES	5	3	0	2	4	Nil	F
PRACTICAL										
7.	PC18161	Physics and Chemistry Laboratory ***(Common to all branches)***	BS	2	0	0	2	1	Nil	F
8.	GE18161	Engineering Practices Laboratory ***(Common to all branches)***	ES	3	0	0	3	1.5	Nil	F
TOTAL				**26**	**18**	**1**	**7**	**22.5**		

SEMESTER II

SNO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	HS18251	Technical English ***(Common to all branches)***	HS	3	3	0	0	3	Nil	F
2.	MA18252	Mathematics for Marine Engineering -II	BS	4	3	1	0	4	Nil	F
3.	IT18251	Computer Applications	ES	3	3	0	0	3	Nil	F
4.	GE18251	Environmental Science and Engineering ***(Common to all branches)***	HS	3	3	0	0	3	Nil	F
5.	ME18201	Engineering Mechanics ***(Common to MR & ME)***	ES	3	3	0	0	3	Nil	F
6.	MR18201	Marine Engineering Thermodynamics	ES	3	3	0	0	3	Nil	F
7.	MR18202	Basics of Marine Engineering	PC	3	3	0	0	3	Nil	F
PRACTICAL										
8.	GE18261	Computer Aided Drafting Laboratory ***(Common to AE,CE & MR)***	ES	3	0	0	3	1.5	Nil	F
9.	MR18211	Workshop Fitting	ES	3	0	0	4	2	Nil	F
TOTAL				**28**	**21**	**1**	**7**	**25.5**		

***Curriculum for I and II semester along with the syllabus for I and II semester Subjects were passed in Board of Studies meeting held on 17.07.2018 and Approved in 6th Academic Council Meeting held on 20.07.2018*

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	MR18301	Marine Hydraulics and Fluid Machinery	**PC**	3	3	0	0	3	Nil	F
2.	MR18302	Marine Manufacturing Technology	**PC**	3	3	0	0	3	Nil	F
3.	MR18303	Marine Machinery Drawing	**PC**	4	3	1	0	4	Nil	F
4.	EE18351	Marine Electrical Machines – I	**PC**	5	2	0	3	4	Nil	F
5.	MR18305	Seamanship, Elementary Navigation and Survival at Sea	**PC**	3	3	0	0	3	Nil	F
6.	MR18306	Marine Refrigeration and Air Conditioning	**PC**	3	3	0	0	3	Nil	F
7.	MR18307	Material Science and Engineering	**ES**	3	3	0	0	3	Nil	F
PRACTICAL										
8.	MR18311	Marine Hydraulics and Fluid Machinery Laboratory	**PC**	4	0	0	4	2	Nil	F
9.	MR18312	Welding Techniques, Lathe and Special Machine Shop	**PC**	6	0	0	6	3	Nil	F
TOTAL				**34**	**20**	**1**	**13**	**28**	-	-

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	MA18451	Computational Methods ***(Common to CH, CE, EE, MR & ME)***	**BS**	3	3	0	0	3	Nil	F
2.	MR18401	Strength of Materials for Marine Engineering	**PC**	4	3	1	0	4	ME18201	F
3.	MR18402	Marine Diesel Engines – I	**PC**	4	3	1	0	4	Nil	F
4.	MR18403	Marine Auxiliary Machinery – I	**PC**	3	3	0	0	3	Nil	F
5.	MR18404	Marine Boilers, Steam Engines and Turbines	**PC**	3	3	0	0	3	Nil	M
6.	EC18451	Marine Electronics	**PC**	3	3	0	0	3	Nil	F
7.	--	**Professional Elective -I**	**PE**	3	3	0	0	3	Nil	F
PRACTICAL										
8.	MR18411	Strength of Materials and Applied Mechanics Laboratory	**PC**	4	0	0	4	2	Nil	F
9.	MR18412	Thermal Engineering and Boiler Chemistry Laboratory	**PC**	4	0	0	4	2	Nil	F
TOTAL				**31**	**21**	**2**	**8**	**27**	-	-

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	MR18501	Ship Construction	**PC**	3	3	0	0	3	Nil	F
2.	MR18502	Marine Diesel Engines - II	**PC**	3	3	0	0	3	Nil	F
3.	MR18503	Marine Auxiliary Machinery – II	**PC**	3	3	0	0	3	Nil	F
4.	EE18551	Marine Electrical Machines – II	**PC**	4	3	1	0	4	EE18351	F
5.	MR18505	Engineering Metrology, Instrumentation and Automation	**PC**	3	3	0	0	3	Nil	M
6.	--	**Open Elective - I**	**OE**	3	3	0	0	3	Nil	F
PRACTICAL										
7	MR18511	Marine Propulsion and Auxiliary Machineries Overhauling Laboratory	**PC**	4	0	0	4	2	Nil	F
8	MR18512	Mechanical Measurement and Instrumentation Laboratory	**PC**	4	0	0	4	2	Nil	F
9	EE18561	Electrical, Electronics and Micro Controller Laboratory	**PC**	4	0	0	4	2	Nil	F
TOTAL				**31**	**18**	**1**	**12**	**25**	-	-

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
1.	MR18611	Marine Workshop Practices and Afloat Training	**EEC**	48	48			12	Nil	F

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	MR18701	Marine Systems and Machinery Design	**PC**	4	2	2	0	4	Nil	M
2.	EE18751	Marine Electrical Technology	**PC**	4	3	1	0	4	EE18551	F
3.	MR18703	Ship's Fire Prevention and Control	**PC**	3	3	0	0	3	Nil	M
4.	MR18704	Stability of Ships	**PC**	4	3	1	0	4	Nil	F
5.	--	**Professional Elective - II**	**PE**	3	3	0	0	3	Nil	F
6.	--	**Open Elective - II**	**OE**	3	3	0	0	3	Nil	F
PRACTICAL										
7.	MR18711	Fire Fighting, Controls and Simulator Laboratory	**PC**	4	0	0	4	2	Nil	F
8.	HS18561	Interview and Career Skills Laboratory ***(Common to all branches except BT and EE)***	**EEC**	3	0	0	3	2	Nil	F
TOTAL				**28**	**17**	**4**	**7**	**25**	-	-

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C	Prerequisites	Fixed/Movable
THEORY										
1.	MR18801	Marine Vehicles Performance	**PC**	4	3	1	0	4	MR18704	F
2.	MR18802	Marine Corrosion and Prevention	**PC**	3	3	0	0	3	Nil	M
3.	MR18803	Safety Precautions and Watch Keeping	**PC**	3	3	0	0	3	Nil	F
4.	--	**Professional Elective - III**	**PE**	3	3	0	0	3	Nil	F
5.	--	**Professional Elective - IV**	**PE**	3	3	0	0	3	Nil	F
PRACTICAL										
6.	MR18811	Project Work	**EEC**	12	0	0	12	6	Nil	F
TOTAL				**28**	**15**	**1**	**12**	**22**	-	-
Total No. of Credits					**187**					

***Curriculum for III to VIII semesters along with the syllabus for III and IV semester Subjects were passed in Board of Studies meeting held on 02.02.2019 and Approved in 7th Academic Council Meeting held on 16.03.2019.*

PROFESSIONAL ELECTIVES

(Offered in ODD Semester)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	GE18053	Disaster Management (Common to CH, CE and MR)	3	0	0	3
2.	MR18001	Engineering Management	3	0	0	3
3.	MR18003	Human Resource Management	3	0	0	3
4.	MR18005	Marine Logistics and Management	3	0	0	3
5.	MR18007	Marine Management and IMO Requirements	3	0	0	3

(Offered in EVEN Semester)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	MR18002	Advanced Marine Heat Engines	3	0	0	3
2	MR18004	Environmental Air Quality	3	0	0	3
3	MR18006	Human Rights	3	0	0	3
4	ME18020	Industrial Robotics (Common to ME, AE and MR)	3	0	0	3
5	GE18051	Intellectual Property Rights (Common to All Branches Except BT)	3	0	0	3
6	MR18008	Marine Engineering Practices	3	0	0	3
7	MR18010	Marine Propellers and Propulsion	3	0	0	3
8	MR18012	Mechanics of Marine Machines	3	0	0	3
9	MR18014	Nuclear Engineering	3	0	0	3
10	MR18016	Offshore Technology	3	0	0	3
11	GE18054	Professional Ethics (Common to CE, CS, IT, EE, EC and MR)	3	0	0	3
12	ME18031	Renewable Energy Resources (Common to ME and MR)	3	0	0	3
13	MR18020	Ship Safety and Environmental Protection	3	0	0	3
14	MR18022	Special Duty Vessels and Type of Operations	3	0	0	3
15	GE18052	Total Quality Management (Common to ME, AE, CS, EC and MR)	3	0	0	3

OPEN ELECTIVES
(Offered in ODD Semester)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	OE18101	Fundamentals of Automobile Engineering	3	0	0	3
2.	OE18103	Fundamentals of Automotive Air Conditioning	3	0	0	3
3.	OE18201	Introduction to Biofuels and Bioenergy	3	0	0	3
4.	OE18203	Basics of Environmental Biotechnology	3	0	0	3
5.	OE18205	Introduction to Bioinformatics and Computational Biology	3	0	0	3
6.	OE18207	Basics of Nanobiotechnology	3	0	0	3
7.	OE18209	Introduction to Biomaterials	3	0	0	3
8.	OE18301	Waste to Energy	3	0	0	3
9.	OE18303	Industrial Safety	3	0	0	3
10.	OE18305	Composite Materials	3	0	0	3
11.	OE18307	Industrial Waste Water Treatment	3	0	0	3
12.	OE18309	Fuel Cell Technology	3	0	0	3
13.	OE18401	Basic Civil Engineering	3	0	0	3
14.	OE18403	Fundamentals of Remote Sensing and GIS	3	0	0	3
15.	OE18501	Basic Operating Systems	3	0	0	3
16.	OE18503	Basics on Cyber Security and Ethical Hacking	3	0	0	3
17.	OE18505	Introduction to Internet of Things	3	0	0	3
18.	OE18507	Multimedia and Animation Techniques	3	0	0	3
19.	OE18509	Python Programming	3	0	0	3
20.	OE18601	Electrical Machines and Applications	3	0	0	3
21.	OE18603	Control system Engineering	3	0	0	3
22.	OE18605	Micro and Smart Grid	3	0	0	3
23.	OE18607	Electric Vehicle Technology	3	0	0	3
24.	OE18609	Nanotechnology	3	0	0	3
25.	OE18701	Autotronics	3	0	0	3
26.	OE18703	Sensing Techniques	3	0	0	3
27.	OE18705	System Design using Microcontrollers	3	0	0	3
28.	OE18801	IT essentials for engineers	3	0	0	3
29.	OE18803	Internet of Everything	3	0	0	3
30.	OE18805	Foundation on Mobile App Development	3	0	0	3
31.	OE18901	Elements of Marine Engineering	3	0	0	3
32.	OE18903	Marine Propulsion	3	0	0	3
33.	OE18001	Basics of Mechanical Engineering	3	0	0	3
34.	OE18003	Elements of Mechanical Components	3	0	0	3
35.	OE18005	Industrial Engineering and Management	3	0	0	3
36.	OE18007	Basics of Energy Resources	3	0	0	3

(Offered in EVEN Semester)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	OE18102	Automotive Fault Diagnostics	3	0	0	3
2.	OE18104	Fundamentals of Automotive Pollution and Control Methods	3	0	0	3
3.	OE18106	Fundamentals of Automotive Safety and Maintenance	3	0	0	3
4.	OE18202	Introduction to Food Manufacturing	3	0	0	3
5.	OE18204	Testing of Biological Materials	3	0	0	3
6.	OE18206	Introduction to Tissue Engineering	3	0	0	3
7.	OE18208	Introduction to Cancer Biology	3	0	0	3
8.	OE18210	Basic Bio-pharmaceutical Technology	3	0	0	3
9.	OE18302	Industrial Pollution Prevention	3	0	0	3

10.	OE18304	Solid Waste Management	3	0	0	3
11.	OE18306	Plant Utilities	3	0	0	3
12.	OE18308	Green Energy	3	0	0	3
13.	OE18310	Energy Management	3	0	0	3
14.	OE18402	Integrated Solid Waste Management	3	0	0	3
15.	OE18404	Life Cycle Assessment	3	0	0	3
16.	OE18502	Artificial Intelligence Basics	3	0	0	3
17.	OE18504	Database Systems and Applications	3	0	0	3
18.	OE18506	Internet Programming	3	0	0	3
19.	OE18508	Introduction to Cloud and Big Data Analytics	3	0	0	3
20.	OE18510	Introduction to Data Structures	3	0	0	3
21.	OE18602	Industrial Automation	3	0	0	3
22.	OE18604	MEMS and Nano Devices	3	0	0	3
23.	OE18606	Renewable Energy Systems	3	0	0	3
24.	OE18608	Indian Power Grid	3	0	0	3
25.	OE18610	Power Converters	3	0	0	3
26.	OE18702	Consumer Electronics	3	0	0	3
27.	OE18704	Introduction to Communication Systems	3	0	0	3
28.	OE18706	Intelligent Robotics Systems	3	0	0	3
29.	OE18802	Embedded and Real Time Systems	3	0	0	3
30.	OE18804	Ethical hacking and IT security	3	0	0	3
31.	OE18806	User Interface Design	3	0	0	3
32.	OE18808	AI for Android	3	0	0	3
33.	OE18902	Introduction to Marine Diesel Engines and Machineries	3	0	0	3
34.	OE18904	Marine Vehicles	3	0	0	3
35.	OE18002	Elements of Automation	3	0	0	3
36.	OE18004	Quality concepts and tools	3	0	0	3
37.	OE18006	Refrigeration and Air conditioning Systems	3	0	0	3
38.	OE18008	Thermal Management of Electronics devices	3	0	0	3

(Offered in ODD or EVEN Semester)

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	OP18001	Sensors and Transducers	3	0	0	3
2	OP18002	Essential Properties for Selection of Materials	3	0	0	3
3	OP18003	Opto Electronics and applications	3	0	0	3
4	OP18004	Basics of Environmental Safety	3	0	0	3
5	OH18001	Gender sensitization and Social Impact	3	0	0	3
6	OH18002	Content Writing	3	0	0	3
7	OH18003	Critical Thinking	3	0	0	3
8	OH18004	Environmental Law, Policy and International Conventions	3	0	0	3
9	OH18005	Urban / Rural Development and Constitutional Provisions	3	0	0	3
10	OH18006	Climate Change and Vulnerability Assessment	3	0	0	3
11	OC18001	Advanced Engineering Chemistry	3	0	0	3
12	OC18002	Industrial Chemistry	3	0	0	3
13	OC18003	Chemistry in Food Industry	3	0	0	3
14	OC18004	Fuel cell Chemistry	3	0	0	3
15	OC18005	Waste water Treatment	3	0	0	3
16	OM18001	Statistical methods for Engineers	3	0	0	3
17	OM18002	Linear Programming	3	0	0	3
18	OM18003	Linear Algebra for Engineers	3	0	0	3
19	OM18004	Transform techniques for Boundary value problems	3	0	0	3

VALUE ADDED COURSES

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	VD18901	Elementary First Aid	2	0	0	2
2.	VD18902	Fire Prevention and Fire Fighting	2	0	0	2
3.	VD18903	High Voltage Course	2	0	0	2
4.	VD18904	Personal Safety and Social Responsibilities	2	0	0	2
5.	VD18905	Personal Survival Technique	2	0	0	2
6.	VD18906	Security training for Seafarers with Designated Security duties	2	0	0	2

The syllabus for V and VI semesters, professional electives, open electives and value added course were passed in BoS meeting held on 30.08.2019 and approved in the 8th Academic Council Meeting held on 13.09.2019

SEMESTER I AND II

SEMESTER-I

HS18151	COMMUNICATIVE ENGLISH (Common to all Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable learners to interact fluently on everyday social contexts.
- To enable learners to engage in conversations in an academic/scholarly setting.
- To enable learners to overcome public speaking barriers.
- To develop learners' ability to take notes and in the process, improve their listening skills
- To develop learners' reading skill through reading text passages for comprehension and contemplation.
- To enable learners to write on topics of general interest and drafting correspondences for general purposes.

UNIT I **9**

Listening - short video clips - conversational scenes form movies, celebrities' speeches/interviews. Speaking - several ways of introducing oneself at several situations, introducing others at several situations, inviting people for several occasions, describing people and their places. Reading - short comprehension passages - making inferences, critical analysis. Writing - completing the incomplete sentences - developing hints from the given information. Grammar - Wh-Questions and Yes or No questions - Parts of speech. Vocabulary development - prefixes - suffixes - articles - countable / uncountable nouns.

UNIT II **9**

Listening - customer care voice files, short narratives - identifying problems and developing telephone etiquettes. Speaking - speaking over skype/whatsapp, making business calls, making self-recorded informative videos, inquiring about a concept/activity, describing a concept/activity. Reading - reading the headlines on news magazines - slogans and taglines from advertisements. Writing - free writing - writing - headlines , slogans and taglines individual inspirations. Grammar - conjunctions, idioms, phrases, quotes. Vocabulary development - guessing the meanings of words in various different contexts.

UNIT III **9**

Listening - courtroom scenes from movies, debates and talks from news channels, notes taking. Speaking - language and tone for arguments, discussion, deliberation, contemplation, expressing opinions, reacting to different situations in an alien country. Reading - language used in instruction manuals of household appliances, cookery and other basic instructions. Writing- understanding the structure of texts - use of reference words, discourse markers-coherence, rearranging the jumbled sentences. Grammar - adjectives - degrees of comparison, framing direct and indirect questions. Vocabulary development - concise approach, single word substitution.

UNIT IV **9**

Listening - Sports commentaries, advertisements with users' criticisms; Speaking - for social causes, for promoting a concept, negotiating and bargaining; Reading - review of a product, movie, movement or a system; Writing - writing for advertisements, selling a product; Grammar - Tenses - Simple Past, Present and Future, Continuous - Past, Present and Future; Vocabulary Development - synonyms, antonyms and phrasal verbs.

UNIT V **9**

Listening - video lectures, video demonstration of a concept; Speaking - presenting papers/concepts, delivering short speeches, discourses on health, suggesting natural home remedies, cleanliness, civic sense and responsibilities; Reading - columns and articles on home science; Writing - correspondences of requests, basic enquiry/observation and basic complaints; Grammar - modal verbs, perfect tenses -

Vocabulary development - collocations.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, learners will be able to

- Read articles and infer meanings from specific contexts from magazines and newspapers.
- Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English.
- Write short write-ups and personal letters and emails in English.

REFERENCES:

1. Department of English, Anna University, Mindscapes : English for Technologists and Engineers. Orient Black Swan, Chennai, 2017.
2. Downes and Colm, "Cambridge English for Job-hunting", Cambridge University Press, New Delhi, 2008.
3. Murphy and Raymond, "Intermediate English Grammar with Answers", Cambridge University Press, 2000.
4. 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

Software

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. CAMBRIDGE Preparation for the TOEFL TEST- Cambridge University Press, 2017.

MA18152	MATHEMATICS FOR MARINE ENGINEERING – I	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

UNIT I THREE DIMENSIONAL ANALYTICAL GEOMETRY 9+3

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 9+3

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 9+3

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 9+3

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 sinx and Cosnx. 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 9+3

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(L:45+T:15): 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 Series, 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

PH18151	ENGINEERING PHYSICS	L	T	P	C
	(Common to all Branches)	3	0	0	3

OBJECTIVES:

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

UNIT I CRYSTAL PHYSICS 12

Unit cell - Bravais Lattices - Miller indices - Distance between Inter planar distance 'd' (derivation) - discussion of various crystal structures: calculation of Atomic radius, Coordination number, effective number of lattice points and Atomic Packing Factor for the SC, BCC, FCC, HCP, Diamond Cubic (derivation) - discussion about the NaCl, Graphite structures. Crystal defects **:** Zero dimensional, one dimensional, Two dimensional and Three dimensional defects. Diffraction of X-rays by crystal planes - Bragg's spectrometer - Powder Diffraction method.

UNIT II THERMAL PHYSICS 6

Modes of heat transfer: Newton's law of cooling - thermal conductivity - Lee's disc method (derivation and expt) - Radial heat flow - Rubber tube method - conduction through compound media (series and parallel).

UNIT III WAVE MECHANICS 9

Quantum principles: Black body radiation - Planck Hypothesis (qualitative), Compton's effect (derivation).

Wave-particle duality - De-Broglie matter waves - Heisenberg's uncertainty principle - Wave function and its significance - Schrödinger's wave equation (time dependent and Time independent) (derivation) - Application of Schrodinger's wave equation - Particle in one dimensional box (derivation) - Degenerate and non-degenerate energy states.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Acoustics: Classification of Sound - Characteristics of Musical Sound - Quality (Timbre), Pitch, Intensity of Sound - Units of Sound - decibel - Reverberation of sound - Reverberation time - absorption of sound energy by materials - Absorption coefficient - Sabine's Formula (derivation) - Factors affecting the acoustics of buildings - Remedies.

Ultrasonics **:** Introduction to ultrasonics - Properties of ultrasonic waves - Production of Ultrasonics - Magnetostriction method, Piezo electric method - detection of ultrasonics - Ultrasonic Acoustic grating - Applications of ultrasonic waves - SONAR, NDT, Sonogram.

UNIT V OPTOELECTRONICS AND FIBER OPTICS 9

Lasers: Basic properties of Lasers - Einstein's coefficients (Derivation) - Population inversion - Types of Lasers - Molecular Gas Lasers (CO_2 Laser) - Solid state Laser (Nd: YAG Laser) - Applications of Lasers in Engineering and Medicine.

Fibre optics: Introduction - Principle and structure of optical fibers - Acceptance angle-Numerical aperture-Types of optical fibers-Optical fiber communication system (block diagram) - Advantages and its applications.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- gain working knowledge of fundamental physics and basic engineering principles in one or more engineering disciplines.
- to understand and to compute problems in Quantum Physics.
- to 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", Dhanput Publications, 2015.
2. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006.
3. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
   Arumugam M, "Materials Science", Anuradha Publications, 2015.

REFERENCES:

1. David Halliday, Robert Resnick Jearl Walker, "Principles of Physics", 10th Edition, Wiley, 2015.
2. Peter Atkins and Julio De Paula, "Physical Chemistry", 10th Edition., Oxford University Press, 2014.
3. Arthur Beiser, Shobhit Mahajan and Rai Choudhury S, "Concepts of Modern Physics", 7th Edition, McGraw Hill Education, 2017.
4. Raghavan V, "Materials Science and Engineering", PHI Learning Pvt. Ltd., 2010.

CY18152 CHEMISTRY FOR MARINE ENGINEERING

L	T	P	C
3	0	0	3

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 nanochemistry.

UNIT I WATER TECHNOLOGY 9

Water its sources and impurities – impurities in fresh water, sea water, distilled water. Introduction to boiler feed water- requirements of boiler feed water, purpose of water treatment in boilers, scale and sludge - causes, effects and prevention.

UNIT II BOILER CHEMISTRY 9

Boiler corrosion – fretting, pitting corrosion, corrosion fatigue, electrochemical corrosion, hydrogen and hydroxyl ions, types and causes of corrosion and its control, factors influencing corrosion, methods of mechanical and chemical de-aeration, dezincification and stress corrosion.

UNIT III BOILER WATER TREATMENT 9

Lime and Soda treatment, pH treatment, salinometer, use of litmus paper, test for partial and 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 (internal and external conditioning methods), total dissolved solids, dissolved oxygen test, use of coagulants, typical test values for smoke and water tube boilers.

UNIT V ENERGY SOURCES AND NANOCHEMISTRY 9

Introduction – properties (Electrical and Mechanical) – carbon nanotubes- types, 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 (L: 45+T:0): 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, 2010.
2. Milton and Leech, “Marine Boilers” Butter worth Publishers, UK 1980.

REFERENCES:

1 Uppal M.M., A Textbook of Engineering Chemistry, 7th Editions, Khanna Publishing, 1988.
2 Skelly J.D., “Water treatment” Imarest Publication, London, 2004.
3 Jackson. L, Morton. TD, “Reed’s General Engineering Knowledge for Marine Engineers”, Bloomsbury USA, 2010.

EE18151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to AE, BT, CE, CS, IT, MR & ME)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic theorems used in Electrical circuits and the principles of measuring instruments.
- To educate the different concepts and function of electrical machines.
- To introduce the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics.
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 10

Ohm's Law - Kirchhoff's Laws - Steady State Solution of DC Circuits using Mesh Analysis - Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase AC Balanced Circuits. Construction and working Principle of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters (Qualitative treatment only).

UNIT II ELECTRICAL MACHINES 10

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

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode - Zener Effect - Zener Diode - LED, Photo diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Photo transistors.

UNIT IV DIGITAL ELECTRONICS 9

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 7

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 Fiber (Block Diagram Approach only)..

TOTAL: 45 PERIODS

OUTCOMES:

- Study the fundamental laws governing electrical circuits and to describe the working of measuring instruments.
- Understand the construction and characteristics of different electrical machines.
- Describe the fundamental behavior of different semiconductor devices and circuits.
- Learn the fundamental concepts of digital electronics circuits.
- Recognize the type of signals, data transfer and able to apply in 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.
. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series,
5 McGraw Hill, Fourth Edition, 2007.
.

GE18151	ENGINEERING DRAWING (Common to all Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- This course will introduce students to Engineering Drawing and build their ability to read drawings and interpret the position and form of simple geometry, culminating into understanding of simple technical assemblies.

UNIT 0 ENGINEERING DRAWING FUNDAMENTALS (Not for Examinat 5

Drawing standard: BIS, Lettering, Dimensioning, Type of lines, Conventions, Geometrical constructions: Dividing a straight line into equal parts, Bisecting a given angle, Construction of polygon - Triangle, Square, Pentagon and Hexagon using drawing tools.

UNIT I CURVES AND PROJECTION OF POINTS AND LINES 15

Construction of Engineering Curves: Conic Sections - Ellipse, Parabola, Hyperbola using Eccentricity method, Cycloid, Involute of Circle and Pentagon.
Projection: Principal Planes, Projection of Points using Four Angles of Projection, Projection of Straight Lines - Lines parallel or inclined to one or both planes using Rotating Line Method in First Angle of Projection.

UNIT II PROJECTION OF PLANES AND SOLIDS 15

Projection of Plane Figures - Inclined to any one Principal Plane,

Projection of Solids - Simple Solids (Prisms, Pyramids, Cone and Cylinder) axis inclined to any one Principal Plane.

UNIT III SECTION OR SOLIDS & DEVELOPMENT OF SURFACES 15

Section of Solids - Sectional views of simple vertical solids cut by section plane inclined to any one Principal Plane.

Development of Surfaces - Development of lateral surfaces of truncated and frustum of simple solids.

UNIT IV PICTORIAL PROJECTION 15

Introduction to Pictorial Projection, Isometric Projection - Principle, Isometric Planes, Isometric Scales, Isometric Projection of simple solids and their combination.
Free Hand Drawing - Orthographic Projection - Orthographic views of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views.

UNIT V PERSPECTIVE PROJECTION 10

Perspective Projection of full solids in simple positions with respect to projection planes by visual ray and vanishing point method.

TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Prepare isometric and perspective sections of simple solids.
- Demonstrate computer aided drafting.

TEXT BOOKS:

1. Bhatt N.D, Panchal Pramod V.M and Ingle R, "Engineering Drawing", Charotar Publishing House, 2014.

REFERENCES:

1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International (P) Limited, 2009.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2009.
3. Gopalakrishna K.R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2010.
4. Natrajan K.V, "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
5. Gowri S and Jeyapoovan T, "Engineering Graphics", Vikas Publishing House Pvt. Ltd., 2011.

PC18161	PHYSICS AND CHEMISTRY LABORATORY (Common to all Branches)	L	T	P	C
		0	0	2	1

PHYSICS LABORATORY

OBJECTIVES:

- To make the student to acquire practical skills in the determination of various physical properties of materials.

LIST OF EXPERIMENTS (Any 5 experiments to be conducted)**:**

1. Determination of compressibility of the liquid - Ultrasonic interferometer.
2. Determination of thickness of the given object by Air wedge method.
3. Determination of dispersive power of a prism by Spectrometer.
4. Determination of Young's modulus of wooden scale by Non-Uniform bending.
5. Determination of wavelength, particle size and numerical aperture of fibre using Lasers.
6. Lee's Disc – Thermal conductivity of the poor conductor.
7. Torsional Pendulum – Determination of Rigidity modulus and moment of inertia.

OUTCOMES:

- The student will be able to analyze the physical principle using the various instruments, also relate the principle to engineering applications.
- The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering.
- The students will be able to think innovatively and also improve the creative skills that are essential for engineering.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Spectrometer, Mercury Vapour lamp, Lee's disc experimental setup, Travelling microscope, Ultrasonic interferometer, Sodium vapour lamp, Diode laser, Optical fiber kit.

CHEMISTRY LABORATORY

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 viscometery.

LIST OF EXPERIMENTS (Any 5 experiments to be conducted)**:**

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Estimation of copper by EDTA.
3. Conductometric titration of a strong acid with a strong base
4. Estimation of iron content of the given solution using potentiometer.
5. Estimation of iron content of the water sample using spectrophotometer.
6. Determination of molecular weight of polymer using viscometer.
7. Determination of Alkalinity in water.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be equipped with hands-on knowledge in the quantitative chemical

analysis of water quality related parameters.

1. Conductivity meter - 10 Nos
2. Spectrophotometer - 10 Nos
3. Ostwald Viscometer - 10 Nos
4. Potentiometer - 10 Nos
5. Electronic Balance - 2 Nos

Common Apparatus: Pipette, Burette, conical flask, iodine flask, porcelain tile, dropper (each 30 Nos.)

REFERENCES:

1. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogels Textbook of Practical Organic Chemistry", 8th Edition, LBS Singapore, 2014

GE18161	ENGINEERING PRACTICES LABORATORY (Common to all Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

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

LIST OF EXPERIEMNTS

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

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, planning and cutting.

II MECHANICAL ENGINEERING PRACTICE

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

Demonstration on:

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.
c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

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 and comparison of energy for resistive and LED load using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Identification of circuit components
   a) Resistor, capacitor, diode (PN & Zener),transistors.
   b) Soldering practice – Circuits – Using general purpose PCB.
2. Evaluating the parameters for DC power supply and AC power supply (peak-peak, rms, average, period, frequency) using function generator and CRO.
3. Study and implementation of logic functions using NAND, NOR, and NOT gates.
4. VI Characteristics of PN Junction diode.
5. VI Characteristics of Solar photovoltaic panel.
6. Design a 5V/12V Regulated Power Supply: using FWR rectifier and IC7805/IC7812.

TOTAL: 45 PERIODS

OUTCOMES:

- Fabricate carpentry components and to lay pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Wiring of basic electrical system and measurement of electrical parameters.
- Study and implementation of basic electronic components, circuits and solar photovoltaic panel.
- Design a basic regulated power supply.

REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. and Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.
6. Mittle V.N, Arvind Mittal, "Basic Electrical Engineering", Tata McGraw Hill(India), Second Edition,2013.
   Sedha R.S., "A Text Book of Applied Electronics", S. Chand & Co., 2014.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Qty
	CIVIL	
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2.	Carpentry vice (fitted to work bench)	15 Nos.
3.	Standard woodworking tools	15 Sets.

4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power Tools: (a) Rotary Hammer (b) Demolition Hammer (c) Circular Saw (d) Planer (e) Hand Drilling Machine (f) Jigsaw	2 Nos
MECHANICAL		
1.	Arc welding transformer with cables and holders	5 Nos.
2.	Welding booth with exhaust facility	5 Nos.
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5.	Centre lathe	2 Nos.
6.	Hearth furnace, anvil and smithy tools	2 Sets.
7.	Moulding table, foundry tools	2 Sets.
8.	Power Tool: Angle Grinder	2 Nos
9.	Study-purpose items: centrifugal pump, air-conditioner	1 each
ELECTRICAL		
1.	Assorted electrical components for house wiring	15 Sets
2.	Electrical measuring instruments	10 Sets
3.	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4.	Megger (250V/500V)	1 No.
5.	Power Tools: (a) Range Finder 2 Nos (b) Digital Live-wire detector	2 Nos.
6.	LED lamp 8 W & 16 W	2 Nos. each
ELECTRONICS		
1.	Soldering guns	10 Nos.
2.	Assorted electronic components for making circuits	50 Nos.
3.	Small PCBs	10 Nos.
4.	Multimeters	10 Nos.
5.	Study purpose ICs: IC7805/IC7812	1 each
6.	Photovoltaic panel: 5 W/10 W	2 Nos.
7.	Light Source for PV panel	1 No.

SEMESTER - II

HS18251	TECHNICAL ENGLISH (Common to all Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable learners to define and understand technical communication and scientific writing
- To expose learners to nuances of seminar presentation, group discussion, and public speaking
- To expose learners to writing for scientific purposes
- To expose learners to drafting correspondences for business purposes
- To expose learners to writing for documenting purposes
- To enable students to have a holistic understanding of job interviews and recruiting process.

UNIT I **9**

Listening - AV files pertaining to manufacturing processes of products, scientific documentaries; **Speaking -** syllable division and word stress, intonation, sharing opinions; **Reading** - news articles related to science and technology; **Writing** - definitions, instruction, recommendation, data interpretation, resume; **Grammar** - tenses and their aspects, sentence connectors - discourse markers, sequential words, active and passive voice, subject-verb agreement.

UNIT II **9**

Listening - AV pertaining to marketing strategies, peer reading and pronunciation; **Speaking** - turn taking, sharing opinions; conducting and attending a meeting, understanding the nuances of spoken communication among internal audience and external audience; **Reading** - analytical documents, descriptive documents; **Writing** - fliers, brochures, resume - letter of application, checklists; **Grammar** - modal verbs, clauses - types and uses, conditional clauses, articles.

UNIT III **9**

Listening - AV related to how to use components, scientific description, **Speaking** - speaking for motivation and initiation, speaking at a seminar presentation; **Reading** - scientific journals, papers; **Writing** - Technical descriptions - process description, purpose and function, PowerPoint, Google forms, user manuals; **Grammar** - phrasal verbs, prepositions, technical and scientific affixes.

UNIT IV **9**

Listening - scientific debates, crisis management; **Speaking** - handling conflicts, speaking about the loss of benefits, progress or decline of business, identifying the connotative meanings, **Reading**- documented evidences of uses and functions of a product, review of a product, **Writing** - memos, follow-up letters, reports - proposal, project, progress reports, sales reports, reports on industrial visits, executive summary. **Grammar** - reported speech and tag questions, sentence structure - comparative, imperative, cause and effect, infinitive of result.

UNIT V **9**

Listening - AV of Group discussions, panel discussions, face to face interviews for recruitment purposes; **Speaking**- speaking at group discussions, interviewing a personality, answering at the interviews; **Reading** - WebPages of topnotch engineering companies, **Writing** - blogging, e-mails, letter of complaint, minutes of the meeting; **Grammar** - one word substitution, collocations, better word/sentence substitution (rephrasing the content/improvising ideas).

TOTAL: 45 PERIODS

Suggested Activities [task based] - case study, guest lectures as models, problem solving, understanding team work.

OUTCOMES:

At the end of the course, learners will be able to

- understand the nuances of technical communication and scientific writing
- present papers and give seminars
- discuss in groups and brainstorm
- draft business correspondences and write for documenting purposes
- face job interviews with confidence

REFERENCES:

1. Department of English, Anna University. Mindscapes : English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
2. Downes, Colm, Cambridge English for Job-hunting, Cambridge University Press, New Delhi. 2008.
3. Murphy, Raymond, Intermediate English Grammar with Answers, Cambridge University Press 2000.
4. Thomson, A.J., "Practical English Grammar 1 & 2", Oxford, 1986.
5. Herbert A J, "The Structure of Technical English", Longman, 1965.

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

Software

1. Face2Face Advance – Cambridge University Press, 2014
2. English Advance Vocabulary- Cambridge University Press
3. IELTS test preparation – Cambridge University Press 2017
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition
5. CAMBRIDGE Preparation for the TOEFL TEST- Cambridge University Press, 2017

MA18252	MATHEMATICS FOR MARINE ENGINEERING – II	L	T	P	C
		3	1	0	4

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 9+3

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 9+3

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 9+3

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 parallelopipeds.

UNIT IV ANALYTIC FUNCTIONS 9+3

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 9+3

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 transforms 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: (L: 45+ T:15): 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. Bali N. P and Manish Goyal, “Text book of Engineering Mathematics”, 3rd Edition, Laxmi Publications (p) Ltd., 2008.
2. Grewal. B.S, “Higher Engineering Mathematics”, 40th Edition, Khanna Publications, Delhi, 2007.

3. William Embleton and Leslie Jackson, “Mathematics for Engineers Vol- I”, 7th Edition, Reed‟s Marine Engineering Series, 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”, 3rd Edition, Pearson Education, 2007.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, 7th Edition, Wiley India, 2007.
4. Jain R.K and Iyengar S.R.K, “Advanced Engineering Mathematics”, 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.

IT18251 COMPUTER APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

The students should be made to:

- Provide sound foundation about the basic computer terminologies, hardware and software devices.
- Introduce the fundamental concepts of in Information Technology to students.
- Introduce cutting-edge technologies and the recent trends in IT.

UNIT I COMPUTER BASICS 9

Characteristics of a computer - Classification of Computers – Computer Organization and Architecture – Central Processing Unit – Communication among various units – Inside a Computer – Data Representation.

Computer Memory and Storage: Memory Hierarchy – Primary and Secondary Storage – Importance of Input and Output Hardware, Types of Input and Output Devices – Computer Terminals.

UNIT II SOFTWARE 9

Definition - Categories of software - Installing and Un-installing software - Software piracy - Software terminologies. WORD PROCESSING - Creating, Editing, Formatting Documents with the Help of Templates & Wizards , Output Options: Printing, Faxing, or Emailing.

SPREADSHEETS - use of worksheet to enter data. Use of in-built basic statistical functions for computations - graphical representation - bar diagram – histogram - scatter plots - pie-chart – box plot.

UNIT III NETWORKS 9

Data Communication – Transmission Media - The Benefits of Networks - Types of Networks – Network Topologies - Client/Server & Peer-to-Peer – Intranets – Extranets – VPNs - Wired and Wireless - Cyber Security Threats - Hackers, & Safeguards, Firewall and Types of Firewall.

UNIT IV INTERNET AND ITS TOOLS 9

Evolution of Internet – Basic Terms – Internet Applications - Narrowband, Broadband, & Access Providers - Internet Tools: Web browsers – E-mail - Search Engines – Instant messaging – HTML: Basics – Web page creation – Scope of computers in marine sciences.

UNIT V EMINENT TECHNOLOGIES 9

Eminent Technologies: Mobile communications, Blue tooth, Global Positioning system, Infra red communication, Smart card.

TOTAL: (L:45 + T:0):45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Understand the characteristics and data processing methodologies of a computer.
- Manipulate and create simple word and excel documents.
- Differentiate various networks and their underlying terminologies.
- Create a simple web page using basic HTML Tools.
- Understand the recent advancement in computers.

TEXT BOOKS:

1. Brian K Williams, Stacey C Sawer “Using Information Technology – A practical introduction to computers and communications”, 11th edition 2015 ,Mc Graw H ill (P) Ltd.,
2. Introduction to Information Technology , ITL Education Solution Ltd. 2nd edition 2012 Pearson Education.

REFERENCES:

1. Turban, Rainer, Potter, “Introduction to Information Technology”, second edition, Wiley Publications.
2. V.Rajaraman, “Introduction to Information Technology”, third edition , PHI India Ltd.

GE18251 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**

(Common to all Branches) **3 0 0 3**

OBJECTIVES:

- To study the nature and facts about environment.
- To study the interrelationship between living organism and environment.
- To implement scientific, technological, economic and political solutions to environmental problems.
- 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 environment - need for public awareness - concept of an ecosystem - structure and function of an ecosystem - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems, Introduction to biodiversity definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity - Biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity - man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II 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 over - utilization of surface and ground water, floods, drought, conflicts over 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. case studies - Land resources: Land as a resource - role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

UNIT III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 10

Definition - causes, effects and control measures Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards - solid waste management: causes, effects and control measures of municipal solid wastes, e-Waste, risk related to e-Waste - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides, land degradation, man induced landslides, soil erosion and desertification.

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 - Principles of green chemistry, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - wasteland reclamation - consumerism and waste products - Environment protection act - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act - central and state pollution control boards - 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, Swine flu, Dengue fever - women and child welfare - role of information technology in environment and human health management - case studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student will be able to

- Solve problems that cannot be solved by mere environmental laws.
- Acquire awareness on environmental issues at their infant stage.
- Integrate facts, concepts and methods for multiple disciplines and apply them to solve environmental and social problems.
- Analyse the connectivity between manmade activities - pollution - environmental issues - social problem and provide eco-friendly solutions.

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2012.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2010.

REFERENCES:

1. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2012.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2011.
4. Tyler Miller. G and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2013.

MR18201	MARINE ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

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 thermodynamic relations and basics of 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 flow conditions. Simple problems

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, available energy. Simple problems

UNIT III PROPERTIES OF PURE SUBSTANCES AND VAPOUR POWER CYCLES 9

Thermodynamic properties of pure substances, property diagram, PVT surface of water, calculation of properties. Introduction – Rankine cycle, Analysis of Rankine cycle, Rankine efficiency, Methods of improving Rankine efficiency, Reheat cycle, Regenerative cycle, Simple problems.

UNIT IV GAS POWER CYCLES 9

Properties of ideal gases, gas laws. Air standard cycles for 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 - Gas turbine cycle – Brayton /Joule cycle, Simple problems.

UNIT V THERMODYNAMIC RELATIONS AND COMBUSTION OF FUELS 9

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

TOTAL: (L:45 + T: 0):45 PERIODS

OUTCOMES:

On completion of this course, students are expected

- To apply first law of thermodynamics to engineering applications.
- To apply second law of thermodynamics to engineering applications.
- To understand properties of steam and apply it to Rankine cycle.
- To understand air standard cycles and analyse them.
- To understand thermodynamic relations and combustion of fuels.

TEXT BOOKS:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition, Anuragam Publications, 2014.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice- Hall of India Pvt. Ltd, 2013.

REFERENCES:

1. Wlliam Embleton obe., “Applied Heat for Engineers”, Reed’s Marine Engineering Series,Vol.3,Thomas Reed Publication, 4th edition, Reprint 2011.
2. K.K.Ramalingam, “Engineering Thermodynamics”, 1st Edition, Scitech Publications (India) Pvt. Ltd., 2009

MR18202 **BASICS OF MARINE ENGINEERING**

L	T	P	C
3	0	0	3

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 RENEWABLE AND NON-RENEWABLE ENERGY SOURCES AND POWER PLANTS 12

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

UNIT II OTTO AND DIESEL CYCLE 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 VAPOUR COMPRESSION AND ABSORPTION REFRIGERATING CYCLES 9

Refrigeration – application and types, Vapour compression refrigeration system, Vapour absorption 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 AND WELDING 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 BASICS OF MACHINES AND DRIVES 6

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: (L:45 + T:0):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", 2 nd Edition, Butterworth Heinemann, London, 1999.

2. Shanmugam.G., Basic Mechanical Engineering 3rd Edition, TATA McGraw-Hill, New Delhi, Year 2000.

REFERENCES:

1. Leslie Jackson and Thomas D. Morton, Reed‟s General Engineering Knowledge for Marine Engineers
2. Duraivelu. K., Richard. S., Basic Mechanical Engineering, 2nd Edition, Dear Publication, Chennai, 200

MR18211	WORKSHOP FITTING	L	T	P	C
		0	0	4	2

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

SHEET METAL **15**

Fabrication of tray, cone and cylinder with sheet metal.

FITTING **15**

Practice in chipping, filing, drilling – Making Vee, square and dove tail joints

WELDING **15**

Arc Welding of butt joint, Lap joint, Tee fillet etc. Demonstration of gas welding.

TOTAL: 45 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

GE18161 COMPUTER AIDED DRAFTING LABORATORY (Common to AE, CE & MR)

L	T	P	C
0	0	3	1.5

OBJECTIVES:

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

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. 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.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. 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).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. 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:

- Students will be able to draw the two dimensional sketches by using different commands in Auto CAD software.
- Students will be able to draw the Isometric projection drawings from the two dimensional drawing and building layouts.
- Students will be able to draw the basic solid models drawing and make a pattern material model for different appearance of the solids

REFERENCES:

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

III SEMESTER

L	T	P	C
3	0	0	3

SEMESTER -III

MR18301 MARINE HYDRAULICS AND FLUID MACHINERY

OBJECTIVES:

- To familiarize with the properties of fluids and the applications of fluid mechanics stability of floating and submerged bodies and its related concepts.
- To impart the knowledge on fluid flow types and dynamics of fluid flow
- To understand the various flow losses in pipes, boundary layer and its behavior
- To understand the dimension analysis, principles of pumps, its velocity triangle, and its behavior
- To gain knowledge of the turbines, its velocity triangle, and its behavior

UNIT I **10**

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)- Variation of fluid pressure with depth - Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid– Buoyancy and Floatation – Metacentric height – stability of floating and submerged bodies.

UNIT II **8**

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 **9**

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 – Haigen 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 **10**

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 **8**

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

Course Outcome:

On successful completion of the course, the student will be able to,

- Identify and obtain the values of fluid properties and relationship between them and they can able to calculate the Meta centre and metacentric height.
- Understand the principles of continuity, momentum, and energy as applied to fluid motions.Recognize these principles written in form of mathematical equations.
- Understand the various losses, boundary layer concept and they can able to calculate the various losses in the pipe flow.
- Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics and able to calculate the different input and output parameters in the centrifugal pump.
- Understand the principles of turbine and they can able to calculate the different input and output parameters in turbine by using velocity triangle.

TEXT BOOKS:

1. Dr.R.K.Bansal, “Fluid mechanics and Hydraulic Machines”,9th revised Edition, Lakshmi publication, 2010
2. R K Rajput, “Fluid Mechanics and Hydraulic Machines” 2nd revised Edition, S.Chand & Company Ltd., New Delhi, 2002

REFERENCES:

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. Munson Young Okiishi Huebsch ,”Fundamentals of Fluid Mechanics” 6th Ed. Willy, 2010.
3. Nag. P.K. , “Basic and applied thermodynamics” 1st edition,2004,Tata Mc Graw Hill
4. Roberson, J.A. and Crowe C.T., “Engineering Fluid Mechanics”, 6th Edition, John Wiley, 1999.
5. Yunus A.cengel, “Fluid mechanics fundamental and application”, 2nd Edition, Mc Graw Hill, 2006

MR18302 MARINE MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop theoretical Knowledge of students on the various Metal joining process.
- To understand the concepts of casting process and to know the different types.
- To study the different methods of finishing processes and to know about the advanced manufacturing techniques
- To study the various metal forming processes.
- To develop theoretical Knowledge of students on the various machining processes.

UNIT I METAL JOINING PROCESSES 9

Classification plastic welding, fusion welding, solid phase welding and sub classification. Study of power sources, electrodes, welding symbols - processes and applications: SMAW, GTAW, GMAW, electro gas welding and Electro Slag, resistance welding. Gas welding, oxy acetylene cutting, brazing and soldering. Under water welding, Friction welding, Friction Stir welding, 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.

ADDITIVE MANUFACTURING: Introduction to additive manufacturing and its types.

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. Shaper and Planer- Principle -parts -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-Y esdee Publishings

Pvt. Ltd. 2012

2. Shan, H.S., "Manufacturing processes", Vol I, 1st Ed. Pearson, 2013

REFERENCES:

1. Chua C.K., Leong K.F., And Lim C.S., "Rapid Prototyping: Principles And Applications", Third Edition, World Scientific Publishers, 2010.

2. Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, Media

Publishers & Promoters,India, 2010

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. Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004.

EE18351 MARINE ELECTRICAL MACHINES – I

L	T	P	C
3	1	0	4

OBJECTIVES:

- To familiarize the constructional details, the principle of operation, methods of testing of DC machines
- To understand the concept of D.C motor
- To develop the knowledge of students on single and three phase transformer connections, types and testing.
- To study the construction and principle of various measuring instruments.
- To develop theoretical Knowledge of students on the various types of distribution system and connection patterns

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

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

UNIT II D.C.MOTORS 8+3

D.C. Motor –their characteristics – starting and reversing – speed – torque equations – starters– speed control - Ward-Leonard control - electronic method of control (using Diode and SCR) – braking of D.C. motor-Testing of D.C. machines for finding out the losses and efficiency.

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 – Instrument transformers – auto-transformers (single phase and three phase) Welding transformers- Transformer standards and specifications.

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. Testing using digital multimeter, clamp meter.

UNIT V DISTRIBUTION AND TRANSMISSION SYSTEM 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- Types of cables (single and three core)- Electrical safety.

TOTAL : 60 PERIODS

OUTCOMES:

Students will be able

CO 1: To gain knowledge about construction and operation of D.C. Machines in general and generators in particular .

CO2: To derive the characteristics and estimate the performance of dc generators and motors.

CO3: To compute the performance parameters of a transformer by suitable tests.

CO4: To distinguish the features of different types of Measuring instruments.

CO5: To describe the structure and functioning of transmission and distribution system.

TEXT BOOKS:

1 Bhag, S. Guru, Huseyin, R. Hiziroglu, “Electric Machinery and Transformers”,3rd Ed. Oxford University Press, 2013.

2. B L Theraja & A K Theraja,’ A Textbook of Electrical Technology Volume I &II (Multicolour 23rd Edition), S. Chand Publishers,Delhi.

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.

5 Edmund GR Kraal, Stanley Buyers, Christopher Lavers, “Basic electro technology for marine engineers”, 4th Ed. Reeds Vol 06

MR18303	MARINE MACHINERY DRAWING	L	T	P	C
		2	0	3	4

OBJECTIVES:

- To understand the fundamentals of Machine Drawing. To understand the conventions, conventional representation, types of sectioning and to practice them.
- To understand fits and tolerances in machine drawing. To solve problems in fits and tolerances in hole based and shaft based systems.
- To understand the sketching of various types of mechanical joints.
- To understand the various machine parts, To prepare assembly drawings from part drawings of the machine parts.
- To learn to prepare assembly drawings and blueprint from part drawings of the machine parts.

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+6

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+9

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

UNIT IV MARINE MACHINERY PARTS 3+12

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

UNIT V MARINE COMPONENTS 3+12

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

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the student will be able

- To understand the fundamentals of Machine Drawing, the conventions, conventional representation, types of sectioning and to practice them.
- To understand the method of sketching to explain the limits, fits and tolerances arcs etc., with respect to the marine machinery.

- To understand the method of sketching of various mechanical joints.
- To understand and practice the various parts of Marine Machinery and the general Marine components
- To practice the assembled view & blueprint of Marine Machinery components.

TEXT BOOKS:

1. Beck, H.G., “Engineering Drawings for Marine Engineers”, 2nd Ed., Reeds Vol 11, Adlard Coles Nautical, London.

2. Gopalakrishna K.R., “Machine Drawing”, 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013.

REFERENCES:

1. 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.
2. N.D.Bhatt, “Machine Drawing”, 46th Edition, Charotar Publication, Mumbai, 2016.
3. Gill P.S., “A text book on Machine Drawing”, S.K. Kataria & sons, Mumbai, 2000.
4. Junnarkar,N.D., “Machine Drawing”,1st Ed. Pearson, 2004 Jindal, U.C., “Machine Drawing”, 1st Ed. Pearson, 2010.
5. Jindal, U.C., “Machine Drawing”, 1st Ed. Pearson, 2010.

MR18305	SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge about Navigation lights and Signals of ship.
- To impart knowledge about operation of Mooring machinery.
- To develop self-confidence and skill for survival at sea.
- To impart knowledge about the organization 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 and 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 light 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 Seamanship duties and Organization on-board ship.
- The students can understand the Mooring Operation.
- The students can understand various Navigation Signals, Lights and equipments.
- The students can operate various life saving equipments like life boats and life rafts.
- The course the students can understand various duties to be performed in Engine room.

TEXT BOOKS:

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

REFERENCES:

1. A.N. Cockcroft, “Seamenship and Nautical knowledge”, 27th Edition, Brown son & Ferguson Ltd., Glasgow 1997.
2. DJ House “ Seamanship Techniques “ 3rd Edition 2009 Butterworth heinemann
3. Capt: TK Joseph “Principles Of Navigation” ARI –New Delhi Publication 1999.
4. Capt: H Subramaniam “ Nautical Watch-keeping” Vijaya Publicatio-Mumbai 1999

MR18306	MARINE REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of this course the students should have gained knowledge on

- Basic Refrigeration and Air Conditioning,
- Marine Refrigeration Plants
- Refrigerated containers and their maintenance.
- Marine Air Conditioning,
- HVAC plant 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 – Coefficient 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 cutouts, setting and testing of cutouts, 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. In addition to this the students are expected be aware of safe and efficient operation of these machineries.

TEXT BOOKS:

1. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd Edition, New Age International (P) Ltd., Publishers, Chennai, 2015

3. Stott J.R, "Refrigerating Machinery and Air Conditioning Plant", Marine Engineering Practice, Vol-1 P Part-04, IMarEST, London,1998.

REFERENCES:

1. Arora C.P., "Refrigeration & Air Conditioning", 3rd Edition, Tata McGraw-Hill, New Delhi, 2014.

2. Maheshwar.C, "Container Refrigeration", First Edition, Witherby Seamanship International,

   Livingston, UK, 2008.

3. Mc George.H.D, "Marine Auxiliary Machinery", 7th Edition, Butterworth Heinemann,

   Woburn, USA, 2015.

4. Taylor. D.A , "Introduction to Marine Engineering", Second Edition, Butterworth Heinemann,

   Woburn, USA, 2011.

5. User manuals of the maker of the Refrigeration plant and Air Conditioning plant on board Ship for further understanding of the system and for troubleshooting.

MR18307	MATERIAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To illustrate the fundamentals of metallurgy on Fe-C system, properties of metals.
- To impart knowledge on the importance of heat treatment and phase transformations with studies on surface treatment.
- To teach the students about the importance of mechanically characterizing of the materials with known methods.
- To impart knowledge on various metal processing methods, destructive and non-destructive testing methods.
- To impart knowledge on various properties of non metals and their marine applications

UNIT I FUNDAMENTALS OF METALLURGY 8

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 - Effect of alloying additions on steel

UNIT II HEAT TREATMENT 11

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 8

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 of testing and mechanical characterization.

UNIT V NEW MATERIALS 9

Non-metallic materials – Polymers – types of polymer, Engineering Ceramics – Properties and applications of Al2 O3, SiC Composites-Classifications-Role of Matrix and reinforcement processing of fiber reinforced plastics- Applications of Composites- applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications – carbon nanotubes: types - Applications of marine materials.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able

- to understand the Fundamentals of Metallurgy, Properties of metals.
- to know about the various heat treatment processes.
- to know about the various mechanical property testing methods.
- to understand the metal processing methods, destructive and non destructive testing methods.
- to know about the various properties of non metals.

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. Jindal,U.C., Atish Mozumder, “Material Science and Metallurgy”, 1st Ed. Pearson, Third Impression 2013.
4. Todd , “Selecting Material For Sea Water Systems”, Marine Engineering Practice,Vol-1, Part-10, IMarEST, London.
5. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 6th edition 2015.

REFERENCES:

1. Eyres, D.J. “Ship Construction” 7th Edition,2015
2. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
3. Book on Engineering knowledge general Vol-1.
4. Askeland, D. “Materials Science and Engineering”. Brooks/Cole, 2010.
5. Smith, W.F., Hashemi, J. & Prakash, R. “Materials Science and Engineering”. Tata McGraw Hill Education Pvt. Ltd., 2014.
6. Dieter, G.E., “Mechanical Metallurgy”, McGraw-Hill, SI Edition, 1988.

	L	T	P	C
MR18311 MARINE HYDRAULICS AND FLUID MACHINERY LABORATORY	**0**	**0**	**3**	**2**

OBJECTIVES:

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

FLUID MECHANICS LAB

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

FLUID MACHINERY LAB

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

List of Experiments

1. Flow measurement using Venturimeter
2. Flow measurement using Orificemetrer
3. Flow measurement using Flow nozzle
4. Flow through pipe- Friction factor
5. Flow through Rectangular notch
6. Flow measurement using Rota meter
7. Performance test on Pelton Wheel
8. Performance test on Reciprocating pump
9. Performance test on Centrifugal pump
10. Performance test on Jet pump
11. Performance test on Francis turbine
12. Performance test on Submersible pump
13. Buoyancy experiment- Meta centric height
14. Flow measurement using Pitot tube
15. 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 behavior of fluids
- To Calculate the frictional losses and Cd of fluids when it passes through various obstructions
- To calculate the performance characteristics of hydraulic pumps and turbines and air compressor

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

FLUID MECHANICS LABORATORY

Sl.No.	Name of the Equipment	Qty.
01	Buoyancy Experiment Cargo Ship Model War Ship Model	 01 01
02	Pitot tube	01
03	Flow nozzle	01
04	Rotameter	01
05	Notches	01
06	Venturimeter	01
07	Orifice meter	01
08	Frictional Losses in pipes	01

FLUID MACHINERY LABORATORY

Sl.No.	Name of the Equipment	Qty.
01	Centrifugal pump	01
02	Impulse Turbine (Pelton)	01
03	Reaction Turbine (Francis)	01
04	Reciprocating pump	01
05	Submersible pump	01
06	Jet pump	01
07	Air compressor	01

MR18312 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.

List of Experiments

Welding Techniques

1 Study of various welding methods
2 Butt joint in downward and horizontal position
3 Lap Joint in downward and vertical position
4 Lap Joint in vertical and horizontal position
5 Butt joint using Gas welding
6 Study and Practice of hand tools
7 Sheet metal work-Fabrication of funnel
8 Making of T fitting(Pipe work)
9 Bending operation in piping work
10 Joining of pipe fittings using welding

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.

List of Experiments

Lathe and Special Machine Shop

1 Study of lathe, shaping machine and drilling machine
2 Facing, center drilling, straight turning and chamfering
3 Step turning, Grooving and Knurling
4 Taper Turning
5 Thread Cutting
6 Spur Gear cutting in milling machine
7 Cylindrical Grinding
8 Internal Keyway cutting
9 Making Cuboid using shaper.

TOTAL : 90 PERIODS

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

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

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

WELDING TECHNIQUES, LATHE AND SPECIAL MACHINE SHOP:

Sl. No.	Name of the Equipment	Qty.
1.	Light duty Lathe	01
2.	Medium duty Lathe	03
3.	Heavy duty Lathe	04
4.	Shaper	01
5.	Slotter	01
6.	Planner	01
7.	Radial drilling m/c	01
8.	Surface grinder	01
9.	Pedestal grinder	01
10.	Vertical milling m/c	01
11.	Universal milling m/c	03
12.	Tool & cutter grinder	01
13.	Gear hobber	01
14.	CNC Lathe Machine	01
15.	Capstan Lathe	01
16.	Cylindrical grinding m/c	01
17.	Power hacksaw	01
18.	Duplicating Lathe	01

WELDING WORK SHOP

Sl. No.	Name of the Equipment	Qty.
1.	Welding Transformer Air Cooled with Fan	04
2.	Maxi – MIG 400A Welding Set	01
3.	AOL make TIG Control Outfit	01
4.	Welding Rectifier Throluxe – 401 MMA	01
5.	Water Cooled Torch 0150102071 400 AMPS	02
6.	Bending Machine Pipe dia ½” to 3”	01
7.	Gas welding and cutting set	02

FITTING SHOP

Sl. No.	Name of the Equipment	Qty.
1.	Power Hacksaw	01
2.	Vernier Height Gauge	02
3.	Surface Plate with stand	02
4.	Fitting Bench Vice	40
5.	Hand tools (Different types)	-

IV SEMESTER

MA18451 COMPUTATIONAL METHODS **L T P C**
(Common to CE/CH/EE/ME/MR) **3 0 0 3**

OBJECTIVES:

- This course aims at providing the basic idea of solving Algebraic and transcendental equations
- To understand basic idea of Interpolation and Approximation
- To learn how to apply Numerical Differentiation and Integration
- To learn application of Numerical solution of Boundary Value Problems
- 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 EIGEN VALUE PROBLEMS 9

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

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals - Lagrange's interpolation – Inverse interpolation using Lagrange's method - Newton's divided difference interpolation – Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

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 9

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 9

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 : 45 hours

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.
- Able to apply interpolation Technique to find intermediate numerical values.
- Students are able to validate experimental values with numerical results.
- They are in a position to formulate the problems in ODE and solve numerically.
- Students are able to find solution for heat transfer and vibration problems arises in their course of study.

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.

		L	T	P	C
MR18401	**STRENGTH OF MATERIALS FOR MARINE ENGINEERING**	**3**	**1**	**0**	**4**

OBJECTIVES:

- To impart knowledge to determine various stresses and strains in simple and composite members under external load.
- To understand and calculate the Shear force and bending moment for the various types of statically determinate and indeterminate beams and to draw the SFD and BMD.
- To impart knowledge on fundamentals of bending stress and shear stress, principle stresses
- To understand and calculate the deflections caused by the external loads on beams and to design open coiled and closed coiled helical springs based on shear and bending.
- To understand and calculate the critical load using the Euler's formula, Rankine formula in column and to understand the concept of thin and thick, compound cylinders

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 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 III 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 IV SLOPE, DEFLECTION AND TORSION 10+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 - 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,STRUCTS,CYLINDERS AND PRESSURE VESSELS 8+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. Lame'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:

At the end of the course the students would have learnt

- To identify and determine the behavior of the materials for simple loads
- To analyze and design the beam based on shear force and bending moment.
- To design the beam based on various stresses to design the cross section of the beam based on loading conditions.
- To calculate the deflection in beams and design the springs.
- To design column and pressure vessel

TEXT BOOKS:

1. Bansal R.K, " A textbook of Strength of Materials", 5th edition, Laxmi Publications (P) Ltd, New Delhi,2010
2. Rajput. R.K. "Strength of Materials", 5th Edition, S. Chand &Co., New Delhi, 2006

REFERENCES:

1. Beer Johnston, Dewolf Mazurek, "Mechanics of Materials", 6th edition, McGraw Hill Education(India) Pvt.Ltd, New Delhi,2014
2. James M Gere, "Mechanics of Materials", 6th Edition, Cengage learning India pvt limited, Delhi, 2006.
3. Jindal, U.C., "Strength of Materials', 1st Ed., Pearson, 2011
4. Rattan S S, " Strength Of Materials", 2nd edition, McGraw Hill Education(India) Pvt.Ltd, New Delhi,2011

MR18402	MARINE DIESEL ENGINES – I	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

- Fuel technology and combustion in I.C. Engines
- Types and characteristics of Marine Diesel Engines
- Construction of Large Marine Propulsion Engines
- Cooling, Scavenging and Supercharging arrangements in Marine Diesel Engines
- Camshaft, Crankshaft and their drive arrangements.

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

Liquid fuels – petroleum distillation process – effects of modern refining on residual fuel Properties of 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 required for combustion – combustion of hydrocarbons (theoretical treatment). Control of NOx, SOx in Exhaust Emission.

UNIT II TYPES & 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 CONSTRUCTION OF LARGE MARINE PROPULSION ENGINES 15

Construction of Bed Plate, Engine chokes and Holding down bolts arrangement. Construction of 'A'frames, Cylinder blocks, Tie bolts, Jack bolts. Construction of Piston- Piston rings – Clearances - Cross heads, Connecting rods, Crank shaft, Bearings, Liner – Construction. 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. Construction and working of Fuel injection pumps-Jerk type and valve type (Sulzer engines), Fuel injectors. Types of liner wear, measurement of clearance in liner and piston.

UNIT IV COOLING, SCAVENGING AND SUPERCHARGING ARRANGEMENTS SCAVENGING SYSTEM 12

Methods of scavenging - Types and methods of supercharging - Super charging arrangements and their Merits & Demerits - Under piston scavenging, Turbocharging.

SUPERCHARGING ARRANGEMENTS

Pulse and constant pressure type; merits and demerits in highly rated marine propulsion engines. Turbocharger construction and its details.

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 V CAMSHAFT, CRANK SHAFT AND THEIR DRIVE ARRANGEMENT 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:

Upon the completion of this course the students can understand

- Fuel technology and combustion in I.C. Engines
- Types and characteristics of Marine Diesel Engines
- Construction of Large Marine Propulsion Engines
- Cooling, Scavenging and Supercharging arrangements in Marine Diesel Engines
- Camshaft, Crankshaft and their drive arrangements.

TEXT BOOKS:

1. Sanyal D.K, “Principle & Practice of Marine Diesel Engines”, 2nd Edition, Bhandarkar Publication, Mumbai, 2010
2. Wood yard, Doug, “Pounder’s Marine Diesel Engines”, 7th Edition, Butter Worth Heinemann Publishing, London, 2014.

REFERENCES:

1. Christensen, Stanley G “Lamb's Questions and Answers on The Marine Diesel Engine”, 8th Edition, Butter Worth Publicatons, 2001
2. Taylor D.A, “Introduction to Marine Engineering”, 2nd Edition, Butter worth – Heinemann, London, 2011.
3. Prof. K. Venkataraman,.Engineering knowledge (Motor) Volume-I, Notes
4. Prof. K. Venkataraman,, Engineering knowledge (Motor) Volume-II, Notes
5. Prof. K. Venkataraman,, Marine diesel engine principle and practice-Notes

MR18403 MARINE AUXILIARY MACHINERY – I

L	T	P	C
3	0	0	3

Objectives

- To impart knowledge on Ship's Engine Room Layout, Piping systems and fittings.
- To impart knowledge on valves, cocks , packing, joints, filters and stainers
  To impart knowledge on Various types of Pumps and its applications.
- To develop theoretical knowledge on Construction details of Heat exchangers, Evaporators
- To study the Ship's steering systems.

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 and their usage. 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 9

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 – maintenance and repairs of same. 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 9

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 – measurement of clearances.

OUTCOMES:

On completion of the course the students will acquire knowledge of

- Ship's Engine Room Layout, Piping systems and fittings.
- valves, cocks , packing, joints, filters and stainers
- 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.

REFERENCE:

1.) Vikram Gokhale, N. Nanda, "Advanced Marine Engineering Knowledge Vol. II", 2nd Edition, Engineer Enterprices, Mumbai, 2001.

2)Vikram Gokhale & N. Nanda, "Marine Engineering Knowledge for Junior Engineers, 3rd Edition, Engineer Enterprises, Mumbai, 1999.

3) T.B.Srinivasan, "Marine Machineries – Operation & Maintenance", 1st Edition, The Institute of Marine Engineers, India.

MR18404 MARINE BOILERS AND STEAM TURBINES L T P C

3 0 0 3

OBJECTIVES:

- To provide knowledge to the students about different type of marine boilers.
- To provide knowledge to the students on the safety valves and the boiler feed system.
- To provide knowledge to the students in on the marine boiler combustion and the fuel oil system.
- To provide knowledge to the students about boiler operation and its maintenance.
- To provide knowledge to the students about the construction, operation and maintenance of turbines.

UNIT I MARINE BOILERS 9

Construction and working of scotch boiler, Cochran boiler. Water tube boiler: - Babcock Wilcox boiler, foster wheeler, Thimble tube boiler, Double evaporation boilers, composite boilers, Lamont exhaust gas boiler. Advantages of water tube boilers. Stresses in boilers, corrosion in steam system.

UNIT II BOILERS MOUNTINGS AND FEED SYSTEMS 9

Construction and working of safety valves: - improved high lift safety valve, full bore safety valve, 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 and manhole door construction. Feed system- Open and close feed system, hot well, cascade tank, observation tank, super heater and its general arrangements. Simple basic treatment for the Feed water.

UNIT III COMBUSTION IN BOILERS 9

Theory of combustion in boiler, construction of various types of burners -pressure jet, blast jet, rotating cup type burner, excess air requirements & furnace refractory materials. Boiler fuel system, construction and operation of soot blowers

UNIT IV OPERATION & MAINTENANCE OF BOILER 9

Boiler blowing down procedure, manhole door opening procedure, tube renewals, procedure for steam raising from cold, boiler operating procedures, inspection and survey of boilers, safety valve over hauling, soot blower-fixed type, retractable soot blower, soot blowing procedure, accumulation pressure testing and hydraulic pressure testing.

UNIT V MARINE STEAM TURBINES 9

Steam turbines- working principle and construction of impulse turbine and reaction turbine. Construction of condensers. Material used in various components such as blades, rotors, casing, nozzle etc…essential boiler water testing

Operation and maintenance of turbine-speed and power control, throttle valve control and nozzle control, emergency operations of turbines, emergency control, vibration in marine steam turbine drain system, turbine gland system, warming through a turbine plant. Turbine bearing and lubrication system

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course the students will have the knowledge & understanding

- Construction of various types of boilers
- Boiler safety and the boiler fed system
- Combustion in boilers
- Operation and maintenance of boiler
- Operation and maintenance of the steam turbines.

TEXT BOOKS:

1. GTH. Flanagan," Marine Boilers" 3rd Edition, Butter Worth, London, 2001.
2. J.H. Milton & R.M. Leach,"Marine steam boilers ", 4th edition, butter worth, London, 1980.
3. Thomas D. Morton, "Reed's Steam engineering knowledge for engineers", Vol 9, 2011.

REFERENCES:

1. L. Jackson & T.D. Morton, "General Engineering Knowledge for marine Engineers", 4th Edition.
2. WILLIAM J.KEARTON, D. Eng." Steam turbine operation.
3. A.K. Ramanujam," Marine Boilers"
4. Engineering knowledge and general boiler notes.

EC18451 MARINE ELECTRONICS **L T P C**
3 0 0 3

Objective:

- To understand the basics of Electronics Circuits**.**
- To learn the concepts of Combinational and Sequential Circuits in Digital Electronics.
- To study about the working of controllers and measuring instruments.
- To understand the working principle of power electronic devices and Satellite Communication.
- To study the architecture and assembly language programming of 8051 microcontroller.

UNIT I BASICS OF ELECTRONIC CIRCUITS 8

Bipolar Junction Transistor (BJT)- Review of characteristics of BJT - Application of BJTas an amplifier, an oscillator and a switch

555 Timer-Introduction-Description of functional diagram -Applications-Missing pulse detector, Frequency divider.

UNIT II DIGITAL CIRCUITS 9

Introduction to Digital Circuits - Boolean expression - Minimization of Boolean expressions using K-Map, Combinational circuits – Multiplexers/ Demultiplexers – Encoders/Decoders - Sequential circuits-Asynchronous and synchronous Counters – Shift Registers - Memory – Different types of Memory

UNIT III CONTROLLERS AND ELECTRONIC INSTRUMENTS 12

Controllers– Basics of Electronic Control Equipment – Control Mechanism of PLC (Programmable Logic Controller), Integrated Automation Control and Monitoring System (IACMS) – Computer Programmable Controller – Relay Circuit Unit – Digital Sequential Control Devices

Electronic instruments: Cathode Ray Oscilloscope – Digital voltmeters – Multimeter – Signal Generators – Q – meters-Data loggers-Transducers for vibration, pressure, volume and velocity measurement

UNIT IV INDUSTRIAL ELECTRONICS 9

Thyristor – Audio Visual Alarms **-** Photoelectric devices – LED – LCD – 7 Segment Display– RADAR – SONAR **–**Fiber optic Gyroscope Sensor –Satellite Communication as applicable to GMDSS, GPS, INMARSAT.

UNIT V MICROCONTROLLERS 7

Introduction to Microcontrollers – Architecture of 8051 - Assembly Language Programming**–** Applications of 8051

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students are able to:

- Analyze the operation of BJT with Characteristics curve.
- Design of sequential circuit using flip flop.
- Do electronic measurements for Industrial applications
- Understand the application of satellite communication.
- Develop algorithm and write assembly language program for 8051 microcontroller.

Text Books:

1. M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011

References:

1. D.Roy Chowdhary,Shail.B.Jain,”Linear Integrated Circuits”,Second edition,New age International 2003.
2. Hofmann, “Global Positioning System”, 5th Edition., Springer, Indian reprint 2007 (Yesdee Publishing Pvt. ltd.)
3. P.S.Bimbhra, “Power Electronics”, 3rd edition, Khanna Publisher, New Delhi, 2001.
4. Umesh Rathore,Ved Prakash Sharma ,:Programmable Logic controller and Microcontroller",First Edition, S.K.KATARIA & SONS,Publisher of Engineering & Computer Book.
5. John.C.Payne,”Marine Electrical and Electronics bible”,Third edition,Sheridan House Publishers,2007

	L	T	P	C
MR18411 STRENGTH OF MATERIALS AND APPLIED MECHANICS LABORATORY	**0**	**0**	**4**	**3**

OBJECTIVES:

To impart skill to the students to understand and conduct the experiments to test materials in the Strength of materials and applied mechanics Laboratory

STRENGTH OF MATERIALS LAB

Tension Test on M.S. Rod.
Compression test – Bricks, concrete cubes.
Deflection Test - Bench type verification of Maxwell theorem.
Tension test on thin wire.
Hardness test on various machines.
Micro hardness test on various nonferrous alloy
Tests on wood - Tension, compression, bending, impact in work testing machine.
Tests on springs - Tension, compression.

APPLIED MECHANICS LAB

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

List of Experiments

1. Double shear Test in U.T.M.
2. Deflection Test - Bench type verification of Maxwell theorem
3. Hardness test on various machines
4. Tests on springs – Tension, compression.
5. Charpy Impact test.
6. Strain measurement using Rosette strain gauge.
7. Tension Test on M.S. Rod
8. Izod Impact Test
9. Load measurement using load indicator, load coils
10. Compression test – Bricks, concrete cubes
11. Micro Hardness test
12. Tests on wood - compression
13. Tension test on thin wire
14. Fatigue test.

TOTAL: 60 PERIODS

OUTCOMES:

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

- To operate the various testing machines.
- To carry out various tests on materials
- To choose the best materials for a particular use , based on the test results

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty.
1.	UTM (Universal Testing Machine)	01
2.	Compression Testing Machine	01
3.	Deflection Testing Rig	01
4.	Hardness – Brinell, Rockwell Testing Machines	01
5.	Micro hardness testing machine	01
6.	Wood testing machine	01
7.	Spring Testing Machines – Tension, Compression	01
8.	Impact Testing Machines – (Izod, Charpy)	01
9.	Load Cells	01
10.	Fatigue Testing Machine	01
11.	Rosette strain gauge.	01

MR18412	THERMAL ENGINEERING AND BOILER CHEMISTRY LABORATORY	L	T	P	C
		0	*0*	*4*	*2*

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 and fresh water

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.

List of Experiments

1. Performance test on steam turbine
2. Determination of dryness fraction of steam using steam calorimeter
3. Performance test on air blower
4. Determination of C.O.P of refrigeration test rig
5. Performance test on air conditioning test rig
6. Determination of calorific value of liquid fuels
7. Determination of Flash and Fire point of given oil
8. Determination of viscosity of oil using redwoods viscometer
9. Performance test on Diesel engine with AVL setup
10. 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.
- Waste water treatment by adsorption method.

List of Experiments

1. To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO3.
2. To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO3.
3. To determine Alkalinity due to Phenolphthaline, total Alk. and Caustic Alk. Of the sample of water (in P.P.M).
4. To determine Phosphate Content of the sample of water.
5. To determine dissolved Oxygen content of the sample of water.
6. To determine sulphate content of given sample of water.
7. To determine Ph-value of the given sample of water.
8. Boiler trial.
9. Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
10. Water Analysis (Fresh and sea water)- Chloride, sulphate, hardness
11. Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.
12. Waste water treatment by adsorption method.

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.

REFERENCES:

1. Laboratory Manuals
2. M.E.P., "Water Treatment", Marine Engineering Practice , Vol-2 Part-14, IMarEST, London
3. Mathur, M.L., Sharma, R.P., "Internal Combustion Engines", 7th Ed. Dhanpat rai Publications, REPRINT 2002
4. Willard W. Pulkrabek, " Engineering Fundamentals of the Internal Combustion Engines", 1st Ed. , PHI Learnings Pvt. Ltd., 2011
5. Flanagan,G.T.H, 'Marine Boilers", 1st Ed. ,Elsevier, 1990

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
THERMAL ENGINEERING LAB

.THERMAL ENGINEERING

Sl.No	Name of the Equipment	Qty.
1.	Internal Combustion Engines Section	01
2.	Fuel and Lubrication Oil Testing Equipments	01
3.	Heat Transfer Equipments	01
4.	Steam Lab. Equipments	01
5.	Refrigeration and Air Conditioning Equipments	01 set
6.	Automobile Components	01
7.	Engine Research Centre	01
8.	Computers with UPS	01
9.	Miscellaneous Equipments	01

INTERNAL COMBUSTION ENGINES SECTION

Sl.No	Name of the Equipment	Qty.
1.	Multi Cylinder Petrol Engine	01
2.	Twin Cylinder Diesel Engine	01
3.	Kirloskar Diesel Engine	01
4.	Greaves Cotton diesel engine	01
5.	Two Stroke Petrol Engine	03 nos
6.	Two Stroke Diesel Engine Model	01
7.	Four Stroke Petrol Engine	01
8.	Four Stroke Diesel Engine Model	01
9.	Two Stroke Petrol Engine Model	01
10.	Multi Cylinder Petrol Engine	01
11.	Four Stroke Single Cylinder Diesel Engine (Anil)	01
12.	MK-12 Petrol Start Kerosene run Engine	01
13.	Battery charger	01

FUELS AND LUBRICATION OIL TESTING EQUIPMENTS

Sl.No	Name of the Equipment	Qty.
1.	Redwood Viscometer	01
2.	Saybolt's Viscometer	01
3.	Closed cup apparatus (Pensky)	01
4.	Bomb Calorimeter with Beckman (Digital)	01
5.	Junker's Gas Calorimeter	01

BOILER CHEMISTRY LAB

Sl.No	Name of the Equipment	Qty.
1	Burette, Pipette, Beaker, Conical Flask, Bunsen Burner	01 each
2	Burette, Pipette, Conical Flask, STD Flask 100ml	01 each
3	Burette, Pipette, Conical Flask, STD Flask	01 each
4	Burette, Pipette, Conical Flask.	01 each
5	Do Bottle, Burette, Pipette, Conical Flask.	01 each
6	Wephlo turbidity meter, STD Flask Pipette.	01 each
7	PH meter, Buffer tablets, beaker.	01 each
8	Petridish, Hot air Oven, Weighing Balance	01 each
9	Water Analysis kit.	01 nos
10	Burner, Silica, Crucible, Electric Bunsen, Petridish Hot air Oven	01 each
11	Burette, Pipette, Conical Flask, turbidity meter, Bunsen Burner, Beaker, STD Flask	01 each

V SEMESTER

MR18501	SHIP CONSTRUCTION	L	T	P	C
		3	0	0	3

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.
- Offshore Technology

UNIT I SHIP TERMS 9

Various terms used in ship construction with reference to ship's parameter e.g. L.B.P.-Moulded Depth - Molded 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-DP systems-principle and operations – firefighting arrangement – Pipe laying ships – special auxiliary service ships– 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. Kongsberg K-Pos DP(OS) Dynamic positioning system with offshore loading application Operator Manual 2001
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.

MR18502	MARINE DIESEL ENGINES - II	L	T	P	C
		3	1	0	4

OBJECTIVES:

To make the students to learn about

- the concept of Marine lubrication
- the Maneuvering systems, indicator diagrams and power calculations
- the Governers, medium-speed engines
- the Engine systems, governers, forces and stresses on engines.
- the Developments in marine 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 MANEUVERING 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, the 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-B&W 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 Publicatiion, 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.

MR18503	MARINE AUXILIARY MACHINERY- II	L	T	P	C
		3	1	0	4

OBJECTIVES:

To impart the knowledge on

- Operation and maintenance of the oil water separator, incinerator and sewage.
- Maintenance, construction and operation of air compressor, deck machinery and purifier.
- Various shaft alignments and its methods, construction and operation of thrust block, stern tube, etc.
- Dry-docking techniques and maintenance of rudder, propeller, bow thruster, etc.
- Practice and the maintence of machinery, planned maintenance, troubleshooting of machineries

UNIT I OPERATION AND MAINTENANCE 9

Operation, Construction, maintenance of oil water separator both manual and automatic versions. Construction, operation, maintenance of incinerator and the sewage treatment plant. Explanation of Marpol relevant annexure and Regulation.

UNIT II THEORY OF OIL PURIFICATION/ AIR COMPRESSOR 9

Construction, operation and maintenance of fuel oil and lub oil purifiers, clarifiers with self de-sludging operation. Theory of air compressor, maintenance and operation of air compressor on board, construction, maintenance and operation of emergency air compressor. Types of bow thrusters, Construction, operation and maintenance of deck machinery, cargo winches, windlass mooring winces. Safe working practice during the operation and the maintenance of the machinery

UNIT III METHODS OF SHAFT ALIGNMENT 9

Construction and operation, maintenance of thrust block, Intermediate shaft. Construction and operation of stern tube, Oil cooled and water cooled stern tube operation and maintenance. Stern tube sealing glands, stresses in the shafting, i.e. intermediate shaft, thrust shaft, Screw shaft. Need for the shaft alignment and different methods of shaft alignment

UNIT IV DRY DOCKING 9

Preparation and procedure to dry docking the vessel, maintenance of hull, underwater fitting and the machine maintenance and repair during the dry docking removal. Maintenance of the rudder and the propeller. Removal and maintenance of tail shaft and stern bearing. Methods of dry docking eg. Slipways, Drydocks, Shiplift system etc. Safe working practice during dry dock works. Purpose of dry docking, Rules and regulation for the dry docking Time interval.

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

Safe working practices and maintenance of the machinery, dealing with the wear and tear, both electrical and mechanical, alignment of components, temporary and permanent repairs. Detection of machinery malfunction and action to prevent damage. 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 brief knowledge on

- Operation and maintenance of the oil water separator, incinerator and sewage.
- Maintenance, construction and operation of air compressor, deck machinery and purifier.
- Various shaft alignments and its methods, construction and operation of thrust block, stern tube, etc.
- Dry-docking techniques and maintenance of rudder, propeller, bow thruster, etc.
- Practice and the maintence of machinery, planned maintenance, troubleshooting of machineries

TEXT BOOKS:

1. DW Smith, “Marine auxiliary machinery”, 6th edition, Butterworth’s, London, 1987.
2. Leslie Jackson and Thomas D. Morton, “Reed’s general engineering Knowledge for marine engineers”, 4th edition, Thomas reed’s, 1999.
3. H.D. McGeorge, “Marine Auxiliary machinery”, 7th edition, Butterworth’s, London, 2011.

REFERENCES:

1. DK Sanyal, “Principle and Practices of marine diesel engine” 2nd edition, Bhandarkar Publication, Mumbai, 1998.
2. MARPOL 73/78, IMO Publication, 2001.
3. Wood yard and Doug, “Pounders Marine Diesel Engine” 7th edition, Butterworth’s Heinemann Publication, London 2001.
4. Heinz P Bloch, Fred K Geitner,” Machinery Component Maintenance and repair” 3rd edition, Elsevier,2010.
5. “Pumping and Piping Diagram”, IME Publication 1999

EE18551	Marine Electrical Machines – II	L	T	P	C
		3	1	0	4

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- IC 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 9

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) Measurement of power and method of finding cable faults.

2) The procedure for producing electricity on board ships through alternators, Design features of Alternators – their construction , operation and associated controls.

3) Principles of operation and construction details of synchronous motors, induction machines

4) Speed control and trouble shooting in induction machines.

TEXT BOOKS:

1. Edmund GR Kraallavers , “Advanced Electro-technology For Marine Engineers”, 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London,2010
2. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.

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”, 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002
4 Charles, I. Hubert, “Electric Machines”, 2nd Ed., Pearson, 2002
5 Ghosh, S., “Electrical Machines”,2nd Ed., Pearson, 2012

MR18505	ENGINEERING METROLOGY, INSTRUMENTATION AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the working of linear, angular, form measuring instruments.
- To provide basic idea about working principle and applications of devices for measurement of temperature, pressure, flow, level, speed and torque, etc.
- To give exposure to basics of control system
- To familiarize with the working of Control system equipments.
- To provide knowledge about Automation and Controls fitted in ships

UNIT I LINEAR, ANGULAR AND FORM MEASUREMENT 9

Introduction to Metrology – Principle and construction of measuring instruments- Linear measurement-Vernier caliper, Micrometer, Height gauge, Depth gauge- angular measurement-Bevel Protector, Auto collimator, Sine bar- Slip gauge-types, applications, and wringing method- Thread measurement - gear measurement, measurement of various element of Gear – Constant chordal method.

UNIT II INSTRUMENTATION 9

Static and dynamic characteristics of measuring instruments. Construction and operation of electrical testing and measuring equipment. Filters, Regulated Power Supply. Transducers and transmitters suitable for measurement of temperature, pressure, flow, level, speed, torque, vibration, humidity and water content with calibration.

UNIT III BASICS OF CONTROL SYSTEM 9

Terms used in control systems, open loop and closed loop control systems - feedback and feed forward control systems -Fundamentals of Automatic Control, Various Automatic Control, ON-OFF Control, Sequential Control, Theory and characteristics of PID control and its tuning, Measurement of Process Value – Temperature (Mechanical, Electrical), Pressure, Level (Direct methods and Inferential methods), Flow, General measurement and process.

UNIT IV CONTROL SYSTEM EQUIPMENT 8

Transmission of Signals – Transmitters, Controlling elements (Pneumatic, Electrical, Electronics).Manipulator Elements – Principles, Operation, Application, Pneumatic, Electrical Servomotor, Hydraulic Servomotor- Features of Pneumatic and Hydraulic Control Equipment.

UNIT V APPLICATION OF CONTROLS ON SHIPS 10

Functions and mechanism of automatic control for main engines and auxiliary machinery - Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery.

Design features and system configuration of automatic control equipment and safety devices for the following - General Requirements, Main Engine, Generator and distribution system, Steam boiler. Application of computers in ship

TOTAL: PERIODS 45

OUTCOMES:

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

- Principle of linear, angular and form measuring instruments
- various devices for measuring temperature, pressure, flow, level, speed, torque, vibration, humidity

- Basics of Control systems.
- Electrical, Electronics, Pneumatic and Hydraulic control systems and its equipments
- Design aspects of control systems on board ships.

TEXT BOOKS:

1. M. Mahajan, “A Text Book of Metrology”, Khanna Publishers, 2015.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005
3. Smith,“Application Of Automatic Machinery And Alarm Equipment In Ships”, Marine Engineering Practice, Vol 1,Part 06, IMarEST, London

REFERENCES:

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

MR18511	MARINE PROPULSION AND AUXILIARY MACHINERY OVERHAULING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

● To impart knowledge about overhauling of equipments associated with Main engine, Auxiliary engine and Auxiliary machinery.

MAIN ENGINE

1. Dismantle and assembly of plate type heat exchanger.

2. Dismantle and assembly of shell and tube type heat exchanger.

3. Inspection of crankcase and measurement of bearing clearance.

4. Dismantle and assembly of Valve type Fuel pump and Fuel injection valve.

5. Dismantle and assembly of Starting air valve, Cylinder relief valve and indicator cock.

AUXILIARY ENGINE

1. Study of Turbo-charger.

2. Study of Cylinder Head construction.

3. Dismantle and assembly of Jerk type fuel injection pump.

AUXILIARY MACHINE

1. Dismantle and assembly of Centrifugal pump, reciprocating pump and valve chest.

2. Dismantle and assembly of Screw pump.

3. Dismantle and assembly of Boiler safety valve and water level Gauge glass.

4. Study of 2 Ram hydraulic steering gear including Emergency steering procedure.

5. Dismantle and assembly of various valves and filters.

6. Study of Cargo-oil pump, Fresh water generator and Purifier.

7. Study of sewage treatment plant and Incinerator.

TOTAL: 60 PERIODS

OUTCOMES:

- At the end of the course,the students are expected to have the ability to dismantle,clean, repair and re-assemble the equipments associated with Main engine.
- At the end of the course,the students are expected to have the ability to dismantle,clean, repair and re-assemble the equipments associated with Auxiliary engine.
- At the end of the course, the students are expected to have the ability to dismantle, clean, repair and re-assemble the equipments associated with auxiliary machinery.

- At the end of course students will be able to appreciate the importance of critical checks.

REFERENCE BOOKS:

1. Marine Auxiliary Machinery – H D Mc George 7th Edition, Reprinted 2015.

2. Introduction to Marine engineering – D A Taylor 2nd Edition, Reprinted 2011.

REFERENCE MANUALS:

1. Operation, Maintenance manuals for Main engine—MITSUI B&W 5L70MCE Power 9000 Kw @ 95RPM of the vessel MT TORM GUNHILD.

2. Operation, Maintenance manuals for Auxiliary engine – SCANIA DIESEL ENGINE DS-11 -43A 20T Power 213KW @ 1800 RPM of the vessel MT TORM GUNHILD.

3. Operation, Maintenance manuals for various auxiliary machinery AIR COMPRESSOR—HV 2/220 DELIVERY 185m^3/Hr , CENTRIFUGAL PUMP NIP 125B-NLX CAPACITY 160 m^3/Hr of the vessel MT TORM GUNHILD.

MR18512	MECHANICAL MEASUREMENT AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

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

A.MEASUREMENT LABORATORY

- Use of precision measuring instruments like micrometer, Vernier, height and depth gauges, surface plate, etc.
- Checking dimensions of a part using slip gauge.
- Use of sine bar for measuring angles and tapers.
- Measurement of tooth thickness by gear tooth Vernier.
- Calibration of dial gauge.
- Taper and bore measurement-using spheres / bore dial gauge/ Telescopic gauge.
- Fundamental dimension of a gear using contour projector.
- Testing squareness of a try square using slip gauges.
- Checking straightness of a surface plate using autocollimator.
- Measurement of angles between centre lines of holes drilled radially on a shaft.
- Measurements of thread parameters using floating carriage micrometer.
- Use of pneumatic comparator and mechanical comparator
- Measurement of Surface roughness using surftester
- Angle measurement using Bevel protector
- Checking of irregular topographies using CMM

List of Experiments

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 angles of oblique drilled holes and V Block.
5. Measurement of tooth thickness by gear tooth vernier and profile projector.
6. Measurements of thread parameters using floating carriage micrometer.
7. Testing squareness of a try square using slip gauges.
8. Measurement of angles of Dovetail.
9. Use of pneumatic comparator
10. Checking straightness of a surface plate using autocollimator.
11. Bore measurement-using spheres
12. Irregular topography measurement using CMM

B. INSTRUMENTATION LABORATORY

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

List of Experiments

1. Torque measurement
2. Force measuring devices - proving rings
3. Pressure measuring devices-pressure and vacuum gauge.
4. Temperature measuring devices like thermometer, thermocouple, radiation pyrometer, etc.
5. Speed measuring devices like tachometer, stroboscope, etc.
6. Study and use of strain- LVDT.

TOTAL: 60 PERIODS

OUTCOMES

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

- 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

EE18561 Electrical, Electronics and Micro Controller Laboratory

L	T	P	C
0	0	4	2

OBJECTIVES:

To impart Practical knowledge in operation and maintenance of Electrical Machines and Electronic equipment's. To enable the students to understand the fundamental concepts of Linear Integrated circuits, Digital Electronics, Micro controller and its applications.

ELECTRICAL

1. Load Test on D.C. Shunt Motor
2. Load Test on D.C.Series Motor
3. O.C.C. & load characteristic of self/separately excited D.C. Generator.
4. Parallel operation of D.C.Shunt Generator
5. Speed control of D.C.Shunt Motor.
6. Load O.C. & S.C. test on single-phase transformer.
7. Parallel operation of single-phase transformers.
8. To connect similar single-phase transformers in the following ways.Y-Y, A-A, A-Yand Y-A.
9. Load Test on Squirrel cage induction motor
10. Load Test on Slip ring induction motor
11. Pole changing motor for various speeds.
12. Synchronization of 3-phase alternator.
13. Trouble shooting in Electric Motors and Transformers. Exercises in Power Wiring and earthing.

ELECTRONICS

1. Operational Amplifier (Inverting, Non–Inverting and Voltage follower).
2. Design of Adder, Subtractor, Integrator, Differentiator using Op amps.
3. Clock signal generation using 555 timer
4. Study of logic gates
5. Design of Adders and Subtractors using logic gates
6. Study of flipflops
7. Implementation of Counters.
8. Study of Linear Variable Differential Transformer.
9. Characteristics of Light Emitting Diodes(LED)

MICROCONTROLLER (Using 8051)

10. Basic arithmetic Operations.

11. Basic Logical operations

12. Interfacing of Stepper motor

Course Outcomes: At the end of the course, the student should be able to:

1. Conducting all types of tests on the Shunt and Series Motors

2. Load tests on the Transformers, parallel operation of single phase Transformers

3. Synchronizing three phase Alternators

4. Trouble shoot electrical motors, transformers

5. Understand the Operation of Operational Amplifier and its applications, digital Electronics, applications 8051 Microcontroller.

TOTAL: 60 PERIODS

VI SEMESTER

MR18611 **MARINE WORKSHOP PRACTICES AND AFLOAT TRAINING**

L	T	P	C
	48		12

OBJECTIVES:

To impart knowledge, skill and to train the students to be able to perform as Engineer officer on board the 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-dairy. During the training period and after completion of training students will be accessed.

TOTAL: 1200 HOURS

OUTCOMES:

On completion of the workshop training, the students are expected to have acquired 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

REFERENCES:

1. Original Equipment Manufacturers Manuals For On Board Equipments 1998
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. Parrlin, "Steering Gear" Marine Engineering Practice, Vol 1,Part 09, IMarEST, London
5. Jones, "A Practical Guide To Marine Fuel Oil Handling," Marine Engineering Practice, Vol 3,Part 19, IMarEST, London

6. Henshall, “Marine Medium Speed Diesel Engines,” Marine Engineering Practice, Vol 1,Part 03, IMarEST, London
7. 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
8. Gopalakrishnan & Banerji, “Maintenance and Spare Parts Management”, PHI Learning Pvt. Ltd., 2010
9. Mishra and Pathak, “ Maintenance Engineering and Management,” 2nd Ed. , PHI Learning Pvt. Ltd., 2012
10. Venkataraman, “Maintenance Engineering and Management,” 1st Ed., PHI Learning Pvt. Ltd., 2010
11. L.Jackson & T.D. Morton, “General Engineering Knowledge for Marine Engineers”, 4th Edition, Thomas Reeds Publication, United Kingdom, 1986.
12. M.E.P., “Operation Of Machinery In Ships Steam Turbines, Boilers”, Marine Engineering Practice, Vol 2,Part 15, IMarEST, London
13. W.Laws, **“**Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.

PROFESSIONAL ELECTIVES

AND

OPEN ELECTIVES

ME18020	INDUSTRIAL ROBOTICS	L	T	P	C
		3	0	0	3

Objectives

To introduce the functional elements of Robotics

To impart knowledge on the direct and inverse kinematics

To introduce the concepts of sensors and machine vision

To educate on various Robot programming and Artificial intelligence

To introduce the robot cell design and robot economics

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, Machin 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-Various Steps; Economic Analysis of Robots - Pay Back Method - EUAC - Equivalent Uniform Annual Cost method.

TOTAL: 45 PERIODS

Course Outcomes

Students are able to

1. Know the functional elements of Robotics
2. Explore the various end effectors and robot kinematics
3. know the concepts of sensors and machine vision
4. familiar on various Robot programming and Artificial intelligence
5. know the robot cell design and robot economics

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.

MR18012 MECHANICS OF MARINE MACHINES **L T P C**

3 0 0 3

OBJECTIVES:

- To learn about the fundamentals of mechanism and machine and also able to understand the velocity and acceleration diagrams
- To study and understand the various parameters of gears and their profiles
- To understand the various control mechanisms such as governors and gyroscopic effect on aero planes and ships.
- To understand the concept of balancing of rotating and reciprocating masses.
- To understand Free, Forced and Torsional Vibration of Single Degree Freedom Systems.

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 – 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 – 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, unbalance due to reciprocating parts – slider crank mechanism

UNIT V VIBRATION **9**

Basic features of vibratory systems – Degrees of freedom – 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 -shaft with two rotors - torsional vibration of major components in Ships - problems.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will have the knowledge of velocity and acceleration of four bar and slider crank mechanisms.
- At the end of this course, students would have technical knowledge of gears and their tooth profiles.
- Upon completion of the course, students will be able to apply the principles of governors and gyroscopes to mechanical engineering application.
- At the end of this course, students will be able to know the concepts of balancing of rotating and reciprocating masses.
- At the end of this course, students will have the knowledge on vibrations.

TEXT BOOKS:

1. Rattan S.S, „.Theory of Machines‟., Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.
2. Sandhu, Singh, “Theory of Machines”, 3rd Ed., Pearson, 20093. Sandhu Singh, “ Theory of Machines”, 3rd Ed., Pearson, 2012

REFERENCES:

1. Shingley, J.E. & John Joseph Uivker, Jr., “Theory of Machines and Mechanisms”, 2nd Ed., McGraw – Hill International Editions, London, 1981.
2. Francis. TSE. Ivan E-Morse Rolland T. Hinkle, “Mechanical Vibrations”, 2nd Ed., CBS Publishers and Distributed, India, 1983.
3. Grover.G.K., “Mechanical vibrations”, 7th Edition, Nem Chand & Bros, Roorkee, India, 2001.
4. Thomas Bevan, “Theory of Machines”, 1st Ed. Pearson, 2011

MR18014	NUCLEAR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain some fundamental knowledge about nuclear physics,
- To study the nuclear reaction and materials,.
- To study the methodology of reprocessing
- To know the various nuclear reactors
- To study the various ways safe disposal of nuclear wastes

UNIT I NUCLEAR PHYSICS 9

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

UNIT II NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium- Fuel for nuclear ships.

UNIT III REPROCESSING 9

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

UNIT IV NUCLEAR REACTOR 9

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors- Nuclear Ships.

UNIT V SAFETY AND DISPOSAL 9

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to understand the basics of nuclear physics and fundamentals of nuclear engineering.
- Students will be able familiarize the various reactions, materials and the applications.
- Students will be able familiarize the methodology of reprocessing

- Students will be able familiarize the various nuclear reactors
- Students will be able to know the safety aspects related to nuclear engineering and disposal of the waste.

TEXT BOOKS:

1. Thomas J.Cannoly, “Fundamentals of nuclear Engineering” John Wiley 1978.

2 Collier J.G., and Hewitt G.F,”introduction to Nuclear power”, Hemisphere publishing, New York,1987.

REFERENCES:

1. Lamarsh J.R., “Introduction to Nuclear Reactor” Theroy, Wesley, 1966.
2. Duderstadt J.J and Hamiition L.J., “Nuclear Reactor Analysis” John Wiley 1976.
3. Walter A.E.and Reynolds A.B., Fast Breeder Reactor, Pergamon Press,1981.
4. Glasstone S. and Sesonske A., Nuclear Reactor Engineering, 3rd Edition, Von Nostrand, 1981.
5. Winterton R.H.S., Thermal Design of Nuclear Reactors – Pergamon Press,1981.

MR18031	RENEWABLE ENERGY RESOURCES	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of the course, the students are expected to know

- The importance and Economics of renewable Energy
- Power generation from Solar Energy
- Power generation from Wind Energy
- Technique of power generation from Bio Energy
- The Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel Cells and Hybrid Systems.

UNIT I INTRODUCTION 9

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil Nadu, India and around the World – Potentials, Achievements Applications and Economics of renewable energy systems.

UNIT II SOLAR ENERGY 9

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III WIND ENERGY 9

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

UNIT IV BIO – ENERGY 9

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Biodiesel – Cogeneration - Biomass Applications

UNIT V OTHER RENEWABLE ENERGY SOURCES 9

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students can understand

- The importance and Economics of renewable Energy
- Power generation from Solar Energy
- Power generation from Wind Energy
- Technique of power generation from Bio Energy

- The Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel Cells and Hybrid Systems.

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

OPEN ELECTIVES

OE18902	Elements of Marine Engineering	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

- Understanding on basic laws of flotation
- Familiarization on Marine propulsion engine
- Knowledge of Marine Auxiliary engine
- Understood about Marine Auxiliary boilers
- Awareness on ship propulsion and steering system

UNIT I Introduction 9

Introduction to Marine Engineering, Marine Engineering Terminologies, Introduction to watch keeping in Engine room, Parts of Ship, Laws of Flotation - Archimedes' principle, Buoyancy, Center of Gravity, Metacentric height, Stability of ship

UNIT II Marine Propulsion Engine 9

Two stroke Large Marine slow speed Diesel Engines - Advantages and disadvantages, Constructional details, Air starting and reversing mechanism, Safety provisions, Lubricating system, cooling water system . Four stroke engines - requirements for using as propulsion engine

UNIT III Marine Auxiliary Engine 9

Four stroke medium speed Diesel engine, their advantages and disadvantages - Constructional details, Piston, Cylinder liner, Cylinder head and its mountings, V-type engine, Comparison of slow speed and medium speed engines

UNIT IV Marine Auxiliary Boiler 9

Water tube boiler, Fire tube boiler - comparison, Scotch boiler, Cochran boiler, Babcock Wilcox boiler, Stress in boilers, Boiler mountings - Pressure gauge, Water level indicator, Feed check valve, Safety valve, Fusible plug, Boiler accessories - Economizer, Super heater, Feed water heater, Feed pump

UNIT V Ship Propellers and Steering Mechanism 9

Types of propellers - Fixed pitch propellers, Controllable pitch propellers, Water jet propellers, Principles of steering gear systems - 2-Ram and 4-Ram steering gear, Electric steering gear, Electro-hydraulic steering gear, Introduction to Rudder

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students should have gained

- Understanding of basic laws of flotation
- Familiarization of Marine propulsion engine
- Knowledge of Marine Auxiliary engine
- Glimpse of Marine Auxiliary boilers
- Awareness on ship propulsion and steering system

TEXT BOOKS:

1. Taylor, “Introduction to Marine engineering”, Revised Second Edition, Butterworth Heinemann, London, 2011
2. J.K.Dhar, “Basic Marine Engineering”, Tenth Edition, G-Maritime Publications, Mumbai, 2011

REFERENCES:

1. Alan L.Rowen, “Introduction to Practical Marine Engineering, Volume 1&2, The Institute of Marine Engineers (India), Mumbai, 2006
2. K.Ramaraj, “ Text book on Marine Engineering”, Eswar Press, Chennai,2018
3. A.S.Tambwekar, “Naval Architecture and Ship Construction”, The Institute of Marine Engineers (India), Mumbai, 2015

OE 18902	INTRODUCTION TO MARINE DIESEL ENGINE AND MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge about basic terminology of IC engine, working cycle of 2-stroke and 4-stroke diesel engine.
- To understand construction and the materials of Components used in Marine diesel engine.
- To impart knowledge about various systems required to Operate Marine diesel engine.
- To understand the Operational Hazard involved in Marine diesel engine.
- To understand the construction and applications of various marine auxiliary machinery.

UNIT I INTRODUCTION TO IC ENGINES 9

Basic terminology and Classification of IC engines, Working principle of 2-Stroke and 4-stroke Diesel engine/petrol engine, Valve timing diagram, Comparison between SI-Engine and CI-Engine.

Slow speed engine, Medium speed engine, High speed engine –Merits, demerits and applications.

UNIT II MARINE DIESEL ENGINE COMPONENTS 9

Cylinder Head and its mountings, Cylinder Liner, Piston – Types of Piston and rings, Cross-head, Connecting rod –Types, Crankshaft, A-frame, Cylinder liner Block, Bedplate – Construction and its Materials.

UNIT III OPERATING SYSTEMS OF MARINE DIESEL ENGINE 9

Lubrication system, Fuel oil system, Cooling water system –fresh water and sea water. Starting air system, Scavenging system- Turbocharger.

UNIT IV HAZARDS IN OPERATION OF MARINE DIESEL ENGINE 9

Scavenge fire – causes and action to be taken. Crankcase explosion – causes and action to be taken. Oil mist detector, Crankcase relief door. Starting air line Explosion.

UNIT V MARINE AUXILIARY MACHIINERY 9

Air compressor- construction-application of compressed air on-board, Purifier and Oily water separator - Construction, working principles. Fresh water generator – construction, working principle. Heat exchanger –Types - Construction and its application. Pumps - Centrifugal, Gear, Screw, Reciprocating- construction and its application on-board.

TOTAL: 45 PERIODS

OUTCOMES:

- The students can understand basic terminology of IC engine, working cycle of 2-stroke and 4-stroke diesel engine.
- The students can understand the construction and materials of the Components used in Marine diesel engine.
- The students can understand the various systems required to Operate Marine diesel engine.
- The students can understand the operational Hazards involved with Marine diesel engine.
- The students can understand the construction and application of marine auxiliary machinery.

TEXT BOOKS:

1. Principles and practice of Marine Diesel engine by D K Sanyal – 2nd Edition Reprint 2010
2. Diesel Engines by A J Wharton – 3rd Edition Rreprinted 2005
3. "Marine Auxiliary Machinery" by HD Mc George, 7th Edition 2011.

REFERENCES:

1. Pounder's Marine Diesel Engine& Gas Turbines By Woodyard – 9th Edition reprinted2014
2. Introduction to Internal Combustion Engines by Richard Stone 3rd Edition reprinted1995
3. Marine Internal combustion Engine by A B Kane 1st Edition Reprinted 2003
4. Medium and High speed Diesel engines for Marine use by S H Henshall Reprinted 2000
5. Lamb's Q & A on Marine Diesel Engines 8th Edition reprinted 2005

OE18903	MARINE PROPULSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart the knowledge on

- Basics of propulsion system and ship dynamics
- Various components assisting the ship propulsion performance
- Various ship velocities and relationship between powers, Resistance and cavitation effects
- Construction of propeller and its types, and Propeller theory
- Types of rudder and interaction of rudder and propeller

UNIT I BASIC SHIP PROPULSION 9

Basic principles of propulsion, Ship propulsion machinery and devices, Ship dynamics, Axial momentum theory, earlier methods of propulsion, Modern propulsion techniques, Diesel propulsion, Steam propulsion.

UNIT II LAYOUT AND PROPULSION EQUIPMENTS 9

Ship load line, Coefficients of forms, Propulsion Design , Fouled hull, Heavy weather and sea margin used for layout of engine, Bow Thrusters, Methods of Stabilizing, shaft tunnel, stern tube, Stern tube sealing, Thrust block, Foundation Bolts, thrust augmented devices.

UNIT III PERFORMANCE OF SHIP 9

Ship propulsion factors, Velocities of the Ship, Resistance of the ship, Hull drag, Effects of Fouling, Ship wake characteristics, Relation between Powers, Fuel consumption, Causes of Propeller Noise and Vibration, Cavitations and its effects of Propeller.

UNIT IV PROPELLER THEORY 9

Propellers and its environment, Types Propeller blade sections, Types of Propeller, Non dimensional geometric parameters of propeller, Construction of Propeller, Propeller material, thrust augmenting devices.

UNIT V RUDDER THEORY 9

Balanced rudder, Unbalanced rudder, Semi-balanced rudder, Spade rudder, Distinguishing Different types of rudder, Propeller and Rudder interaction-Force acting on the Rudder, construction of Rudder, Pintle Bearing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Basic propulsion system, ship dynamics
- Various components assisting the ship propulsion performance
- Ship velocities and relation between powers, Resistance of ship, Cavitations effects etc.
- Construction of propeller and its types
- Rudder and its types, design criteria of rudder.

TEXT BOOKS:

1. E.A. Stokoe**, "**Reeds Naval architecture for the marine engineers**,**4th edition,2009
2. E.A. Stokoe "Reeds Ship construction for marine engineers", Vol 5,2010
3. GP. Ghose, "Basic Ship propulsion",2015

REFERENCES:

1. KJ Rawson and EC Tupper, "Basic Ship theory I" Vol 1,5th Edition,2001
2. KJ Rawson and EC Tupper "Basic Ship theory II" Vol 1,5th Edition,2001
3. DJ Eyers and GJ Bruse, "Ship Construction", 7th Edition, 2006.
4. EC Tupper, "Introduction to Naval architecture" 4th edition, 2006.
5. Kemp & Young "Ship construction sketch & Notes", 2004.
6. John Carlton, "Marine Propulsion" 2nd Edition,2007
7. "Basic principle of ship Propulsion" MAN,2017

OE18904	Marine Vehicles	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

- Elementary knowledge on ship, safety, prevention of pollution and hazards on board ship
- Familiarization on different types of ships
- Knowledge of Shipbuilding Materials
- Understood Welding and cutting processes used in shipbuilding
- Awareness on governing bodies in shipping industry

UNIT I Introduction to Marine Engineering 9

Importance of shipping and blue economy, Marine terminologies - Ship, Important features, Principal dimensions - Displacement - Tonnage - Safety - Prevention of pollution - Hazards on board ships

UNIT II Types of Ship 9

General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships - Oil tankers - Bulk carriers - Liquefied gas carriers - Liquefied Natural Gas carriers - Liquefied Petroleum Gas carriers - Chemical tankers - Passenger ships

UNIT III Shipbuilding Materials 9

Types of Steels used in Shipbuilding - High tensile steels, Corrosion resistant steels, Steel sandwich panels, Steel castings, Steel forgings - Other shipbuilding materials, Aluminium alloys, Aluminium alloy sandwich panels, Fire protection especially for Aluminium Alloys, Fiber Reinforced Composites

UNIT IV Metal Joining and cutting process used in shipbuilding 9

Rivets, Electric arc welding processes - Slag-shielded arc welding, Manual and Automatic arc welding, Submerged arc welding, Stud welding, Gas-shielded arc welding - TIG , MIG, Gas cutting, Water jet cutting

UNIT V Governing Bodies for Shipping Industry 9

Role of **IMO** (International Maritime Organization), **SOLAS** (*International Convention for the Safety of Life at Sea*), **MARPOL** (International Convention for the Prevention of Pollution from Ships) , **MLC** (Maritime Labour Convention), **STCW 2010** (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers), Classification societies, Administration authorities

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, students would have gained

- Elementary knowledge on ship, safety, prevention of pollution and hazards on board ship
- Familiarization on different types of ships
- Knowledge of Shipbuilding Materials
- Perception on Welding and cutting processes used in shipbuilding
- Awareness on governing bodies in shipping industry

TEXT BOOKS:

1. D.J.Eyres, “Ship Constuction”, Seventh Edition, Butter Worth Heinemann Publishing, USA, 2015
2. Dr.DA Taylor, “Merchant Ship Naval Architecture”IMarEST publications, 2006

REFERENCES:

1. Kemp & Young “Ship Construction Sketches & Notes”, Butter Worth Heinemann Publishing, USA, 2011
2. MARPOL Consolidated Edition , Bhandakar Publications, 2018
3. SOLAS Consolidated Edition , Bhandakar Publications, 2016