INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
NAAC ACCREDITED WITH 'A' GRADE
Marching Beyond 25 Years Successfully

School of Maritime Studies

B.E MARINE ENGINEERING

REGULATION 2021

CURRICULUM AND SYLLABUS

(Based on Choice Based Credit System)

Effective from the Academic Year

2021 - 22

Department of Marine Engineering

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PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: Become successful Marine Engineers who are able to be competent, innovative and productive in addressing the needs of the Shipping Industry or pursue higher education and research.

PEO2: Grow professionally with their knowledge and proficient skills throughout their career.

PEO3: Demonstrate high standard of ethical conduct, positive attitude and societal responsibilities.

PROGRAMME OUTCOME (PO)

PO1: Apply knowledge of mathematics, science and engineering in their specialization involving complex engineering problems.

PO2: Analyze a problem, identify, formulate and solve engineering problems using basic fundamental Principles of mathematics and science.

PO3: Design a system component or process to meet the desired needs and standards within realistic constraints such as public health and safety, social and environmental considerations.

PO4: Design and conduct experiments, as well as do research, analyze and interpret data and give clear solutions.

PO5: Use and learn the limitations involved in recent techniques, skills and modern engineering tools necessary for engineering practice

PO6: Assess the local and global impact of engineering solutions on individuals, organization and society and the consequent responsibilities relevant to their professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8: Understand the professional and ethical responsibilities and norms of engineering practice.

PO9: Work with multi-disciplinary teams, involve in team activities and accomplish a common goal.

PO10: Communicate effectively with engineering community for presentation, documentation of reports adopting the design standards.

PO11: Understand engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Meet contemporary issues and create advance technologies and will be engaged to lifelong learning in the broadest scale.

PROGRAMME SPECIFIC OUTCOME

PSO1: Attain knowledge to carry out the watch keeping duties of an engineer officer on board a ship in a safely manner

PSO2: Attain Knowledge to maintain and operate machinery and equipment fitted on board ships at operational level

VISTAS - SCHOOL OF MARITIME STUDIES
B.E MARINE ENGINEERING DEGREE COURSE
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
APPLICABLE FROM 2021 - 2012 ACADEMIC YEAR ONWARDS

Total Number of Credits: 190

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – I									
CC	21EMR001	Mathematics – I	3	0	0	2	40	60	100
CC	21EMR002	Electrical Engineering Basics	2	0	0	2	40	60	100
CC	21EMR003	Engineering Drawing	3	0	0	3	40	60	100
AECC	21EMR201	Technical English	3	0	0	2	40	60	100
AECC	21EMR202	Workshop Technology	3	0	0	2	40	60	100
AECC	21EMR203	Engineering Mechanics	4	0	0	3	40	60	100
AECC	21EMR204	Applied Mechanics Lab	0	0	2	1	40	60	100
DSE	21EMR101	Electrical Engineering Basic Lab	0	0	3	2	40	60	100
SEC	21EMR251	Computer Science	1	0	0	1	40	60	100
SEC	21EMR252	Basic Workshop 1	0	0	6	6	40	60	100
TOTAL			**19**	**0**	**11**	**24**			
Category	**Code**	**Title of the Course**	**Hour / Week**			**Credits**	**Maximum Marks**		
			Lecture	**Tutorial**	**Practical**		**CA**	**SEE**	**Total**
SEMESTER – II									
CC	21EMR004	Mechanics Of Materials	4	0	0	2	40	60	100
CC	21EMR005	Mathematics II	3	0	0	2	40	60	100
CC	21EMR006	Materials Science I	2	0	0	2	40	60	100
CC	21EMR007	Marine Machinery Drawing I	3	0	0	2	40	60	100
AECC	21EMR205	Fluid Mechanics	3	0	0	3	40	60	100
AECC	21EMR206	Thermodynamics I	4	0	0	3	40	60	100
AECC	21EMR207	Hydraulics Lab	0	0	1	1	40	60	100
DSE	21EMR102	Safe Working Practices	0	0	3	2	40	60	100
SEC	21EMR253	Strength of Materials Lab	0	0	1	1	40	60	100
SEC	21EMR254	Basic Workshop II	0	0	6	6	40	60	100
TOTAL			**19**	**0**	**11**	**24**			

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – III									
CC	21CMRE31	Electric Motors and Starters I	4	0	0	3	40	60	100
CC	21CMRE32	Analog Electronics	5	0	0	3	40	60	100
CC	21CMRE33	Material Science II	3	0	0	2	40	60	100
CC	21CMRE34	Marine Machine Drawing II	3	0	0	2	40	60	100
AECC	21CMRE35	Deck Machinery	3	0	0	3	40	60	100
AECC	21CMRE36	Thermodynamics II	4	0	0	3	40	60	100
CC	21CMRE37	Electrical Testing and Measuring Equipment	2	0	0	1	40	60	100
AECC	21PMRE31	Electrical Machines Lab	0	0	2	2	40	60	100
AECC	21PMRE32	Electronics I Lab	0	0	2	2	40	60	100
DSE	21PMRE33	Advanced Marine Workshop(Deck/M/C)	0	0	4	3	40	60	100
DSE	21PMRE34	Advanced Marine Workshop (Electrical)	0	0	2	1	40	60	100
TOTAL			**24**	**0**	**12**	**25**			

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – IV									
CC	21CMRE41	Electric Motors and Starters II	4	0	0	3	40	60	100
CC	21CMRE42	Digital Electronics & Communication	3	0	0	2	40	60	100
CC	21CMRE43	Thermal Engineering	3	0	0	2	40	60	100
AECC	21CMRE44	Safe Maintenance on Ships	3	0	0	2	40	60	100
AECC	21CMRE45	Marine Auxiliary Machinery	4	0	0	3	40	60	100
AECC	21CMRE46	Mechanics of Machines	2	0	0	2	40	60	100
AECC	21PMRE41	Electrical Workshop-Motors/Starters	4	0	0	3	40	60	100
AECC	21PMRE42	Electronics II Lab	0	0	3	2	40	60	100
DSE	21PMRE43	Advanced Marine Workshop (MAM I)	0	0	2	2	40	60	100
SEC	21SMRE41	Lube Oil. Fuel Oil and Cooling Systems	2	0	0	2	40	60	100
SEC	21PMRE44	Communication Lab	0	0	2	2	40	60	100
TOTAL			**25**	**0**	**7**	**25**			

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – V									
CC	21CMRE51	Marine Internal Combustion Engineering I	5	0	0	4	40	60	100
CC	21CMRE52	Electronics & Control Systems for Marine Machinery	5	0	0	4	40	60	100
AECC	21CMRE53	Marine Engineering Practice I	2	0	0	2	40	60	100
AECC	21CMRE54	Marine Electrical Technology I	2	0	0	2	40	60	100
DSE	21DMRE51	Marine Environmental Pollution Control	3	0	0	2	40	60	100
DSE	21PMRE51	Seamanship Practical	0	0	2	1	40	60	100
DSE	21PMRE52	Advanced Marine Workshop (MEP I)	0	0	5	4	40	60	100
GE	21GMRE51	Seamanship and Commercial Geography	2	0	0	1	40	60	100
GE	21PMRE53	Anti-Pollution Lab (In Advanced Mar W/S)	0	0	2	1	40	60	100
SEC	21PMRE54	Control Engineering Lab	0	0	2	3	40	60	100
		TOTAL	**19**	**0**	**11**	**24**			
Category	**Code**	**Title of the Course**	**Hour / Week**			**Credits**	**Maximum Marks**		
			Lecture	**Tutorial**	**Practical**		**CA**	**SEE**	**Total**
SEMESTER – VI									
CC	21CMRE61	Marine Internal Combustion Engineering II	5	0	0	4	40	60	100
CC	21CMRE62	Ship Construction	3	0	0	3	40	60	100
CC	21CMRE63	Advanced Marine control Engineering & Automation	3	0	0	3	40	60	100
AECC	21CMRE64	Refrigeration, Air-Conditioning & Ventilation Systems	3	0	0	3	40	60	100
AECC	21CMRE65	Marine Electrical Technology II	2	0	0	2	40	60	100
AECC	21CMRE66	Naval Architecture I	3	0	0	3	40	60	100
DSE	21PMRE61	Advanced Marine Workshop-Refrigeration And Air-conditioning Trainer	0	0	1	1	40	60	100
DSE	21PMRE62	Advanced Marine Electrical Workshop - II	0	0	5	2	40	60	100
SEC	21PMRE63	Ship-in-Campus- Diesel Engine Lab	0	0	4	2	40	60	100
SEC	21PMRE64	Ship-in-Campus- Ship Construction	0	0	2	1	40	60	100
SEC	21PMRE65	Ship-in-Campus(Pumps and Auxiliaries –I)	0	0	2	1	40	60	100
TOTAL			**19**	**0**	**15**	**25**			

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – VII									
CC	21CMRE71	Marine Power Plant Operation	4	0	0	4	40	60	100
CC	21CMRE72	Monitoring And Protection Of Electrical Systems	3	0	0	2	40	60	100
AECC	21CMRE73	Pumps And Pumping Systems	3	0	0	3	40	60	100
AECC	21CMRE74	Marine Engineering Practice II	2	0	0	2	40	60	100
AECC	21CMRE75	Naval Architecture II	3	0	0	3	40	60	100
AECC	21PMRE71	Advanced Marine Workshop (MEP II)	0	0	3	3	40	60	100
GE	21PMRE74	Control Systems & Automation Lab	0	0	3	2	40	60	100
SEC	21PMRE73	Ship-in-Campus(Pumps and Auxiliaries II)	0	0	2	1	40	60	100
SEC	21PMRE75	ship-in-Campus (Watch-Keeping)	0	0	3	2	40	60	100
TOTAL			**15**	**0**	**10**	**22**			

Category	Code	Title of the Course	Hour / Week			Credits	Maximum Marks		
			Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER – VIII									
CC	21CMRE81	Fire Prevention, Fire-Fighting and Life-Saving Appliances	3	0	0	3	40	60	100
CC	21CMRE82	Marine Boilers And Steam Engineering	3	0	0	2	40	60	100
CC	21CMRE83	Elementary Design Of Marine Machinery	2	0	0	2	40	60	100
AECC	21CMRE84	Marine Engineering Practice III	2	0	0	2	40	60	100
AECC	21CMRE85	Leadership, Team-Building And Ship Security	2	0	0	1	40	60	100
AECC	21CMRE86	Engine Room Resources Management	2	0	0	2	40	60	100
AECC	21CMRE87	Maritime Legislation	3	0	0	2	40	60	100
DSE	21PMRE81	Marine Engineering Practice III-Simulator Lab	0	0	3	2	40	60	100
DSE	21PMRE82	Marine Machinery Start-Up (S-I-C)	0	0	2	1	40	60	100
GE	21PMRE83	Boiler Shop	0	0	2	1	40	60	100
SEC	21PMRE84	Fire-Fighting / Life-Saving Appliances Lab	0	0	4	3	40	60	100
TOTAL			**17**	**0**	**11**	**21**			

VISTAS - SCHOOL OF MARITIME STUDIES
B.E MARINE ENGINEERING DEGREE COURSE
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
APPLICABLE FROM 2021 - 2012 ACADEMIC YEAR ONWARDS

PASS MARKS

S.No	Code	Title of the Course	Internal		External		Total		Credits
			Min.	Max.	Min.	Max.	Min.	Max.	
SEMESTER - 1									
1	21EMR001	Mathematics – I	--	40	24	60	40	100	2
2	21EMR002	Electrical Engineering Basics	--	40	24	60	40	100	2
3	21EMR003	Engineering Drawing	--	40	24	60	40	100	3
4	21EMR201	Technical English	--	40	24	60	40	100	2
5	21EMR202	Workshop Technology	--	40	24	60	40	100	2
6	21EMR203	Engineering Mechanics	--	40	24	60	40	100	3
7	21EMR204	Applied Mechanics Lab	--	40	24	60	40	100	1
8	21EMR101	Electrical Engineering Basic Lab	--	40	24	60	40	100	2
9	21EMR251	Computer Science	--	40	24	60	40	100	1
10	21EMR252	Basic Workshop 1	--	40	24	60	40	100	6
SEMESTER - 2									
11	21EMR004	Mechanics Of Materials	--	40	24	60	40	100	2
12	21EMR005	Mathematics II	--	40	24	60	40	100	2
13	21EMR006	Materials Science I	--	40	24	60	40	100	3
14	21EMR007	Marine Machinery Drawing I	--	40	24	60	40	100	2
15	21EMR205	Fluid Mechanics	--	40	24	60	40	100	2
16	21EMR206	Thermodynamics I	--	40	24	60	40	100	3
17	21EMR207	Hydraulics Lab	--	40	24	60	40	100	1
18	21EMR102	Safe Working Practices	--	40	24	60	40	100	2
19	21EMR253	Strength of Materials Lab	--	40	24	60	40	100	1
20	21EMR254	Basic Workshop II	--	40	24	60	40	100	6

S.No	Code	Title of the Course	Internal		External		Total		Credits
			Min.	Max.	Min.	Max.	Min.	Max.	
SEMESTER - 3									
21	21CMRE31	Electric Motors and Starters I	--	40	24	60	40	100	3
22	21CMRE32	Analog Electronics	--	40	24	60	40	100	3
23	21CMRE33	Material Science II	--	40	24	60	40	100	2
24	21CMRE34	Marine Machine Drawing II	--	40	24	60	40	100	2
25	21CMRE35	Deck Machinery	--	40	24	60	40	100	3
26	21CMRE36	Thermodynamics II	--	40	24	60	40	100	3
27	21CMRE37	Electrical Testing and Measuring Equipment	--	40	24	60	40	100	1
28	21PMRE31	Electrical Machines Lab	--	40	24	60	40	100	2
29	21PMRE32	Electronics I Lab	--	40	24	60	40	100	2
30	21PMRE33	Advanced Marine Workshop(Deck/M/C)	--	40	24	60	40	100	3
31	21PMRE34	Advanced Marine Workshop (Electrical)	--	40	24	60	40	100	1
SEMESTER - 4									
32	21CMRE41	Electric Motors and Starters II	--	40	24	60	40	100	3
33	21CMRE42	Digital Electronics & Communication	--	40	24	60	40	100	2
34	21CMRE43	Thermal Engineering	--	40	24	60	40	100	2
35	21CMRE44	Safe Maintenance on Ships	--	40	24	60	40	100	2
36	21CMRE45	Marine Auxiliary Machinery	--	40	24	60	40	100	3
37	21CMRE46	Mechanics of Machines	--	40	24	60	40	100	2
38	21PMRE41	Electrical Workshop-Motors/Starters	--	40	24	60	40	100	3
39	21PMRE42	Electronics II Lab	--	40	24	60	40	100	2
40	21PMRE43	Advanced Marine Workshop (MAM I)	--	40	24	60	40	100	2
41	21SMRE41	Lube Oil. Fuel Oil and Cooling Systems	--	40	24	60	40	100	2
42	21PMRE44	Communication Lab	--	40	24	60	40	100	2

S.No	Code	Title of the Course	Internal		External		Total		Credits
			Min.	Max.	Min.	Max.	Min.	Max.	
SEMESTER - 5									
43	21CMRE51	Marine Internal Combustion Engineering I	--	40	24	60	40	100	4
44	21CMRE52	Electronics & Control Systems for Marine Machinery	--	40	24	60	40	100	4
45	21CMRE53	Marine Engineering Practice I	--	40	24	60	40	100	2
46	21CMRE54	Marine Electrical Technology I	--	40	24	60	40	100	2
47	21DMRE51	Marine Environmental Pollution Control	--	40	24	60	40	100	2
48	21PMRE51	Seamanship Practical	--	40	24	60	40	100	1
49	21PMRE52	Advanced Marine Workshop (MEP I)	--	40	24	60	40	100	4
50	21GMRE51	Seamanship and Commercial Geography	--	40	24	60	40	100	1
51	21PMRE53	Anti-Pollution Lab (In Advanced Mar W/S)	--	40	24	60	40	100	1
52	21PMRE54	Control Engineering Lab	--	40	24	60	40	100	3
SEMESTER - 6									
53	21CMRE61	Marine Internal Combustion Engineering II	--	40	24	60	40	100	4
54	21CMRE62	Ship Construction	--	40	24	60	40	100	3
55	21CMRE63	Advanced Marine control Engineering & Automation	--	40	24	60	40	100	3
56	21CMRE64	Refrigeration, Air-Conditioning & Ventilation Systems	--	40	24	60	40	100	3
57	21CMRE65	Marine Electrical Technology II	--	40	24	60	40	100	2
58	21CMRE66	Naval Architecture I	--	40	24	60	40	100	3
59	21PMRE61	Advanced Marine Workshop-Refrigeration And Air-conditioning Trainer	--	40	24	60	40	100	1
60	21PMRE62	Advanced Marine Electrical Workshop - II	--	40	24	60	40	100	2
61	21PMRE63	Ship-in-Campus- Diesel Engine Lab	--	40	24	60	40	100	2
62	21PMRE64	Ship-in-Campus- Ship Construction	--	40	24	60	40	100	1
63	21PMRE65	Ship-in-Campus(Pumps and Auxiliaries –I)	--	40	24	60	40	100	1

S.No	Code	Title of the Course	Internal		External		Total		Credits
			Min.	Max.	Min.	Max.	Min.	Max.	
SEMESTER - 7									
64	21CMRE71	Marine Power Plant Operation	--	40	24	60	40	100	4
65	21CMRE72	Monitoring And Protection Of Electrical Systems	--	40	24	60	40	100	2
66	21CMRE73	Pumps And Pumping Systems	--	40	24	60	40	100	3
67	21CMRE74	Marine Engineering Practice II	--	40	24	60	40	100	2
68	21CMRE75	Naval Architecture II	--	40	24	60	40	100	3
69	21PMRE71	Advanced Marine Workshop (MEP II)	--	40	24	60	40	100	3
70	21PMRE74	Control Systems & Automation Lab	--	40	24	60	40	100	2
71	21PMRE73	Ship-in-Campus(Pumps and Auxiliaries II)	--	40	24	60	40	100	1
72	21PMRE75	ship-in-Campus (Watch-Keeping)	--	40	24	60	40	100	2
SEMESTER - 8									
73	21CMRE61	Marine Internal Combustion Engineering II	--	40	24	60	40	100	3
74	21CMRE62	Ship Construction	--	40	24	60	40	100	2
75	21CMRE63	Advanced Marine control Engineering & Automation	--	40	24	60	40	100	2
76	21CMRE64	Refrigeration, Air-Conditioning & Ventilation Systems	--	40	24	60	40	100	2
77	21CMRE65	Marine Electrical Technology II	--	40	24	60	40	100	1
78	21CMRE66	Naval Architecture I	--	40	24	60	40	100	2
79	21PMRE61	Advanced Marine Workshop-Refrigeration And Air-conditioning Trainer	--	40	24	60	40	100	2
80	21PMRE62	Advanced Marine Electrical Workshop - II	--	40	24	60	40	100	2
81	21PMRE63	Ship-in-Campus- Diesel Engine Lab	--	40	24	60	40	100	1
82	21PMRE64	Ship-in-Campus- Ship Construction	--	40	24	60	40	100	1
83	21PMRE65	Ship-in-Campus(Pumps and Auxiliaries –I)	--	40	24	60	40	100	3

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FIRST YEAR – FIRST SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – I						
CC	21EMR001	Mathematics – I	3	0	0	2
CC	21EMR002	Electrical Engineering Basics	2	0	0	2
CC	21EMR003	Engineering Drawing	3	0	0	3
AECC	21EMR201	Technical English	3	0	0	2
AECC	21EMR202	Workshop Technology	3	0	0	2
AECC	21EMR203	Engineering Mechanics	4	0	0	3
AECC	21EMR204	Applied Mechanics Lab	0	0	2	1
DSE	21EMR101	Electrical Engineering Basic Lab + Workshop	0	0	3	2
SEC	21EMR251	Computer Science	1	0	0	1
SEC	21EMR252	Basic Workshop 1	0	0	6	6
TOTAL			19	0	11	24

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FIRST YEAR – FIRST SEMESTER

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR201	TECHNICAL ENGLISH	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Use English in written and oral form (Table A – III/1)

COURSE PLAN

UNIT I Oral Communication **(08)**

Simple, Compound and Complex sentences – impersonal passive voice – Use of Articles – Use of Prepositions – Commonly mispronounced and wrongly spelt words – Reading text: skimming for general information.

UNIT II Written Communication **(12)**

Introduction to the characteristics of technical style – writing definitions and descriptions – note making – Listening and transferring of information from text to graphic forms - bar charts, flow-charts.

UNIT III Reading **(12)**

Reading Comprehension - scanning for information – inferring meaning from context - Listening and guided note-taking - using notes – giving suitable headings / subheadings for paragraphs

UNIT IV Grammar and Vocabulary **(12)**

Word formation with prefixes and suffixes – Parts of Speech – Verb patterns - adjectives, adverbs - matching words with meanings - British and American Vocabulary – Marine Vocabulary.

UNIT V Listening **(10)**

Extensive listening – listening for general content – listening to fill up missed text – intensive listening – listening for specific information.

TOTAL 54 HOURS

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO 1- Read and write effectively with appropriate competence andperformance.

CO 2 -Write effectively and persuasively and produce different types ofwriting such as narration, description, exposition and argument aswell as creative, critical, analytical and evaluative writing.

CO 3 - Read different genres of texts, infer implied meanings and criticallyanalyze and evaluate them for ideas as well as for method ofpresentation.

Textbook:

1. English for Engineers and Technologists Vol. 1 and 2, Division of Humanities and Social Sciences, Anna University, Orient Longman Pvt. Ltd.,

Reference Book:

Effective Technical Communication, by Rizvi M. Ashraf, Tata McGraw-Hill publishing company ltd., New Delhi.

Web Source:

https://www.usingenglish.com/

Code	Subject	Lesson	Tutorial	Practical	Credit
21EMR001	MATHEMATICS I	54	0	0	2

COURSE OBJECTIVE

1. To introduce the process of differentiating a function.
2. To expand the functions by differentiation.
3. To differentiate the functions of two or more variables and its applications.
4. To describe the basic ideas of integration and advanced properties.
5. To elaborate integration in the practical life problems and find the area of the geometrical structure.

COURSE PLAN

UNIT I Arithmetic (8)

Indices, surds, logarithms, quadratic equations, Partial fractions, arithmetical progression, geometric progression, Binomial theorem and its applications.

UNIT II Geometry (6)

Plane and coordinate geometry coordinates of a point, changing of axes, the circle and the parabola.

UNIT III Trigonometry (8)

Simple relations between trigonometric ratios. Compound angles, inverse trignometrical functions, trigonometrically equations, relations between angles and sides of triangle. Solution of triangle, sum of a cosine curve and sine curve.

UNIT IV Differential Calculus (16)

Differential calculus: Differentiation of algebraic, circular, exponential, logarithmic functions of products, quotients functions, simple implicit function. Successive differentiation – intro and notation, nth order derivatives of std functions, nth order derivatives using (a) trig identities and standard functions. Liebnitz's Theorem. Macluarin's Theorem and Standard Expansions Taylor's Theorem. Indeterminate forms and L'Hospital's Rule. Curve tracing of Cartesian and Polar Curves.

UNIT V Differential Calculus (16)

Functions of Several variables, limits and continuity. Partial derivatives – definitions, geometrical interpretation and rules of partial differentiation, Higher order partial derivatives, Homogeneous functions and Euler's Theorem, Total derivatives and Chain Rules, Implicit functions and Composite functions, Errors and Approximations, Maxima and Minima, LaGrange's multiple.

TOTAL 54 HOURS

COURSE OUTCOME

CO-1 To know the basic number systems.
CO-2 To do practical problems by using A.P & G.P
CO-3 To remember the formulas of binomial theorem.
CO-4 To know about cone & the diagrams
CO-5 To know about the basic geometrical concepts.

Text Books:

1. Higher Engineering Mathematics, 39th edition, by B.S. Grewal, Khanna Publishers, New Delhi.

Reference Books

1. Engineering Mathematics, by Venkataraman M.K., The National Publishers, Chennai
2. A text book of Applied Mathematics, Volume 1 and 2, P.N. Wartikar and J.N. Wartikar

Web Source: https://thebookee.net/at/a-textbook-of-applied-mathematics-by-pn-wartikar-pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR002	ELECTRICAL ENGINEERING BASICS	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control system (Table A – III/1)
- Manage operations of electrical and electronic equipment (Table A – III/2)

COURSE PLAN

UNIT I (8)

Introduction – Electric current, power, circuit elements – Ohm's law – series circuits – parallel circuits – Kirchhoff's Law – Faraday's law - Coulomb's law of electrostatics

UNIT II (6)

AC Circuits – Fundamentals of AC- RMS value – Average value – R, RL, RLC RC circuits with numerical problems – Behaviour of AC in pure resistance, capacitance and inductive circuits - Power consumed and Power factor, Volt-Amperes (VA) and Reactive Power.

UNIT III (10)

Ployphase circuits – Phase voltage, line voltage, power factor, power calculation, phase sequence – Relation between the Phase and Line voltages and currents for Star and Delta Connections, Balanced and unbalanced three-phase loads (Star & Delta) – Generation of 3 phase AC – need and conditions for parallel operation – numerical problems

UNIT IV (6)

Energy stored in inductor and capacitor, Charging and discharging characteristics of capacitor. Practical Application: Battery (Lead acid) construction and it's working. Maintenance, charging and sulfation in batteries.

UNIT V (6)

Introduction to HV systems – advantages – Distribution of electrical energy, system of wiring and installation – Types of earthing - Earthing of installation.

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

TOTAL 36 hours

COURSE OUTCOME

CO 01 Evaluate and analyze various electrical circuits and their parameters.

CO 02 Differentiate, compute and summarize the behavior of various load elements in AC electrical circuits.

CO 03 Evaluate and infer three phase circuit parameters. Also to enumerate the importance and conditions for parallel operation.

CO 04 Assess and predict energy storage process in inductors, capacitors and batteries.

CO 05 State and define HV system, earthing methodologies and electron emission.

Text Books: Basic Electrical Engineering by B L Theraja Volume I

Reference Books: Electrical Machinery by P.S. Bhimbhara.

Web Source: https://logicwork.in/download-a-text-book-of-electrical-technology-all-volumes-123-4-by-bl-theraja-pdf-free/

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR003	ENGINEERING DRAWING	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipments (Table A – III/1)

COURSE PLAN

UNIT I Introduction to Technical Drawing (12)

Draughtsmanship, lettering, dimensioning, types of lines and correct use of drawing instruments. Construction of geometrical figures specially showing joining of straight lines and curves. Free hand sketching

UNIT II Curves used in Engineering Practice (12)

Conic sections construction of ellipse, parabola and hyperbola by various methods. Drawing of spirals involutes, cycloids, epicycloids and hypocycloids, helixes.

UNIT III Projections (10)

Projection of points and lines. Projection of solids **-** Axis perpendicular to a plane and axis parallel to planes, axis parallel to one plane and inclined to the other, and axis inclined to both planes.

UNIT IVDevelopment of surfaces and curves of intersections (10)

Developing the surface of prisms. Pyramids and cones and drawing the curves of intersection of cylinders to cylinders, cylinders to cones, and other solids.

UNIT V Development of Springs and Threads (10)

Detailed drawings of helical springs of round and rectangular sections square thread formation in proper helical form.

TOTAL 54 hours

COURSE OUTCOME

CO 01	To apply draftsmanship skills like printing of lettering and numbering and basic dimensioning system on technical drawing.
CO 02	To apply free hand sketch on technical drawing with respect to first and third angle orthographic projection method.
CO 03	To construct various curves like ellipse, Parabola, hyperbola and special curves.
CO 04	To construct projection of points. Lines, solid object axis parallel to vertical plane, horizontal plane and inclined plane.
CO 05	To conclude the development of Prism, Pyramids and cones, To create drawing of round cross section and rectangular cross section helical springs , square thread and v thread

Text Book:

1. Natarajan Engineering Graphics using Machines.

Reference Books:

1. N. H. Dubey Engineering Drawing.
2. N.D. Bhatt Engineering Drawing.
2. V. M. Panchal, Engineering Drawing.
4. R. K. Dhawan, Engineering Drawing.
5. T. Jeyapoovan, Engineering Graphics using Machines.

Web Source: https://www.youtube.com/watch?v=UfVEjDhTQcQ

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR202	WORKSHOP TECHNOLOGY	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain and repair shipboard machinery and equipments (Table A – III/1)

COURSE PLAN

UNIT I Common workshop Tools **(10)**

Description and used of different types of calipers, Straight edges, Try squares. Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Taps, V-Block, Face plate, Marking Blocks Carpentry Tools, Pattern maker's tools, Smithy tools and Mouldings tools

UNIT II Measuring instruments & Inspection **(10)**

Description and use of steel rule, Vernier's Scale, Micro-meter, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire gauge, Pattern Maker's Scale, Taper gauge, snap gauge, Plug gauge, Optical method of measurement, principles of interchangeability, limit system, uses of limit gauge.

UNIT III: Metal work - joints **(6)**

Permanent joints. Riveting. Soldering. Self-secured joints.

UNIT IV Welding **(12)**

Safety and Health when welding. Principles of electric Arc welding. Principles of gas welding. Welded joints and low carbon steels. Common faults in welded joints. Inspection and Non-destructive testing.

UNIT V Machine Processes in Manufacture **(16)**

Plate work – marking out, thermal cutting, Mechanical cutting, Cutting forces, Stresses and power; Friction of chip on tool. Plate Forming, Bending plates. Pipe work. Manufacturing of components, gauges, deck machinery, gearing, clutches.

TOTAL 54 hours

COURSE OUTCOME

CO 01	To identify different types of caliper,Straight edges, Try Square ,other workshop tools.
CO 02	To distinguish between difference measuring Instrument.
CO 03	To evaluate optical method measurements and principle of interchangeability.
CO 04	To categories mental work and types of joints, To analyze plate work and it's mechanism.
CO 05	To evaluate principle of electric Arc Welding, Gas Welding and common Faults in Welded Joints.

Text Books

1. Hajra Choudhry, Workshop Technology.

Reference books

1. Chapman, Workshop Technology.
2. O.P. Khanna, Workshop Technology.

Web Sources:

https://www.youtube.com/watch?v=A9m_3onoVV8

https://thebookee.net/wo/workshop-technology-by-hajra-chaudhary-pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR251	COMPUTER SCIENCE	18	0	0	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Use Computer Applications

COURSE PLAN

UNIT I Introduction **(4)**

Information – need for information – evolution of information processing – elements of computer processing systems. Classification of Computers based on size, design and purpose – Hardware: CPU- components RAM ROM – Motherboard structure - Storage devices. Personal Computer Software – systems and applications – word processing packages – Spread sheet packages MS office. MS Word – MS EXCEL – MS Power Point

UNIT II Programming Languages **(2)**

Machine language – assembly languages, high level languages – fourth generation languages

UNIT III Operating Systems **(4)**

Concept and functions of operating systems – batch processing – multi programming – real time – time sharing distributed systems- familiarity with common operating systems.
DOS: Functions of DOS, structure booting – internal and external commands

UNIT IV Internet **(4)**

Internet topology – how internet works – email - www (World Wide Web) - web sites – LAN - search engines.

UNIT VShipboard Applications **(4)**

Alarms – data storage – inventory control - use of spread sheets for voyage planning – maintenance schedules – PMS - simulation – artificial Intelligence

TOTAL 18 hours

COURSE OUTCOME

CO 01	To illustrates the technologies used in generation of computers.
CO 02	To explain about the principles and characteristics of computers, to create applications in Artificial Intelligence.
CO 03	To distinguish the machine languages and their features.
CO 04	To utilize internet topology, Uniform Resource Locator and WWW.
CO 05	To implement the applications of computers onboard.

Text Book:

1. Alexis Leon & Mathews Leon, Fundamentals of Information Technology.

Reference Books:

1. M.S. Chisleft, Marine Simulation & Maneuverability.
2. George Reyholds, Principles Of Information systems.
3. Abraham Silberschatz Operating Systems.

Web Sources:

https://www.youtube.com/watch?v=26QPDBe-NB8
https://www.youtube.com/watch?v=aYjGXzktatA

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR203	ENGINEERING MECHANICS	72	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to understand static and dynamic analysis of simple machines and significance of friction

COURSE PLAN

UNIT I Statics **(16)**

Scalar & Vector quantities - addition/subtraction. Graphic representation of Forces -parallelogram of forces - resultant of two forces - conditions for a number of forces to be in equilibrium. Force as a vector, Triangle and polygon of forces, Resultant and equilibrium of a system of concurrent, coplanar forces. Lami's theorem. Parallel forces in a plane. General cases of forces in a plane. Couples. Method of moments. Palin trusses. Method of joints, method of sections. Method of members. Centroids, areas and volumes of composite bodies (Pappu's Theorem). Centre of Gravity - definition centre of gravity - centre of gravity of (a) suspended mass (b) mass supported at a single point - C.G. of regular shaped masses.

UNIT II Dynamics **(16)**

Linear Motion. Graphs and equations for displacement, speed, velocity and uniform acceleration. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration. Kinematics of particles and rigid bodies. Impulse and momentum principle. Work and energy principle. Rectilinear motion. Curvilinear motion. Motion of projectiles. Use of D'Alembert's formula. Instantaneous centre. Problems on constant force or force with linear variation. Potential Energy. Kinetic energy. Newton's Laws of motion. Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action. –

UNIT III Simple Machines (Static Analysis) **(16)**

Simple lifting machines. Graphics of load and effort and efficiency. Linear Law. Velocity Ratio, Mechanical Advantage and Efficiency of Wheel and axle, Differential Wheel and Axle, Rope pulley blocks, differential pulley blocks, Warwick Screw, worm driven chain blocks, and sincle and double purchase crab winches. Virtual Work, Moment of Inertia of plane figures. Moment of inertia of material bodies. (10)

UNIT IVSimple Machines (Dynamic Analysis) **(16)**

Law of Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action. Periodic motion (SHM). Acceleration of connected bodies. Effect of simple air friction on motion under effect of gravity. Kinetic energy of translation and rotation. Flywheels. Impulse forces. Governors including sleeve friction. Simple pendulum. Simple vibrations. Dynamic balancing of masses rotating in one plane. Basic dynamics of the engine mechanism. Balancing – Simple harmonic Motion).

UNIT Friction **(8)**

Coefficient of friction. Friction angle. Energy and power lost due to friction in simple bearings. Friction in belt drive, Efficiency of screw-jack (Square and Vee Thread)

TOTAL 72 hours

COURSE OUTCOME

CO 01 To understand scalar & vector quantities.
CO 02 To understand Graphic representation of Forces.

CO 03	To analyze Graphs and equations for displacement, speed, velocity and uniform acceleration.
CO 04	To apply concepts to do Problems on constant force or force with linear variation.
CO 05	To distinguish and understand different Simple lifting machines.

Text Book:

1. In-house developed Hand outs

Reference:

1. V Ramesh Babu Engineering Mechanics.
2. Dr Sadhu Singh Engineering Mechanics.

Web Source:

https://www.youtube.com/watch?v=USBB7ttg_Zw

https://www.youtube.com/watch?v=9UIw3vzLKC4

CODE	SUBJECT	Lesson	Tutorial	Practical	Credits
21EMR204	APPLIED MECHANICS LAB	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

List of Experiments

1. To verify the Principles of Moment with the help of (a) Bell Crank Lever & (b) Moments of Stand
2. To determine the magnitude and nature of forces acting on the different members of—(a)Wall Crank,(b)Shear Leg Apparatus,&(c)Derrick Crane.
3. To determine the Young's Modulus of a Loaded Beam.
4. To determine the co-efficient of friction between leather and metal in an inclined plane.
5. To prove that if a system of uniplanar forces is in equilibrium, the links respectively given in magnitude and direction taken in order form a closed polygon. If any number of forces acting at a point be such that they can be represented in magnitude, direction and sense by the sides of a closed polygon taken in order, then they shall be in equilibrium.
6. To find out the Mechanical Advantage, Velocity Ratio, Theoretical Effort, Efficiency, Friction, the equation giving the relation between Load and Actual Efforts, and draw graphs with load as base for(i)Efficiency (ii)Actual Effort (iii)Mechanical Advantage and (iv)Friction for the following machines
   (a)Screw Jack;
   (b) Worm and Worm Wheel
   (c) Compound Wheel and Axle
   (d)Single Purchase Crab and
   (e)Double Purchase Crab.
7. To determine the value of 'g"(acceleration due to gravity)by means of
   (a) Atwoods Machine, and,
   (b)Fletcher's Trolley.
8. To determine the Moment of Inertia and Radius of Gyration of a Fly Wheel.

TOTAL 36 hours

Course outcome:

CO 01	To Examine the Principle of Moment with help of Bell Crank Level
CO 02	To Determine the Magnitude, nature of Force and Young's Modulus in Loaded Beam
CO 03	To Evaluate the Co-efficient of Friction between Metal and inclined plane.
CO 04	To prove Uniplanar force is equilibrium in closed polygon law and To determine the Moment of inertia and Radius of gyration in Flywheel
CO 05	To Estimate Mechanical Advantage, Velocity Ratio, Efficiency and effort in Worm and Worm Wheel, Compound Wheel and Axle, Single Purchase Crab and Double Purchase Crab.

Text Book: In-house developed Lab Manual.

Web Source:

https://www.youtube.com/watch?v=alHUJ-jvrpU&list=PLCGTVPoYH6Rbj2Ye38lQgUKACNMMem-wA

Code	Subject	Lessons	Tutorial	Practical	Credits
21EMR252	BASIC WORKSHOP 1	0	0	144	6

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A – III/1)

Fitting

1. To make a hexagon block from a round bar by chipping and filing
2. To make a Male-Female V- fitting.
3. To make a T-Fitting.
4. To make a dove tail fitting
5. To make a Square fitting
6. To make a H fitting.
7. To make outside calipers of given dimensions.

TOTAL 144 hours.

Course outcome:

CO 01	Develop a hexagon block from a round bar by chipping and filing
CO 02	Create a male joint and T joint
CO 03	Fabricate a dovetail fitting
CO 04	Fabricate a Square fitting
CO 05	Fabricate a H fitting and tofabricate an outside caliper of given dimensions.

Text Book

1. In house Manual as per TAR Book

Reference Book:

1. T. Jeyapoovan, M. Saravanapandian and S. Pranitha, Engineering Practices Lab manual (3rd Edition)

Web Source:

https://www.youtube.com/watch?v=jbRgJbIGAwc

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR002	Electrical Engineering Basic Lab + Workshop	0	0	54	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control system (Table A – III/1)
- Manage operations of electrical and electronic equipment (Table A – III/2)
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A – III/2)

List of Experiments to be carried out

1. Measurement of resistance using battery, voltmeter and ammeter.
2. Determination of equivalent resistance of the resistors when they are connected in Series, Parallel and Series-parallel combinations.
3. Measurement of voltage, current, power in a DC circuit
4. Measurement of voltage, current, power and energy in a single phase AC circuit, and calculation of power factor
5. Measurement of voltage, current, power and energy in a three phase AC circuit and calculation of power factor, KVA & KVAR in a three phase circuit by two wattmeter method.
6. Calculation of fuse rating in different electrical distribution circuits.
7. Calculation of Amperage and type of protective devices for various motor ratings using name plate details.
8. Applications of HV equipment and advantages of HV
9. Calculation of current and time to charge a battery (given AH and volts rating) using typical Battery charging circuit.

TOTAL 54 hours

COURSE OUTCOME

CO 01	Can compute basic electrical parameters of AC & DC circuits
CO 02	Can observe and copy the values and ratings of elements in the circuit
CO 03	Can Apply the knowledge of series and parallel circuits.
CO 04	Can construct and illustrate experiments and thereby measure the required parameters
CO 05	Can enumerate and recall the applications and advantages of HV systems.

Text Book: 1. In-house Laboratory Manual

Reference Books: P S Bhimbhara, Electrical Machinery

Web Source:
https://www.youtube.com/watch?v=iTMd_3zxmrw

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FIRST YEAR – SECOND SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – II						
CC	21EMR004	Mechanics Of Materials	4	0	0	2
CC	21EMR005	Mathematics II	3	0	0	2
CC	21EMR006	Materials Science I	2	0	0	2
CC	21EMR007	Marine Machinery Drawing I	3	0	0	2
AECC	21EMR205	Fluid Mechanics	3	0	0	3
AECC	21EMR206	Thermodynamics I	4	0	0	3
AECC	21EMR207	Hydraulics Lab	0	0	1	1
DSE	21EMR102	Safe Working Practices	0	0	3	2
SEC	21EMR253	Strength of Materials Lab	0	0	1	1
SEC	21EMR254	Basic Workshop II	0	0	6	6
TOTAL			19	0	11	24

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FIRST YEAR – SECOND SEMESTER

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR004	MECHANICS OF MATERIALS	72	0	0	2

COURSE OBJECTIVE:

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Stress and Strain – Direct stress and strain. Modulus of Elasticity. Shear Stress and strain. Modulus of rigidity. Factor of Safety. Stress due to restricted expansion or contraction of single members. Hydrostatic stresses and the corresponding strains. Relationship between the three elastic constants. Thermal stress. Axial stresses in composite materials. Strength of welded joints.

UNIT II **(12)**

Thin shells – Circumferential and longitudinal stress in thin cylindrical shells subject to internal pressure. Thick cylinders. Lame's Theory, Compound cylinders. Springs – Springs with axial load. Calculations for mean diameter of springs, wire diameter and number of coils. Close-coiled helical spring.

UNIT III **(16)**

Concept of strain energy. Strain energy due to normal and shear stresses. Strain energy due to impact loads. Resilience. Compound stress and strain. Stresses on an oblique section. General two-dimensional stress system. Principal planes and principal stresses. Strain on an oblique section. Determination of principal strains. Principal strain in three dimensions. Principal stresses derived from principal strains. Mohr's diagram for stress and strain. Combined bending and twisting. Equivalent bending and twisting moment. Shear, bending and torsion. Theories of failure.

UNIT IV **(16)**

Bending of Beams. Torsion. Combined stress. Simply supported beams. Cantilevers. Shearing Force and Bending Moment diagrams for cantilevers, simply supported beams with concentrated and uniformly distributed loads. Stress due to bending. Application of impact loads.

UNIT V **(16)**

Deflection of built-in beams and continuous beams by Integration and Macaulay's method. Moment area method of deflection coefficient. Deflection due to shear. Deflection by graphical method. Clapeyron's Three moment theorem. Applied problems. Thin curved bar. Strain energy due to bending. Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems.

TOTAL 72 hours

Course outcome:

CO 01	To organize and relate between different stress and strain
CO 02	To analyze categories shells, thick cylinders and applied lame's theory.
CO 03	To Evaluate calculation for mean diameter of spring – wire diameter and Non of coils.
CO 04	To perceive concept of strain energy due to normal and shear stress, Impact Load to determine principle strain.
CO 05	To analyze bending f beam torsion combines stress,to evaluate deflection of built – beams, continuous beams.

Text Books: 1. Ramamrutham, Strength of Materials (Mechanics of Solids).

Reference Books: 1. Rajput, Strength of materials

Web Source:

https://archive.org/details/StrengthOfMaterialsByRamamrutham/Aerospace%20Structural%20Analysis%2C%20Olivier%20A%20Bauchau%2C%202002/page/28/mode/2up

https://www.youtube.com/watch?v=oAzwClT1GRQ&list=PLOAuB8dR35oft2ZLc1sHseypNMAiG_TeJ

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR005	MATHEMATICS II	72	0	0	2

COURSE OBJECTIVE:

- To able to understand integral calculus.
- To impart knowledge on ordinary differential calculus

COURSE PLAN

UNIT I **(12)**

Integral calculus- Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under a curve, volume by revolution. First moment of the area and the position of a centroid of an area. Work done by variable forces. Mean values. Root Mean square values of Sin nX and CosnX. The Rules of Guldinus.

UNIT II **(16)**

Integral Calculus - Theories of Parallel axes and Perpendicular Axes. Second moments of area and moments of inertia of rectangular and circular laminas. Multiple integrals. Double and Triple Integrals. Regions of integration and change of order of integration. Spherical, Polar and Cylindrical co-ordinates. Applications to area and volume, mass of wire, lamina and a solid. Centre of gravity of a wire lamina and solid. Moment of Inertia using multiple integrals.

UNIT III **(16)**

Ordinary differential equations – Definition, order and degree. Formation of differential equation. Solution of first order, first degree equations in variables separable form, homogeneous equations, other substitutions. Equations reducible to homogeneous and exact differential equations. Linear differential equations of the first order and first degree, reducible to linear.

UNIT IV **(16)**

Applications to electrical circuits and orthogonal trajectories. Nth order Linear Differential equations – definition and complementary function solution. Methods of obtaining the particular integral. Method of variation of parameters. Method of undetermined coefficients. Cauchy's homogeneous LDE and Legendre's equation. System of ordinary differential equations. Simultaneous equations in symmetrical form. Applications to deflection of beams, struts and columns.

UNIT V **(12)**

Calculus of finite differences – Difference operators and relations between them, Algebra of finite difference operators, Newton's forward and backward interpolation formulae, Stirling's interpolation formula, Lagrange's Interpolation formula, Numerical differentiation, Numerical integration, Difference equations – definition formation and solution, Linear difference equation with constant coefficients.

TOTAL 72 **hours.**

COURSE OUTCOME

CO 01	To solve problems on Integration also find the Area and Volume.
CO 02	To relate Integration with the real life problems and find Area and Volume by using multiple integral.
CO 03	To form and solve the ordinary differential equation of first order and first degree.
CO 04	To solve the ordinary differential equation of higher order and first degree.
CO 05	To apply the ordinary differential equation with the real life problems, to solve problems of differentiation and integration by using difference operators.

Text Books

1. B.S Grewal, Higher Engineering Mathematics,Khanna Publishers, New Delhi, 39th edition.

Reference:

1. Venkataraman.M.K, Engineering Mathematics, The National Publishers, Chennai
2. P.N. Wartikar, J.N. Wartikar,A text book of Applied Mathematics" Volume 1 and 2

Web Source:

https://www.youtube.com/watch?v=o75AqTInKDU

https://easyengineering.net/higher-engineering-mathematics-by-b-s-grewal/

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR006	MATERIALS SCIENCE I	36	0	0	2

COURSE OBJECTIVE:

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

COURSE PLAN

UNIT I (8)

Basic metallurgy. Atomic packing – directionally and non-directionally bonded atoms, Crystal structure, Space lattice. Ionic and molecular crystals; interfacing in crystals, Non-crystalline solids; elastomeric; long chain and molecular compounds. Metals and Processes.

UNIT II (8)

Properties of solid solutions and alloys, Types of Binary alloys, Thermal Equilibrium Diagrams, Cooling curves, Eutectic, Eutectoid and Peritectic reaction. Metals used in ship-building. Properties and uses. Non-metallic materials.

UNIT III (8)

Characteristics and limitations of process used for fabrication and repair. Process heat treatment of carbon steel. Material selection-alteration of environments-Comparison of cathodic and anodic protection, Protective coating- metallic coating and other inorganic coating-protection by means of paints in ships.

UNIT IV (6)

Properties and parameters considered in the fabrication and repair of systems and components – Materials under load, vibration, self-secured joints, permanent joints, bonding plastics, adhesives and bonding, pipe work.

UNIT V (6)

Iron-carbon equilibrium diagram. Non-ferrous alloys, different types of iron and steel. Its Properties and uses in industry, Alloys of iron and steel. Nonferrous metals and alloys, Effects of various elements on steel and cast iron.

COURSE OUTCOME

CO 01 To understand basic metallurgy.
CO 02 Application of metallurgic process in ship building
CO 03 Application of heat treatment process and anti corrosion techniques
CO 04 To know the characteristics and limitations of process used for fabrication and repair.
CO 05 Distinguish between alloy , non alloy and different types of iron and steel

TOTAL 36 hours.

Text Books: 1. O P Khanna, Material Science and Metallurgy, Dhanpat Rai Publishers.

Reference: 1. R S Khurmi, Material Science
2. R B Choudry, Material Science and Metallurgy
3. Thomas H Courtney, Mechanical Behavior of Materials

Web Source:

https://www.youtube.com/watch?v=6L-r3hx0NLM
http://www.issp.ac.ru/ebooks/books/open/Materials_Science_and_Technology.pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR007	MARINE MACHINERY DRAWING I	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipments (Table A – III/1)

COURSE PLAN

UNIT IORTHOGRAPHICPROJECTIONS: **16**

Orthographic Projections in 1st&3rd angle projections of simple machine components from given isometric drawings; Drawing of third view from the given two views in Orthographic Projections. Learn toput dimensions in different views Details of Sectioning :Sectioning of components a the central axis; Part Sectioning 'Off-centre Sectioning and Off-set Sectioning; simple assembly drawing switch sectional views. Projection of Port and openings in hollow cylinders; Parallel cut and radial cut ports; Rectangular & Tapered Ports in right cylinders; Tapered ports in tapered cylinders

UNIT II SCREW THREADSANDFASTENERS **12**

Locking and retaining devices. Riveted type fastenings. Welded connections. Standard Bolts, studs,nuts&tappedholes-Specialbolts&screwse.g.tappedbolts,collarboltsandstuds, pinching screws, cheese headed and round headed screws; Various types of locking arrangements of nuts.

UNIT III ISOMETRIC PROJECTION AND DESIGNCHARACTERISTICS **12**

Use of Isometric scale. Isometric drawing of simple solids like prisms, pyramids, cylinders and cones. Sectional Views of Simple machine components in isometric. Design characteristics of bearings, seals, lubrication arrangement, ballan droller bearings. Isometric and oblique projections.

UNIT IV CONVENTIONSFORDRAWING **08**

Threadformation,Nuts,Bolts&Studs–V-threadsandsquarethreaddetails;Metric&BSP threads; General conventions for drawing of threads in engineering drawings;

UNIT VMACHINERYDRAWING **10**

Interpretationofmachinerydrawings.Interpretationofhydraulicandpneumaticdiagrams.

TOTAL 54 hours.

COURSE OUTCOME

CO 01	To apply orthographic projection in first and third angle projection method.
CO 02	To identify internal sectioning of machinery components, To interpret machinery drawings, hydraulic and pneumatic diagrams.
CO 03	To distinguish between various locking arrangements using bolt, nets and contrast between riveted and welded connections.
CO 04	To make use of characteristics of lubrication arrangements on bearings.
CO 05	To construct the formation of V thread, square thread, metric thread and conventional drawing.

Text Books: P.S. Gill, Machine Drawing

Reference: 1. H.K. Beck, Engineering Drawing

2. R. K. Dhawan, Engineering Drawing.

Web Source:

https://www.youtube.com/watch?v=j5nwO-JwVv4

https://easyengineering.net/machine-drawing-by-narayana/

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR205	FLUID MECHANICS	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(14)**

Properties of fluid density. Compressibility. Vapor pressure. Capillarity. Cavitation phenomena. Viscosity and its measurement. Rotating viscometer. Equilibrium of floating bodies. 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 liquid surface. Impact of jets – force exerted by a a jet on flat and curved plates and at pipe bends. Surge pressure and control. Blade diagrams for a centrifugal pump.

UNIT II **(16)**

Bernoulli's equation and applications. Venturi-meter. Euler's formula. Bernoulli's formula. Energy equations and applications. Flow rate measurement – Venturimeter, Orifice meter, Pitot tube. Coefficients of velocity, contraction of area, and discharge. Fluid flow and characteristics of major ship's pumping systems. Description of all fluid systems on board. Operation and material construction of devices/equipment in the system.

UNIT III **(8)**

Full- bore flow of liquids under a constant head. Flow through an orifice. Flow through pipes. Flow through concentric pipes. Flow through parallel plates. Coefficients of velocity, contraction of area and discharge.

UNIT IV **(8)**

Dimensional Analysis & dynamically similarity: Use of dimension for finding conversion factors: Dimensions equation: Methods of finding dimensional groups; Geometrical and dynamical similarity, General principle; dynamically similarity problems

UNIT V **(8)**

Losses of energy in pipelines; Losses due to sudden increase in pipe diameter, Losses due to sudden contraction in diameter, friction losses, Shock losses, derivation of Darcey's and Chezy's formula: Hydraulic Grade line and Energy Line, Pipes in series and in parallel, Equivalent Pipe

TOTAL 54 hours

COURSE OUTCOME

CO 01	To analyze properties of fluid density, compressibility, capillarity, cavition phenomena. And Interpret venuri-meter, Euler's Formula.
CO 02	To study about various flow rate measurement methods
CO 03	To distinguish changes in flow characterics through various components.
CO 04	Application of dimensional analysis and dynamic similarities
CO 05	To analyze loss energy in pipelinesdue to various factors

Text Books: 1.R. K Bansal, Fluid Mechanics

Reference: 1. Jagdish Lal, Hydraulic Machines

Web Source: https://www.youtube.com/watch?v=VvDJyhYSJv8

https://studymaterialz.in/a-textbook-of-fluid-mechanics-and-and-hydraulic-machines-bansal-pdf-book/

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR206	THERMODYNAMICS I	60	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

COURSE PLAN

UNIT I Thermodynamic Definitions (10)

Heat, Work, Energy, System, Boundary, Control, Volume. Working substance, phase properties, Phase diagrams. Point function, Path function, Reversible and irreversible process; P-V Diagram of work transfer in reversible processes; Closed system and Open System; Steady flow process and Non-flow process - Specific heat capacity – specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances. Linear, superficial and volumetric expansion due to temperature changes. Co-efficients and the relationships between them.

UNIT II First Law of Thermodynamics (10)

First law of thermodynamics and its application to various processes; Steady- Flow Energy Equation; Non-Flow Energy Equation; Applied Problems. Boyles and Charles law for perfect gases. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process. Relationship between pressure, temperature and volume. Work done, change in internal energy.

UNIT III Second Law of Thermodynamics (12)

Statements of the Second Law of Thermodynamics. Carnot's cycle, Thermodynamic Reversibility. Carnot's principle, Carnot's cycle for a gas, deductions from Carnot's cycle. Thermodynamic temperature scale. Steam and Gas processes on T-S and H-S charts, Entropy and irreversibility. Applied problems.

UNIT IV Properties of Mixture of Gases and Gas Vapours (14)

Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric Analysis of Gas mixtures, Gibb's Law – Dalton's Law, Mean value of a Gas constant. Equivalent Molecular weight, Density, specific volume, specific Heat and molar heat capacity of a gas mixture.

UNIT V Compressors and IC Engines (14)

Reciprocating Air compressors: Elementary principles and cycles of operation. Calculation of work done, indicator diagrams.

IC engines: Elementary principles and cycle of operation, actual indicator diagrams, mean effective pressure, work done, power developed, indicated and brake thermal efficiency, mechanical efficiency, overall efficiency, fuel consumption and heat balance.

TOTAL 60 hours

COURSE OUTCOME

CO 01 Illustrate basic concepts for solving problems in open and closed system.

CO 02	Apply first law concepts in various processes. Illustrate the significance of thermodynamics relations
CO 03	Apply second law concepts to illustrate the concept of irreversibility
CO 04	Apply concepts of entropy.
CO 05	Study the properties of mixture of gases & gas vapors, Study the working of compressors & IC engines for solving the problems in calculating the efficiency and work done.

.**Text Books:**

1. P.L. Ballaney, Thermal Engineering

Reference Books:

1. Nag, Engineering Thermodynamics
2. Domkundwar and Kothanda Raman, A course in Thermal Engineering
3. B.K. Sarkar, Thermal Engineering

Web Source:

https://www.youtube.com/watch?v=F_jtpWcZjME

http://www.freepdfbook.com/thermodynamics-by-pk-nag/

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR253	STRENGTH OF MATERIALS LAB	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

List of Experiments

1. Rockwell hard
2. Brinell hardness test
3. Universal testing machine – stress – strain curve
4. Torsion test on mild steel rod
5. Impact test – Izod and Charpy test
6. Compression test on a coil spring

TOTAL 36 HOURS

COURSE OUTCOME

CO 01	To analyze the Hardness of Materials Through Rockwell Hardness.
CO 02	To compare the Hardness of Materials Through Brinell Hardness.
CO 03	To Examine Universal Testing Machine – Stress – Strain Curve, To Estimate the compression test on a coil spring.
CO 04	To Inspect the Torsion Test on Mild Steel rod
CO 05	To Determine Impact Test –IZOD and CHARPY test

Text Book: In-house developed Lab Manual.

Web Source:

https://www.youtube.com/watch?v=VtswxEhTz8Y

https://www.youtube.com/watch?v=qzdAwjujnkM

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR254	BASIC WORKSHOP II	0	0	144	6

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A – III/1)

UNIT I Grinding **(24)**

- Grinding tools familiarization - Checking of angles with tool angle gauge - Grinding of cutting tools -Grinding of welded joints

UNIT II Lathe Work **(32)**

- Straight Turning - Step Turning -Taper Turning - Thread cutting on Lathe

UNIT III Shaping and Drilling **(32)**

- Familiarization of shaping machine - Tools employed in shaping - Shaping a specimen - Machine Drilling - Hand Tapping of threads

UNIT IV Welding **(32)**

Arc Welding

- Bead building - Closed Butt joint - Square Butt Joint - Single Vee Butt Joint - Single Bevel Butt Joint - T Joint - Lap Joint - Outside corner joint - Fillet joint (Flat) - Horizontal Butt Joint - Horizontal Filet joint - Vertical Butt Joint - Vertical Fillet joint

UNIT V Welding **(24)**

Gas Welding: Butt joint Fillet joint - Vertical up Fillet

Gas Cutting

- Round cutting
- Beveling

TOTAL 144 HOURS

COURSE OUTCOME

CO 01	Choose appropriate grinding tools used for various jobs, demonstrate grinding of cutting tools and welded joints
CO 02	Demonstrate techniques involved in operation of lathe work.
CO 03	Create a model using shaping machine
CO 04	Carry out drilling operation in safe manner
CO 05	Classify different types of joints using arc welding technique. Demonstrate the process of arc welding and Carry out gas welding and gas cutting safely.

TEXTBOOKS: S.K Hajra Choudhry" Workshop Technology "MPP, 14th edition, 2013

Web Source:

https://www.youtube.com/watch?v=Vcfau3bJ8hE

https://www.youtube.com/watch?v=uQPCdwegXzc

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR102	SAFE WORKING PRACTICES	0	0	90	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III / A)

List of experiments

(Advanced Marine Workshop)

Safety measures to be taken for repair and maintenance of the following marine machinery:

1. General shipboard safety procedures - Working aloft, working in restricted areas, enclosed spaces, hazardous spaces, handling heavy equipment, use of safety harness, tool-kit belts, communications (10)

2. Procedures for isolating, and safety checks prior to overhaul of : (i) an Air Compressor (ii) an Air-Conditioning Compressor (iii) a Fridge Compressor(iv) a Centrifugal Pump (v) A Reciprocating pump (vi) a Screw displacement pump (vii) a Gear Pump (viii) a Vane type pump (ix) an air cooler (x) Main Engine Scavenge spaces inspection (xi) Main Engine Crankcase inspection (xii) Dismantling any Main Engine Part (xiii)Aux Engine Crankcase inspection (xiv) Dismantling any Aux Engine part (xv)Inspection of Boiler furnace (xvi) Inspection of a Fuel Oil tank (xvii) Overhaul of hydraulic equipment (xviii) Inspection of Main Air Receiver (xix) Overhaul of FO Separator (xx) Main Switch Board (20 items@4h each = 80h).

TOTAL 90 HRS

COURSE OUTCOME

CO 01	To develop knowledge about General safeties and Working aloft in restricted areas
CO 02	To interpret Isolation, safety procedure prior overhauling air compressor, A/C compressor and reefer compressor and inspection of air reservoir
CO 03	To list out the Procedure for isolating and safety checks prior to overhaul of air cooler
CO 04	To develop skill of Dismantling and maintenance of boiler furnace
CO 05	To plan Inspection of fuel oil tank and overhauling of hydraulic equipment, To list out the Procedure for isolating and safety checks prior to overhauling of fuel oil separator

Text Book: In-house developed Work Manual

Reference:

1. Code of Safe Working Practices for Merchant Seamen.

Web Source:

https://www.youtube.com/watch?v=gk_E-SlC8kM

Code	Subject	Lesson	Tutorial	Practical	Credits
21EMR207	HYDRAULICS LAB	0	0	18	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operational fuel, lubrication, ballast and other pumping systems and associated control systems (Table A – III /1)

FLUID MECHANICS EXPERIMENTS

1. To determine the meter constant of the venturimeter

2. To determine the efficiency of a Pelton wheel

3. To determine the co-efficient of velocity of contraction and co-efficient of discharge of water through orifice/s.

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

COURSE OUTCOME

CO 01	To calculate metre constant of venturimeter.
CO 02	To analyze efficiency of pelton wheel.
CO 03	To determine co-efficient of velocity of contraction.
CO 04	To calculate co-efficient of discharge of water through orifice/s.
CO 05	To determine the friction co-efficient for the flow of water through a pipe.

Text Book: In-house developed Work Manual

Web Source:

https://www.youtube.com/watch?v=LfqadPBKim8

https://www.youtube.com/watch?v=Qlie8g_YYPc

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
SECOND YEAR – THIRD SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – III						
CC	21CMRE31	Electric Motors and Starters I	4	0	0	3
CC	21CMRE32	Analog Electronics	5	0	0	3
CC	21CMRE33	Material Science II	3	0	0	2
CC	21CMRE34	Marine Machine Drawing II	3	0	0	2
AECC	21CMRE35	Deck Machinery	3	0	0	3
AECC	21CMRE36	Thermodynamics II	4	0	0	3
CC	21CMRE37	Electrical Testing and Measuring Equipment	2	0	0	1
AECC	21PMRE31	Electrical Machines Lab	0	0	2	2
AECC	21PMRE32	Electronics I Lab	0	0	2	2
DSE	21PMRE33	Advanced Marine Workshop(Deck/M/C)	0	0	4	3
DSE	21PMRE34	Advanced Marine Workshop (Electrical)	0	0	2	1
TOTAL			24	0	12	25

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE31	ELECTRIC MOTORS AND STARTERS I	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

COURSE PLAN

UNIT I

DC machines-Principle of working, Self-Excitation, Types of DC generators - generation of back-EMF and load/voltage characteristics, Armature reaction, commutation, brush shift, Methods of voltage control, paralleling procedures and load sharing for DC GeneratorsNumerical problems.

UNIT II

Constructional details and characteristics of DC Series, shunt and compound-wound motors. Loses in DC machines.

Unit III

Types of DC motor starters, protection of DC motors & speed control of DC motors.

UNIT IV

AC Machines: Theory of rotating magnetic fields. Relation between frequency and no of poles and speed of a machine. Relation between slip, rotor emf and frequency, torque-speed characteristics. Numerical problems.

UNIT V

Three phase Generators

Construction, working and characteristics of Brushless and Brushed alternators, Three phase transformers - theory of transformers and their onboard usage. Coupling, load sharing and changing-over generators.

TOTAL 54 h

COURSE OUTCOME

CO 01	Can Interprete and summarize the operation of DC machines
CO 02	Can analyze and infer the construction and characteristics of DC machines
CO 03	Can categorize and select appropriate starter, protection and speed control method for a given DC motor.
CO 04	Can define and describe the fundamentals of AC machines.
CO 05	Can outline and explain outline the working and application of Alternators and transformers.

Text Book: BL Theraja, Electrical Technology VOL-II
References: P. S. Bimbhara, Electrical Machinery
Web Source:
https://www.youtube.com/watch?v=gZLXLG668JE
https://www.ebooknetworking.net/ebooks/ps-bimbhra.html

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE32	ANALOG ELECTRONICS	90	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Semi Conductors - Types of Semi Conductors, Electrical characteristics, Diffusion and Drift, Mobility. Characteristics of diodes, Diodes as a rectifier, Zener diodes, Varistors, Thermistors and Non Linear Resistors their function and operation. Symbols used.

UNIT II **(24)**

Transistors - The junction transistor and its basic characteristics, The transistor as an amplifier, Full wave, half wave, Bridge Rectifiers, DIAC, TRIAC. SCR, UJT, LED. Integrated Circuits and Large Scale Integrated Circuits (LSI). IC555 based timers, Clipping, Clamping, Multivibrators using transistors & IC555. Basics of digital electronics

UNIT III **(18)**

Regulated power supplies Series Regulators, Shunt regulators.

Oscillators – circuit diagram and explanation – requirements for Oscillations phase shift Oscillator Wien Bridge oscillators, Crystal Oscillators.

Power Amplifiers circuit diagram and explanation. Class A, B & C amplifier, efficiency, distribution. Design theory, Symmetry, Practical complementary push-pull amplifier.SMPS

UNIT IV **(12)**

Industrial Electronics Devices: Silicon Control Rectifier (power control), MosFET, Insulated Gate Bipolar Transistor (IGBT), Photo-Electric Devices, Inverters.

Flow charts for manual and automatic control systems. Op amp based P,I, D, PI and PID closed loop systems.

UNIT V **(24)**

Power Electronics: Adavantages of solid state drives and devices, Fully controlled converters, Choppers, Inverters, AC voltage controllers and cycloconverters.

TOTAL 90 HOURS

COURSE OUTCOME

CO 01	Can compare and contrast various electronic components like diodes, varistors, thermistors etc.,
CO 02	Can relate and explain the working of transistor based circuits.
CO 03	Can describe and enumerate the different types of power supplies, oscillators and amplifiers
CO 04	Can identify, justify and summarize the types of power electronic devices and control loop mechanisms.
CO 05	Can observe and recognize the advantages of solid state circuits.

Text Books

1. V.K. Metha & Rohit, Principle of Electronics

Reference Books

1. B.L. Theraja & A.K. Theraja, Electrical Technology, Volume IV
2. Floyd, Electronic Devices, Pearson Education, -7TH Edition.

Web Source:

https://www.youtube.com/watch?v=J4oO7PT_nzQ
https://www.youtube.com/watch?v=AcxDiesy-nI
https://entrancetutorials.com/principles-of-electronics-vk-mehta-and-rohit-mehta-pdf/

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE33	MATERIAL SCIENCE II	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A-III/1)

COURSE PLAN

UNIT I **(12)**

Vibrations. Failure modes – viz plastic deformation, fracture, fatigue, creep. Fatigue loading, Mechanisms of fatigue, fatigue curve, fatigue tests. Design criteria in fatigue. Stress concentration. Creep phenomena and creep – resisting alloys. Creep curve. Short time and longtime creep tests. Development of creep resisting alloys.

UNIT II **(12)**

Technology of materials – Metallurgy of steel and cast Iron, chromium, ceramic, Titanium, PTFE in shipboard systems. Properties, characteristics and applications of materials used in machinery on board ships

UNIT III **(10)**

Engineering processes used in construction and repair. Heat treatment principles and process for ferrous and non-Ferrous metals and alloys. Effect on structure and properties. Deformation and Fracture of materials in services.

UNIT IV **(12)**

Process of welded repair and construction, Advantages and disadvantages. Types of welds, defects in welds. Mechanical testing of materials. Destructive testing of materials

UNIT V **(08)**

Insulating materials, plastic and rubber, PVC, Resins, Adhesives and Bonding plastics, Non-destructive examination and testing of materials.(tests carried out on typical welded seam of a water tube boiler drum)

TOTAL 54hours

COURSE OUTCOME

CO 01	To identify various vibrations and categorize the failure modes caused by it.
CO 02	To make use of Metallurgy of steel and cast iron and learn about the properties and applications.
CO 03	To analyze the functioning of materials in engineering process and failure of materials in service
CO 04	To understand welding repairs and interpret strength of weld through testing.
CO 05	Application of insulation materials and NDTonboard ships.

Text Book:

1. O.P. Khanna, Dhanpat, Material Science and Metallurgy, Rai Publishers

Reference Books:

1. R.S. Khurmi, Material Science
2. Avner, Introduction to Physical Metallurgy.
3. R.B. Choudry, Material Science and Metallurgy
4. George .E. Dieter, Mechanical Metallurgy

5. Thomas .H. Courtney, Mechanical Behavior of Materials

Web Source:

https://www.youtube.com/watch?v=qcHjDLCJxfI

https://www.youtube.com/watch?v=WsCutkh_LWk

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE34	MARINE MACHINE DRAWING II	72	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A-III/1)

COURSE PLAN

UNIT I MAINENGINESYSTEM **12**

Main Engine System, Piston four stroke, Air-inlet valve, Automatic valve, Starting Air Pilot valve, Burner Carrier,

UNIT II BOILERMOUNTINGS **16**

BoilerMountingsBoilerBlow-Downvalves,FullBoreSafetyvalve,Platetypegaugeglass,High lift Safetyvalve

UNIT IIIENGINECOMPONENTS **16**

Engine Components, Connecting rod with bearings, Rocker Arms, Starting Air valve, 4-stroke piston

UNIT IVMARINECOMPONENTS **12**

Marine Components Ballast Chest, Bilge suction strainer, Tele-motor receiver, Turbine Flexible Coupling, Flow regulator, Pedestal Bearing, Tunnel Bearing,

UNIT VAUXILIARYCOMPONENTS **16**

Auxiliary components, Fuel Oil Strainer, Reducing valve, Return and Non-return globe valves, Quick Closing Valve, Stern Tube & Tail Shaft, Mitchell Thrust Block, Cross head and Guide shoe.
(Minimum of three drawings to completed for each unit in class remaining should be completed as home assignment)

TOTAL 72 HOURS

COURSE OUTCOME

CO 01	To Interpret on piping, hydraulic and pneumatic diagrams
CO 02	To develop assembling and dismantling on air inlet valve, automatic valve, starting air valve and pilot valve.
CO 03	To interpret assembling and dismantling on boiler mounting blow down valves, plate type gauge glass, full bore and high lift safety valve.
CO 04	To interpret engine components of connecting rod with bearings, rocker arms, starting air valve & four stroke pistons
CO 05	To interpret drawing assembling and dismantling on telemotor receiver, bilge suction strainer & ballast chest and assembling and dismantling of oil fuel strainer, & reducing valve.

Text Book: 1. P.S. Gill, Machine Drawing

Reference Books: H.K. Beck, Engineering Drawing
R. K. Dhawan, Engineering Drawing

Web Source:
https://www.youtube.com/watch?v=i1Abti0zBMM

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE35	DECK MACHINERY	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A-III/1)

COURSE PLAN

Principles and operation of the following types of Deck Machinery:

UNIT I **(08)**

Windlass and Mooring Winches – construction, operation and precautions while operating. Routine maintenance of these machines. Circuit diagrams of hydraulic systems. Bow-Thruster Systems and their Remote Control.

UNIT II **(12)**

Cargo Cranes – Electro-hydraulic and totally hydraulic systems. Various movements of the cranes and the safety features installed on such Cranes.

UNIT III **(12)**

Hydraulic and Mechanical hatch-cover operation. Operation of hydraulic ramps, bow-doors on ferries. Operation of large bore Ballast System valves using hydraulics. Hydraulic Circuit diagrams.

UNIT IV **(06)**

Life Boat Winch and accommodation Ladder Winch. Constructional features, operation and maintenance required.

UNIT V **(16)**

Steering Gear 4 ram and 2 ram type – Hydraulic Transmitter and receiver. Electrical Telemotor. Line diagrams of Steering Gear systems. Rotary vane type Steering. Emergency steering Gear. Testing of Steering departure and arrival port.

TOTAL 54h

COURSE OUTCOME

CO 01	Explain construction and working of windlass and mooring winches
CO 02	Function of bow thruster system and control
CO 03	Classify types of cargo cranes(electro hydraulic and total hydraulic), distinguish various crane movements and safety.
CO 04	Function of various hydraulic systems onboard and analyze various hydraulic circuits and Classify various types of steering gear also explain their operation and testing
CO 05	Explain construction and operation of LSA and importance of maintaining LSA

Text Book: Prof K Venkatraman, Marine Auxiliary Machinery
Reference: McGeorge, Marine Auxiliary Machinery
Web Source:
https://www.academia.edu/33568067/Marine_Auxiliary_Machinery_pdf
https://www.youtube.com/watch?v=QTWNHlsersw

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE36	THERMODYNAMICS II	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

COURSE PLAN

UNIT I **(12)**

Steam and Two Phase System: Phase; Equation of Steam; Temperature- Pressure Diagrams; Triple Point; Specific Enthalpy and Entropy Diagrams; Use of Steam table and Steam Charts; Pressure volume and Enthalpy and Entropy Diagrams Internal energy vapours Super critical vapours; Non flow processes with Steam; Applied Problems.

UNIT II **(08)**

Steam Cycle: Carnot's cycle for steam and ideal efficiency. Rankine cycle with dry saturated steam and superheated steam. Feed Pump work. Rankine Efficiency, cycle efficiency, Isentropic Efficiency, work ratio, Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency. Applied problems.

UNIT III **(10)**

Boilers and Evaporators: Boilers and Calculations; Boiler Thermal Efficiency and Equivalent Evaporation of a Boiler; Basic calculations on the effect of Condenser Leakage and Impure feed, dissolved solids and scale in Boilers; Density of water and its control in Boilers & Evaporators. Applied Problems.

UNIT IV **(12)**

Steam Turbines: General Principles of impulse and Reaction Turbines – Velocity Diagrams for simple impulse and impulse – Reaction Turbine. Compounding of impulse Turbine-Pressure and velocity compounding. Force on blades, work done by Blades, Axial Trust, Blade or Diagram Efficiency. Effect of Friction on blades, Applied Problems.

UNIT V **(12)**

Steam Engines: Modified Rankine cycle for steam engines, Hypothetical Indicator Diagram. Mean Effective pressure and work transfer, Diagram factor. Indicated power, specific steam consumption. Indicated Thermal Efficiency. Efficiency ratio, Engine Efficiency, Energy Balance, Applied Problems.

TOTAL 54 HOURS

COURSE OUTCOME

CO 01 To understand Steam and Two Phase System.

CO 02 To understand Non flow processes with Steam.

CO 03 To understand Steam Cycle: Carnot's cycle for steam and ideal efficiency.

CO 04 To understand Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency.

CO 05 To understand Boilers and Evaporators.

Text Books: 1. P.L. Ballaney, Thermal engineering

Reference Books Nag, Thermal Engineering

Damkundwar, Kothandaraman, A course in Thermal Engineering.

Web Source: https://www.youtube.com/watch?v=RaRc0oHBk5M

https://www.youtube.com/watch?v=fsXpaPSVasQ

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE37	ELECTRICAL TESTING AND MEASURING EQUIPMENT	36	0	0	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)

COURSE PLAN

UNIT I

Functional elements of measurement systems, Types of meters, types of errors, sources of errors, statistical analysis of data, calibration and standards, safe handling and usage of measuring equipment.

UNIT II

Tests on HV and LV apparatus onboard ships, Construction & working of electrical testing and measuring equipment: Insulation Tester. Testing of Insulators, bushings, Circuit breakers, cable testing.

UNIT III

Construction & Working of electrical testing and measuring equipment: Multi-Tester, Continuity tester & Clamp Meter

UNIT IV

Balanced and unbalanced three-phase loads (Star & Delta), Measurement of Power by various wattmeter methods. Comparison of Analog meters & digital meters. Moving coil, moving iron, dynamometer type analog meters.

UNIT V

Construction and operation of electrical testing and measuring equipment: Digital meters for voltage, current, speed, frequency, power factor, phase sequence, salinometer. LED, LCD, CRT, TFT displays.

TOTAL 36 hours.

COURSE OUTCOME

CO 01 Can define and describe the elements, types, errors, data and safe handling of meters

CO 02 Can express and explain testing of LV and HV devices used onboard with insulation tester.

CO 03 Can analyze and outline the working of multi tester, clamp meter and continuity tester for tests on electrical equipment.

CO 04 Can compare and contrast various analog and digital meters with their applications in three phase and single phase power measurement.

CO 05 Can list and relate the operation of digital meters and displays.

Text Book: 1. AL Theraja and BL Theraja, Electrical Technology VOL I

Ref Book: 1. A.K. Sawhney "Electrical, Electronic measurement & Instrumentation"

Web Source:

https://www.youtube.com/watch?v=QqZcFJ7ya6Y

https://engineeringreads.com/electrical-technology-basic-electrical-engineering-in-s-i-units-volume-i-by-b-l-theraja%E2%80%8E-a-k-theraja-pdf/

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE31	ELECTRICAL MACHINES LAB	0	0	36	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A-III/1)

List of Experiments

1. Testing of continuity, insulation and grouping of coils of AC and DC Motors.
2. Load test on DC shunt generator.
3. Speed control of DC motors by armature and field control.
4. Load test on DC shunt motor.
5. Study of single phase and three phase transformers.
6. Open circuit characteristics of DC generator.
7. Connecting a three phase Induction Motor with DOL starter and measurement of power and speed.
8. Load test on three phase alternator.
9. Parallel operation of DC generators.
10. Parallel operation of AC generators.

TOTAL 36 HRS

COURSE OUTCOME

CO 01	Can perform and illustrate tests on electrical motors
CO 02	Can determine and evaluate the characteristics and efficiency of AC & DC machines.
CO 03	Can test and assess proper functioning of coils in AC & DC motors
CO 04	Can estimate and infer the machine parameters during working conditions
CO 05	Can prepare and manage parallel operation on generators.

Text Book – In-House developed Lab Manual

Web Source:

https://www.youtube.com/watch?v=dMgTxtSdUcM

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE32	ELECTRONICS I LAB	0	0	36	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

List of experiments

1. Study of half wave and full wave rectification circuit without and with filter
2. Characteristics of Semi conductor diode
3. Volt – ampere characteristics of Zener diode
4. Characteristics of Thermistor
5. Characteristics of LED
6. Characteristics of Field Effect Transistor
7. Characteristics of SCR
8. Characteristics of TRIAC
9. Speed Control of DC motor using SCR.

COURSE OUTCOME

CO 01	Identify and Classify different types of electronic devices.
CO 02	Demonstrate the operating principle and output characteristics of pn junction diodes, zener diode, FET, rectifiers and different diode circuits.
CO 03	Relate the characteristics of SCR & TIAC
CO 04	Illustrate the speed control of DC motor using SCR
CO 05	Operate and use electronics devices for various applications according to their characteristics

TOTAL 36 HOURS

Text Book: In-house developed Lab Manual

Web Source:

https://www.youtube.com/watch?v=9h7_vDUE908

https://www.youtube.com/watch?v=IEju3AT1olk

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE33	ADVANCED MARINE WORKSHOP (DECK M/C)	0	0	72	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A-III/1)

Operate/overhaul the following Deck M/c:

1) Windlass – precautions while operating. Routine maintenance of these machines. Circuit diagrams of hydraulic systems.

2) Mooring Winches – Precautions while operating. Routine maintenance of these machines. Circuit diagrams of hydraulic systems

3) Electro - Hydraulic and totally hydraulic systems. Maintenance and testing of safety features.

4) Hydraulic circuit diagram of Mechanical hatch-cover & its operation.

5) Hydraulic circuit diagram of hydraulic ramps & Bow door its operation and maintenance.

6). Hydraulic Circuit diagrams of large bore Ballast System valves, its operation and maintenance

7) Maintenance of Life Boat Winch and accommodation Ladder Winch.

8) Maintenance and testing of steering gear.

9) Emergency steering procedure.

TOTAL 72hrs

COURSE OUTCOME

CO 01	To demonstrate operation of Windlass and Mooring Winches.
CO 02	Application hydraulic systems in deck machinery and testing safety features
CO 03	Application of hydraulics on cranes and hatch covers.
CO 04	To demonstrate maintenance of winches
CO 05	To test emergency steering gear and its maintenance.

Text Book: In-house developed Lab Manual

Web source:

https://www.youtube.com/watch?v=BXnpSzL7mOo
https://www.youtube.com/watch?v=kq-nOh4aTp8

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE34	ADVANCED MARINE WORKSHOP(ELECTRICAL)	0	0	54	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)

LIST OF JOBS/EXPERIMENTS

1. Opening up, study and use of: Insulation tester. Safety precautions to be observed.

2. Opening up, study and use of: Continuity tester. Safety precautions to be observed.

3. Opening up, study and use of: Multi-tester. Safety precautions to be observed.

4. Opening up, study and use of: Clamp meter. Safety precautions to be observed.

5. Opening up, study and use of: Analog and digital tachometers. Safety precautions to be observed.

6. Opening up, study and use of: Analog and digital frequency meters. Safety precautions to be observed.

7. Opening up, study and use of: Analog and digital Power factor meters. Safety precautions to be observed.

8. Testing of power electronic components such as SCR, TRIAC, MosFET and IGBT.

9. Testing of relay coils, Contactors, Timers and other safety devices.

TOTAL 54 hours.

COURSE OUTCOME

CO 01	Apply safety precautions during testing and measuring electrical parameters using analog/digital meters.
CO 02	Analyze the working of various electrical measuring equipment
CO 03	Organize and perform regular maintenance methods on electrical and electronic meters.
CO 04	Test and find faults in electrical and electronic testing equipment.
CO 05	Solve faults in electrical and electronic testing equipment.

Text Book: In-house developed Lab Manual

Reference: AL Theraja and BL Theraja, Electrical Technology

Web Source:
https://www.youtube.com/watch?v=CWulQ1ZSE3c

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
SECOND YEAR – FOURTH SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – IV						
CC	21CMRE41	Electric Motors and Starters II	4	0	0	3
CC	21CMRE42	Digital Electronics & Communication	3	0	0	2
CC	21CMRE43	Thermal Engineering	3	0	0	2
AECC	21CMRE44	Safe Maintenance on Ships	3	0	0	2
AECC	21CMRE45	Marine Auxiliary Machinery	4	0	0	3
AECC	21CMRE46	Mechanics of Machines	2	0	0	2
AECC	21PMRE41	Electrical Workshop-Motors/Starters	4	0	0	3
AECC	21PMRE42	Electronics II Lab	0	0	3	2
DSE	21PMRE43	Advanced Marine Workshop (MAM I)	0	0	2	2
SEC	21SMRE41	Lube Oil, Fuel Oil and Cooling Systems	2	0	0	2
SEC	21PMRE44	Communication Lab	0	0	2	2
TOTAL			25	0	7	26

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE41	ELECTRIC MOTORS AND STARTERS II	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

COURSE PLAN

UNIT I

Three phase AC induction motors, three phase synchronous motors, Constructional details & Theory of synchronous and induction motors, effect of varying frequency and voltage of AC motors, Numerical Problems

UNIT II

Speed control of three phase induction motors, DOL, autotransformer, star-delta & Soft starters, IGBT(Insulated Gate Bipolar Transistor) motor speed control, motor speed control by Thyristors,

UNIT III

Single phase Induction motors - Split-Phase starting, Shaded-Pole Starting, Repulsion Motor Starting, Capacitor Motor, hysteresis motor, AC series motor.

Special electrical machines - Synchronous induction Motor, Power Synchros, Position Synchros, Linear Motor, Switched reluctance motor, Permanent magnet machines, Brushless D.C machines, Stepper motor & AC servo motors.

UNIT IV

Distribution Systems, HV and LV switch gear, distribution and equipment- Coupling and breaking connection between switchboard and distribution panels.

UNIT V

Basics of electric propulsion systems, power distribution systems – distribution, insulation, transformer, types.

TOTAL 54 hours

COURSE OUTCOME

CO 01	Can analyze and infer the construction and operation of AC machines
CO 02	Can compare and contrast the various starting speed control methods of three phase induction motors.
CO 03	Can categorize and select appropriate single phase induction motor and special electrical motor depending on their applications
CO 04	Can identify and describe the functions of distribution systems and switchgear arrangements.
CO 05	Can outline and explain outline the basics of electrical propulsion and transformers.

Text Book: BL Theraja, Electrical Technology VOL-II

References: P.S.Bimbara, Electrical Machinery

Web Soruce:

https://www.youtube.com/watch?v=mQ-gPMDv-tI

https://civildatas.com/download/electrical-machinery-by-bimbhra.

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE42	DIGITAL ELECTRONICS & COMMUNICATION	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

COURSE PLAN

UNIT I **(24)Operation Amplifier Theory**: Concept of Differential Amplifiers. Linear OP-amp circuits. Digital Circuits: Logic System and Gates. Binary and BCD codes, Boolean algebra, Simplifications, Flips-flops; Counters; Registers and Multiplexers.

UNIT II **(18)**

Converters: Analog to Digital (AD) and Digital to Analog (DA) converters and their use in Data-Loggers. Various Sensors used on board ship- Pressure Sensors - Temperature Sensors – Level Sensors - RPM Sensors – Photo Sensors - Water Salinometer

UNIT III **(16)**

TTL & CMOS GATES: Digital integrated Circuits, Semi – conductor Memories-ROM, RAM and PROM. Industrial Electronics: Power rectification, Silicon Control rectifier power control, Photo-Electric Devices. Electronic Control equipment – PLC – Integrated Automation Control and Monitoring System (IACMS), Computer programmable controller, Relay circuit Unit, Digital Sequential Control devices

UNIT IV **(16)Communication devices**: Communication systems, Modulation and Demodulation, their necessity and circuit explanation. AM, FM, Wireless communication, Radio Transmitters and Receivers, T-V broadcasting, Radar Communication, Pulse Communication. Practical use of VHF.

UNIT V **(16)**

Electronic Instruments: Cathode Ray Oscilloscope, Digital Voltmeters and frequency – meters, Multimeters; Voltmeter and signal Generators, Q-Meters. Flow Chart for Automatic and other Control Systems – Depiction and understanding of flow-charts, symbols utilization, and processes involved.

TOTAL 90 HOURS

COURSE OUTCOME

CO 01 Compare and contrast linear and digital circuits

CO 02 Can relate and explain the need and operation of D/A & A/D converters

CO 03 Can describe and enumerate the different types of memory and building blocks of PLC systems.

CO 04 Can identify, justify and summarize the types of communication and technology adapted.

CO 05 Can observe and recognize the working of electronic measuring processes and equipment.

Text Book: 1. V.K.Mehta, Electronics engineering

Reference Books:

1. B.L. Theraja & A.K. Theraja, Electrical Technology – Volume IV.
2. Morris Mano, Digital Design Pearson education - 3rd Edition.

Web source:

https://www.youtube.com/watch?v=HicZcgdGxZY

https://www.academia.edu/42933156/Basic_Electrical_Engineering_VK_Mehta

Code	Subject	Lesson	Tutorial	Practicals	Credit
21CMRE43	THERMAL ENGINEERING	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

COURSE PLAN

UNIT I

Air Compressors – Elementary principles and cycles of operation. Calculation of work done. Indicator diagrams. Numerical examples.

UNIT II

Properties of steam – Saturated steam, dry, wet. Dryness fraction. Superheated steam. Internal energy. Enthalpy. Specific volume. Steam tables. Throttling. Advantages of using steam expansively. Numerical examples.

UNIT III

Rankine cycle. Operation principle and basic construction of and materials of steam turbine. Impulse turbine. Reaction turbine. Elementary principles of steam turbines including simple velocity diagrams for impulse and reaction turbines. Force and work on blades. Numerical examples.

UNIT IV

Combustion – Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air. Numerical examples.

UNIT V

Gas dynamics. Gas nozzles and Steam nozzles. One dimensional flow of gases through varying cross-section, critical pressure ratio, convergent nozzle, convergent-divergent nozzle. Gas turbine – open cycle gas turbine-operation, principle and basic construction. Effect on thermal efficiency due to change in pressure ratio, inclusion of intercooler, reheaters and heat exchangers construction)

TOTAL 54hours

COURSE OUTCOME

CO 01 To understand the working of air compressors.

CO 02 To interpret various properties of steam.

CO 03 To understand steam turbines and its principles of operation

CO 04 To analyze combustion – Fuel and air requirement.

CO 05 To gain knowledge on gas dynamics and types of gas turbines.

Text Book: A P. Ballaney, Thermal Engineering

Reference:

1. Nag, Thermal Engineering
2. D0mkundwar, Kothanda Raman, A course in Thermal Engineering
3. Rajput, Power plant Engineering
4. Dr. R. Yadav, Steam and Gas Turbines
5. B.K. Sarkar, Thermal Engineering

Web source:

https://www.youtube.com/watch?v=bJluUxA7aaY

https://www.youtube.com/watch?v=AcyXnT5R2P0

Code	Subject	Lesson	Tutorial	Practicals	Credit
21SMRE41	LUBE OIL, FUEL OIL, AND COOLING SYSTEMS	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Engine Room Layout**:** Lay-out of Main and Auxiliary machinery in engine rooms in different ships – bulk carriers, tankers, RO-RO, Passenger vessels.

UNIT II **(12)**

Lay-out of piping arrangement for Main Lube Oil system. Main circulation system and Continuous by-pass purification system. Components of the system – Filters, Coolers. Lube oil properties and testing of lube oil.

UNIT III **(09)**

Lay-out of piping arrangement for Main Engine Fuel Oil system. Components of the system – Filters, heaters, flow meters, quick closing valves, drain and collection arrangements.

UNIT IV **(12)**

Lay-out of piping arrangement for Fuel Oil Bunkers and Transfer system. Components of the system – Filters, heaters, sampling arrangement. Bunker precautions and Procedure. Onboard testing of fuel oil.

UNIT V **(09)**

Lay-out of piping arrangement for Main Jacket Cooling Water System. Components of the system – Filters, Coolers, Valves, Temperature Control valves, Thermostatic valves for temperature control.
Testing and maintenance (chemical treatment) of cooling water.

TOTAL 54 hours

COURSE OUTCOME

CO 01	Classify various types of ships with elaborate sketch an engine room layout
CO 02	Explain with a layout of lube oil pipeline system and its associated equipments. Discuss main circulation and continuous bypass purification system.
CO 03	Explain with a layout of fuel oil pipeline system with its associated components onboard a ship, components of Cooling water system with a layout.
CO 04	Explain with a layout of fuel oil bunkering and transfer system
CO 05	Discuss importance of bunker procedures and precautions.

Text Book: Prof Venkatraman, Marine Auxiliary Machinery

Reference: H. D. Mc George, Marine Auxiliary Machinery
R. A. Taylor, Marine Auxiliary Machines

Web Source:
https://www.pfri.uniri.hr/bopri/documents/23_AuxiliaryMarineMachinery_000.pdf
https://www.youtube.com/watch?v=uNJWZzmQnYc

Code	Subject	Lesson	Tutorial	Practicals	Credit
21CMRE44	SAFE MAINTENANCE ON SHIPS	72	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

General safety and cleanliness on board. Risk Assessment – Introduction – Key terms – Principles – What and when to assess and by whom-Elements of risk assessment – Guidance on main elements of risk assessment.

UNIT II **(16)**

Personal protective equipment. Its use and care – Introduction – employer duties – worker duties-types of equipment – head protection-hearing protection-face and eye protection-respiratory protective equipment-head and foot protection-protection from falls-body protection. Carriage of tools. Use of helmets and goggles in specific work areas. Reporting and standard communication systems between individuals and between work stations.

UNIT III **(16)**

Work Activities – Safe Systems of Work – Introduction – Working aloft and outboard – portable ladders – cradles and stages – Bosun's chair-Working from punts – work in machinery spaces-Boilers – Unmanned Machinery spaces – Refrigeration Machinery – Scaffolding-

UNIT IV **(16)**

Maintenance – Introduction – General – Floorplates and hand rails – Machinery maintenance- Boilers – Auxiliary machinery and equipment-Main engines-Refrigeration machinery and refrigerated compartments-steering gear – hydraulic and pneumatic equipment-electrical equipment-Main switch boards-distribution switchboards-electrical machinery- High Voltage systems-storage batteries –general – lead acid-alkaline batteries- radio and associated equipment – valves and semi-conductor devices

UNIT V **(12)**

Use of Safety Signs –Introduction – Signs and notices – Occasional signs – Electrical wiring-Gas cylinders – pipe lines – portable fire extinguishers – International color coding of signs –
Permit to work systems – Introduction – Sanction-to-test systems – Permit to work in UMS, enclosed space, machinery equipment, Hot Work – Working aloft – General electrical – HV electricity – Sanction to test above 1000V.

TOTAL: 72hours

COURSE OUTCOME

CO 01	To make use of general safety cleanliness on board ship and RISK assessment.
CO 02	To categorize personal protective equipments and its use and care.
CO 03	To estimate safe systems of work on board ducks and machinery spaces.
CO 04	To Categorize machinery maintenance on boilers, auxiliary machinery, main engines and refrigeration compartments.
CO 05	To adopt safety science and notices, occasional science, portable fire extinguishers and color coding system, permit to work system on UMS, enclosed spaces, machinery spaces and high voltage electricity on board.

Text Book: Code of Safe Practices for Merchant Seamen – Consolidated Edition 2010

Web Source:

https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/normativeinstrument/wcms_618575.pdf

https://www.youtube.com/watch?v=qNW16qenuHo

Code	Subject	Lesson	Tutorial	Practicals	Credit
21CMRE45	MARINE AUXILIARY MACHINERY	72	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I

Propulsion transmission systems including thrust and shaft bearings and stern-tubes.(oil-filled and water-lubricated lignum-vitae, and Thordon types. Types of propellers and features – fixed pitch, CPP. Materials of construction. Cavitation.

UNIT II

Heat Exchangers: Tubular and plate type, reasons of corrosion, leakages – erosion tube removal, plugging, pressure testing. Materials used. Fouling of tubes – plates. Renewal of sacrificial anodes

Filters: Strainers and filters, types of marine filters - auto cleaner and duplex filters, micro filters, Static filters. Priming and core maintenance of filters.

UNIT III

Steering Gear, Stabilizers, Bow Thrusters – principles, operation, types, materials of construction, hydraulic power pumps and control systems for above. Maintenance of steering gear system.

UNIT IV

Air Compressors – System principles, materials of construction, operation, the compression process, inter and after coolers. Air Bottles – Construction and mountings.

UNIT V

Evaporators and distillers- Principles, Operation, materials of construction. Flash evaporators, Multiple-effect evaporation.

Construction, characteristics and operation of Fresh Water Generators.

TOTAL 72 hours.

COURSE OUTCOME

CO 01	Function of Propulsion transmission systems
CO 02	Elaborate the function of Heat Exchangers
CO 03	List the principles, operation and types of Steering systems
CO 04	Importance of Compressors onboard vessels
CO 05	Appraise the operation of Evaporators and Distillers and Construct the characteristics and operation of Fresh Water Generators

Text Book: Prof K Venkatraman, Marine Auxiliary Machinery.

Reference: H. D. Mc George, Marine Auxiliary Machinery

R. A. Taylor, Marine Auxiliary Machines

Web Source:

https://www.youtube.com/watch?v=9lm2ubpOoL4

https://www.youtube.com/watch?v=mb-NjsxxOcc

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE46	MECHANICS OF MACHINES	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

COURSE PLAN

UNIT I **(6)**

Kinematics and Link Mechanics: Relative motion between bodies moving in different planes. Instantaneous center method; Rubbing velocities at pin joints. Graphical construction for relative and acceleration in different link and sliding mechanisms. Analytical determination of velocity and acceleration. Forces in Crank and connecting rods. Inertia force on link connecting rods etc. effect of friction.

UNIT II **(6)**

Turning Moment & Flywheel: Function of a flywheel. Crank effort diagram. Fluctuation of speed and energy. Effect of centrifugal tension on flywheel, Inertia torque and its effect on Crank Effort Diagrams.

UNIT III **(9)**

Belts and Chains: Flat belts and effect of centrifugal tension. Initial Belt tension & conditions for maximum power transmission. Roller & inverted tooth chains. **Gears:** Spur Gears – Various definitions – P.C.D., module, Interference, Gear ratio and center distance of simple and compound gear trains. Fundamental Law. Tooth profiles – proportions. Bevel and Worm Gears. Plain and epicyclic gear trains.

UNIT IV **(6)**

Balancing: Balancing of masses rotating in one or different planes, dynamic forces at bearings; Primary and secondary balance of multi-cylinder in-line engines and configurations. Balancing Machines.
Gyroscope: Gyroscopic couple, vector representation of torque and angular momentum, steady rectangular precession; vector treatment; steady conical precession; Motion involving steady procession; Application to ship's stabilization.

UNIT V **(9)**

Vibration: Free Harmonic vibrations, linear motion of an elastic system, and Angular motion of an elastic system. Differential equation of motion. Single and two degrees of freedom.
Torsional vibrations: Single rotor system, rotor at end and rotor in the middle. Effect of inertia of shaft, two rotor system, rotors at both ends and rotors at one end. Three rotor and multi rotor system. Torsionally equivalent shafts, geared system – whirling.
Forced vibrations: Forced linear and angular vibrations, periodic force transmitted to support, periodic movement of the support. Damping

TOTAL 36hours

COURSE OUTCOME

CO 01	To analyze Relative motion between bodies moving in different planes.
CO 02	To understand Analytical determination of velocity and acceleration.

CO 03 To interpret Function of a flywheel.
CO 04 To understand Effect of centrifugal tension on flywheel.
CO 05 Application of Flat belts and effect of centrifugal tension.

Text Books:

1. Ballaney, Theory of Machines

Reference Books:

1. Bevan and Green, Theory of Machines
2. Gupta, Theory of Machines

Web source:

https://www.youtube.com/watch?v=1YTKedLQOa0
https://learncreative.net/r-s-khurmi-theory-of-machines-pdf/

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE41	ELECTRICAL WORKSHOP – MOTORS/STARTERS	0	0	72	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

COURSE PROFILE

1. Dismantling and study of AC motor – 3 ph induction type – squirrel cage type.
2. Dismantling and study of AC motor – 3 ph induction type – wound rotor type.
3. Dismantling and study of AC motor – 1 ph induction type – capacitor start type
4. Dismantling and study of AC motor – 1 ph induction type – capacitor start/capacitor run Type
5. Stator armature winding of 3ph squirrel cage type induction motor
6. Single-phase AC motor starter – wiring connections
7. Direct-on-line starter for 3ph AC motor – wiring connections
8. Star-Delta Starter for 3ph AC motor
9. Auto-transformer starter for 3ph induction motor
10. Transformer winding – 1 phase
11. Transformer winding – 3 phase
12. Soft starting – 3 ph induction motor

COURSE OUTCOME

CO 01 Can name the various parts of the electrical motors, starters and generators.

CO 02 Can compare the constructional details of various electrical machines.

CO 03 Can construct the control circuits for starting of various types of electrical machines

CO 04 Can analyze the control circuits and various parts of the electrical machines.

CO 05 Can compare and explain the various control circuits for electrical machines and Can develop the various control circuits for electrical machines.

Text Book: In-house developed Lab Manual

Reference: AL Theraja & BL Theraja, Electrical Technology

Web source:
https://www.youtube.com/watch?v=km8MSWm39Z0
https://engineeringreads.com/electrical-technology-volume-iv-electronic-devices-and-circuits-by-b-l-theraja%E2%80%8E-a-k-theraja-pdf/

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE42	ELECTRONICS II LAB	0	0	36	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)

List of Experiments:

1. Push Pull Amplifier.
2. Study of Integrator and Differentiator
3. Study of Inverting and Non inverting amplifier
4. Verification of Logic Gates truth tables
5. Study of multiplexers & de multiplexers
6. Study of Analog to Digital converter.
7. Study of Digital to Analog Converter.
8. Study of 555 Timer
9. Construct an inverter to convert DC to AC.

TOTAL 36hours

COURSE OUTCOME

CO 01 To explain the push pull amplifiers
CO 02 To compare integrator and differentiator
CO 03 To design inverting and non inverting amplifier
CO 04 To understand multiplexers and demultiplexers
CO 05 To test the A/D and D/A and To function 555 timer

Text Book: In-house developed Lab Manual

Web Source:

https://www.youtube.com/watch?v=FKvnmxte98A

https://www.youtube.com/watch?v=OPvs7A554Rw

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE43	ADVANCED MARINE WORKSHOP(MAM I)	0	0	54	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

List of Experiments

1. Inspection of propulsion transmission systems including thrust and shaft bearings and stern-tubes. (Oil-filled and water-lubricated lignum-vitae, and Thordon types).
2. Types of propellers and features – fixed pitch, CPP. Materials of construction. Cavitation.
3. Heat Exchangers: Tubular and plate type, reasons of corrosion, leakages – erosion tube removal, plugging, pressure testing. Materials used. Fouling of tubes – plates. Renewal of sacrificial anodes
4. Filters: Strainers and filters, types of marine filters, auto cleaner and duplex filters, Static filters. Priming and core maintenance of filters.
5. Steering Gear, Stabilizers, Bow Thrusters – principles, operation, types, materials of construction, hydraulic power pumps and control systems for above.
6. Air Compressors – Opening up and overhaul of cylinder heads, valves, inter and after coolers.
7. Air Compressors – Safe start-up, operation, shut-down, and charging of Air Bottles
8. Air Bottles – inspection and overhaul of mountings and inspection Air of Bottles.
9. Construction, characteristics and operation of Fresh Water Generators (Vacuum distillation).

TOTAL 54 hours

COURSE OUTCOME

CO 01	To categorize the duplex filter and auto backwash filter
CO 02	To develop skill to overhaul of air compressor
CO 03	To asses maintenance and inspection of air receiver
CO 04	To plan bunkering and watch keeping
CO 05	To identify engine room layout and pipe line system and To list out the types of propeller and the material of construction

Text Book: In-house developed Workshop Manual

Web Source:

https://www.youtube.com/watch?v=OyQ3SaU4KKU

https://www.youtube.com/watch?v=mb-NjsxxOcc&t=282s

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE44	COMMUNICATION LAB	0	0	18	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain a safe Engineering watch (Table A – III/1)
- Use internal communication systems (Table A – III/1)

List of study experiments

1) Sound power telephones

2) Megaphones

3) voice pipe

4) Engine Telegraph

5) VHF radio

6) walkie talkie

7) Engineers call alarm

8) Dead man alarm

9) Satellite communication system

10) Intercom

COURSE OUTCOME

CO 01 Classify and test various communication devices used onboard ships.

CO 02 Illustrate/demonstrate the working of communication systems onboard.

CO 03 Select and utilize engine room resources for internal and external communication.

CO 04 Assess proper working of communication devices onboard.

CO 05 Inspect and maintain a safe engineering watch.

Web Source:

https://www.youtube.com/watch?v=LPNa7xZqLu4

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
THIRD YEAR – FIFTH SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – V						
CC	21CMRE51	Marine Internal Combustion Engineering I	5	0	0	4
CC	21CMRE52	Electronics & Control Systems for Marine Machinery	5	0	0	4
AECC	21CMRE53	Marine Engineering Practice I	2	0	0	2
AECC	21CMRE54	Marine Electrical Technology I	2	0	0	2
DSE	21DMRE51	Marine Environmental Pollution Control	3	0	0	2
DSE	21PMRE51	Seamanship Practical	0	0	2	1
DSE	21PMRE52	Advanced Marine Workshop (MEP I)	0	0	5	4
GE	21GMRE51	Seamanship and Commercial Geography	2	0	0	1
GE	21PMRE53	Anti-Pollution Lab (In Advanced Mar W/S)	0	0	2	1
SEC	21PMRE54	Control Engineering Lab	0	0	2	3
		TOTAL	19	0	11	24

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE51	MARINE INTERNAL COMBUSTION ENGINEERIN	90	0	0	4

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(18)**

Characteristics of I.C. Engine : 4 – stroke and 2 – stroke cycles; Deviation from Ideal Condition in actual engines; Limitation in parameters, Timing Diagrams of 2-stroke and 4 – stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes mean piston speed, M.C.R. & C.S.R. ratings. Practical heat balance diagrams and thermal efficiency.

UNIT II **(18)**

General Description of I.C. Engines: Marine Diesel Engine of M.A.N., Sulzer, B & W make constructional details of I.C. Engines: Principal components: Jackets and Liners, Cylinder heads. Pistons, Cross heads, Connecting rods, Bed plates, A-frames, welded construction for bed plates & frames. Tie rods.

UNIT III **(18)**

Scavengingsystems: Scavenging arrangements in 2 – stroke engines; air charging and exhausting in 4 – stroke engines; various types of scavenging in 2 – stroke engines; Uni – flow, loop, cross scavenging, their merits and demerits Scavenge pumps for normally aspired engines; under piston scavenging, Scavenge manifolds.

UNIT IV **(18)**

Supercharging arrangements: Pulse and Constant Pressure type; their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers.

UNIT V **(18)**

Marine Gas Turbines: Brief history of development. Principle of simple open-cycle gas turbine, gas turbine with regenerator, intercooler. Definition of Air Rate, Work ratio, compressor and turbine efficiencies. Basic gas turbine components. Materials of construction of the various components.

TOTAL 90 hours

COURSE OUTCOME

CO 01 Explain various thermodynamic cycles used in IC engine and to compare the thermodynamic cycles to the actual working of engine and solve problems based on cycle

CO 02 Classification of IC engines based on various parameters and valve timing of 2S and 4S engine

CO 03 Identify various components of IC engine and explain function of each component with their material of construction.

CO 04 Explain scavenging and various methods of scavenging, discuss supercharging and its methods

CO 05 Explain various thermodynamic cycles, their efficiencies in Gas turbine and identify components associated.

Text Book:

1. Prof. K. Venkataraman. Marine Internal Combustion Engineering I & II.

Reference Books:

1. Doug wood yard, Pounder's Marine Diesel Engines – 8th Edition

Web Source:

https://www.youtube.com/watch?v=nXnH_DzO53Y

http://160592857366.free.fr/joe/ebooks/Automative%20engineering%20books/Introduction_to_Internal_Combustion_Engines.pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE52	Electronics & Control Systems for Marine Machinery	72	0	0	4

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)
- Manage operation of electrical and electronic control equipment.
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A - III/2)

COURSE PLAN

UNIT I **(12)**

Basic Control Engineering concepts. Open loop and closed loop control. Elements of closed loop control system. PV, CO and SV of a control system. Transfer function of closed loop and open loop systems. Time response and frequency response analysis on stability of systems.

UNIT II **(18)**

Fundamentals of automatic control systems. Various types – ON/OFF control, Continuous Control, Sequential Control. Various examples and comparison.

UNIT III **(12)**

Filters, regulated power supply. Transducers and Transmitters suitable for measurement of temperature, pressure, flow, level, speed, torque, vibration, and water content. Measurement of process value. Temperature (Mechanical, Electrical), Pressure, Level (Direct and inferential methods), Flow.

UNIT IV **(18)**

Transmission of signals- Transmitters, controlling elements (Pneumatic, electrical).
Manipulator elements – principles, operation, application of pneumatic, electrical and hydraulic servomotors.

UNIT V **(12)**

Significance of a controller in a closed loop system. Introduction to PID control. Detailed study on P, PI, PD and PID controllers. Design of an opamp 741 based P, PI, PD and PID controller with various examples.

TOTAL 72 hours

COURSE OUTCOME

CO 01 Analyze basic control engineering, classification of functions and relationships of control actions.

CO 02 Compare and Evaluate the various types of control actions with examples.

CO 03 Describe and enumerate the different methods of measuring process values in control system

CO 04 Identify, justify and summarize the operation and pneumatic, electric and hydraulic systems.

CO 05 Observe the significance of controller and design P, PI & PID controllers of control systems.

Text Books:

1. D A Taylor, Marine Control Practice, Butterworth and Co (Publishers) Ltd,2nd Edition, London 1987.

2. G J Roy, Instrumentation and Control– Kandy Series.

Reference:

1. L F Adams, Engineering Instrumentation and Control, English Language Book Society,1st Edition 1984.

2. Leslie Jackson, Instrumentation and Control Systems,Thomas Reed Publications Ltd, 3rd Edition, London, UK.

Web Source:

https://www.youtube.com/watch?v=ozeYaikI11g

http://host.bglot.com/Introduction_to_Marine_Engineering/TAYLOR,%20D.%20A.%20(1996).%20Introduction%20to%20Marine%20Engineering%20(2nd%20ed.).pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE53	MARINE ENGINEERING PRACTICE I	72	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Characteristics and limitations of materials used in construction and repair of ships and equipment. – Steel – mild steel, carbon steel, cast iron, wrought iron, aluminium and aluminium alloys, copper, tin, plastics, composites.

UNIT II **(16)**

Design characteristics and selection of materials in the construction of equipment – Main engine cylinder liners, pistons, crankshafts and bearings. Material for boilers, super-heaters, steam turbines casing, blades, rotor etc. Gas turbine casings, rotors, blades, combustion chambers etc.

UNIT III **(16)**

Safety measures to be taken to ensure a safe working environment, and for use of hand tools, powered hand tools, machine tools (Centre Lathe, Soldering, Thermal cutting, Inspection, safety and health when carrying out above operations – using appropriate specialized tools(for overhaul of particular machinery items) and precision measuring instruments (micrometers, liner gauges, tachometers, feeler gauges, UTG).

UNIT IV **(16)**

Types of valves used in the shipping industry. Construction, material and operation of all types of valves. General maintenance of valves, cutting/grinding of valve seat and valve lid. Testing of valves after overhauling (Hydraulic).
Maintenance – various methods used for truing of bent shaft/spindles.
Procedure to check trueness of shaft.

UNIT V **(12)**

Use of various types of sealants and packings for various applications on board- Superheated Steam, Sea water, Fresh water, Lub oil, Refrigerant lines, chemicals.

TOTAL 72 hours.

COURSE OUTCOME

CO 01 List the different types of materials used in Steam systems. (K3)

CO 02 Elaborate various types sealants and Packing . (K6)

CO 03 Motivate the students about the safe working practices while using tools. (K3)

CO 04 Importance of using specialized overhauling tools of machinery. (K5)

CO 05 Analyze the construction work process by using welding process and tests carried out on a typical periodic survey.. (K3)

Text Book: 1. Prof K Venkatraman, Marine Internal Combustion engineering I and II by
2. W A Chapman, Workshop Technology by W A Chapman

Reference: 1. Code of Safe Working Practices for Merchant Seamen.

Web Source:

https://www.youtube.com/watch?v=W2NTYg6fZY0

https://www.youtube.com/watch?v=XxAhrF7KZuE

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE54	MARINE ELECTRICAL TECHNOLOGY I	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage operation of electrical and electronic control equipment
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A – III/2)
- Maintenance and repair of electrical and electronic equipment (Table A – III/1)

COURSE PLAN

UNIT I **(6)**

Starting, parallel operation and changing of alternators. Synchronizing methods – scope and lamp. Load sharing. Parallel operation of Diesel Generator and Shaft Generator. Maintenance required on Alternators and motors and paralleling equipment.

UNIT II **(9)**

Purpose of emergency power supply. Emergency Generator & Different Starting methods including auto-start. Emergency batteries construction and its different types (Lead acid and alkaline battery) & duties. Location of emergency power. Maintenance required on all the above equipment.

UNIT III **(9)**

Alternative Source of Power**:** Safety devices on emergency switch board – Interconnection between the MSB and emergency switch board. Shore Supply – Specifications as per Voltage / Frequency, precautions while taking shore supply. List the essential services supplied with electrical power. Describe the maintenance routine of all the above equipment, including circuit breakers.

UNIT IV **(6)**

Switchboard construction – Main and Emergency – different switchgear & protective devices, Grounded and insulated neutral systems, precautions adopted in High Voltage Distribution system. Transformers .Cables & temperature classification. Describe the maintenance routine of all the above equipment, including circuit breakers.

UNIT V **(6)**

Motor & Control Equipments: Types of marine motors, types of enclosures, protective devices on motors explain how excitation of a motor is produced and supplied. Describe how a generator is cooled and why heaters are fitted. Describe the maintenance required on these items.

TOTAL 36hours.

COURSE OUTCOME

CO 01 To explain Starting parallel operation and changing of alternators

CO 02 To examine the Maintenance required on alternators and motors and paralleling equipments.

CO 03 To construct the Emergency batteries construction and its different types

CO 04 To inspect the Maintenance routine of all equipment, including circuit breakers.

CO 05 To design Cables and temperature classification and protection devices for motors

Text Books:

1. Eltsan Fernandez, Marine Electrical Technology.

Reference Books:

1. Dennis .T. Hall,Practical Marine Electrical Knowledge.
2. Gokhale & Nanda, Marine Electro Technology and Electronics.

Web Source:

https://www.youtube.com/watch?v=_NnxdPKWsIg

Code	Subject	Lesson	Tutorial	Practical	Credits
21DMRE51	MARINE ENVIRONMENTAL POLLUTION CONTROL	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Ensure compliance with pollution prevention requirements (Table A-III/1)

COURSE PLAN

UNIT I **(9)**

Marine environment – Marine environmental awareness. Marine ecology, seas and coastal areas. Ship's discharges to the sea and their environmental impact.

UNIT II
(12)

Precautions during bunkering, loading discharging oil cargo, tank cleaning, pumping out bilges, and knowledge of construction and operation of oil pollution prevention equipment in Engine room, and on various types of ships.

UNIT III **(12)**

MARPOL 73/78-Alll Annexes, equipment requirements and their documentation, including necessary Record Books. Ballast Water Management Convention 2004. Anti-Fouling Convention 2001. Oil Pollution Act 1990.

UNIT IV **(12)**

Responsibilities under the relevant requirements of the international Convention for the prevention of Pollution from Ships – Annex I, Annex II, Annex III, Annex IV, Annex V, Annex VI. Ballast Water Management Convention 2004. Anti-Fouling Convention 2001. Oil Pollution Act 1990.

UNIT V
(9)
Environmental impact of accidental and operational discharges. Emissions to air from ships. Other pollutants. Proactive measures to control pollution and maintain the environment. Emergency situations-action to be taken to protect and safeguard the environment.

TOTAL: 54hours.

COURSE OUTCOME

CO 01 To explain marine environmental pollution, its impact, precaution for oil transfer & operation of pollution prevention equipments.

CO 02 To elaborate MARPOL requirements, its documentation & various convention (ballast water management).

CO 03 To adapt various annexes in MARPOL.

CO 04 To explain OPA 90 & antifouling convention, emergency actions to protect & safeguard the environment

CO 05 To discover environmental impact of accidental & operational discharges**.**

TEXT BOOK: MATERIAL DEVELOPED IN-HOUSE.

Web Source:

https://www.arma.org.au/wp-content/uploads/2017/03/marine-pollution.pdf

https://www.youtube.com/watch?v=izQrz5BMvTc

Code	Subject	Lesson	Tutorial	Practical	Credits
21GMRE51	SEAMANSHIP AND COMMERCIAL GEOGRAPHY	36	0	0	1

COURSE OBJECTIVE

- Able to understand seamen duties, mooring practice, anchors etc.

COURSE PLAN

UNIT I **(6)**

Seamen & their duties: Ship's department, general ship knowledge and nautical terms like poop-deck, forecastle, bridge etc. navigational lights and signals: Port & starboard, forward and aft mast lights, colors and location.

UNIT II **(9)**

Rope Knots and Mooring: Types of knots. Practice of knot formation.

UNIT III **(6)**

Anchors: Their use, dropping and weighing anchor, cable stopper. Navigation: General knowledge of principles of navigation compasses, echo sounder.

UNIT IV **(9)**

World Transport – Ports – Types, Characteristics and establishment issues – Major ports of the world – Government Policy.

UNIT V **(6)**

Economics of Sea Transport – Major Shipping Routes – Weather Routing – Fishing Zones – Off shore Oil and Power Installations.

TOTAL: 36 hours.

COURSE OUTCOME

CO 01 To identify parts of the ship, to classify ship's complement & to make use of navigational lights for navigation.

CO 02 To utilize knots on ships, to take part in mooring a ship at berth. To classify & categorize types of anchors and their usage

CO 03 To interpret principles and use of navigational equipments.

CO 04 To assess major ports of the world & importance of world transport.

CO 05 To distinguish economics of sea transport, to classify major shipping routes and fishing zones.

Text Book:

1. Capt. V.K. Bhandarkar, Seamanship, Bhandarkar Publications

Reference Books: D.J. House, Seamanship Techniques.

Web Source:

https://anzaliport.pmo.ir/pso_content/media/digitallibrary/2013/1/book13/13.pdf
https://www.youtube.com/watch?v=2YvwXJGsbEg

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE51	SEAMANSHIP PRACTICAL	0	0	36	1

COURS OBJECTIVE

- Able to understand semen duties, ship departments, signals, lights etc.

COURSE PLAN

- Seamen & their duties
- Ship's departments
- General ship knowledge
- Nautical terms like poop-deck, Forecastle, bridge etc.
- Navigational lights
- Signals
- Port & starboard, forward and aft mast lights, Colors and location
- Ropes and wires
- Mooring
- Types of knots.
- Anchors, their use, dropping and weighing anchor
- Cable stopper
- General knowledge of principles of navigation
- Compasses
- Echo sounder.

COURSE OUTCOME

CO 01 To identify parts of the ship & apply navigation lights for navigation.

CO 02 To make use of flags for signaling and taking part in mooring operation

CO 03 To choose and decide on the type of knots to be used.

CO 04 To inspect and take part in using cable stoppers.

CO 05 To determine the use of various navigational equipments.

Text Book:

1. In-house lab manual

Web Source:

https://www.youtube.com/watch?v=VIMWa5Hjeqk

https://www.youtube.com/watch?v=ZsTqIkVYLII

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE52	ADVANCED MARINE WORKSHOP (MEP I)	0	0	144	4

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A – III/1)

COURSE PLAN

Job I **(24)**

Dismantle Main engine cylinder liners, pistons, crankshafts, bearings.

Job 2 **(24)**

Material for boilers, super-heaters, steam turbines casing, blades, rotor etc. Gas turbine casings, rotors, blades, combustion chambers etc.

Job 3 **(24)**

Safety measures to be taken to ensure a safe working environment, and for use of hand tools, powered hand tools, machine tools (Centre Lathe, Soldering, Thermal cutting,

Job 4 **(24)**

The process of welded repair and construction. Advantages and disadvantages. Types of welds. Defects in welds. Destructive and Non-destructive testing of welds. (Tests carried out on a sample of a typical welded seam of a water tube boiler drum.)

Job 5 **(24)**

Use of various types of sealants and packings for various applications on board- Superheated Steam, Sea water, Fresh water, Lub oil, Refrigerant lines, chemicals.

Job 6 **(24)**

Inspection, safety and health when carrying out above operations – using appropriate specialized tools (for overhaul of particular machinery items) and precision measuring instruments (micrometers, liner gauges, tachometers, feeler gauges, UTG).

TOTAL 144 hours.

COURSE OUTCOME

CO 01 To demonstrate dismantling of engine parts
CO 02 To study the material requirement for various machineries and sealants
CO 03 To assess the safety measures required to operate hand and machine tools
CO 04 To demonstrate welding repairs and its testing
CO 05 To handle precision measuring instruments and carrying out Health and safety inspection.

Web Source:
https://www.youtube.com/watch?v=FHbrU2_JIKE
https://www.youtube.com/watch?v=pM639mqWWf0

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE53	ANTI-POLLUTION LAB (IN ADVANCED MAR W/S)	0	0	24	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Ensure compliance with pollution prevention requirements (Table A-III/1)

COURSE PLAN

Job 1 **(12)**

Demonstrate use of pollution Check Lists. Equipment to be made ready and proficiency in its use to be demonstrated. (200 ltr Drum, Sawdust, Scoop, Buckets, Mops, Wilden Pump with suction and discharge hoses. All Reports to be recorded.

Job 2 **(12)**

Dummy assessment of the environmental impact of accidental oil discharges. Carry out mock drill on various actions to be taken in such an event, assuming the vessel is on the US Coast. Follow-up with preventive measures to avoid recurrence of the event. Show complete documentation of the drill.

Job 3

OWS – starting and stopping procedure, operation in special areas.

TOTAL: 24 hours.

COURSE OUTCOME

CO 01	To understand the usage of checklists to combat pollution
CO 02	To demonstrate usage of pollution prevention equipments
CO 03	To assess the impact of pollution on the environment.
CO 04	To demonstrate pollution control drill
CO 05	To assess, what preventive measures are required to avoid pollution.

Reference:MARPOL with latest Amendments

Web Source:

https://www.youtube.com/watch?v=PZUoaoTfT0A

https://www.michigan.gov/documents/explorelabscience/Measuring_Air_Pollution_Experiment_559910_7.pdf

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE54	CONTROL ENGINEERING LAB	0	0	36	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic & control systems (Table A – III/1)
- Manage operation of electrical & electronic control equipment.
- Operation, surveillance, performance assessment & maintaining safety of propulsion plant & auxiliary machinery (Table A – III/2).

Control engineering Lab experiments:

1. Study on open loop control system.
2. Study on a closed loop system (level controller).
3. Study on operation of automatic viscosity controller (temp control) of a given fuel.
4. Analog & digital measurement of flow of fluid in given pipe.
5. Simulation of a level control system with closed loop & PID controller.
6. Study on operation of a PID based temperature controller.
7. Study on operation of a 3 term (PID) pneumatic controller.
8. Study the operation of AVR control on a brushless generator.
9. Study the operation & maintenance of steering gear system.
10. Study the operation of automatic combustion control of steam boiler.

TOTAL 36 hours

COURSE OUTCOME

CO 01 Analyze and interpret electrical and electronic diagrams.

CO 02 Organize and study the characteristics of open loop and closed loop control systems

CO 03 Solve faults and troubles on electrical and electronic control systems.

CO 04 Perform and illustrate control operations on temperature, viscosity and voltage of alternators.

CO 05 Test and operate propulsion and auxiliary machinery with its control equipment.

Text Book: In-house developed Lab Manual.

Web Source:

https://www.youtube.com/watch?v=uK15lhFMXdE&list=PLBBGwIiUvNPDYNygN-GkVgHcEaQsrH8nC

https://www.youtube.com/watch?v=DE0hWLdkckg

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
THIRD YEAR – SIXTH SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – VI						
CC	21CMRE61	Marine Internal Combustion Engineering II	5	0	0	4
CC	21CMRE62	Ship Construction	3	0	0	3
CC	21CMRE63	Advanced Marine control Engineering & Automation	3	0	0	3
AECC	21CMRE64	Refrigeration, Air-Conditioning & Ventilation Systems	3	0	0	3
AECC	21CMRE65	Marine Electrical Technology II	2	0	0	2
AECC	21CMRE66	Naval Architecture I	3	0	0	3
DSE	21PMRE61	Advanced Marine Workshop-Refrigeration And Airconditioning Trainer	0	0	1	1
DSE	21PMRE62	Advanced Marine Electrical Workshop - II	0	0	5	2
SEC	21PMRE63	Ship-in-Campus- Diesel Engine Lab	0	0	4	2
SEC	21PMRE64	Ship-in-Campus- Ship Construction	0	0	2	1
SEC	21PMRE65	Ship-in-Campus(Pumps and Auxiliaries- I)	0	0	2	1
TOTAL			19	0	15	26

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE61	MARINE INTERNAL COMBUSTION ENGINEERING II	72	0	0	4

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(16)**

Propulsive characteristics of Diesel engines including speed, output and fuel consumption. Engine lay-out and load diagrams. Fuel oil preparation systems **Combustion of Fuels in I.C. Engines:** Grades of suitable fuels. Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, Fuel injectors and its detail. Ignition delay, after burning.

UNIT II **(12)**

Marine Diesel Engine – trunk and Crosshead types. Compression pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure. Design aspects of combustion chamber. Control of NOX, SOX in Exhaust emission. Dual fuel engines and its effects on emission control.

UNIT III **(16)**

Assessment of engine power, and running adjustments to maintain performance. Operational limits of Power Plants. **Lubrication systems:** need for lubrication – types of Lubrication systems.
Lubrication systems: lubrication arrangement in diesel engines including coolers & filters, cylinder – lubrication, linear wear and preventive measures, combinations of lubricating oil its effect and preventive measures.
Improvements in lubricating oils through use of additives types of additives Monitoring engines through lubricating oil analysis reports.

UNIT IV **(16)**

Control and Alarm systems associated with automatic operation of a Diesel Power Plant.UMS operation ofPower Plant. Governors (Hydraulic and Electronic).Turbochargers, supercharging and scavenge system. **Cooling systems:** Various Cooling media used; their merits and demerits, cooling of Pistons, cylinder jackets & cylinder heads, bore cooling, Coolant conveying mechanism and systems, maintenance of coolant and cooling system.

UNIT V **(12)**

Detection, Safety and prevention: Causes and prevention of crank case explosions, and scavenge fires, safety fittings, Uptake fire, starting air-line explosion.

TOTAL 72 HOURS

COURSE OUTCOME

CO 01 Analyze propulsive characteristics of diesel engine.

CO 02 Importance of Fuel atomization, Ignition quality, Ignition delay ,after burning and fuel injectors

CO 03 Classify and compare Marine diesel engines- Trunk vs crosshead type, Importance of compression ratio its effects. Assess engine power and running adjustments to maintain performance.

CO 04 Importance of Lubrication, liner wear and preventive measures, lubricating oil properties and its effects. Determine causes and prevention of crankcase explosion.

CO 05 Discuss control and Alarm systems associated with auto operation of a diesel power plant. Scavenging, turbo charging and super charging.

Text Books:

1. K.Venkataraman, Marine Diesel Engines Sec. I, II

Reference Books:

1. Doug Woodyard, Pounder's Marine Diesel Engines, 8th Edition
2. D. Aranha, Marine Diesel Engines Sec. I.

Web Source:
https://www.liscr.com/sites/default/files/NOx%20Technical%20Code%202008%2C%20as%20amended.pd.pdf

https://www.youtube.com/watch?v=IM8rxp8qB8k

Code	Subject	Lesson	Tutorial	Practica	Credit
21CMRE62	SHIP CONSTRUCTION	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain seaworthiness of the ship (Table A – III/1)
- Control trim, stability and stress (Table A – III/2)

COURSE PLAN

UNIT I **(9)**

Common terms used in the measurement of steel ships – Length overall, Length between perpendiculars, breadth overall, moulded depth, draught and freeboard. Definitions of ship-building terms in general use. Descriptions and sketches of structural members in ordinary types of steel ships. Load lines, Deck Line, Freeboard, Plimsoll Line.

UNIT II **(12)**

Water-tight doors, Hatches, Rudders, Bow-thrusters, Propellors, Watertight bulkheads. Double bottoms. Anchors and cables. Descriptive treatment of the effect of liquids on stability. Arrangements for the carriage of dangerous goods in bulk. Ventilation arrangements (natural and mechanical) for pump rooms in tankers and for cargo holds and oil fuel tanks.

UNIT III **(12)**

Forepeak and after-peak tanks. Double-bottom and deep tank filling and pumping arrangements. Compartmental drainage. Leveling arrangements for damaged side compartments. Ship dimensions and form- general arrangement of general cargo ships, tankers, bulk carriers, combination carriers, container ships, RO-RO and passenger ships. Definitions of camber, rise of floor, flare, sheer, rake, etc.

UNIT IV **(9)**

Ship stresses- hogging and sagging, racking, panting, pounding, slamming, etc. Hull structure- Proper names for the various parts, standard steel sections used, Bow and Stern construction, Stern frame. Structural arrangements forward and aft to withstand panting and pounding, etc.

UNIT V **(12)**

Fittings- water-tightness of the hatches, openings in oil tankers, chain lockers and attachment of cables. Bilge piping system. Ballast System. Sounding pipes and air pipes. Propellors and rudders- construction of rudders and propellers, controllable pitch propellers, stern-tube arrangement. Ship Survey Rules. Functioning of Ship Classification Societies. Surveys during construction. Periodical surveys for retention of Class, and Statutory Surveys.

TOTAL 54hours.

COURSE OUTCOME

CO 01 To determine ship building terms and structural members of steel ships

CO 02 To inspect double bottom tanks & watertight bulkheads

CO 03 To compare general arrangement of general cargo ship, container ship, tankers, bulk

carriers, combination carriers, roro ships & passenger ships

CO 04 To analyze ship stresses – hogging, sagging, racking, pounding, panting, slamming

CO 05 To discuss ship survey rules, survey during construction, periodical surveys

Text Book:

1. E A Stokoe, Reed's Ship Construction for Marine Engineers – Volume 5.

Reference:

1. Kemp and Young, Ship Construction – Sketches and Notes
2. D J Eyres,Ship Construction.

Web Source:

https://www.youtube.com/watch?v=BXnpSzL7mOo&t=50s

https://www.youtube.com/watch?v=UTiG9zBzH_g

Code	Subject	Lesson	Tutorial	Practica	Credits
21CMRE63	**Advanced Marine control Engineering & Automation**	**54**	**0**	**0**	**3**

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate electrical, electronic and control systems (Table A – III/1)
- Manage operation of electrical and electronic control equipment.
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A - III/2)

COURSE PLAN

UNIT I **(8)**

Theory and characteristics of P-I-D control, and its tuning. V-I, I-V, P-I and I-P Converters. Microprocessor, microcontroller and PLC controlled systems.

UNIT II **(18)**

Basics of Programmable Logic Controllers. Concept of a generalized PLC configuration. CPU, Power Supply, Rack, I/O Modules- DI, DO, AI, AO, specialty modules, PLC Rack Power Supply, Addressing, Serial communication Network, Remote Input Output Terminals (RTU), PLC Programming, Programmable Logic Controller (PLC) Overview, PLC and Control System Components, Number Systems and Codes, Creating Relay Logic Diagrams. PLC and SCADA applications onboard ships.

UNIT III **(10)**

Application of Controls on Ships: Marine Boiler – Automatic Combustion control, Air – Fuel ratio control, Boiler water level control- single and two element, Steam pressure control, Fuel oil viscosity control, Lubricating oil temperature control, Jacket/piston cooling temperature control, Instruments for UMS classification.

UNIT IV **(10)**

Application of Controls on Ships: Proportional controller for Boiler Feed water control. Steering Gear control system with Auto Pilot, Direct reversing cam less engine control system, Purifier automatic de-sludging control system, Cargo handling crane operation control system

UNIT V **(10)**

Functions and mechanism of automatic control for Main Engines and Auxiliary Machinery. Generator distribution system, steam boiler, oil purifier, refrigeration, pumping systems, steering gear, cargo handling equipment and deck machinery..

Design features and system configuration of automatic control equipment and safety devices for the following – Main Engine, Generator and distribution system, and Steam Boiler.

TOTAL 56 hours

COURSE OUTCOME

CO 01 To define and describe the proportional, integral & derivative (PID)action and programmable logic controller (PLC)

CO 02 To analyze the characteristics of proportional, integral & derivative (PID)action and programmable logic controller (PLC)

CO 03 Relate and explain the applications of control systems used onboard ships.

CO 04 Interpret and summarize the application of control systems used onboard ships.

CO 05 Compare and assess the design features and system configuration of automatic control equipment and safety devices onboard ships.

Text Books:

1. D A Taylor, Marine Control Practice, Butterworth and Co (Publishers) Ltd,2nd Edition, London 1987.

2. G J Roy, Instrumentation and Control– Kandy Series.

Reference:

1. L F Adams, Engineering Instrumentation and Control, English Language Book Society,1st Edition 1984.

2. Leslie Jackson, Instrumentation and Control Systems,Thomas Reed Publications Ltd, 3rd Edition, London, UK.

Web Source:

https://cdn.automationdirect.com/static/eBooks/Control-System-Engineering-eBook.pdf

https://www.youtube.com/watch?v=AvrHKPqL6Jk

Code	Subject	Lesson	Tutoria	Practical	Credits
21CMRE64	REFRIGERATION, AIR-CONDITIONING & VENTILATION SYSTEMS	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Introduction- Marine refrigeration Cycle. Principles of refrigeration. Circuit diagrams and components of Vapor Compression Refrigeration System. Construction and materials used for the various components. Cargo refrigeration system and Domestic Refrigeration System (Brine and Direct Cooling). Construction of cold rooms.**Refrigeration:** Design and construction of various components of refrigeration plants i.e. compressor, condenser, evaporator, expansion valves, and control and safety equipments. Reliquefaction system on gas carriers.

UNIT II **(9)**

Operation of refrigeration Systems (Cargo and Domestic). Automatic Operation. Normal operating parameters. Abnormal operation, fault detection and remedial measures. Reefer Container plant operation. Data loggers and temp monitoring systems. Defrosting systems. Operation and maintenance of refrigeration plants, control of temperature in different chambers, changing of refrigerant/Oil, purging of air, defrosting methods,

UNIT III **(12)**

Introduction to Air Conditioning. Psychrometric principles. Why imperative on tankers. Circuit diagrams and components of Air Conditioning System. Construction and materials used for the various components. **Air conditioning:** necessity on board ships, different systems, control of rooms, air change requirements, design considerations, maintenance.

UNIT IV **(12)**

Operation of Air Conditioning Systems. Cabin cooling, Cabin heating and humidity control. Automatic Operation. Normal operating parameters. Recirculation options and duct layouts. Abnormal operation, fault detection and remedial measures. Provisions for isolation of ducts at various locations during a fire situation.

UNIT V **(9)**

Ventilation of cargo holds (natural and forced), Accommodation and Engine Rooms. Types of blowers used. Emergency shut-off in case of fire. **Ventilation:** Ventilation of engine room, pump room, CO2 and battery rooms, air change requirements, design considerations, maintenance.

TOTAL: 54hours.

COURSE OUTCOME

CO 01 To explain basic refrigeration concepts, refrigeration system components, temperature monitoring system & automatic operation.

CO 02 To discuss the operation, maintenance & troubleshooting of refrigeration plant.

CO 03 To explain basic air conditioning concepts & air conditioning system components, duct layouts, operation & HVAC control

CO 04 To discuss the operation, maintenance & troubleshooting of air conditioning plant.

CO 05 To assess the ventilation requirements for different ship areas & choose the types of blowers for ventilation.

Text Book:

1. Leslie Jackson and W Embleton, Reed's General Engineering Knowledge – Volume VIII

Reference:

1. Arora, Refrigeration and Air Conditioning.
2. Jordan and Priester, Refrigeration and Air Conditioning.

Web Source:

https://gmpua.com/CleanRoom/HVAC/Cooling/Handbook%20of%20Air%20Conditioning%20and%20Refrigeration.pdf

https://www.youtube.com/watch?v=Xein99Ve2BI&t=4s

Code	Subject	Lesson	Tutoria	Practica	Credits
21CMRE65	MARINE ELECTRICAL TECHNOLOGY II	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)

COURSE PLAN

UNIT I **(6)**

Miscellaneous Marine electrical equipment Alarm System: Alarm system (types, supply) on board-watertight doors, bow-doors, oxygen analyzer, High & low level alarms, navigational lights, emergency radio operation, main engine telegraph, steering gears, Electrical Deck Cranes.

UNIT II **(9)**

Maintenance of electrical systems, fault finding & repair: Type of faults & indications on Generator, motor & distribution systems, different testing equipments & meters (multimeter / megger, clampmeter, etc) Salvaging a motor. Detection of faults on electrical circuits – Indications & corrective arrangements, necessary precautions & care while fault finding and repair, preventive maintenance, periodic surveys, spares requirement.

UNIT III **(9)**

Mandatory requirements for electrical installations. Ship's lighting. Safe working practices. Electrical protective devices. Specification and installation of cables for various shipboard uses. Special electrical practice**:** Rules and regulations & operation of electro-hydraulic & electrical steering gear, Diesel-electric and turbo electric propulsion system.

UNIT IV **(6)**

Electrical systems for operation in flammable areas. . Special electrical practice for oil, gas and chemical tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class), flame proof Ex 'd' and intrinsic safety Ex 'i' Ex 'e', and Ex 'n' equipments and their applications in zones, maintenance of Ex-protected apparatus.

UNIT V **(6)**

Safe Electrical practice: Safe watch – keeping, points to check on electrical machineries, switch gears & equipments, microprocessor control and maintenance – electrical fire fighting, precautions against electric shock and related hazards.

TOTAL 36 hours

COURSE OUTCOME

CO 01 To Understand the Marine Electrical Equipment Alarm System.

CO 02 To Apply the Essential Services on board ship.

CO 03 Analysis the Faults on Electrical Circuits.

CO 04 Identify, Trouble Shoot the Problems and Preventive Maintenance.

CO 05 Apply the concepts of intrinsic safety Ex 'i' Ex 'e', and Ex 'n' Equipments & Safe Watch-Keeping.

Text Book:

1. Marine Electrical Technology by Elsan Fernandez.

Reference Books:

1. Practical Marine Electrical Knowledge by Dennis .T. Hall.
2. Marine Electro Technology and Electronics by Gokhale & Nanda.

Web source:

https://khinzawshwecom.files.wordpress.com/2018/04/elec-marine-searchable.pdf

https://www.youtube.com/watch?v=ymJecngCD-s

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE66	NAVAL ARCHITECTURE I	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain seaworthiness of the ship (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

Principal terms used in Naval Architecture – Geometry of ships.
Hydrostatic calculations: Ship lines, displacement calculation, first and second moment of area.

UNIT II **(12)**

Tons per Cm. Immersion, Co-efficient of forms, wetted surface area, similar figures, centre of gravity, effect addition and removal of masses.

UNIT III **(9)**

Simpson's rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rule, Tchebycheff's rule and their applications.

UNIT IV **(12)**

Transverse stability of ships- statical stability at small angles of heel, calculation of BM, meta centric height- inclining experiment- free surface effect –

UNIT V **(9)**

Transverse stability at large angles of heel – curves of statical stability- dynamical stability.

TOTAL 54 hours

CO 01 To evaluate hydrostatic calculations
CO 02 To analyze centre of gravity in effect of adding weight, removing weight & shifting weight
CO 03 To estimate Simpson's rules in application to area and volume
CO 04 To apply statical stability at small angles of heel
CO 05 To assess effect of metacentric height(GM),metacentric radius(BM) & Free surface effect and study about transverse stability

Text Books:

1. E.A. Stokoe, Reeds Naval Architecture for Marine Engineers, Volume V.

Reference Books:

1. Vikram Gokhale & N. Nanda,Naval Architecture & Ship Construction
2. Eric .C. Tupper, Introduction to Naval Architecture
3. R. Munro Smith, Ship Construction Naval Architecture

Web Source:

https://www.usna.edu/NAOE/_files/documents/Courses/EN400/02.04%20Chapter%204.pdf
https://www.youtube.com/watch?v=BXnpSzL7mOo&t=99s

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE61	ADVANCED MARINE WORKSHOP – REFRIGERATION AND AIRCONDITIONING TRAINER	0	0	18	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

LIST OF EXPERIMENTS

1. Familiarization of the circuit and components of a Refrigeration system, including its automatic temperature control **(9)**

2. Familiarization of the circuit and components of an Air Conditioning System, including its automatic temperature control **(9)**

TOTAL: 18hours

COURSE OUTCOME

CO 01 To understand refrigeration system and its components.

CO 02 To understand air conditioning system and its components.

Text Book: In-house developed Lab Manual

Web Source:

https://www.youtube.com/watch?v=vlpT7JNU3U4

https://www.youtube.com/watch?v=F2iCHWAibsg

Code	Subject	Lesson	Tutorial	Practical	Credit
21PMRE62	ADVANCED MARINE ELECTRICAL WORKSHOP	0	0	36+72	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)

LIST OF EXPERIMENTS (Total 18 @ one per week)

Alarm system (types, supply) on board for-

1. Watertight doors & Bow-doors,
2. Oxygen analyzer,
3. High & low level alarms, Navigational lights,
4. Steering gears
5. Electrical Deck Cranes.
6. Starting and running precautions, procedure of an alternator with load.
7. Starting procedure for removal of interlock, starting and testing emergency generator.
8. Synchronization of alternators afloat ship(SIC).

Fault finding & repair: Type of faults & indications on:

9. Generator
10. Motor
11. Trace and study on Distribution systems, different testing equipments & meters (multimeter / megger, clampmeter, etc)
12. Detection of faults on electrical circuits – Indications & corrective arrangements, necessary precautions & care while fault finding and repair, preventive maintenance, periodic surveys, spares requirement.
13. Salvaging a motor.
14. Mandatory requirements for electrical installations. Electrical protective devices. Specification and installation of cables for various shipboard uses.

Electrical systems for operation in flammable areas. .

15. Special electrical practice for oil, gas and chemical tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class), flame proof Ex ‘d’ and intrinsic safety Ex ‘i’ Ex ‘e’, and Ex ‘n’ equipments 16. Their applications in zones; maintenance of Ex-protected apparatus.

Safe Electrical practice:

Safe watch – keeping, points to check on:

17. Electrical machinery – Switch gears & equipment
18. Electrical fire fighting, precautions against electric shock and related hazards.

TOTAL: 36+72= 108hours

COURSE OUTCOME

CO 01 Explain and demonstrate various alarm systems used onboard ships.

CO 02 Apply safety precautions and safe working practices preventing electrical hazards and damage.

CO 03 Distinguish working areas and enclosures onboard ships depending on temperature, pressure and flame proof systems.

CO 04 Organize maintenance of electrical machines.

CO 05 Inspect and analyze malfunctions in electrical systems by fault finding.

Text Book:

1. Marine Electrical Technology by Eltsan Fernandez.

Reference Books:

1. Practical Marine Electrical Knowledge by Dennis .T. Hall.
2. Marine Electro Technology and Electronics by Gokhale & Nanda.

Web Source:

https://www.youtube.com/watch?v=LvEqLof7fUE

https://www.youtube.com/watch?v=AoDTdThc074

Code	Subject	Lesson	Tutorial	Practical	Credit
21PMRE63	SHIP-IN-CAMPUS – DIESEL ENGINE LAB	0	0	72	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

LIST OF EXPERIMENTS

Repair and maintenance of Main propulsion engines

1. Procedure for dismantling and assembling of main engine unit, including all cylinder head mountings.
2. Inspect condition, wear, clearances etc. of Piston, Piston rings, Cylinder head, Cylinder liner, air starting valve, fuel injectors, relief valve, and exhaust valve. Prepare decarbonizing report.
3. Procedure for dismantling and assembling Main Engine bearing (a)Main bearings (b)Crosshead bearings (c)Bottom End bearings .
4. Inspect above bearings, check clearances, drops, and criteria for rejection of a white metalled bearing.
5. Crankshaft deflection, purpose, procedure tabulation and interpretation of results.
6. Causes of crankshaft misalignment.

Repair and maintenance of auxiliary engines.

1. Procedure for dismantling and assembling auxiliary engine for (a) complete over haul (b) top overhaul.
2. Inspect cylinder head, piston , piston rings liner bottom end bearings, fuel injector, inlet, exhaust valves , air starting valve distributor take clearances , measure wear down , and prepare a report .
3. Carry out crank case inspection tappet clearance, fuel valve priming.
4. Crank shaft deflections.
5. Generator maintenance routines /schedules.
6. Check fuel pump timing.
7. Starting procedure.
8. Check working of safety cut outs
9. Safe working procedure for various operations.

TOTAL: 72 hours

COURSE OUTCOME

CO 01 To measure crankshaft deflection and interpret its data
CO 02 To measure and understand about various clearances, wear and tear of engine components.
CO 03 To demonstrate maintenance of various engine components including adjustments of fuel and valve timings.
CO 04 To test safeties associated with engine control systems
CO 05 Application of PMS to reduce breakdowns

Text Book:

1. In-house developed manual.

Web Source:

https://www.youtube.com/watch?v=iZg_qux3axg

https://www.youtube.com/watch?v=OfDr1lEe0Cg

Code	Subject	Lesson	Tutorial	Practical	Credit
21PMRE64	SHIP-IN-CAMPUS – SHIP CONSTRUCTION	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain seaworthiness of the ship (Table A – III/1)

LIST OF JOBS

TO STUDY AND REPORT ON THE CONSTRUCTION OF THE FOLLOWING:

1. Ship's hull – vertical portion – plating and welds

2. Ship's hull – curved portion of stern – plating and welds

3. Machinery Room lay-out

4. Steering Compartment and Main Steering Gear

5. Rudder construction

6. Stern-tube and propeller

TOTAL: 36hours

COURSE OUTCOME

CO 01 To evaluate the vertical portion of ship's hull

CO 02 To evaluate curved portion of stern for ship's hull

CO 03 To assess about the layout of machinery spaces

CO 04 To examine the steering gear and construction of rudder

CO 05 To understand the construction and functions of stern tube and rudder

Text Book:

1. E A Stokoe, Reed's Ship Construction for Marine Engineers – Volume 5.

Reference:

1. Kemp and Young, Ship Construction – Sketches and Notes
2. D J Eyres,Ship Construction.

Web Source:

https://www.youtube.com/watch?v=0S9QeP0EFzk

https://www.youtube.com/watch?v=uTSPg1K36sU

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE65	SHIP-IN-CAMPUS (PUMPS AND AUXILIARIES -I)	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A – III/1)
- Manage fuel, lubrication and ballast operations (Table A – III/2)

PUMPS

LIST OF EXPERIMENTS TO BE CARRIED OUT

1. Precautions to be taken before starting a pump.

2. Safety precaution before starting maintenance work on a pump

3. Starting procedure for centrifugal pump.

4. Learn starting and stopping of Engine Room Bilge pump and its construction features

5. Learn starting and stopping of cargo oil pumps(framo) on tankers.

7. Learn starting and stopping of Stripping pumps on tankers.

8. Gear Pump**:** Dismantle & reassemble screw pump: Rotors / Gears – seals- bearings- relief valve, pump body. Examine for wear and damage, check clearances and back lashes. Repair/ adjust seals.

COURSE OUTCOME

CO-1 To demonstrate starting of a pump following the procedures.

CO-2 To understand Safety precaution before starting maintenance work on a pump.

CO-3 To understand about starting and stopping of bilge pump.

CO-4 To understand about starting and stopping of cargo oil pump and stripping procedures**.**

CO-5 To understand about starting and starting of positive displacement pump**.**

Text Book:

1. In-house developed manual

Web Source:

https://www.youtube.com/watch?v=9xDIGvdNAO8

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FOURTH YEAR – SEVENTH SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – VII						
CC	21CMRE71	Marine Power Plant Operation	4	0	0	4
CC	21CMRE72	Monitoring And Protection Of Electrical Systems	3	0	0	2
AECC	21CMRE73	Pumps And Pumping Systems	3	0	0	3
AECC	21CMRE74	Marine Engineering Practice II	2	0	0	2
AECC	21CMRE75	Naval Architecture II	3	0	0	3
AECC	21PMRE71	Advanced Marine Workshop (MEP II)	0	0	3	3
GE	21PMRE74	Control Systems & Automation Lab	0	0	3	2
SEC	21PMRE73	Ship-in-Campus(Pumps and Auxiliaries II)	0	0	3	2
SEC	21PMRE72	ship-in-Campus (Watch-Keeping)	0	0	2	2
TOTAL			15	0	10	22

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FOURTH YEAR – SEVENTH SEMESTER

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE71	**MARINE POWER PLANT OPERATION**	90	0	0	4

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN:

UNIT I **(18)**

Safe Engineering Watch-Keeping-Procedures to be adopted in safe Watch-keeping. Procedures for Handing Over/Taking over a Watch. Routine work doing Watch-keeping, such as soot-blowing, cleaning of filters, pumping out of bilges through Oily Bilge Separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system. Remote operation of pumping system and associated controls, purification and clarification of fuel oil, purification and clarification of lube oil.

UNIT II **(18)**

Practical Knowledge – Ensure Safe Working Practices – Risk Assessment – Safety Officials – Personal Protective equipment – Work equipment- Safety Induction – Fire Precautions – Emergency procedures.

UNIT III **(18)**

Safe movement on board ship. Safe system of working – Entering enclosed or confined spaces – Permit to work systems – Manual handling of equipment – Use of work equipment – Lifting devices – Maintenance of machinery – Hot Work-Painting hazards – Hazardous substances – Noise and vibrations.

UNIT IV **(18)**

Emergency procedures, such as: action to be taken in the event of fire, including fire drills, flooding of Engine room, rescue operations for injured persons, action in case of stoppage of the main engine, auxiliary engines and associated systems.

UNIT V **(18)**

Actions in the event of Main Engine auto slow-down and shut down. Main Boiler auto shut-down. Power Failure. Emergency procedure for other equipment/Installations. Emergency Steering. Black-out operations and power restoration, and propulsion Plant restart. Interpretation of functional tests on communication and control systems. Maintenance of machinery space Log Book and the significance of the readings taken.

COURSE OUTCOME

CO 01 Discuss watch keeping procedures and plan watch keeping routines and operation

CO 02 Importance of safe working practices , PPE and emergency procedures on board

CO 03 Discuss safe system of working

CO 04 Evaluate various hazards and list action to be taken in case of emergency and emergency starting of machinery

CO 05 List action to be taken in case of stoppage of machinery and in the event of failure of main engine and boiler.

Text Books:

1. Prof K Venkatraman, Marine Auxiliary Machinery

2. Prof K Venkatraman, Marine Internal Combustion Engineering Vol I and Vol II.

3. The Running and maintenance of Marine Machinery (Institute of Marine Engineers, London.)

Reference Books:

1. Code of Safe Working Practices for Merchant Seamen.

2. J Cowley ,Marine Auxiliary Machinery

3.Rushbrooke, Fire Aboard.

4.STCW Convention 2010

Web Source:

http://gpnuapada.in/wp-content/uploads/2020/05/PPE-notes.pdf

https://www.youtube.com/watch?v=mVP69RUtyFU

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE72	MONITORING AND PROTECTION OF ELECTRICAL SYSTEMS	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)
- Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition (Table A – III/2)

COURSE PLAN

UNIT I **(12)**

Electrical and simple electronic diagrams. Electric and electronic symbols and interpretations of flow diagrams and circuits. Software Version Control – Programmable Logic controllers, Microcontrollers, Digital techniques.

UNIT II **(9)**

Trouble shooting of electrical and electronic control equipment. Electrical Safety. Test equipment. Interpretation of circuit symbols. Logical six-step trouble-shooting procedure.

UNIT III **(12)**

Power Generation. Prime mover electrical control. Main Air Circuit breaker. Protection of generators.Safe Electrical practice**:** Safe watch – keeping, points to check on electrical machineries, switch gears & equipments, microprocessor control and maintenance electrical fire fighting, precautions against electric shock and related hazards.

UNIT IV **(9)**

Electrical distribution system. Motors. Electrical Survey requirements. Function test of electrical, electronic control equipment and safety devices.

UNIT V **(12)**

Calibrate and adjust transmitters and controllers. Fault-finding in Control Systems. Trouble shooting of monitoring systems- Test and calibration of sensors and transducers of monitoring systems.

TOTAL 54 hours.

COURSE OUTCOME

CO-01 To understand electrical Symbols & Implementation of that in circuits and Controlling with PLC, MC

CO-02 To find electrical fault using General procedures and test equipment

CO-03 To gain knowledge about different types of switch gear protection, Generator protection and its maintenance

CO-04 To apply different types of application of Motors on board and power Distribution system

CO-05 To test calibrate and to monitor the system

Text Book:

1. Elsan Fernandez ,Marine Electrical Technology.

Reference Books:

1. Dennis .T. Hall, Practical Marine Electrical Knowledge
2. Gokhale & Nanda , Marine Electro Technology and Electronics

Web Source:

https://www.philadelphia.edu.jo/academics/mlazim/uploads/Power%20System%20protection%20-%20Part%2001.pdf

https://www.youtube.com/watch?v=ZSCEfJ4TXW4

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE73	PUMPS AND PUMPING SYSTEMS	36	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A – III/1)
- Manage fuel, lubrication and ballast operations (Table A – III/2)

COURSE PLAN

UNIT I **(8)**

Centrifugal Pumps: Introduction of Pumps, Types of Centrifugal Pimp, Priming of pump, Calculations of various heads, Losses and efficiency, Work done per unit weight, Velocity diagrams at inlet and exit, calculation of power, Torque on shafts, Performance of pumps & Characteristic Curves, Cavitation in Centrifugal Pumps,. Net positive suction head, Minimum speed and Specific speed of pump, Applied problems.

UNIT II **(8)**

Reciprocating Pumps: Introduction and comparison with other pumps, various types, single and double acting, sing and multi cylinder, Co-efficient of discharge, Negative slip of pump theoretical indicator diagrams, effect of acceleration and friction head on indicator diagram, Cavitation and separation, Maximum speed with cavitation & separation. Use of air vessel.

UNIT III **(6)**

Impulse and reaction turbines: Introduction of turbines, various types of turbines, velocity triangles and work done and efficiency of various turbines. Impulse turbine – Pelton wheels. Inward radial flow reaction turbine – francis turbine, Degree of reactions, Axial flow reaction turbine, Kaplan Turbine, Draft tube, Specific Speed, Unit Quantities etc

UNIT IV **(6)**

Ship systems - Bilge ,ballast, cargo systems. Physical and chemical properties of fuels and lubricants – Production of oils from crude oil-properties and characteristics of fuels and lubricants

UNIT V **(6)**

Shore side and shipboard sampling and testing of fuel oil – interpretation of test results – contaminants including microbial infection – treatment of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling

TOTAL 36 hours

COURSE OUTCOME

CO-1 To study and interpret the construction, features and characteristics of centrifugal pumps.

CO-2. To study and interpret the construction, features and characteristics of reciprocating pumps.

CO-3 To demonstrate the difference in operation characteristics of different types of turbine.

CO-4 To study fluid flow and characteristics of major ships pumping system and describe all

fluid system on board

CO-5 To test and analyze the condition of lube oil, fuel oil and cooling water.

Text Books:

1. Prof K Venkatraman , Marine Auxiliary Machinery
2. Prof K Venkatraman, Marine Internal Combustion Engineering Vol I and Vol II
3. R.K. Bansa , Fluid Mechanical by

Reference Books:

1. Jagdish Lal, Hydraulic Machines
2. J Cowley, Marine Auxiliary Machinery

Web Source:

http://www.energyefficiencyasia.org/docs/ee_modules/Chapter%20Pumps%20and%20Pumping%20Systems.pdf

https://www.youtube.com/watch?v=fHLkZV2_Cb4

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE74	MARINE ENGINEERING PRACTICE II	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

COURSE PLAN

UNIT I **(6)**

Construction and characteristics of Separators – Purifiers and Clarifiers.

UNIT II **(6)**

Fuel Oil preparation and treatment – Operation and principles and materials of construction of purifiers and clarifiers.

UNIT III **(6)**

Change-over of Remote/Automatic to Local Control for ALL Main and auxiliary Systems. Safe Working Practices in carrying out hot work and welding.

UNIT IV **(9)**

Procedures to be followed when handling heavy machinery parts, and overhauling of engines. Man-entry and hot work in enclosed compartments. Safe and efficient operation and maintenance of Marine Diesel Engines. Crankcase inspection, Depth gauge and crankshaft deflections.

UNIT V **(9)**

Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment. Preparation for work on machinery. General maintenance procedures for centrifugal pumps, screw and gear pumps, valves, air compressors and heat exchangers.

TOTAL 36 hours.

COURSE OUTCOME

CO 01 Explain the principles of Clarifier & Purifier and sequence of operation. (K2)

CO 02 Develop the working knowledge of purification piping layout. (K6)

CO 03 List the rules & regulation of automation on ships. (K6)

CO 04 Discuss the procedures & hazards of hot work on board ships. (K2)

CO 05 E valuate the main engine cylinder head removal procedure. (K3)

Text Books:

1. Marine Auxiliary Machinery by Prof K Venkatraman

2. Marine Internal Combustion Engineering Vol I and Vol II by Prof K Venkatraman.

3. The Running and maintenance of Marine Machinery (Institute of Marine Engineers, London.)

Reference Books:

1. Code of Safe Working Practices for Merchant Seamen.

2. Marine Auxiliary Machinery by J Cowley.

Web Source:

https://www.pfri.uniri.hr/bopri/documents/23_AuxiliaryMarineMachinery_000.pdf

https://www.youtube.com/watch?v=D6zX2P6G7Y4

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE75	NAVAL ARCHITECTURE II	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain seaworthiness of the ship (Table A – III/1)
- Control trim, stability and stress(Table A – III/2)

COURSE PLAN

UNIT I **(12)**

Longitudinal stability and trim:Strength of ships - Curves of buoyancy and weight, curves of load, shearing force and bending moments, alternate methods, standard conditions, balancing ship on wave, approximation for max. Shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal strength, moment of inertia of section, section modulus. MCT1, change of L.C.B. with change of trim, change of trim due to adding and deducting weights, change in draft – associated numerical

UNIT II **(9)**

Trim: Trim because of filling / flooding several tanks with different densities, alteration of draft due to change in density, flooding calculations, floodable length curves, **Trim:** M.O.T. method for determination of floodable lengths, factors of sub division, loss of stability due to grounding, docking stability, pressure on chocks.

UNIT III **(12)**

Propulsion : Definitions, apparent and real ships wake, thrust, relation between powers, relation between pressure and speed, Resistance and powering - Froude's law- frictional resistance-residuary resistance-calculation of naked power-various efficiencies-calculation of effective power-admiralty coefficient – applied problems

UNIT IV **(9)**

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

UNIT V **(12)**

Propeller: Blade element theory, law of similitude and model tests with propellers, measurement of pitch, cavitations. Propeller types, fixed pitch and variable pitch. Propeller types - Ring propeller, Kort nozzles, Voith Schneider propeller - propulsion tests, Geometry and geometrical properties of screw propellers, ship model correlation ship trials.

Motion of ship on waves - theory of waves, Trochoidal waves, relationship between line of orbit centers and the undistributed surface, Sinusoidal waves. Rolling in unresisting media, rolling in resisting media, practical aspects of rolling, antirolling devices.

TOTAL 54 hours

COURSE OUTCOME

CO 01 To determine change of trim due to adding and deducting weights

CO 02 To analyze loss of stability due to grounding, docking stability& pressure on chocks

CO 03 To solve resistance and powering calculations

CO 04 To analyze types of rudder, model experiments & turning trials

CO 05 To analyze blade element theory, geometry of propeller and waves

Text Book:

1. E.A. Stokoe , Reeds Naval Architecture for Marine Engineers Volume V.

Reference Books:

1. Vikram Gohale & N. Nanda, Naval Architecture & Ship Construction
2. Eric .C. Tupper, Introduction to Naval Architecture
3. Munro Smith, Ship Construction Naval Architecture
4. D.R. Durrett, Ship Stability for Master and Mates

Web Source:

https://www.academia.edu/31699224/Reed_s_Volume_4_Naval_Architecture_for_Marine_Engineers

https://www.youtube.com/watch?v=ON_irzFAU9c

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE71	ADVANCED MARINE WORKSHOP (MEP II)	0	0	144	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of shipboard machinery and equipment (Table A – III/1)

LIST OF JOBS/EXPERIMENTS

1. Construction and characteristics of A Fuel Oil Separator – Purifier - Opening up, identification of parts, inspection for damage and reassembly. Start up after re-assembly.

2. Construction and characteristics of A Fuel Oil Separator – Clarifier - Opening up, identification of parts, inspection for damage and reassembly. Start up after re-assembly.

3. Setting up purification system for Fuel Oil using a Purifier-Clarifier combination in series.

4. Draw up check lists for procedures to be followed when doing hot work, gas cutting, arc welding.

5. Draw up check lists for procedures to be followed when (i)moving heavy machinery items within the Engine Room (ii) working aloft in Machinery Spaces..

6. Draw up check lists for procedures to be followed when the Main Engine is to be opened up for overhaul.

7. Draw up check lists for procedures to be followed when Crankshaft deflections of the Main Engine are to be taken. List the precautions and tabulate the results.

8. Draw up check lists for procedures to be followed when Main Bearing clearances of the Main Engine are to be taken. List the precautions and tabulate the results.

9. Draw up check lists for procedures to be followed when the running gear of an Auxiliary Engine is to be checked. Set the valve tappets of a 4-stroke Auxiliary Engine. List the precautions and tabulate the results.

TOTAL 144 hours.

COURSE OUTCOME

CO 01 Understanding the constructional features of Oil Separator. (K2)

CO 02 Applying purification system knowledge to obtain clean fuel oil. (K6)

CO 03 Formulate procedures to be followed for moving heavy machinery. (K6)

CO 04 Demonstrating the procedures to be followed for Main Engine Overhaul. (K6)

CO 05 Appraising the precautions to be taken for taking Engine clearances and safe working practices (K5)

Text Book: In-house developed Lab Manual

Reference:

1. Prof K Venkatraman, Marine Auxiliary Machinery

2. Prof K Venkatraman, Marine Internal Combustion Engineering Vol I and Vol II.

Web Source:

https://www.man-es.com/docs/default-source/marine/4510_0017_02web.pdf

https://www.youtube.com/watch?v=2HI_dsnKRtg

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE73	SHIP-IN-CAMPUS (PUMPS AND AUXILIARIES - II)	0	0	54	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A – III/1)
- Manage fuel, lubrication and ballast operations (Table A – III/2)

PUMPS

LIST OF EXPERIMENTS TO BE CARRIED OUT

1. Centrifugal Pump - Casting impeller- wear rings- shaft bearings- gland seal- air pump & float chamber mechanical seal. Various types of impellers. Dismantle & reassemble centrifugal pumps: Identify all parts – Check for wear – wastage of casing, pitting, trueness of shaft, condition of bearings, seals, wear rings alignment of pump and motor.

2. **Reciprocating pump:** Cylinders, piston/ bucket rings, valves, glands, relief valve. Dismantle & reassemble pump. Measure cylinder liner wear, ring gaps, overhaul valve/ seats. Various links, bushes relief valve gland packing etc.

3.Screw Pump: Dismantle & reassemble screw pump: Rotors / Gears – seals- bearings- relief valve, pump body. Examine for wear and damages, check clearances and back lashes. Repair/ adjust seals.

4. Dismantling and assembling procedure , check diaphragm, valves, pneumatic air inlet valve of wilden pump.

5. Trials after overhauling. Data to be checked (all the above types of pumps.)

TOTAL 90 hours.

COURSE OUTCOME

CO-1 To Understand apply practical knowledge towards overhaul of centrifugal pump

CO-2 To apply practical knowledge towards overhaul of reciprocating pumps

CO-3 To apply practical knowledge towards overhaul of screw pump

CO-4 To demonstrate the ability to dismantle and assembling of wilden pump

CO-5 To asses and interpret the performance of pumps after overhauling.

Text Book: In-house developed Lab Manual

Reference: 1. Prof K Venkatraman, Marine Auxiliary Machinery

2. Mc George, Marine Auxiliary Machinery

3. Reed's General Engineering Knowledge for Marine Engineers – Volume VIII.

Web Source:

https://www.energy.gov/sites/prod/files/2014/05/f16/pump.pdf

https://www.youtube.com/watch?v=XpcCUtYzwy0

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE74	CONTROL SYSTEMS AND AUTOMATION LAB	0	0	54	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintenance and repair of electrical and electronic equipment (Table A – III/1)
- Manage troubleshooting, restoration of electrical & electronic control equipment to operating conditions (Table A – III/2).

Control engineering Lab experiments:

1. Study the circuitry for forward and reversing of 3 phase induction motor using soft starter & contactors.
2. Speed control of DC motor using microcontroller based system.
3. Speed control of AC motor using microcontroller based system.
4. Study and test the alarm of an oil mist detector.
5. Study the testing and maintenance of a fire detection unit (Ionization chamber & CO_2 detector).
6. Troubleshooting and restoration of electrical and electronic systems with components such as fuses, circuit breakers, contactors, timers, cables, resistor, diodes, SCRs etc.,
7. Study and differentiate manual and software controlled VMC machine.
8. Introduction to CNC machine.
9. PLC systems:
   a. System Hardware Identification
   b. PLC system configurations, installations
   c. PLC to I/O Device interface
   d. PLC programming

TOTAL 54 hours

COURSE OUTCOME

CO 01 Analyze the operation of digital and microcontroller based speed control on motors.

CO 02 Organize and apply regular tests on electrical and electronic control equipment.

CO 03 Solve faults and troubles on electrical and electronic control systems used onboard ships.

CO 04 To analyze the operation of CNC and VMC machines.

CO 05 To illustrate and experiment with digital, microcontroller and PLC based control systems.

Text Book: In-house developed Lab Manual.

Web Source:

https://fac.ksu.edu.sa/sites/default/files/lab-manual_v3_0.pdf

https://www.youtube.com/watch?v=BXMtnP-gf5s

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE72	SHIP-IN-CAMPUS (WATCH-KEEPING)	0	0	72+48	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain a safe engineering watch (Table A – III/1)
- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

LIST OF JOBS/EXPERIMENTS

1. Procedures for Handing Over/Taking over a Watch
2. Routine work doing Watch-keeping, such as soot-blowing, cleaning of filters, pumping out of bilges through Oily Bilge Separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system.
3. Purification and clarification of fuel oil, purification and clarification of lube oil
4. Ensure Safe Working Practices – Risk Assessment – Safety Officials
5. Personal Protective equipment – Work equipment- Safety Induction
6. Fire Precautions – Emergency procedures.
7. Safe movement on board ship. Safe system of working – Entering enclosed or confined spaces –Permit to work systems
8. Manual handling of equipment – Use of work equipment – Lifting devices
9. Hot Work-Painting hazards - Hazardous substances – Noise and vibrations.
10. Emergency procedures, such as action to be taken in the event of fire, including fire drills
11. Emergency procedures, such as action to be taken in the event of flooding of Engine room, including drills
12. Rescue operations for injured persons
13. Emergency action in case of stoppage of the Main Engine, Auxiliary Engines, and/or associated systems.
14. Emergency action in case of auto shutdown of the Main Boiler, and/or associated systems
15. Procedures for Emergency Steering
16. Power Black-out, restoration of power and sequence restarting of various machinery
17. Interpretation of functional tests on communication and Control Systems
18. Maintaining Engine Room Log Book and significance of the readings entered there-in.

TOTAL 120 hours.

COURSE OUTCOME

CO 01 To develop skill of handing over and taking over a watch, routines during watch keeping (a)soot blowing (b)cleaning of filters(c)pumping bilges through ows (d)fuel oil transfers(e)ballasting and de-ballasting(f)fire pump system

CO 02 To asses risk and develop safe working practices while handling hand tools and power tools

CO 03 To list out the ppe and hazardous substances(painting hazards, chemical handling, noise and vibrations)

CO 04 To categorize between fire precautions and preventions and emergency procedure(engine room fire, galley fire, accommodation fire, cargo hold fire)

CO 05 To assess and make plan for enclosed space entry and hot work on tankers

Text Books:

1. In house manual

Reference Books:

1. Code of Safe Working Practices for Merchant Seamen.
2. J Cowley, Marine Auxiliary Machinery
3. Rushbrooke, Fire aboard, 4. STCW Convention 2010

Web Source:

https://veeteedeamet.ee/sites/default/files/content-editors/regulation34eng.pdf
https://www.youtube.com/watch?v=gk_E-SlC8kM&t=79s

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FOURTH YEAR – EIGHT SEMESTER

Category	Code	Title of the Course	Hour / Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER – VIII						
CC	21CMRE81	Fire Prevention, Fire-Fighting and Life-Saving Appliances	3	0	0	3
CC	21CMRE82	Marine Boilers And Steam Engineering	3	0	0	2
CC	21CMRE83	Elementary Design Of Marine Machinery	2	0	0	2
AECC	21CMRE84	Marine Engineering Practice III	2	0	0	2
AECC	21CMRE85	Leadership, Team-Building And Ship Security	2	0	0	1
AECC	21CMRE86	Engine Room Resources Management	2	0	0	2
AECC	21CMRE87	Maritime Legislation	3	0	0	2
DSE	21PMRE81	Marine Engineering Practice III-Simulator Lab	0	0	3	2
DSE	21PMRE82	Marine Machinery Start-Up (S-I-C)	0	0	2	1
GE	21PMRE83	Boiler Shop	0	0	2	1
SEC	21PMRE84	Fire-Fighting / Life-Saving Appliances Lab	0	0	4	3
TOTAL			17	0	11	21

SCHOOL OF MARITIME STUDIES, VISTAS
B.E MARINE ENGINNERING COURSE 2021 - 2022 Onwards
FOURTH YEAR – EIGHT SEMESTER

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE81	FIRE PREVENTION, FIRE-FIGHTING AND LIFE-SAVING APPLIANCES	54	0	0	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Prevent, control and fight fires on board (Table A – III/1)
- Operate life-saving appliances (Table A-III/1)

COURSE PLAN

UNIT I **(12)**

Fire hazard aboard ships**:** Fire triangle, fire tetrahedron, fire chemistry, spontaneous combustion, and limits of inflammability. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. Controls of Class A, B, C & class D fires, combustion products & their effects on life safety.

UNIT II **(9)**

Fire protection built in the ships: SOLAS convention, requirements in respect of materials of construction and design of ships, (class A,B, type BHDS.)
Detection and Safety Systems**:** Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships.

UNIT III **(12)**

Firefighting equipment: Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships. Properties of chemicals used, water mist fire suppression system. Bulk carbon-dioxide. Fireman's outfit, its use and care. Maintenance, testing and recharging of appliances, preparation, fire appliance survey. Breathing apparatus types, uses, and principle.

UNIT IV **(9)**

Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds galley, etc. fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments. Ship board organization for fire and emergencies, fire control plan, human behavior. Special precautions for prevention, inert gas systems, fighting fire in tankers, chemical carriers and gas carriers.

UNIT V **(12)**

Ship's lifeboats- their construction, operation and maintenance. Equipment renewal intervals. Life-boat surveys. Life boat launching using Davits. Construction operation and maintenance of davits and LB Winches and associated gear. Life Rafts - construction, operation and maintenance. Maintenance routines required on gravity davits. Function, location, construction and maintenance of EEBDs in Engine Rooms and Pump Rooms Neil Robertson stretcher - its use, and maintenance.

TOTAL 54 hours

COURSE OUTCOME

CO 01 Explain fire hazards onboard and fire basics. Elaborate methods of control of fire onboard.

CO 02 Discuss in detail about fire protection built in ships also to analyze fire detection and fire safety systems

CO 03 Applying knowledge to fight emergencies using ship board organizational setup.

CO 04 Maintenance and testing of fire fighting appliances. elaborate techniques adopted for extinguishing fire at different location onboard a ship

CO 05 Understanding the significance of construction and operation of Life saving appliances onboard and maintenance of EEBD and Neil Robertson stretcher.

Text Book:

1. H.D. McGeorge, Marine Auxiliary Machinery
2. LSA and FFA code

Reference Book:

1. Dr J. Cowley , Running and Maintenance of Marine Auxiliary Machinery.
2. Rushbrooke, Fire Aboard.

Web Source:

https://www.usbr.gov/power/data/fist/fist5_2/vol5-2.pdf

https://www.youtube.com/watch?v=9TIPAvGotXI

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE82	MARINE BOILERS AND STEAM ENGINEERING	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

COURSE PLAN

UNIT I **(12)**

VARIOUS TYPES OF MARINE BOILERS AND BOILER MOUNTINGS : Cochran Boiler, Spanner Boiler, Clarkson thimble tube, waste-heat recovery calculation, Lamont exhaust gas boiler, Composite boilers, and water tube boilers – Babcock Wilcox; Foster Wheeler – D-type, Double evaporation boilers. **Boiler Mountings:** Safety valves – Improved High Lift, Full lift and full Bore type - procedure for setting. Gauge glass – Ordinary plate type and remote indicator- blowing of gauge glass. Automatic feed regulator, three element High & Low water level alarms, Main Steam stop valve, Retractable type Soot blower.

UNIT II **(12)**

OPERATION CARE AND MAINTENANCE OF BOILERS: Pre-commissioning procedures - preparing for Survey - Hydraulic tests, steam raising and Operating procedures, Action in the event of shortage of water. Blowing down of boiler, laying up a boiler; general maintenance External and internal tube cleaning. Tube renewals, etc, Maintenance inspection and survey of boilers. **Refractory:** Purposes of Refractory types of Refractory and reasons for failure.

UNIT III **(9)**

Oil Burning: Procedure of liquid fuel burning in open furnace, various types of atomizer - overhauling of FO Burner. Furnace arrangement for oil burning, Boiler control system i.e. master control, fuel control, air control & viscosity control, Introduction to Automation.

UNIT IV **(12)**

Operation and maintenance: Turbine drain system, turbine gland system, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls, emergency operations of turbines, vibration in marine steam turbine, steam turbine losses. **Lubrication of Turbines:** Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication - Oil system and emergency lubrication arrangement. Breakdown and faultfinding.

UNIT V **(9)**

Condensers: Types of condensers, constructional details, location & working principles, contraction and expansion allowances, leak test. Effect of Change of temperature, circulating water quantity, change of main engine power, condenser surface**.**

TOTAL 54hours

COURSE OUTCOME

CO 01 Classify types of marine boilers and list its mountings

CO 02 Analyze various operation of boilers and importance of care and maintenance of boilers

CO 03 Importance of furnace arrangement for oil burning and discuss procedure of liquid burning in open furnace.

CO 04 Discuss operation of steam turbines and its maintenance.

CO 05 Classify types of condensers, their constructional detail and working principles and effect of change of temperature, circulating water qty, change of engine power and condenser surface

Text Book:

1. J.H. Milton & R.M. Leach, Marine Steam Boilers, by Butter worth, 4TH Edition London 1980.

Reference Books:

1. G.T.H. Flanagan, Marine Boilers,Butterworth 3rd edition, , London 2001.

2. Marine Steam Engines and Turbines, 4TH Edition, by C.McBirnie, Butterworth, London 1980.

3. K.M.B. Donald, Marine Steam Turbines, Institute of Marine engineers, 1st Edition ,London, 1977.

4. L. Jackson &T.D. Morton, General Engineering Knowledge of Marine Engineering,Thomas Reed Publication, 4th edition, , United Kingdom, 1986.

5. Thomas D. Morton, Steam Engineering Knowledge for Marine Engineers, Thomas Reed Publication, 3rd edition, London, 1979.

Web Source:

https://www.pfri.uniri.hr/bopri/documents/24_Steam_turbines_000.pdf

https://www.youtube.com/watch?v=cH2_Jukf5WU

Code	Subject	Lessons	Tutorials	Practicals	Credits
21CMRE83	ELEMENTARY DESIGN OF MARINE MACHINERY	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintain safety of propulsion plant and auxiliary machinery (Table A – III/2)

COURSE PLAN

UNIT I **(6)**

Procedure in Machine Design - Concepts of design, procedure and processes, Design synthesis, Economic consideration in design, Feasibility, Preliminary Design alternative, Preliminary & final plans & drawings.

UNIT II **(6)**

Elementary design considerations of following: Main propulsion Engine (Diesel Engine), Auxiliary Diesel Generato gas turbine.

UNIT III **(6)**

Elementary design considerations of following: Main propulsion Engine (Steam Turbine), Turbo-electric propulsion. Turbo-generator

UNIT IV **(9)**

Start-up and shut down procedures for the following ships' Power plant:
(i) Diesel Engine (ii) Steam turbine (iii) Main WT Boiler. Include all auxiliary machinery in each case.

UNIT V **(9)**

For all propulsive Plants above determine operating limits, maintain operational surveillance, carry out performance assessment, and ensure safety of operation of Main Propulsion and Auxiliary equipment.

TOTAL 36 hours.

COURSE OUTCOME

CO 01 Access the procedure for machine design. (K5)
CO 02 Explain the concepts of design. (K5)
CO 03 Design of Main propulsion engine. (K6)
CO 04 Explain start up procedures. (K5)
CO 05 Analyze safety operation of machinery and its performance (K5)

Text Book: 1. R. S. Khurmi & J.K.Gupta, A Textbook of Machine Design

Reference:

1. Dougwood yard, Pounder's Marine Diesel Engine ,8th Edition
2.CAD Computer Aided Design.

Web Source:

https://www.pfri.uniri.hr/bopri/documents/23_AuxiliaryMarineMachinery_000.pdf
https://www.youtube.com/watch?v=SuM-4yMMv4Y

Code	Subject	Lessons	Tutorials	Practicals	Credits
21CMRE84	MARINE ENGINEERING PRACTICE III	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage safe and effective maintenance and repair procedures
- Detect and identify the cause of machinery malfunctions and correct faults
- Ensure safe working practices (Table A – III/2)

COURSE PLAN

UNIT I **(9)**

Detect and identify the cause of machinery malfunctions and correct faults – practical knowledge- Detection of machinery malfunctions, localization of faults – actions to prevent damage – destructive and non-destructive testing

UNIT II **(9)**

Unplanned or break-down maintenance – inspection and adjustment of all relevant equipment.- Risk assessment and evaluation before commencement of maintenance activity.

UNIT III **(12)**

Theoretical knowledge of Marine Engineering Practice and Maintenance of Machinery. Methods of dealing with wear and tear of machinery, both electrical and mechanical. Alignment of machinery components. Correction of defects. Temporary and permanent repairs in the event of breakdown. Manageable breakdowns and Emergency Repairs.

UNIT IV **(12)**

Management and conduct of ship maintenance by Planned Maintenance and Preventive Maintenance. Theory of condition monitoring and its application on board ships. Principles of Tribology and its practice. Statutory Certification of ships and Class verification. Surveys for maintenance and renewal of Class, and Statutory Certificates.

UNIT V **(12)**

Safe Working Practices. Planning for Dry-docking and major repairs. Planning and execution of safe maintenance activity and repair procedures taking into account technical, legislative, safety procedural specifications, appropriate plan, specification of materials and equipment available for maintenance and repairs. Trials and restoration of the Plant after repairs.

TOTAL 54 hours.

COURSE OUTCOME

CO 01 Detect and Identify the cause of Machinery malfunctions. (K5)

CO 02 Evaluate Destructive examination results. (K5)

CO 03 Analyze and manage breakdowns and Emergency Repairs. (K4)

CO 04 Develop attitude for safe maintenance activity. (K3)

CO 05 Ability to interpret machinery trial reports. (K5)

Text Book: The Running and Maintenance of Marine Machinery – Institute of Marine Engineers, London.

Reference: Code of Safe Working Practice for Merchant Seaman-Consolidated Edition 2010.

Web Source:

https://www.youtube.com/watch?v=NjfZKRBkHkc

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE85	LEADERSHIP, TEAM-BUILDING AND SHIP SECURITY	36	0	0	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Application of leadership and teamworking skills (Table A – III/1)
- Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any

COURSE PLAN

UNIT I **(6)**

Knowledge of shipboard Personnel management and training – Engineer and Manager.

UNIT II **(6)**

Human resource management -Training and development - Negotiation skills

UNIT III **(6)**

Ability to apply task and workload management. Communication, Team-building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.

UNIT IV **(9)**

Knowledge and ability to apply decision-making techniques – Management processes and functions. Situation and Risk Assessment. Identify and generate options. Select course of action. Evaluate effectiveness

UNIT V **(9)**

Security-Working knowledge of maritime security terms and definitions, maritime security levels. Drills and exercises under IMO Codes and Circulars. Techniques for monitoring restricted areas on board. General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.

TOTAL 36 hours

COURSE OUTCOME

CO 01 To Develop the training knowledge in shipboard Personnel Management.

CO 02 To Develop negotiation skills, leadership qualities in Human resource Management.

CO 03 To Examine the Time, Resource constraints in order to inspect task and workload

management.

CO 04 To Appraise the effectiveness of decision making skill to justify the course of action.

CO 05 To Build onboard accessing, controlling, monitoring, security levels with different techniques and maintenance systems.

Text Books:

1. Jagmeet Makkar,Principles of Ship Management.
2. Capt Subramanian, Principles of Ship Management.

Reference Books:

1. Maritime Security code.

Web Source:

https://www.asisonline.org/globalassets/publications-and-resources/documents/securitymanagement-asis-teambuilding.pdf

https://www.youtube.com/watch?v=VFjkqmUP84w

Code	Subject	Lesson	Tutorial	Practical	Credits
21CMRE86	ENGINE ROOM RESOURCES MANAGEMENT	36	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Maintain a safe Engineering watch (Table A – III/1)
- Use internal communication systems (Table A – III/1)

COURSE PLAN

UNIT I **(6)**

Introduction to Resources Management, Related Conventions(ISM Code), Quality, safety and environmental Management systems.

UNIT II **(9)**

Engine Room Resource management. Effective corrections, allocation of resources. Time and resource constraints. Personnel relationships on board. Working in a multi-cultural environment.

UNIT III **(6)**

Knowledge and ability to apply effective Resource Management. Allocation, assignment and prioritization of resources.

UNIT IV **(6)**

Effective communication on board and ashore. Application to task, workload management and decision making. Decisions taken should reflect consideration of team experience.

UNIT V **(9)**

Development and implementation of Project plans. Overview of standard operating procedures for typical Engine Room running and maintenance operations. Project planning and control with emphasis on Maintenance Management.

TOTAL 36 hours

COURSE OUTCOME

CO 01 To analyze & utilize available resources in engine room.
CO 02 To adapt the quality and safety conventions.
CO 03 To develop resource allocation, prioritization, workload management and decision taking skills.
CO 04 To build effective communication onboard and ashore and support multi cultural environment
CO 05 To elaborate the standard operating procedure for typical engine room, its maintainance and implementing the project plans.

Text Book:

1. Nanda and Ghokale, Basic Marine Engineering Knowledge

Reference Books:

1. Nanda and Ghokale, Environmental Protection and Ship Safety.
2. J.K. Dhar, Marine Engineering Knowledge.

Web Source:

https://www.youtube.com/watch?v=DKNoIIpkWyE
https://www.youtube.com/watch?v=pOSvu_9cKwA

Code	Subject	Lessons	Tutorials	Practicals	Credits
21CMRE87	MARITIME LEGISLATION	54	0	0	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Monitor compliance with legislative requirements (Table A – III/1)

COUSE PLAN

UNIT I **(12)**

Knowledge of relevant International Maritime Law embodied in international agreements and applicable conventions. Requirements and responsibilities under the Safety of Life at Sea Convention 1974, Load Lines Convention 1966, and Standards of Training, Certification and Watch-Keeping Convention 1978. Brief description of SO:LAS 1974. Obligation to carry out surveys and maintain validity of certificates, maintain records. Obligations and rights of the master.

UNIT II **(9)**

International Health Regulations. Understand the practical applications of medical guides; understand process of Radio medical advice; demonstrate knowledge of actions to be taken in case of accidents or illnesses that are likely to occur on board ships. WHO's International Health Regulations 2005(IHR). International Medical Guide for ships (IMGS). IMO's Medical First-Aid Guide. WHO's guidelines for drinking water quality.

UNIT III **(12)**

Treaties, conventions, Protocols, Rules and regulations: International Maritime Organization, List of IMO Conventions. Introduction to International Labor Organization (ILO), World Health Organization. Authorities, Regulations and responsibilities under International Instruments affecting the Safety of Ships, Passengers, Crew or Cargo: United Nations Law of the Sea (UNCLOS). ILO's International Maritime Labor Convention 2006 (MLC2006). Convention on the International Regulations for Preventing Collisions at Sea (COLREG) 1972 International Convention on Salvage 1989; Lloyd's Standard Form of Salvage Agreement (LOF2000) Convention on the Limitation of Liability of Maritime Claims 1976. International Convention for the Unification of certain Rules of Law relating to Bills of Lading (Hague-Visby Rules).

UNIT IV **(9)**

Surveys and Audits, certification and their validity. Classification Societies-Role of Classification Societies. International Association of Classification Societies. Certificates and other documents that are required to be on board ships by International Conventions, how they may be obtained, and period of their legal validity – 1. List of Certificates and documents as per SOLAS Annex I 2. Additional Certificates and documents required on board ships.

UNIT V **(12)**

ISM Code and its requirements – Safety Management System, Documentation and Certification. National Legislation – Merchant Shipping Act 1958: Role of Maritime Administration (Directorate General of Shipping) and its functions; DGS Rules and MS Notices; Flag State Requirements; Statutory Surveys and Certification; Port State Control. Charter Parties. Marine Insurance, General Average, and P&I Clubs.

TOTAL 54 hours.

COURSE OUTCOME

CO 01 To explain relevant International Maritime Law embodied in international agreements.

CO 02 To adapt requirements and responsibilities under SOLAS 1974, Load Lines Convention 1966 and STCW Convention 1978.

CO 03 To explain International Health Regulations, practical applications of medical guides and International Labor Organization.

CO 04 To elaborate Surveys and Audits, certification and their validity.

CO 05 To explain ISM Code, its requirements, safety Management System, Documentation and Certification.

Text Book: 1.Jagmeet Makkar, Principles of Ship Management.
2. Capt Subramanian, Principles of Ship Management.

Reference:

1. IMO Publications : SOLAS, MARPOL, STCW, ILO Conventions,
2. Indian Merchant Shipping Act 1958. 3.
3. Indian DGS website.
4. IACS Publications.
5. Business and Law for the Ship-Master

Web Source:

https://www.pfri.uniri.hr/bopri/documents/02_MaritimeLaw.pdf

https://www.youtube.com/watch?v=vQdX2VSpqhE

Code	Subject	Lessons	Tutorials	Practicals	Credits
21PMRE81	MARINE ENGINEERING PRACTICE III - SIMULA LAB	0	0	54	2

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage safe and effective maintenance and repair procedures
- Detect and identify the cause of machinery malfunctions and correct faults
- Ensure safe working practices (Table A – III/2)
- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A – III/2)

Engine Simulator Lab Experiments

1. Familiarization With Plant arrangements on Simulator Panels.
2. Familiarization With Instrumentation and Control System for Main and Auxiliary Machineries.
3. Familiarization With Operational Procedures for Pumps and Pumping Systems.
4. Familiarization With Operational Procedures for Air Compressors, Purifiers, Hydrophor System.
5. Familiarization With Operational Procedures for Diesel operated aux. engines.
6. Familiarization With Operational Procedures for Steam driven Turbine Generator.
7. Familiarization With Operational Procedures for Aux. Boiler& Exhaust Boiler.
8. Familiarization With Operational Procedures for Main Propulsion Diesel Engine.
9. Familiarization With Operational Procedures for Inert Gas and COPT system.
10. Familiarization With Operational Procedures for OWS, Incinerator plant.

TOTAL 54 hours

COURSE OUTCOME

CO-1 To familiarize Plant arrangements on Simulator Panels.

CO-2 To familiarize Instrumentation and Control System for Main and Auxiliary Machineries.

CO-3 To understand Procedures for Pumps and Pumping Systems.

CO-4 To understand Procedures for Air Compressors, Purifiers, Hydrophore System.

CO-5 To practically implement the Procedures to start Diesel operated aux. engines.

Text Book: In-house developed Lab Manual.

Reference: Manufacturer's (ARI) Instruction Manual

Web Source:

https://www.youtube.com/watch?v=NGTTZXPhI6U

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE82	MARINE MACHINERY START-UP(S-I-C)	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Manage the operation of propulsion plant machinery
- Plan and schedule operations
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (Table A – III/2)

LIST OF JOBS/EXPERIMENTS

1. Sketch the layout of bilge pumping system
2. Sketch the layout of ballast pumping system
3. Sketch the layout of steam and condensate line
4. Sketch the layout of Feed water line
5. Sketch the layout of cooling water line
6. Sketch the layout of cargo oil pumping system in oil tankers
7. Sketch the layout of fuel oil line.

TOTAL 36 hours.

COURSE OUTCOME

CO 01 To identify the layout of ballast pumping system and bilge pumping system

CO 02 To identify the layout of feed water line and cooling water line

CO 03 To identify the layout of steam and condensate line and cargo oil pumping system in oil tanker.

CO 04 To identify the layout of fueloil line and Starting and stopping of generator.

CO 05 To list out trouble shooting mechanism of auxiliary engine

Text Books:

1. In-house developed Lab Manual.

Reference Books:

1. Doug Woodward, Pounder's Marine Diesel Engines, 8th Edition.
2. D. Aranha, Marine Diesel Engines Sec. I

Web Source:

https://www.youtube.com/watch?v=z-YFanGK-34

Code	Subject	Lesson	Tutoria	Practical	Credits
21PMRE83	BOILER SHOP	0	0	36	1

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Operate main and auxiliary machinery and associated control systems (Table A – III/1)

Code	Subject	Lesson	Tutorial	Practical	Credits
21PMRE84	FIRE-FIGHTING/LIFE-SAVING APLLIANCES LAB	0	0	54+54	3

COURSE OBJECTIVE: At the end of the course, the cadet should be able to

- Prevent, control and fight fires on board (Table A – III/1)
- Operate life-saving appliances (Table A-III/1)

COURSE PLAN

List of Experiments (Fire-Fighting)

Testing and operation of:

1. Jet type water nozzle/.spray type water nozzle
2. Combined spray/jet nozzle
3. Fog nozzle.
4. Fire hoses – operation and maintenance - uncoiling for use, operation, cleaning with FW after use, draining and recoiling and stowing on drum. Instantaneous coupling on fire lines.
5. Soda acid type extinguisher – operation, cleaning and recharging
6. Foam type extinguisher – operation, cleaning and recharging.
7. Dry powder – operation, cleaning and recharging.
8. Operation use and functions of breathing apparatus: (a)Self contained type (b) Bellow Type
9. Use of fireman's outfit.

List of Experiments (Life-Saving)

1. Study of working of FRP lifeboat
2. Study of construction of FRP life-boat, and list of equipment on board
3. Maintenance of equipment in life-boat and Rules regarding checking them, renewal of provisions.
4. Features, use and maintenance of life jackets.
5. Construction and operational details of the life raft giving importance to manual and hydrostatic release devices.
6. Construction and operation of gravity davits for life-boat
7. Maintenance routines required on gravity davits
8. Function, location, construction and maintenance of EEBDs in Engine Rooms and Pump Rooms
9. Neil Robertson stretcher - its use, and maintenance.

TOTAL 54+54 = 108 hours.

COURSE OUTCOME

CO 01 To Test operation of jet fog and spray type water nozzle

CO 02 To develop skill operation ,cleaning and recharging of soda acid, foam, dry chemical types extinguisher

CO 03 To develop skill of fire mans outfit, Neil Robert son stretcher ,its use and maintenance

CO 04 To analyze construction and operation for liferaft and gravity davits for life boat and EEBD

CO 05 To develop skill of operation use and function of breathing apparatus (1)self contained (2)bellow type

Text Books: IN-HOUSE PREPARED LAB MANUAL.

Web Source:

https://www.youtube.com/watch?v=If9QLnmUqUQ