SRI VENKATESWARA COLLEGE OF ENGINEERING,

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

B.E., Marine Engineering

CURRICULUM AND SYLLABUS

REGULATION – 2022

CHOICE BASED CREDIT SYSTEM

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

SRI VENKATESWARA COLLEGE OF ENGINEERING,

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

REGULATIONS 2022

B. E. MARINE ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To nurture academically sound, disciplined and competent marine engineers.
2. To provide opportunity for students to work as part of teams on multidisciplinary projects or companies
3. To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems and to prepare them for graduate studies.

PROGRAM OUTCOMES (POs)

PO	GRADUATE ATTRIBUTES
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2.	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineeringactivities with an understanding of the limitations.
6.	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant to the professional engineering practice.
7.	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the 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 multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

13. To facilitate the students to continuously upgrade their technical competency as mandated by IMO (International Maritime Organization).
14. To meet the STCW (Standards of Training, Certification & Watch-keeping) requirements as amended from time to time.
15. To create awareness among the students to continuously contribute towards the societal betterment and protection of global environment.

PEO's – PO's& PSO's MAPPING:

POs	PEOs		
	I	II	III
1.			✓
2.			✓
3.			✓
4.			✓
5.			✓
6.	✓	✓	
7.	✓		
8.	✓		
9.		✓	
10.		✓	
11.		✓	✓
12.	✓		✓
13.	✓		
14.	✓		
15.		✓	

SRI VENKATESWARA COLLEGE OF ENGINEERING,

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REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

B. E. MARINE ENGINEERING

CURRICULUM AND SYLLABUS FOR SEMESTERS I AND II

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

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
1.	IP22151	Induction Program ***(Common to all branches)***		--	--	--	--	--	Nil	
Theory Subjects										
2.	HS22151	Tamil language and Heritage of Ancient Tamil Society ***(Common to all branches)***	HS	1	0	0	1	1	Nil	
3.	HS22152	Communicative English ***(Common to all branches)***	HS	3	0	0	3	3	Nil	
4.	MA22152	Applied Mathematics I for Marine Engineers	BS	3	1	0	4	4	Nil	
5.	PH22152	Engineering Physics ***(Common to AE,CE, ME, MN, MR)***	BS	3	0	0	3	3	Nil	
6.	CY22154	Chemistry for Marine Engineering	BS	3	0	0	3	3	Nil	
7.	ME22101	*Engineering Drawing* ***(Common to ME, MN, MR)***	ES	1	0	4	3	5	Nil	
8.	MR22101	Introduction to Marine Engineering	PC	3	0	0	3	3	Nil	
Practical Subjects										
9.	CY22161	Chemistry Laboratory ***(Common to all branches except AD, CS, IT)***	BS	0	0	2	1	2	Nil	
10.	MR22111	Fitting Workshop	ES	0	0	4	2	4	Nil	
			Total	**17**	**1**	**10**	**23**	**28**		

 # Ideally a semester contains 15 weeks

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
Theory Subjects										
1.	HS22251	Science and Technology in Ancient Tamil Society ***(Common to all Branches)***	HS	2	0	0	2	2	Nil	
2.	HS22252	Technical English ***(Common to all branches)***	HS	3	0	0	3	3	Nil	
3.	MA22252	Applied Mathematics II for Marine Engineers	BS	3	1	0	4	4	Nil	
4.	MR22202	Material Science and Engineering	ES	3	0	0	3	3	Nil	
5.	ME22201	Engineering Mechanics ***(Common to ME, MN and MR)***	ES	3	0	0	3	3	Nil	
6.	IT22252	Computer Applications and Python programming	ES	2	0	2	3	4	Nil	
7.	MR22201	Thermal Engineering for Marine Engineers	PC	3	0	0	3	3	Nil	
8.	EE22151	Basic Electrical and Electronics Engineering ***(Common to all branches except CH, EE and EC)***	ES	3	0	0	3	3	Nil	
Practical Subjects										
9.	MR22211	Computer Aided Drafting Laboratory	ES	0	0	2	1	2	Nil	
10.	EE22111	Basic Electrical and Electronics Laboratory ***(Common to all branches except EC)***	ES	0	0	2	1	2	Nil	
11.	PH22161	Physics Laboratory ***(Common to all branches except BT)***	BS	0	0	2	1	2	Nil	
			Total	**22**	**1**	**8**	**27**	**31**		

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
Theory Subjects										
1.	MA22352	Computational Methods	BS	3	0	0	3	3	Nil	F
2.	MR22301	Hydraulics and Fluid Machinery for Marine Engineers	PC	3	0	0	3	3	Nil	F
3.	MR22302	Marine Auxiliary Machinery I	PC	3	0	0	3	3	Nil	F
4.	EE22351	Marine Electrical Machines I	PC	3	0	0	3	3	Nil	F
5.	MR22303	Seamanship, Elementary Navigation and Survival at Sea	PC	3	0	0	3	3	Nil	F
6.	MR22304	Marine Boilers and steam Turbines	PC	3	0	0	3	3	Nil	F
7.	MR22305	Marine Diesel Engines -I	PC	3	0	0	3	3	Nil	F
Practical Subjects										
8.	MR22311	Marine Hydraulics and Fluid Machinery Laboratory	PC	0	0	4	2	4	Nil	F
9.	MR22312	Thermal Engineering and Boiler Chemistry Laboratory	PC	0	0	4	2	4	Nil	F
Total				**21**	**0**	**8**	**25**	**29**	-	-

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-isite	Position
				L	T	P	C			
Theory Subjects										
1.	MR22401	Solid Mechanics	PC	3	1	0	4	4	Nil	F
2.	MR22402	Ship Construction	PC	3	0	0	3	3	Nil	F
3.	MR22403	Marine Diesel Engines II	PC	3	0	0	3	3	Nil	F
4.	EE22451	Marine Electrical Machines II	PC	3	0	0	3	3	Nil	F
5.	MR22404	Marine Auxiliary Machinery II	PC	3	0	0	3	3	Nil	F
6.	GE22451	Environmental Sciences and Sustainability (Common to All Branches)	BS	3	0	0	3	3	Nil	F
7	MR22405	Manufacturing Technology for Marine Engineers	PC	3	0	0	3	3	Nil	F
Practical Subjects										
8.	MR22411	Applied and Solid Mechanics Laboratory	PC	0	0	4	2	4	Nil	F
9.	MR22412	Advanced Welding Techniques, Lathe and Special Machines Laboratory	PC	0	0	4	2	4	Nil	F
			Total	**21**	**1**	**8**	**26**	**30**	-	-

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
Theory Subjects										
1.	MR22501	Metrology ,Instrumentation and Automation	PC	3	0	0	3	3	Nil	F
2.	MR22502	Ship's Fire Prevention and Control	PC	3	0	0	3	3	Nil	F
3.	MR22503	Professional Ethics for Marine Engineers	PC	3	0	0	3	3	Nil	F
4.	****	Professional Elective I	PE	3	0	0	3	3	Nil	F
5.	****	Professional Elective II	PE	3	0	0	3	3	Nil	F
6.	****	Professional Elective III	PE	3	0	0	3	3		
7.	****	Mandatory Course	MC	--	--	--	--	3	--	--
Practical Subjects										
8.	MR22511	Fire Fighting, Controls and Simulator Laboratory	PC	0	0	4	2	4	Nil	F
9.	MR22512	Mechanical Measurement and Instrumentation Laboratory	PC	0	0	4	2	4	Nil	F
			Total	**18**	**0**	**8**	**22**	**29**	-	-

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq uisite	Position
				L	T	P	C			
1.		Marine Workshop Practices and Afloat Training	**EEC**	1200 Hrs				16	NIL	F
Total								**16**		

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
Theory Subjects										
1.	MR22701	Stability of Ships	PC	3	0	0	3	3	Nil	F
2.	EE22751	Marine Electrical Technology	PC	3	0	0	3	3	Nil	F
3	EE22752	Marine Electronics	PC	3	0	0	3	3	Nil	F
3.	--	Professional Elective IV	PE	3	0	0	3	3	Nil	F
4.	--	Professional Elective V	PE	3	0	0	3	3	Nil	F
5.	--	Open Elective - I	OE	3	0	0	3	3	Nil	F
Practical Subjects										
7	MR22711	Marine Propulsion and Auxiliary Machineries Overhauling Laboratory	PC	0	0	4	2	4	Nil	F
8.	EE22761	Electrical, Electronics and Micro Controller Laboratory	PC	0	0	6	3	6	Nil	
9.	HS22511	Interview and Career Skills Laboratory *(Common to AD, AE, CS, EE, EC, IT, MR, ME AND MN)*	EEC	0	0	3	2	4	Nil	F
Total				**15**	**0**	**14**	**25**	**32**	-	-

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY#	PERIODS PER WEEK				TOTAL Hours	Prereq-uisite	Position
				L	T	P	C			
Theory Subjects										
1.	MR22801	Marine Vehicles Performance	PC	3	0	0	3	3	Nil	F
2.	MR22802	Marine Management and IMO Requirements	PC	3	0	0	3	3	Nil	F
3.	****	Professional Elective VI	PE	3	0	0	3	3	Nil	F
4.	****	Open Elective II	OE	3	0	0	3	3	Nil	F
6	HS22851	Gender Sensitisation for Marine Engineers	DGC	2	0	0	2	2	Nil	F
Practical Subjects										
7.	MR22811	Project Work	**EEC**	0	0	20	10	20	Nil	F
TOTAL				**14**	**0**	**20**	**24**	**34**		
TOTAL CREDITS								**188**		

PROFESSIONAL ELECTIVE (PE) COURSES : VERTICALS

VERTICAL 1 : Diversified Group -1

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	MR22011	Surface Engineering and Coating Technology	PE	3	0	0	3
2.	MR22012	Marine Engineering Equipment Design	PE	3	0	0	3
3.	EE22911	Electrical Technology for Marine Engineers	PE	3	0	0	3
4.	MR22013	Marine Refrigeration and Air Conditioning	PE	3	0	0	3
5.	MA22911	Mathematical Foundation for Data Science and Artificial Intelligence	PE	3	0	0	3
6.	MR22014	Marine Machinery Drawing	PE	3	0	0	3
7.	MR22015	Marine Logistics and Management	PE	3	0	0	3
8.	MR22016	Safety Precautions and Watch Keeping	PE	3	0	0	3

VERTICAL 2: Diversified Group -2

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	IT22921	Data Science for Marine Engineers	PE	3	0	0	3
2.	MR22022	Advances in Marine Propulsion Engines	PE	3	0	0	3
3.	MR22023	Marine Propellers and Propulsion	PE	3	0	0	3
4.	MR22024	Mechanics of Marine Machines	PE	3	0	0	3
5.	MR22025	Offshore Technology	PE	3	0	0	3
6.	MR22026	Shipboard Leadership and Management	PE	3	0	0	3
7.	MR22027	Basic Concepts of Marine Insurance	PE	3	0	0	3
8.	MR22028	Ship Safety and Environmental Protection	PE	3	0	0	3

VERTICAL 3: Diversified Group -3

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	MR22031	Special Duty Vessels and Type of Operations	PE	3	0	0	3
2.	MR22032	Marine Corrosion and Prevention	PE	3	0	0	3
3.	MR22033	Marine Environment and Air Quality	PE	3	0	0	3
4.	CH22041	Renewable Energy Resources (Common to CH, ME, MN and MR)	PE	3	0	0	3
5.	MR22034	Marine Vibration Measurement Techniques	PE	3	0	0	3
6.	MR22035	Energy Efficient Ship Operation	PE	3	0	0	3
7.	MR22036	Fuel Lubrication Technology	PE	3	0	0	3

VERTICAL 4: Diversified Group -4

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	MR22041	Ship Recycling	PE	3	0	0	3
2.	MR22042	Roles of Classification Society	PE	3	0	0	3
3.	MR22043	Material Handling Equipments	PE	3	0	0	3
4.	MR22044	Dry Docking and Ship Repairs	PE	3	0	0	3
5.	MR22045	Emergency Management and Damage Control	PE	3	0	0	3
6.	MR22046	Marine Resource Management	PE	3	0	0	3
7.	MR22047	Marine Engineering Safety Practices	PE	3	0	0	3

OPEN ELECTIVES

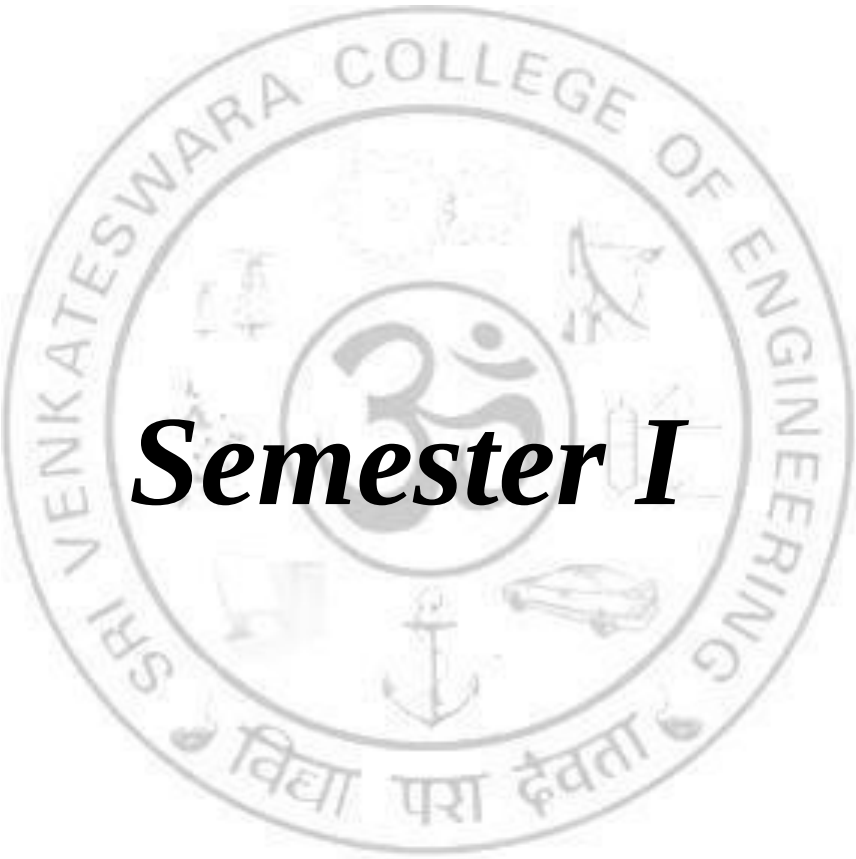
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	OE22901	Elements of Marine Engineering	OE	3	0	0	3
2.	OE22902	Marine Propulsion	OE	3	0	0	3
3.	OE22903	Marine Vehicles	OE	3	0	0	3
4.	OE22904	Introduction to Marine Diesel Engines and Machineries	OE	3	0	0	3

VALUE ADDED COURSES

S.NO		COURSE TITLE
1.	VD22901	Basic Safety Training (BST)
2.	VD22902	Security Training for Seafarers with Designated Security Duty (STSDSD)
3.	VD22903	High Voltage Operational Level Course

MANDATORY COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	MC22001	Indian Constitution (Common to all branches)	MC	3	0	0	3
2.	MC22002	Essence of Indian Traditional Knowledge (Common to all branches)	MC	3	0	0	3
3.	MC22003	Gender Sensitization (Common to all branches)	MC	3	0	0	3



Semester I

HS 22151	தமிழ் மொழியும் தமிழர் மரபும் Tamil Language and Heritage of Ancient Tamil Society *(Common to all branches)*	L	T	P	C
		1	0	0	1

பாடத்தின் நோக்கங்கள் :

- தமிழ் மொழியின் தோற்றம் பற்றியும், திணை கருத்துக்கள் வாயிலாக வாழ்வியல் முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.
- இந்திய தேசிய சுதந்திர இயக்கத்தில் தமிழர்களின் பங்களிப்பு மற்றும் தமிழர்களின் மேலாண்மை முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்

அலகு 1 தமிழுக்கும் தொழில் நுட்ப கல்விக்கும் உள்ள தொடர்பு மொழி மற்றும் பாரம்பரியம்:: (3)

இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழில் செம்மொழி இலக்கியம் - உ.வே. சுவாமிநாத ஐயர்., ஆறுமுக நாவலர் ஆகியோரின் பங்களிப்பு - தொழில் நுட்ப கல்வியில் தமிழ் மொழிக் கல்வியின் முக்கியத்துவம்.

LANGUAGE AND HERITAGE: Language families in india – Dravidan Languages – Tamil as a Classical language – Classical Literature in Tamil – Contribution of U. Ve. Saminathaiyar. Arumuka Navalar – Importance of Tamil language in technical education

அலகு 2 திணை கருத்துக்கள் (9)

திணை கருத்துக்கள்: - ஐந்து வகை நிலங்கள், தமிழர்களின் தாவரங்கள் மற்றும் விலங்கினங்கள், கடவுள்கள், தொழில்கள் , வாழ்க்கை முறை, பண் , கூத்து , உணவு முறை - தொல்காப்பியம் மற்றும் சங்க இலக்கியங்களில் இருந்து அகம் மற்றும் புறம் கருத்து - தமிழ் அறம் கருத்து - சங்க காலத்தில் கல்வி மற்றும் எழுத்தறிவு - பண்டைய நகரங்கள் மற்றும் சங்க காலத்தில் துறைமுகங்கள் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - சோழ மன்னர்களின் வெளிநாட்டு வெற்றிகள்.

Thinai concepts : -Five types of lands, animals, Gods, occupation, life styles, music, dance , food style, Floara and Fauna of Tamils - Agam and puram concept from Tholkappiyam and Sangam Literature – Aram concept of Tamil – Education and Literacy during Sangam Age – Ancient cities and Ports of Sangam Age – Export and Import during Sangam Age - Overseas Conquest of Cholas

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அலகு 3 தமிழரின் மரபு (3)

இந்திய தேசிய சுதந்திர இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பு:- சுப்ரமணிய பாரதி, வாஞ்சிநாதன், சுப்பிரமணிய சிவா, வீரபாண்டிய கட்டபொம்மன், வா.. ஊ சிதம்பரம் பிள்ளை, தீரன் சின்னமலை, மருது பாண்டிய சகோதரர்கள், பூலி தேவர், திருப்பூர் குமரன், வீர மங்கை வேலுநாச்சியார் - ,தமிழர் **இலக்கியங்களில் மேலாண்மை கருத்துக்கள் (கி. மு. 500 முதல் கி. பி 200 வரை)** – அகநானூறு, புறநானூறு, திருக்குறள் ஆகியவற்றில் மேலாண்மைக் கருத்துகள்..

Contribution of Tamils to Indian National Freedom Movement and Indian Culture : Contrinutions of Subramanya Bharathi, Vanchinathan, Subramaniya Siva, Veerapandiya Kattabomman, V O Chidambaram Pillai, Dheeran Chinnamalai, The Maruthu Pandiyar, Puli Thevar, Tiruppur Kumaran, Veera Mangai Velunachiyar

பாடநெறி முடிவுகள் :

பா .வெ . எண் CO	பாடத்திட்டத்தின் வெளிப்பாடு Course Outcomes	RBT Level
CO - 1	மாணவர்கள் தமிழ் மொழி தோற்றம் பற்றி தெரிந்து கொள்வார்கள் Students will learn about the origin of the Tamil language	1
CO – 2	தமிழர்களின் வாழ்வியல் முறைகளை தெரிந்து கொள்வார்கள் They will know the ways of life of Tamils.	2
CO - 3	தமிழர்களின் சுதந்திர போராட்ட வீரர்களை பற்றியும், மேலாண்மை முறைகளை பற்றியும் தெரிந்து கொள்வார்கள் They will know about the freedom fighters of Tamils and the management of Tamils	2

பாட நூல்கள்:

1. பொன். முத்துகுமாரன் (2002), **"தமிழ் மரபு"**, காந்தளகம், 68, அண்ணா சாலை, சென்னை 600 002.
2. பி. டி ஸ்ரீனிவாச ஐயங்கார் ***(தமிழக்கமும் திறனாய்வும்)*** புலவர் கா. கோவிந்தன் (1988), **"தமிழர் வரலாறு (முதல் பகுதி)"**, திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூற்பதிப்பு கழகம் ,154, TTK சாலை, சென்னை 18.
3. டாக்டர் கே கே பிள்ளை (2009), **"தமிழக வரலாறு மக்களும் பண்பாடும்"**, உலக தமிழாராய்ச்சி நிறுவனம், தரமணி , சென்னை 600113
4. முனைவர். ச. இராஜேந்திரன் (2004), **"தமிழில் சொல்லாக்கம்"**, தஞ்சாவூர் தமிழ் பல்கலைக் கழகம் வெளியீடு

HS22152 **COMMUNICATIVE ENGLISH**

(Common to all the branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Enable learners to interact fluently on everyday social contexts.
2. Train learners to engage in conversations in an academic/scholarly setting.
3. Instil confidence in learners to overcome public speaking barriers.
4. Develop learners' ability to take notes and in the process, improve their listening skills
5. Enhance learners' reading skill through reading text passages for comprehension and contemplation.
6. Improve learners' skills to write on topics of general interest and drafting correspondences for general purposes.

UNIT I **9 Hours**

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

UNIT II **9 Hours**

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

UNIT III **9 Hours**

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

UNIT IV **9 Hours**

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

UNIT V **9 Hours**

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

TOTAL: 45 PERIODS

REFERENCES:

1. Department of English, Anna University, Mindscapes : English for Technologists and Engineers. Orient Black Swan, Chennai, 2017.
2. Downes and Cambridge English for Job-hunting, CambridgeUniversity Press, New Delhi, 2008.
3. Murphy and Raymond, & quot;Intermediate English Grammar with Answers, Cambridge University
4. Press, 2000. Thomson, A.J., & ;Practical English Grammar, Oxford, 1986.

Websites

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

Software

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

OUTCOMES:

Upon successful completion of the course, the students will be able to

CO No.	CO Statements	RBT LEVEL
1	Acquire adequate vocabulary for effective communication	3
2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and news papers.	3
3	Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.	4
4	Comprehend conversations and short talks delivered in English.	6
5	Write short write-ups and personal letters and emails in English	6

COURSE ARTICULATION MATRIX

CO	Pos														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.										3					
2.										3					
3.										3					
4.										3					
5.										3					

3 means 'a strong correlation' as **the students will use all the four skills (Listening, Speaking, Reading and Writing) with appropriate body language in formal and informal environment.**

MA22152 APPLIED MATHEMATICS I FOR MARINE ENGINEERS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

The Student should be made to:

1. Understand the concepts of three-dimensional analytic geometry.
2. Acquire the concepts of differential calculus which are widely used in marine engineering problems.
3. Compute derivatives using the chain rule or total differentials
4. Study geometry integrals and its applications to relevant engineering problems.
5. Acquire knowledge mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I THREE DIMENSIONAL ANALYTICAL GEOMETRY (9+3)

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

UNIT II DIFFERENTIAL CALCULUS (9+3)

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

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UNIT III FUNCTIONS OF SEVERAL VARIABLES (9+3)

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

UNIT IV INTEGRAL CALCULUS (9+3)

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

UNIT V MULTIPLE INTEGRALS (9+3)

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

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

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Apply the basic concepts of analytical geometry in marine engineering problems.	3
2	Apply the basic notion of calculus to engineering problems and to tackle different geometries.	3
3	Perform calculus for more than one variable and its applications in engineering problems.	3
4	Perform integration to compute arc lengths, volumes of revolution and surface areas of revolution.	3
5	Apply integration to compute multiple integrals, area, moment of inertia, integrals in polar coordinates, in addition to change of order	3

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).
3. William Embleton and Leslie Jackson, "Mathematics for Engineers Vol- I", 7th Edition.

REFERENCES:

1. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.
2. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications(p) Ltd., 2014.
3. Reed's Marine Engineering Series, Thomas Reed Publications, 1997.

WEB LINK:

1. https://home.iitm.ac.in/asingh/papers/classnotes-ma1101.pdf
2. http://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3										3			
2.	3	3	3	3								3			
3.	3	3	3	3								3			
4.	3	3										3			
5.	3	3	2	2								3			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

PH22152 ENGINEERING PHYSICS

(Common to AE, CE, ME, MN, MR Branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M. I - M.I of circular disc, solid cylinder, hollow cylinder, solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

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

UNIT III ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting Acoustics of buildings and their remedies. Production of Ultrasonics by Magnetostriction and Piezoelectric methods -

Acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications – Sonogram.

UNIT-IV: PHOTONICS AND FIBER OPTICS 9

Photonics: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser – $C0_2$ Laser – Applications. **Fiber optics:** principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication-fibre optic sensors: pressure and displacement- Endoscope.

UNIT V: CRYSTAL PHYSICS **9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances- coordination number and packing factor for SC, BCC, FCC, HCP and diamond structure (qualitative) - crystal imperfections: point defects, line defects – Burger vectors, stacking faults

TEXTBOOKS:

1. Gaur R.K. and Gupta S.L, "Engineering Physics", Dhanput Publications, 2015.
2. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006.
3 Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
4 Arumugam M, "Materials Science", Anuradha Publications, 2015.

REFERENCES:

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

Course outcomes

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Gain knowledge in Mechanics	**2**
2	Evaluate the concepts of properties of matter and thermal physics	**3**
3	Learn to solve the issues related to defects in the buildings due to acoustic design and the significance of ultrasonic waves	**3**
4	Develop an understanding of photonics and Fiber Optic communication system	**2**
5	Classify and demonstrate the fundamentals of crystals and their defects.	**3**

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	2		2						1					
2.	3	2		2						1		2			
3.	3		2		3	2	1			1					
4.	3		2		3	2	1			1		2			
5.	3	2	2							1					

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CY22154 CHEMISTRY FOR MARINE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

On completion of the course the students are expected to;

6. Have a thorough knowledge of water chemistry and feed water treatment methods.
7. Have a knowledge of various water analysis procedures
8. To study the basic principles of corrosion and its control
9. Have a basic concept on nanochemistry and energy sources and storage devices.

UNIT I WATER TECHNOLOGY 09

Water its sources, classification and types of impurities – significance of impurities such as turbidity, colour, acidity, alkalinity, hardness, chlorides, sulphates, iron and manganese, DO, BOD, COD. Impurities in fresh water, sea water, distilled water. Boiler feed water- Introduction and requirements, purpose of water treatment in boilers, scale and sludge - causes, effects and prevention.

UNIT II WATER TESTING 09

Hardness, disadvantages of hard water in domestic field, industrial field, estimation of hardness by EDTA method, treatment for hardness (internal and external conditioning methods), total dissolved solids, dissolved oxygen test, test for partial and total alkalinity, chloride, sulphite, phosphate test, salinometer and its uses, use of litmus paper, typical test values for smoke and water tube boilers.

UNIT III WATER TREATMENT 09

Lime and Soda treatment – Hot lime and cold lime soda process, pH treatment, use of coagulants, caustic soda treatment, condensate line treatment, Demineralization, Zeolite process, Desalination of water - reverse osmosis and electro-dialysis, priming, foaming and control, effects of salts and gases in feed water, domestic water treatment – primary treatment and disinfection (UV, ozonation, chlorination and breakpoint chlorination)

UNIT IV CHEMISTRY OF CORROSION & ITS CONTROL 09

Introduction – Dry or chemical corrosion – mechanism, Pilling Bed worth rule, Wet or Electrochemical corrosion -mechanism – fretting, pitting corrosion, corrosion fatigue, types and causes of corrosion, dezincification and stress corrosion, factors influencing corrosion, Corrosion control - methods of mechanical and chemical de-aeration - material selection and design, sacrificial anodic protection, impressed current cathodic protection, Protective coatings – galvanizing, tinning, electroplating and paints.

UNIT V NANOCHEMISTRYAND ENERGY SOURCES 09

Introduction – Distinction between molecules, nanomaterials and bulk materials, size dependent properties, properties of nanoparticles, nanoclusters, nano rods and carbon nano tubes. Synthesis of nanomaterials – chemical vapour deposition and laser ablation method - applications of nanomaterials in medicine, agriculture, electronics, fuel cells and catalysis, Batteries- primary battery (dry cell) secondary batteries – alkaline batteries – lead acid, Ni-Cd and Li batteries, principles and applications of solar cells, wind energy, hydrogen and oxygen- fuel cell and next generation batteries

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO No	CO Statements	RBT Level
1	Classify the various sources and possible impurities of water and the purpose of feed water treatment for boilers	2
2	Describe the concepts of boiler corrosion, their types, causes and corrosion control techniques.	3
3	Illustrate the various boiler water treatment methods.	2
4	Explain the concept of hardness, its types and removal methods, also estimate the hardness present in a water sample.	2
5	Discuss about energy sources, Nano chemistry and its significance.	2

TEXT BOOKS:

1. Jain P.C. and Monika Jain, Engineering Chemistry, 4th Edition, Dhanpat Rai & Sons, New Delhi,2010.
2. Milton and Leech, "Marine Boilers" Butter worth Publishers, UK 1980.

REFERENCES:

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

At the end of the course, add the course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3									
2.	3	3										2			
3.	3											2			
4.	3	3	2			3									
5.	3		2			3	1								

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

ME22101	ENGINEERING DRAWING (Common to ME, MN, MR)	L 2	T 0	P 2	C 3

OBJECTIVES :

- This course will introduce the students to build their ability to read drawings and interpret the position and form of simple geometries.

UNIT 0 CONCEPTS AND CONVENTIONS AND GEOMETRIC CONSTRUCTION (NOT FOR EXAM) **2**

Importance of drawing in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning. Geometric construction - to draw perpendiculars, parallel lines, divide a line and circle, to draw equilateral triangle, square, regular polygons.

UNIT I CYCLOIDAL CURVES, INVOLUTE AND PROJECTIONS OF POINTS, LINES **10**

Basic construction of cycloid, epicycloid and hypocycloid - Drawing of tangents and normal to the above curves. Construction of involutes of square, pentagon and circle - Drawing of tangents and normal to the above involutes.

Orthographic projection – Introduction to Principal Planes of projections - First angle projection - projection of points. Projections of straight lines (only first angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.

UNIT II PROJECTIONS OF PLANES AND PROJECTIONS OF SOLIDS **12**

Projections of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Projections of regular solids like prisms, pyramids, cylinder, cone when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

UNIT III SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Sectioning of regular solids like prisms, pyramids, cylinder and cone in vertical position when the section plane is inclined to one of the principal planes and perpendicular to the other - Drawing of sectional front and top views and true shape of section.

Development of surfaces of simple and sectioned solids - prisms, pyramids cylinders and cones.

UNIT IV ISOMETRIC PROJECTION AND INTERSECTION OF SURFACES **12**

Introduction to Pictorial Projection - Principles of isometric projection - Isometric scale - Isometric projection of regular solids (prisms, pyramids, cylinder, cone), truncated solids and their combination in vertical position.

Line of intersection - Determining the line of intersection between surfaces of two interpenetrating solids with axes of the solids intersecting each other perpendicularly, using line method - Intersection of two square prisms and intersection of two cylinders are only to be considered

UNIT V FREE-HAND SKETCHING 12

Free-hand sketching – Sketching procedures – Steps in sketching - Orthographic views (front, top and side views) of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views (front, top and side views)

TOTAL : 60 (30 L+30P) PERIODS

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

CO No	CO statements	RBT level
1	***Construct*** conic sections and curves and sketch the orthographic views of lines as per drawing standards	3
2	***Draw*** orthographic projections of plane surfaces and simple solids in various positions	3
3	***Draw*** the various views of sectioned solids and develop the lateral surfaces of simple solids.	3
4	***Draw*** isometric projections of simple solids and their combinations and the orthographic projection of the intersection of surfaces of simple solids.	3
5	***Sketch*** the orthographic projections of a given isometric view and vice versa using free hand.	3

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Venugopal K. and Prabhu Raja V., "Engineering Drawing+AutoCAD", New Age International (P) Limited, 6th edition, 2022

REFERENCES :

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112105294
2. https://nptel.ac.in/courses/112103019

COURSE ARTICULATION MATRIX

	PROGRAM OUTCOMES												PSO		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1										1					
CO2										2					
CO3										2					
CO4										3					
CO5										3					

1- Weak, 2 – Moderate, 3 - Strong

L	T	P	C
3	0	0	3

MR22101 INTRODUCTION TO MARINE ENGINEERING

COURSE OBJECTIVES:

1. To impart knowledge on marine power plants.
2. To give an overview of Marine auxiliary machines to the students
3. To make students understand the functioning of the Marine refrigeration system.
4. To make students aware of the air-conditioning system and processes.
5. To impart knowledge on HVAC Components and Reefer containers

UNIT I MARINE POWER PLANTS 9

Introduction to Marine Power Plants – Diesel Engine – 2 stroke & 4 stroke engines, Steam turbine, gas turbine, nuclear power plant, major components and principle of working, selection of the type of plant, advantages of co-generation & Combined power plant cycles, Environmental impact of power generation using fossil fuels and nuclear energy.

UNIT II INTRODUCTION TO MARINE AUXILIARY MACHINERY 11

Overview of Marine Auxiliary Machines, Air compressor - principle, types and importance of compressed air, Principle and importance of Fuel oil and Lubricating oil purifiers – Various types of pumps and their application – Various types of heat exchangers, Various of types of valves and application, Types of packing materials for exhaust gas, steam, fuel oil, lubricating oil, water, chemicals, refrigerants, piping systems.

UNIT III MARINE REFRIGERATION 8

Typical marine refrigerating plants with multiple evaporator systems – construction and operation, starting and stopping of Marine refrigeration plant, safety measures in refrigeration plants, refrigerant charging procedure. Refrigeration in Liquefied gas carriers

UNIT IV MARINE AIR CONDITIONING 8

Psychrometry and Principles of Air conditioning – Comfort conditions - Typical marine Air conditioning and Ventilation system – construction and working, Starting and stopping procedure for Marine Air-conditioning plant, Maintenance & Troubleshooting

UNIT V HVAC COMPONENTS & REEFER CONTAINERS 9

Refrigeration compressors – types, L.P cut out, H.P cut out, lubricating oil low pressure cut out. Refrigeration Condensers – types and construction. Expansion valves – types and construction. Types of refrigerated cargoes, importance of maintaining temperature, humidity, oxygen content and air flow in reefer container.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

CO No	CO Statements	RBT Level
1	Relate the difference between power plants used in marine industry and their environmental impacts.	2
2	Apply the knowledge of Marine auxiliary machinery to work on-board the ships.	3
3	Relate the difference between shore based and marine refrigeration systems.	2
4	Apply the knowledge of Marine air conditioning systems to work on-board the ships	3
5	Apply the Principle of HVAC Components to run marine refrigeration units safely and efficiently.	3

TEXT BOOKS:

1. D.A.Taylor, "Introduction to Marine Engineering", Second Edition, Butterworth Heinemann, Woburn, USA, 2011.
2. Arora C.P., "Refrigeration & Air Conditioning", 3rd Edition, Tata McGraw-Hill, New Delhi, 2014.
3. J.R.Stott, "Refrigerating Machinery and Air Conditioning Plant", Marine Engineering Practice, Vol-1 P Part-04, IMarEST, London, 1998.

REFERENCES:

1. McGeorge.H.D, "Marine Auxiliary Machinery",7th Edition, Butterworth Heinemann, Woburn, USA, 2015
2. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd Edition, New Age International (P) Ltd., Publishers, Chennai,2015
3. C. Maheshwar, "Container Refrigeration", First Edition, Witherby Seamanship International, Livingston, UK, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3					2	2					3	3	3	
2.	3					2	2					3	3	3	
3.	3					2	2					3	3	3	
4.	3					2	2					3	3	3	
5.	3					2	2					3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CY22161 **CHEMISTRY LABORATORY**
(Common to all branches except AD, CS, IT)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

The objective of the Chemistry Laboratory is to acquaint the students with the basic phenomenons/concepts of chemistry, the students face during the course of their studies in the industry and engineering field.

1. To appreciate the need and importance of water quality parameters for industrial and domestic use.
2. To gain the knowledge on electrochemical instrumentation techniques like potential and current measuring used in electrochemistry applications
3. To impart knowledge on separation of components using paper chromatography.
4. To enhance the thinking capability about polymers and properties like molecular weight.

LIST OF EXPERIMENTS (Minimum 8 Experiments)

1. Determination of DO content of water sample by Winkler's method.
2. Determination of strength of given hydro chloric acid using pH meter
3. Determination of the strength of acids in a mixture using conductivity meter
4. Estimation of iron content of the water sample using spectrophotometer (phenanthroline /thiocyanate method)
5. Determination of total, temporary & permanent hardness of water by EDTA Method.
6. Estimation of iron content of the given solution using potentiometer.
7. Determination of alkalinity in water sample.
8. Determination of Single electrode potential.
9. Separation of components from a mixture of red and blue inks using Paper chromatography.
10. Determination of molecular weight of polymer by using Ostwald's/Ubbelohde viscometer.

TOTAL: 15 Periods

OUTCOMES:

Upon successful completion of the course, students will be able to:

CO No	CO Statements	RBT Level
1	Distinguish hard and soft water, solve the related numerical problems on water, purification and its significance in industry and daily life.	3
2	Interpret the knowledge of instruments to measure potential and current related parameters.	2
3	Demonstrate the basic principle for separation of components using paper chromatography.	3
4	Evaluate the molecular weight of a polymer using Ostwald's/Ubbelohde Viscometer.	3

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Common apparatus: Pipette, Burette, conical flask, porcelain tile, dropper (each 30 nos)

1	Iodine flask	30 Nos
2	pH meter	5 Nos
3	Conductivity meter	5 Nos
4	Spectrophotometer	5 Nos
5	Oswald/UbbelohdeViscometer	30 Nos

TEXT BOOKS:

1. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel"s Textbook of practical organic chemistry", LBS Singapore 1994.
2. Jeffery G.H., Bassett J., Mendham J.and Denny vogel"s R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980

At the end of the course, add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	2				3	3	3	1		1	2			
2.	3	2	1			3	3	3							
3.	3					3	3					2			
4.	3			1		3	3	3							

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22111 **FITTING WORKSHOP**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

1. To impart knowledge in handling various workshop tools
2. To Impart knowledge in the fabrication of sheet metal components
3. To Impart knowledge in making different joints – V, square and round
4. To Impart knowledge in joining metals through arc welding – butt, lap and corner joint

LIST OF EXPERIMENTS

SHEET METAL **15**
Fabrication of tray, cone and cylinder with sheet metal

FITTING **15**
Practice in chipping, filing, drilling – Making V, square and half-round joints

WELDING **15**
Arc Welding of the butt joint, Lap joint, and Corner joint. Demonstration of gas welding.

TOTAL: 45 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Handle different workshop tools	3
2	Have the Knowledge of sheet metal fabrication	3
3	Fabricate different joints like V, Square and Round	3
4	Have knowledge of joining metals using the Arc welding process	2

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3											3	3	3	
2.	3											3	3	3	
3.	3					2						3	3	3	
4.	3					2						3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Semester II

		L	T	P	C
HS 22251	அறிவியல் மற்றும் தொழில் நுட்பத்தில் தமிழ் **Science and Technology in Ancient Tamil Society** ***(Common to all branches)***	2	0	0	2

பாடத்தின் நோக்கங்கள் :

- அறிவியலில் தமிழின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.
- தொழில்நுட்பத்தில் தமிழ் பாரம்பரியத்தின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்

அலகு 1 அறிவியல் தமிழ் (5)

கருவி உருவாக்கம் - ஆராய்ச்சி மேம்பாடு - கல்வி வளர்ச்சி - அறிவியல் தமிழ் சொற்கள் உருவாக்கம்.

Scientific Tamil : Tool Development - Research Development - Educational Development - Scientific Tamil words Creation.

அலகு 2 தொழில் நுட்பத்தில் தமிழ் (25)

வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் : சங்க காலத்தில் கட்டுமானப் பொருட்கள் - சோழர்களின் பெரிய கோவில்கள் மற்றும் பிற வழிபாட்டு தலங்கள் - பல்லவர்களின் சிற்பங்கள் மற்றும் கோவில்கள் (மாமல்லபுரம்) - நாயக்கன் கால கோவில்கள் (**மதுரை மீனாட்சி அம்மன் கோவில்**), திருமலை நாயக்கர் மஹால், செட்டி நாட்டு வீடுகள்.

Design and Construction Technology : Building materials in Sangam age – Great temples of Cholas and other workship places – Sculptures and Temples of Pallavas (Mamallapuram) – Temples of Nayakas period (Madurai Meenakshi amman temple), Thirumalai Nayakar Mahal, Chetti Nadu Houses.

உற்பத்தி தொழில்நுட்பம் : கப்பல் கட்டும் கலை, உலோகவியல் ஆய்வுகள், தங்கம், தாமிரம், இரும்பு பற்றிய அறிவு - தொல்பொருள் சான்றுகள் – சுட்டக் களிமண் மணிகள், சங்கு மணிகள், எலும்பு மணிகள்.

Manufacturing Technology : Art of Ship building, Metallurgical studies, Knowledge about Gold, Copper, Iron – Archeological evidences – Terracotta beads, Shell beads, Bone beads.

விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பம் : அணைகள், ஏரிகள், குளங்கள், மதகுகள், சோழர் கால குமுழி தூம்பு ஆகியவற்றின் முக்கியத்துவம் - கால்நடை பராமரிப்பு, கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள். விவசாயம் மற்றும் வேளாண் செயலாக்கம் - கடல் பற்றிய அறிவு - மீன்பிடித்தல், முத்து குளித்தல், சங்கு சேகரித்தல்.

Agriculture and Irrigation Technology: Dams, Tank, ponds, sluice, Significance of Kumuzhi Thoompu of Cholas period- Animal Husbandry, Wells designed for cattle use. Agriculture and Agro processing, - Knowledge about Sea – Fisheries, Pearl, Conche diving.

தமிழ் கணினி: அறிவியல் தமிழ் வளர்ச்சி - தமிழ் கணினி, தமிழ் புத்தகங்களின் டிஜிட்டல் மயமாக்கல், தமிழ் டிஜிட்டல் நூலகம், தமிழ் மென்பொருள் உருவாக்கம்

- தமிழ் மெய்நிகர் அகாடமி - சொற்குவை திட்டம்.

Tamil Computing : Development of Scientific Tamil – Tamil Computing, Digitization of Tamil books, Tamil Digital Library, Development of Tamil Softwares – Tamil virtual Academy – Sorkuvai project.

தமிழின் எதிர்காலமும் தகவல் தொழில்நுட்பமும்- உலகமயமாக்கலும் தகவல் தொழில் நுட்பமும் - கணினிக்கு தமிழ் கற்று கொடுத்தல் - தமிழ் மொழித் தொழில் நுட்பத்தில் வளங்கள்.

Future of Tamil and Information Technology- Globalization and Information Technology-Teaching Tamil for Computer-Resources in Tamil Language Technology.

பாடநெறி முடிவுகள் :

பா .வெ . எண்	பாடத்திட்டத்தின் வெளிப்பாடு	RBT Level
CO - 1	அறிவியலில் தமிழ் மொழியின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள் They will know about the use of Tamil language in science	2
CO – 2	பல்வேறு தொழில்நுட்பத்தில் தமிழ் மொழியின் தாக்கம் பற்றி அறிந்து கொள்வார்கள் They will learn about the influence of Tamil language in various technologies	3

பாட நூல்கள்:

டாக்டர், வா·செ ·குழந்தைசாமி (1985), " அறிவியல் தமிழ் " , பாரதி பதிப்பகம், 126/108, உஸ்மான் சாலை, தியாகராய நகர் , சென்னை 600017

சுப· திண்ணப்பன், (1995), "கணினியும் தமிழ் கற்பித்தலும்", புலமை வெளியீடு, 38-B மண்ணத்நதோட்டத் தெரு, ஆழ்வார்பேட், சென்னை 600018

மு· பொன்னவைக்கோ, (2003), "வளர் தமிழில் அறிவியல் – இணையத்தமிழ்", அனைத்திந்திய அறிவியல் தமிழ்க்கழகம், தஞ்சாவூர் 615 005.

துரை. மணிகண்டன், (2008), "இணையமும் தமிழும்", நல் நிலம் பதிப்பகம், 7-3, சிமேட்லி சாலை, தியாகராய நகர், சென்னை 600 017

HS22252 **TECHNICAL ENGLISH**
(Common to all the branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Enable learners to define and understand technical communication and scientific writing
2. Expose learners to the technicalities of seminar presentation, group discussion, and public speaking
3. Develop learners' writing skills for scientific and documenting purposes
4. Improve learners' ability to draft correspondence for business purposes
5. Cultivate learners' ability to holistically understand the nuances of job interviews and recruiting process.

UNIT I **9 Hours**

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

UNIT II **9 Hours**

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

UNIT III **9 Hours**

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

UNIT IV **9 Hours**

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

UNIT V **9 Hours**

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

TOTAL: 45 PERIODS

REFERENCES:

1. Department of English, Anna University. *Mindscapes: English for Technologists and Engineers.* Orient Blackswan, Chennai. 2012.

2. Downes, Colm, *Cambridge English for Job-hunting*, Cambridge University Press, New Delhi. 2008

3. Murphy, Raymond, *Intermediate English Grammar with Answers*, Cambridge University Press 2000.

4. Thomson, A.J., *Practical English Grammar 1 & 2*, Oxford, 1986.

5. Herbert A J, *The Structure of Technical English*, Longman, 1965.

Websites

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

Software

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

OUTCOMES:

Upon successful completion of the course, the students should be able to

CO No	CO Statements	RBT LEVEL
1	Understand the nuances of technical communication and scientific writing	3
2	Present papers and give seminars	6
3	Discuss in groups and brainstorm	6
4	Draft business correspondences and write for documenting purposes	6
5	Face job interviews with confidence	6

COURSE ARTICULATION MATRIX

COs	POs														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.										3					
2.										3					
3.										3					
4.										3					
5.										3					

3 denotes 'a strong correlation' as **the students will use all the four skills (Listening, Speaking, Reading and Writing) with appropriate body language in technical and professional situations.**

L	T	P	C
3	1	0	4

MA22252 APPLIED MATHEMATICS II FOR MARINE ENGINEERS

COURSE OBJECTIVES:

The student should be made to:

1. Understand the concepts of ordinary differential equations in the field of engineering.
2. Understand the methods to solve higher order differential equations and apply real time engineering problems.
3. Acquire the concepts of vector calculus for solving problems.
4. Understand the concepts of analytic functions which are widely used in marine engineering problems.
5. Acquire knowledge in Laplace transforms which are used in efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS – FIRST ORDER AND APPLICATIONS **12**

Definition, order and degree, formation of differential equation. Solution of first order, first degree equations in variable separable form, homogeneous equations, other substitutions, equations reducible to homogeneous and exact differential equations. Equations reducible to the exact Integration Factor, Linear differential equation of first order first degree, reducible to linear, applications to electrical circuits and orthogonal trajectories.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS – HIGHER ORDER AND APPLICATIONS **12**

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

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UNIT III VECTOR CALCULUS **12**

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

UNIT IV ANALYTIC FUNCTIONS **12**

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

UNIT V LAPLACE TRANSFORM **12**

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transforms as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

. **TOTAL: 60 PERIODS**

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Apply the basic concepts of ordinary differential equations and its applications in marine engineering problems.	3
2	Apply various techniques in solving differential equations.	3
3	Solve gradient, divergence and curl of a vector point function and related identities, evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	3
4	Recognize fundamental properties of analytic functions and construct simple conformal maps.	3
5	Apply Laplace transforms to solve differential equations.	3

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERENCES:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications(p) Ltd., 2014.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).
3. Reed's Marine Engineering Series, Thomas Reed Publications, 1997.

WEB LINK:

1. https://nptel.ac.in/courses/111/105/111105134/
2. https://nptel.ac.in/courses/111/105/111105121/

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	2									3			
2.	3	3	2									3			
3.	3	3										3			
4.	3	3										3			
5.	3	3	2									3			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22202 MATERIAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamentals of metallurgy, Fe-C system, properties of metals and crystallography.
2. To introduce the importance of heat treatment and phase transformations with studies on surface treatment.
3. To acquaint the students with the importance of mechanically characterizing of the materials with known methods.
4. To impart knowledge on material selection for marine applications, welding and corrosion metallurgy, bonding and NDT.
5. To introduce the students to the properties of various new materials and their marine applications.

UNIT I FUNDAMENTALS OF METALLURGY 10

Basic metallurgy, metals, and properties of materials used on board ships. Crystallography – Crystal structures: BCC, FCC and HCP – directions and planes – linear and planar densities – crystal imperfections –edge and screw dislocations –grain and twin boundaries - Metallurgy of steel and cast iron - Iron - Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure - Aluminium, copper and its alloys - Effect of alloying additions on steel.

UNIT II HEAT TREATMENT 10

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

UNIT III MECHANICAL PROPERTIES AND TESTING 9

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

UNIT IV MATERIAL SELECTION, WELDING METALLURGY, CORROSION METALLURGY, BONDING AND NDT 8

Selection of materials in construction of marine equipment, bonding plastics, adhesives and bonding, Welding Metallurgy - HAZ around a weld –significance, metallurgical effects on corrosion, materials selection - alteration of environments – marine coatings. Destructive and non-destructive testing of materials – different methods of testing and mechanical characterization.

UNIT V NEW MATERIALS 8

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand the Fundamentals of Metallurgy, Properties of metals and crystallography.	2
2	Understand the various heat treatment processes.	2
3	Understand the various mechanical property testing methods.	2
4	Understand how different materials are selected for different uses on board ships, welding and corrosion metallurgy, bonding, and Non-destructive testing.	2
5	Appreciate the various properties of the latest materials, including non-metals.	2

TEXT BOOKS:

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", 9th Indian Edition, Prentice-Hall of India, 2013.
2. Parasihivamurthy, K.I., "Material Science and Metallurgy", 1st Ed. Pearson, 2012.
3. Jindal, U.C., Atish Mozumder, "Material Science and Metallurgy", 1st Ed. Pearson, Third Impression 2013.
3. Todd, "Selecting Material for Sea Water Systems", Marine Engineering Practice, Vol-1, Part-10, IMarEST, London.
4. Raghavan. V, "Materials Science and Engineering", 6th edition, Prentice Hall of India Pvt. Ltd, 2015.

REFERENCES:

1. Eyres, D.J. "Ship Construction" 7th Edition, 2015.
2. William D Callister "Material Science and Engineering", John Wiley and Sons, 7th Edition, 2007.
3. E. McCafferty "Introduction to Corrosion Science", Springer, 2010th Edition.
4. Askeland, D. "Materials Science and Engineering", Brooks/Cole, 1st Edition, 2010.
5. Smith, W.F., Hashemi, J. & Prakash, R. "Materials Science and Engineering", 5th Edition, Tata McGraw Hill, 2013.
6. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill, SI Edition, 1988.
7. Sindo Kou., "Welding Metallurgy", Wiley, 2nd Edition, John Wiley and Sons, 2003.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	2											3	3	
2.	3	2											3	3	
3.	3	2					2						3	3	
4.	3	2				2	2						3	3	
5.	3	2				2	2						3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

ME22201 **ENGINEERING MECHANICS**

(Common to ME, MN and MR)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand the concept of equilibrium of particles.
2. To understand the concept of equilibrium of rigid bodies.
3. To understand the concept of first and second moment of the area.
4. To understand the concept of various types of frictions and applications.
5. To understand the principle of work energy method, Newton's law and the impact of elastic bodies.

UNIT I BASICS AND STATICS OF PARTICLES **9**

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

UNIT II STATICS OF RIGID BODIES AND ANALYSIS OF STRUCTURES **9**

STATICS OF RIGID BODIES: External, Internal forces - moment of a force - varignon's theorem - moment of a couple - resolution of a force into a force and a couple - reduction of a system of forces - reactions at supports and connections - equilibrium of a two and three force bodies - case studies.

ANALYSIS OF STRUCTURES: Simple trusses - method of joints, method of sections - joints under special loading conditions - space trusses - analysis of frames.

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA **9**

Centroid of areas, composite areas, Centre of Gravity- Theorems of Pappus and Guldinus- Parallel axis theorem and perpendicular axis theorem - determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration - mass moment of inertia of simple solids.

UNIT IV FRICTION **9**

Laws of dry friction - angles of friction-coefficient of static and kinetic friction - wedges - surface contact friction - belt friction - journal bearings - axle friction - thrust bearings - disc friction - Point contact friction - wheel friction - rolling resistance - case studies.

UNIT DYNAMICS OF PARTICLES **9**

KINEMATICS: Introduction-plane, rectilinear and rotary motion-time dependent motion -rectangular coordinates - projectile motion.

KINETICS: Newton's II law - D'Alembert's principle - Energy - potential energy - kinetic energy - conservation of energy - work done by a force - work energy method.

IMPULSE AND MOMENTUM: Concept of conservation of momentum - Impulse-Momentum principle - Impact - Direct central impact, oblique central impact, impact of a moving train on the spring board.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand and analyze the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.	2
2	Understand and analyze the concept of reaction forces and moment of various support systems with rigid bodies in 2D and 3D in equilibrium.	2
3	Evaluate centroid, Area moment of Inertia and Mass moment of Inertia of cross section of any structural member.	3
4	Correlate the engineering problems dealing with force, displacement, velocity and acceleration equations	3
5	Evaluate the problems in friction and rigid body dynamics	3

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11th Edition, 2017.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.
3. Rajasekaran S and Sankarasubramanian G, "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.
6. NPTEL Course on Engineering Mechanics, IIT Guwahati Prof. U.S. Dixit, Dr. G. Saravana Kumar (https://nptel.ac.in/courses/112103108)

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	2	2	1	2								2		
2.	3	2	2	1	2								2		
3.	3	2	3	1	3								2		
4.	3	2	3	1	3								2		
5.	3	2	3	1	3								2		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

IT22252 COMPUTER APPLICATIONS AND PYTHON PROGRAMMING

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

1. Provide a sound foundation about the basic computer terminologies, hardware and software devices.
2. Introduce fundamental concepts and cutting-edge technologies in Information Technology
3. Use Python data structures –- lists, tuples, dictionaries in solving a problem
4. To define Python functions and call them.
5. To develop Python programs with conditionals and loops.

UNIT I COMPUTER BASICS 6+3

Characteristics of a computer - Classification of Computers – Computer Organization and Architecture – Central Processing Unit – Communication among various units – Data Representation – Number System - Computer Memory and Storage: Memory Hierarchy – Primary and Secondary Storage – Importance of Input and Output Hardware – Computer Terminals.
Suggested Activities: Practical – Word Processing and Spreadsheet

UNIT II NETWORKS AND INTERNET 6+3

Data Communication – Transmission Media - The Benefits of Networks - Types of Networks – Network Topologies - Client/Server & Peer-to-Peer – VPNs - Wired and Wireless Networks - Basic Internet Terms – Internet Applications - Narrowband, Broadband, & Access Providers - Internet Tools: Web browsers – E-mail - Search Engines.
Suggested Activities: Practical
Demonstration of basic networking commands.

UNIT III COMPUTER SECURITY AND EMINENT TECHNOLOGIES 6+3

Computer Security: Introduction to Computer Security – Security Threats – Cryptography and types – Firewall and Types of Firewall. Eminent Technologies: Mobile communications, Blue tooth, Global Positioning system, Electronic Data Interchange.
Suggested Activities : Practical : Demonstration of System Management and user management.

UNIT IV DATA, EXPRESSIONS, STATEMENTS 6+3

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; function definition and use, flow of execution, parameters and arguments – Local and Global Scope; Conditional Statements – Iterative Statements
Suggested Activities
Practical :Demonstration of programs using basic features of python.

UNIT V STRING, LISTS, TUPLES, DICTIONARIES 6+3

Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Lists: list operations, list slices, list methods, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods;
Suggested Activities : Practical - Demonstration of programs using Strings, Lists, Tuples and dictionary

TOTAL: 45 PERIODS

OUTCOMES:

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

CO No	CO Statements	RBT Level
1	Understand the characteristics and data processing methodologies of a computer.	2
2	Differentiate various networks and their underlying terminologies.	3
3	Understand the recent advancements in computers.	2
4	Develop algorithmic solutions to simple computational problems by decomposing into multiple functions	5
5	Represent compound data using Python lists, tuples, dictionaries for solving problems	4

TEXT BOOKS:

1. Introduction to Information Technology, ITL Education Solution Ltd. 2nd edition 2012 Pearson Education.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/OReilly Publishers, 2016 _(http://greenteapress.com/wp/ think-python/)

REFERENCES:

1. Brian K Williams, Stacey C Sawer "Using Information Technology – A practical introduction to computers and communications", 11th edition 2015 ,Mc Graw H ill (P) Ltd.,
2. Turban, Rainer, Potter, "Introduction to Information Technology", second edition, Wiley Publications.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.

Evaluation Method

60% Theory and 40% Practical

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	1	3							3			2			
2.	1	3							3			2			
3.	1	3							3			2			
4.	1		3	2	1				3			2			
5.	1		3	2	1				3			2			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22201 THERMAL ENGINEERING FOR MARINE ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The students should be able,

1. To apply the first law of thermodynamics to engineering applications.
2. To analyze heat engine, heat pump and refrigerator using the second law of thermodynamics.
3. To understand steam formation, properties of steam and apply it to the Rankine cycle.
4. To understand air standard cycles and analyze them.
5. To understand the basics of refrigeration.
6.

UNIT I FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS 9

Thermodynamic concepts – concepts of continuum, thermodynamic properties, equilibrium processes, thermodynamic cycle, work, heat, temperature and Zeroth law of thermodynamics. First law of thermodynamics – applications to closed and open systems, internal energy, specific heats, enthalpy – application to steady flow devices in Marine Engineering. Simple problems

UNIT II SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS 9

Thermodynamic systems – Second law of thermodynamics, Statements, T-s diagrams, Reversibility, causes of irreversibility, Carnot theorem, Carnot cycle, Reversed Carnot cycle, difference between heat engine, refrigerator and heat pump, applications to marine engineering. Clausius inequality, entropy, available energy. Simple problems

UNIT III STEAM FORMATION AND RANKINE CYCLE 9

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

UNIT IV AIR STANDARD CYCLES 9

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

UNIT V REFRIGERATION 9

Vapour compression cycle -components and principle of operation, refrigerating effect, Co-efficient of Performance, Methods of improving C.O.P. Vapour absorption Refrigeration – Components and principle of operation, Marine Refrigerants and their desirable properties, ODP, GWP, use of Refrigerant tables and charts – Simple Problems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	To understand the first law of thermodynamics along with engineering applications.	2
2	To recognize heat engines, heat pumps and refrigerators and applications of the second law of thermodynamics.	3
3	To comprehend the steam formation process, properties of steam and it's application to Rankine cycle.	3
4	To analyse various air standard cycles and their application.	3
5	To know the vapour compression refrigeration cycle and its analysis.	2

TEXT BOOKS:

1. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill, 2016.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition, Anuragam Publications, 2014.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd, 2015.

REFERENCES:

1. William Embleton OBE., "REEDS Applied Heat for Engineers", Thomas Reed Publication, 4th Edition, Reprint 2011.
2. K.K. Ramalingam, "Engineering Thermodynamics", 1st Edition, Scitech Publications (India) Pvt. Ltd., 2009
3. R.K. Rajput, "Thermal Engineering", 9th Edition, Laxmi Publications, 2014

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3	3							3	
2.	3	3				3	3							3	
3.	3	3				3	3							3	
4.	3	3				3	3							3	
5.	3	3				3	3							3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

EE22151 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

1. To understand the basic theorems used in electrical circuits.
2. To educate on the different concepts and functions of electrical machines.
3. To introduce electron devices and their applications.
4. To explain the principles of digital electronics.
5. To impart knowledge on the principles of measuring instruments.

UNITI ELECTRICALCIRCUITS 9

Ohm's Law – Kirchhoff's Laws - Steady State Solution of DC Circuits using Mesh and Nodal Analysis - Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase AC Balanced Circuits.

UNIT II ELECTRICAL MACHINES 9

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

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode - Zener Effect - Zener Diode - LED, Photo diode and its Characteristics-Half Wave and Full Wave Rectifiers-Voltage Regulation. Bipolar Junction Transistor-Common Emitter Configuration, Characteristics and CE as an Amplifier - Photo transistors.

UNIT IV DIGITAL ELECTRONICS 9

Number System Conversion Methods–Simplification of Boolean Expression using K-Map – Half and Full Adders – Flip-Flops – Shift Registers - SISO, SIPO, PISO, PIPO and 4-bit Synchronous and Asynchronous UP Counters.

UNIT V MEASURING INSTRUMENTS 9

Types of Signals: Analog and Digital Signals- Construction and working Principle of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters. Instrumentation Amplifier, – R-2R ladder Type D/A Converter - Flash Type and Successive Approximation Type A/D Converter.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2. Sedha. R.S., "A Text Book of Applied Electronics", S.Chand & Co., 2014.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics Engineering", Tata McGraw Hill, 2013.
2. Mehta VK, "Principles of Electronics", S. Chand &Company Ltd, 2010.
3. M. Morris Mano, "Digital Logic & Computer Engineering", Prentice Hall of India, 2004.
4. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, Fourth Edition, 2007.

BL – Bloom's Taxonomy Levels

CO No	CO Statements	RBT LEVEL
1	Compute the electric circuit parameters for simple problems	4
2	Understand the construction and characteristics of different electrical machines.	4
3	Describe the fundamental behavior of different semiconductor devices and circuits.	4
4	Design basic digital circuits using Logic Gates and Flip-Flops.	4
5	Analyze the operating principles and working of measuring instruments.	4

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	3	3			2					2			
2.	3	3	3	3			2					2			
3.	3	3	3	3			2					2			
4.	3	3	3	3			2					2			
5.	3	3	3	3			2					2			

MR22211 COMPUTER AIDED DRAFTING LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To develop skills to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING:

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

TOTAL: 45 PERIODS

OUTCOMES:

CO No	CO Statements	RBT Level
1	Students will be able to draw the two-dimensional sketches by using different commands in Auto CAD software.	3
2	Students will be able to draw the Isometric projection drawings from the two dimensional drawing and building layouts.	3
3	Students will be able to draw the basic solid models drawing and make a pattern material model for different appearance of the solids.	3

REFERENCES:

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3		3									3		
2.	3		3									3		
3.	3		3									3		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

EE22111 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To provide exposure to the students with hands-on experience in the basics of Electrical and Electronics wiring connection and measurements.
- To introduce the students to Electrical Machines and the basic laws of Electrical Circuits.

LIST OF EXPERIMENTS

1. Wiring – Residential house wiring and Stair case wiring.
2. (a) AC Analysis- Measurement of electrical quantities–voltage, current, power, and power factor using RLC.
   (b) Study of three phase system.
3. Energy conservation - Measurement and comparison of energy for incandescent lamp and LED lamp.
4. (a) Identification of circuit components (Resistor, Capacitor, Diode and BJT) and soldering practice.
   (b) Signal Measurement- Measurement of peak to peak, RMS, average, period, frequency of signals using CRO.
5. (a) VI Characteristics of Solar photovoltaic panel.
   (b) Design of Solar PV Array and Battery sizing for Residential solar PV system.
6. Design a 5V/12V Regulated Power Supply using FWR and IC7805 / IC7812.
7. DC Analysis- Verification of Ohm's Law and Kirchhoff's Laws.
8. Study of transformer and motor characteristics.

TOTAL: 30 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Wiring of basic electrical system and measurement of electrical parameters.	4
2	Verifying the basic laws of electric circuits and understanding the working of Electrical Machines	4
3	Study of basic electronic components, circuits and solar photovoltaic panels and their implementation.	4
4	Understand the concept of a three-phase system.	4
5	Construct a fixed voltage regulated power supply and measure the signals in each stage.	4

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	3	3					2			2			
2.	3	3	3	3					2			2			
3.	3	3	3	3					2			2			
4.	3	3	3	3					2			2			
5.	3	3	3	3					2			2			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

PH 22161 **PHYSICS LABORATORY**

L	T	P	C
0	0	2	1

(Common to all branches except BT)

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS: (Any EIGHT Experiments)

1. a) Determination of Wavelength, and particle size using Laser.

   b) Determination of acceptance angle in an optical fiber.

2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.

3. Determination of the wavelength of mercury spectrum – spectrometer grating.

4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.

5. Determination of Young's modulus by non-uniform bending method.

6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.

7. Determination of Rigidity modulus of a given wire -Torsional Pendulum

8. Energy band gap of a Semiconductor

9. Determine the Hysteresis loss of a given Specimen

10. Calibration of Voltmeter & Ammeter using potentiometer.

OUTCOMES:

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

REFERENCES:

1. "Physics Laboratory practical manual", 1st Revised Edition by Faculty members, 2018.

Course outcomes

CO No	CO Statements	RBT Level
1	Analyze the physical principle involved in the various instruments; also relate the principle to new application.	4
2	Comprehend the experiments in the areas of optics, mechanics and thermal physics to nurture the concepts in all branches of engineering.	3
3	Apply the basic concepts of Physical Science to think innovative and also improve the creative skills that are essential for engineering.	3
4	Evaluate the process and outcomes of an experiment quantitatively and qualitatively	3
5	Extend the scope of an investigation into whether or not the results come out as expected	3

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.	3	3	2	3	2				3	1		2			
2.	3	3		3		2			3	1		2			
3.	3	3	2	3	2	2			3	1		2			
4.	3	3		3					3	1		2			
5.	3	3		3	2				3	1		2			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

III SEMESTER

MA22352 COMPUTATIONAL METHODS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Learn the solution of algebraic, transcendental equations, system of linear equations.
2. Understand the concept of Interpolation and approximation.
3. Learn how to apply Numerical Differentiation and Integration.
4. Familiarize in solving Initial Value Problems.
5. Understand how to solve Boundary Value Problems in Partial Differential Equations.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

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

UNIT II INTERPOLATION AND APPROXIMATION 9

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

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

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

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

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

UNIT V BOUNDARY VALUE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Have the fundamental knowledge of solving an algebraic or transcendental equation, linear system of equations.	3
2	Appreciate the numerical techniques of interpolation in various intervals.	3
3	Apply the numerical techniques of differentiation and integration for engineering problems.	3
4	Solve Initial value problems using an appropriate numerical technique.	3
5	Solve Boundary value problems using finite difference method.	3

TEXT BOOKS:

1. Grewal. B.S., and Grewal. J.S., Numerical methods in Engineering and Science, Khanna Publishers, 11th Edition, New Delhi, 2017.
2. Jain M.K., Iyengar. S.R.K., and Jain. R.K, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi, 2015.
3. William Embleton OBE and Leslie Jackson, Reed's Mathematics for Engineers,Adlard Coles Nautical,London,2011.(for Marine Engineers)

REFERENCES:

1. Chapra. S.C., and Canale.R.P., Numerical Methods for Engineers, Tata McGraw Hill,7th Edition, New Delhi, 2015.
2. Sankara Rao. K., Numerical methods for Scientists and Engineers, Prentice Hall of India, 3rd Edition, New Delhi, 2007.
3. Gerald. C. F., and Wheatley. P. O., Applied Numerical Analysis, Pearson Education, Asia, New Delhi, 2009.
4. Venkataraman. M.K. Numerical Methods in Science and Engineering, National Publishers, 2001.
5. Kandasamy. K., Thilagavathy. K., and Gunavathi. K., Numerical Methods, S. Chand & Company Ltd., New Delhi, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	2	2								2			
2.	3	3	2	3								3			
3.	3	3	2	3								3			
4.	3	3	2	3								3			
5.	3	3	2	3								3			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22301 HYDRAULICS AND FLUID MACHINERY FOR MARINE ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the basic properties of fluids, fluid mechanics and the applications of fluids mechanics to stability of floating and submerged bodies as it related to marine engineering.
2. To introduce Fluid flow types and the dynamics of fluid flow and calculation of metacentre and metacentric height.
3. To acquaint the student with various flow losses in pipes, boundary layer and its behaviour.
4. To acquaint the student with dimension analysis, principles of pumps, its velocity triangle, and its behaviour.
5. To acquaint the student with turbines, its velocity triangle, and its behaviour.

UNIT I PROPERTIES OF FLUIDS AND APPLICATIONS OF FLUID MECHANICS 9

Properties of fluid – pressure head – Pascal's law – absolute and gauge pressures – measurement of pressure – manometers (single, U-tube, differential). Variation of fluid pressure with depth – Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid– Buoyancy and Floatation – Metacentric height – stability of floating and submerged bodies.

UNIT II DYNAMICS OF FLUID FLOW 8

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

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

UNIT III LOSSES IN PIPES AND BOUNDARY LAYER BEHAVIOUR 9

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

UNIT IV PUMPS 10

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

UNIT V TURBINES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand different fluid properties, the relationship between the different parameters that affect fluid properties and calculate metacentre and metacentric height.	3
2	Understand the principles of continuity, momentum, and energy as applied to fluid motions, recognize and apply these principles in the form of mathematical equations and also to understand and calculate metacentre and metacentric height.	3
3	Understand various losses in fluid flow, boundary layer concept and apply these to calculate losses in pipes.	3
4	Understand and apply dimensional analysis to predict physical parameters influencing fluid flow and calculate different input and output parameters in the centrifugal pump.	3
5	Understand and apply the principles of turbines, governing of turbines and calculate the different input and output parameters in turbine by using velocity triangle.	3

TEXT BOOKS:

1. Dr. R. K. Bansal, "Fluid mechanics and Hydraulic Machines", 9th revised Edition, Lakshmi publication, 2010.
2. R K Rajput, "Fluid Mechanics and Hydraulic Machines", 6th Edition, S. Chand & Company Ltd, New Delhi, 2015.
3. Gupta, S.C.," Fluid Mechanics and Hydraulic Machines" 1st Ed. Pearson, 2011.
4. A.K. Mohanty, "Fluid Mechanics", 2nd Edition, PHI, 2000.

REFERENCES:

1. Bruce, R. M., Donald, F.Y., Theodore, H.O., "Fundamentals of Fluid Mechanics" 6thEdition, John Wiley & Sons (Asia) Pvt. Ltd. India, 2010.
2. Nag. P.K., "Basic and Applied Thermodynamics" 2nd edition,2009, Tata Mc Graw Hill.
3. Roberson, J.A. and Crowe C.T., "Engineering Fluid Mechanics", 6th Edition, John Wiley, 1999.
4. Yunus A. Cengel, "Fluid mechanics fundamental and application", 2nd Edition, McGraw Hill, 2006.
5. Joy, "Hydraulic Power Transmission in Marine Machinery", Marine Engineering Practice Vol-1, Part-07, IMarEST, London,2002.

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3	2										3	3	
2.	3	3	2										3	3	
3.	3	3	2	2									3	3	
4.	3	3	2	2		1						2	3	3	
5.	3	3	2			1						1	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22302 **MARINE AUXILIARY MACHINERY I**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart the knowledge on Ship's Engine Room Layout, Piping systems and fittings.
2. To acquaint the students with various types of Pumps and its applications.
3. To impart knowledge on construction and working of heat exchangers, evaporator, RO system.
4. To impart the knowledge Ship's steering systems.
5. To introduce the importance of valves, cocks, packing, joints, filters and strainers.

UNIT I ENGINE ROOM LAYOUT, PIPING SYSTEMS AND FITTINGS 9

Layout of main and auxiliary machinery in Engine Rooms in different ships, Expansion joints in pipelines, Bilge and ballast pipeline system, fuel oil bunkering and transfer system, bunkering procedure, precautions taken, fuel oil service system to main and auxiliary engines, lubricating oil system, Engine FW and SW cooling system, Central priming systems, control and service air system, domestic freshwater and seawater hydrophore system, Drinking water system.

UNIT II VALVES, COCKS, PACKING, JOINTS, FILTERS AND STAINERS 8

Straight way cocks, right angled cock, "T" cock, spherical cock, Boiler gauge glass cylindrical cock. Globe valves, SDNR valve, swing check valve (storm valve), Gate valves, Butterfly valves, Relief Valves, Quick closing valves, Pressure reducing valves, Control valves and their application. Change over valve, valve actuators, steam traps. Packing material, engine room thermal Insulation and materials, Seals and its purpose, bearing seal, Application of non-rubbing seals and rubbing seals, simple felt seal, seals suitable for various speed, V-ring seals, Lip seals. Filtration process, filter elements basket strainers, duplex, edge type strainers, auto-kleen strainers, back flushing Filter, magnetic filter, rotary filters, fine filters.

UNIT III PUMPS 9

Classifications of pumps and its requirements, Centrifugal pumps, Gear pumps, screw pumps, reciprocating pump, Pump characteristics and performance, Application of pumps on board the ship. Priming and pump central priming system, Care and maintenance of Pumps, operation of all pumping systems on board such as bilge and ballast.

UNIT IV HEAT EXCHANGERS, EVAPORATORS AND DISTILLERS 10

Heater and cooler : Principle of surface heat transfer, materials used in all the above heat exchangers , Various types of heat exchanger, single and double pass , construction and operation of shell and tube type, plate type heat exchanger, repair and maintenance of heat exchanger, Lubricating oil coolers, fuel oil steam heaters, fresh water coolers, compressed air coolers, Main Engine charge air cooler, Fresh water heaters, steam condensers, evaporators and condensers in refrigeration system, thermal expansion.

Fresh water generator : Principle of distillation on board the ship, Distillation of water, Method for controlling the scale formation, single effect and double effect shell type evaporator, low pressure vacuum type evaporator, flash evaporators, Multiple effect evaporators, Salinometer, Reverse osmosis plan and drinking water treatment.

UNIT V STEERING SYSTEM **9**

Hydraulic telemeter system, pawl and ratchet Mechanism, hydraulic power unit, Heleshaw pump working principle, construction and operation, 2-ram and 4-ram steering gear, hunting gear and floating lever, principle operation of emergency steering gear system, Electro-hydraulic steering gear, Raphson and slide Actuators, Rotary vane steering gear, safety features, relief, isolating and bypass Valves, Rudder carrier bearing and bearing clearance, steering system regulations and testing, steering system regulations and testing, trouble shooting rectification and maintenance, Navigational safety of a ship, trouble shooting of steering gear system, rudder restraining, requirements for large tankers and gas carrier, additional requirements.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand the Ship's Engine Room Layout, Piping systems and fittings.	2
2	Know various types of valves and strainers used onboard the ship in various systems.	2
3	Know the various classification and types of Pumps, Applications based on the requirement on board the ship.	2
4	Understand the construction and working of heat exchangers, evaporator, RO system.	2
5	Understand the knowledge of Ship's steering systems.	2

TEXT BOOKS:

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

REFERENCE:

1. Vikram Gokhale, N. Nanda, "Advanced Marine Engineering Knowledge Vol. II", 2nd Edition, Engineer Enterprices, Mumbai, 2001.
2. Vikram Gokhale & N. Nanda, "Marine Engineering Knowledge for Junior Engineers, 3rd Edition, Engineer Enterprises, Mumbai, 1999.
3. T.B. Srinivasan, "Marine Machineries – Operation & Maintenance", 1st Edition, The Institute of Marine Engineers, India.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3	3									3	2	3	
2.	3	2	3	1	3							3	3	3	
3.	3	3	3		1							3	2	3	
4.	3			1	2							3	3	3	
5.	3	2	3	2	1							3	2	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

EE22351 MARINE ELECTRICAL MACHINES I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge on D.C. Machines used in Marine Engineering
2. To understand starting and speed control of D.C. motor
3. To expose the students on single and three phase transformer
4. To develop theoretical Knowledge of various measuring instruments fitted on boards ships
5. To familiarize various types of distribution system and connection patterns

UNIT I PRINCIPLES OF D.C. MACHINES AND GENERATORS 9

Principles of DC machines – construction – winding and E.M.F equations – armature reaction – commutation – brush shift – compensating winding – D.C. generator – their characteristics- methods of excitation - Self excitation, generation of back e.m.f and load/ voltage characteristics – Methods of voltage control- parallel operation- load sharing for D.C. generators – performance equations

UNIT II D.C.MOTORS 9

D.C. Motor –their characteristics – starting and reversing – speed – torque equations– Types of starters – speed control including electronic method of control – braking of D.C. motor, Ward-Leonard control- protection of D.C. series, shunt and compound wound motors and generators

UNIT III TRANSFORMERS 12

Transformers – types and applications – operating principle – E.M.F. Equations – phase diagrams under no load and load conditions – leakage resistance – equivalent circuits –voltage regulation – losses and efficiency – open circuit and short circuit tests – parallel operation – three phase transformers – core and shell type – Instrument Transformers - CT and PT – auto- transformers (single phase and three phase) - specification of coolants.

UNIT IV INSTRUMENTS AND TESTING 6

Digital ammeter, voltmeters, wattmeter and energy meter – Cathode Ray Oscilloscope - Cathode Ray Tube Theory & Construction - measurement with CRO – DSO - Block diagram- Data acquisition - Construction and operation of electrical testing and measuring equipment – Insulation tester, Continuity tester, Multi tester, Clamp meter.

UNIT V DISTRIBUTION AND TRANSMISSION SYSTEM 9

General structure of electrical power systems, Power transmission & distribution through overhead lines & underground cables- D.C. and A.C. transmission and distribution - Two wire and three wire D.C. system- A.C. transmission single phase and three phase, three wire four wire distribution - Comparision of D.C. and A.C. transmission, effect of voltage drop, copper utilization under different systems, single and double fed distributors - fuses, HV and LV switch gear, distribution and equipment - Coupling and breaking connection between switchboard and distribution panels.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand the characteristics of D.C. Generator	2
2	Analyze the performance and speed control of D.C. motors	4
3	Estimate the performance parameters of a transformer by suitable tests	3
4	Explain the operating principles and working of measuring instruments	3
5	Describe the structure and functioning of transmission and distribution system.	3

TEXT BOOKS:

1. Edmund G R, Kraallavers, "Advanced Electo-technology For Marine Engineers", 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London, 2010.
2. Bhag, S. Guru, Huseyin, R. Hiziroglu, "Electric Machinery and Transformers", 3rd Edition, Oxford University Press, 2013.
3. B L Theraja & A K Theraja, 'A Textbook of Electrical Technology Volume I &II' (Multicolour 23rd Edition), S. Chand Publishers, Delhi, 2005.
4. IHerman, "Electrical Transformers and Rotating Machines", 3rd Ed. Cengage, First Indian Reprint, Yesdee Publishings Pvt. Ltd, 2012.
5. Edmund GR Kraal, Stanley Buyers, Christopher Lavers, 'Basic electro technology for marine engineers', 4th Edition, Vol 06, Bloomsbury Publishing, 2013
6. Hughes Edward, "Electrical technology", 2nd edition, "ELBS with DP Publications", USA, 1996.
7. I.J Nagrath and D.P Kothari, "Basic Electrical Engineering", 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.

REFERENCES:

1. Uppal S.L., 'Electrical Power', 13th Edition, Khanna publishers, Mumbai, 2002.
2. Berde M.S., 'Electric Motor Drives', 3st Edition, Khanna Publishers, Mumbai, 1994.
3. W. Laws, 'Electricity applied to Marine Engineering', 4th edition, The Institute of Marine Engineers, London, 1998.
4. Gorti Ramamurthi, 'Handbook of Electrical Power Distribution', 2nd Edition, Universities Press, 2009.
5. https://nptel.ac.in/courses/108105155
6. https://archive.nptel.ac.in/courses/108/105/108105017/#

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	2	1									3	3		
2.	3	2	1									3	3		
3.	3	2	1									3	3		
4.	3	2										3	3		
5.	3	2										3	3		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22303 **SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the ship board organization of personnel and their duties.
2. To impart knowledge on Anchor, Mooring winches and windlass and their operations.
3. To acquaint the students with elementary navigational knowledge.
4. To impart knowledge of survival equipment and skills for survival at sea.
5. To learn the duties and responsibilities of engine room personnel and their actions on emergencies.

UNIT I SHIP BOARD ORGANIZATION AND DUTIES OF SEAMEN 10

Various departments on board ships, Introduction to the terms used on board ships like poop deck, forecastle, navigational bridge, etc. Deck Equipment: winches, windlass, derricks, cranes, gypsy, capstan, hatches and their function. Navigational lights and signals: port and starboard, forward and aft mast light colours and their location. Flags used on board ships, Flag etiquette, sound signals. Importance of look outs, bad weather precautions.

UNIT II MOORING OPERATIONS 8

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

UNIT III ELEMENTARY NAVIGATION 8

Preliminary knowledge of principal stars, Sextant, Navigation compasses, Echo sounder, GPS, GLONASS, Log and its uses, Barometer and weather classification, G.M.T and Time Zones, Wireless, Navigational Instruments, Radar and Satellite navigation.

UNIT IV SURVIVAL AT SEA AND SURVIVAL EQUIPMENT 10

Life Boat and Life Raft, Construction, equipment carried EPRIB, SART, TPA, capacity to carry. Life buoy, Davits and their operation, Launching of life rafts (Inflatable type) Embarkation into lifeboat and life raft. Survival pack, Stowage and securing arrangement, Abandon ship: Manning of lifeboat and life raft. Muster list. Radio and alarm signals, Distress signals (S.O.S) Distress Calls time and Radio frequency. Pyrotechnics. Survival factors and challenges, equipment available, duties of crew members, Initial action on boarding survival craft, maintaining the craft.

UNIT V DUTIES OF ENGINE ROOM PERSONNEL 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand the ship board organisation of personnel and their duties	2
2	Comprehend knowledge on Anchor, Mooring winches and windlass and their operations	2
3	Understand elementary navigational techniques	2
4	Gain knowledge of survival equipment and skills for survival at sea	2
5	Understand the duties and responsibilities of engine room personnel and their actions on emergency situations in engine room.	2

TEXT BOOKS:

1. Capt. J. Dinger, "Seamanship Primer", 7th Edition, Bhandarkar Publications, Mumbai 1998.
2. Kemp & Young, "Seamanship Notes", Stanford Maritime limited, 1997.
3. Graham Danton, "The theory and practice of seamanship", 11th Edition, Routledge, New York, USA Reprint 2005.

REFERENCES:

1. A.N. Cockcroft, "Seamanship and Nautical knowledge", 27th Edition, Brown son & Ferguson Ltd., Glasgow 1997.
2. D.J House "Seamanship Techniques" 3rd Edition, Butterworth Heinemann, 2009.
3. Capt. T. K. Joseph "Principles of Navigation" ARI –New Delhi Publication 1999.
4. Capt. H. Subramaniam "Nautical Watch-keeping" Vijaya Publication -Mumbai 1999

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3					3	3		3			3	3	3	
2.	3					3	3		3			3	3	3	
3.	3	2	1			3	3		3	2		3	3	3	
4.	3					3	3		3			3	3	3	
5.	3					3	3		3			3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22304 **MARINE BOILERS AND STEAM TURBINES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge about marine boilers and their parts with functions
2. To introduce the importance of boiler mountings and the safety of boilers to the students
3. To acquaint the students with boiler combustion systems
4. To impart the knowledge about the steam turbine and cargo oil transfer system using turbine pumping on tankers
5. To impart knowledge of operation and the maintenance of boilers installed on board the ship

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UNIT I MARINE BOILERS **9**

Uses of steam onboard the ship, steam system onboard the ship, various parts of boiler, Construction and working of smoke tube boiler- Scotch boiler, Cochran boiler, Water tube boiler: - Babcock Wilcox boiler, foster wheeler, Thimble tube boiler, Double evaporation boilers, Thermal oil boiler Advantages of water tube over smoke tube boilers, Stresses acting boilers.

UNIT II BOILERS MOUNTINGS AND BOILER FEED SYSTEMS **9**

Various mountings on boilers, construction and working of improved high lift safety valve, full bore safety valve. Safety regulations for boiler safety valve, Construction and working of various types of gauge glass used on board the ship, I-Gema remote gauge glass , Feed check valve, Automatic feed water regulator, Manhole door construction. Feed system- Open and close feed system, Cascade tank, observation tank, super heater and its arrangements, steam and condensate system.

UNIT III COMBUSTION IN BOILERS **9**

Boiler's fuel oil service system , Need for atomization of fuel, Furnace refractory materials and its types, Air register, Combustion Theory, construction of various types of burners - Pressure jet, blast jet, Rotating cup type burner, Blast jet burner, Gas burner, Mitsubishi-Dual fired burners, Kawasaki-Ultrasonic atomizer, Turndown ratio, Throughput, Effect of excess air, Construction and operation of soot blowers. Fixed and retractable type soot blower, features for efficient combustion, monitoring of combustion in the boiler.

UNIT IV MARINE STEAM TURBINES **9**

Construction and working of impulse & reaction turbines, Construction of condensers, Regenerative condensers, Materials used in turbine components. Turbine-speed and power control, operations of turbine by controls, vibrations in turbine, turbine drain system, turbine gland system, warming up of turbine. Turbine bearing, turbine sealing and lubrication system, Cargo oil transfer-operation system using turbines, methods to increase the efficiency of turbine

UNIT V OPERATION & MAINTENANCE OF BOILER **9**

Procedure for blowing through the gauge glass, Boiler blowing down procedure, Boiler manhole door opening procedure, Identification and renewal of boiler tubes, Raising steam from cold, boiler operating procedures, Inspection and survey of boilers, Safety valve over hauling procedure, Soot blowing procedure, Corrosion in steam system, Boiler accumulation pressure testing and hydraulic pressure testing, Basic feed water treatment, Action to be taken in shortage of water inside the boiler, water hammering in pipe.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Understand the basic parts and various types of boiler and its working	2
2	Know the various mountings and the safety of the boiler	2
3	Understand the working of various types of burner and the combustion process of the boiler	2
4	Know the various parts and working of turbine and its systems.	2
5	Understand the operational procedure of the boiler and the maintenance to be performed on the boiler.	3

TEXT BOOKS:

1. GTH. Flanagan, "Marine Boilers" 3rd Edition, Butter Worth, London, 2001.
2. Atul Kumar Gupta, " Marine Boilers" 1st edition , January 2020
3. Thomas D. Morton, "Reed's Steam engineering knowledge for engineers", Vol 9, 2011.
4. J.H. Milton & R.M. Leach, "Marine steam boilers" , 4th edition, butter worth, London, 1980.

REFERENCES:

1. L. Jackson & T.D. Morton, "General Engineering Knowledge for marine Engineers", 4th Edition.
2. William J.Kearton D. Eng "Steam turbine operation".

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3		3									3	3	3	
2.	3	3	3									3	3	3	
3.	3	3			1							3	3	3	
4.	3			1	3							3	3	3	
5.	3	3	3	2	2							3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22305 MARINE DIESEL ENGINES I

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

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

UNIT I FUEL TECHNOLOGY AND COMBUSTION IN I.C. ENGINES 9

Liquid fuels – petroleum distillation process – effects of modern refining on residual fuel Properties of fuel oil for marine diesel engines – testing and properties of fuel oils – shore side and shipboard sampling and testing. Treatment of fuel for contaminants including microbiological infection. Combustion of fuel – air required for combustion – combustion of hydrocarbons (theoretical treatment). Pollutants as per MARPOL annexure VI and emission control measures.

UNIT II TYPES AND CHARACTERISTICS OF MARINE DIESEL ENGINES 9

Deviation from ideal condition in actual engines. General construction and working of Slow Speed and Medium Speed engines engine cycles and Timing Diagrams. Mean Effective Pressure and Indicated Power: Mean Piston speed, M.C.R., C.S.R. and overload ratings of engine. Study of heat balance diagram and thermal efficiency and its uses. Means to improve better heat utilization. Thermal efficiency and Mechanical efficiency

UNIT III CONSTRUCTION OF LARGE MARINE PROPULSION ENGINES 9

Construction of Bed Plate, Engine chokes and holding down bolts' arrangement. Construction of 'A 'frames, Cylinder blocks, Tie bolts, Jack bolts. Construction of Piston- Piston rings – Clearances - Cross heads, Connecting rods, Crank shaft, Bearings, Liner – Construction. Cylinder lubrication - Construction of Quills – Wet and Dry Quills - Cylinder cover and mountings. Construction of Cross head and bearings, Connecting rod and bearings - Diaphragm and piston rod gland (Stuffing box)- Construction. Construction and working of Fuel injection pumps-Jerk type and valve type (Sulzer engines), Fuel injectors. Types of liner wear, measurement of clearance in liner and piston.

UNIT IV COOLING, SCAVENGING AND SUPERCHARGING ARRANGEMENTS SCAVENGING SYSTEM 9

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

Turbocharging - Pulse and constant pressure type; merits and demerits in highly rated marine propulsion engines. Turbocharger construction and its details. Comparison of Supercharging with Turbo charging – merits and demerits.

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

UNIT V CAMSHAFT, CRANK SHAFT AND THEIR DRIVE ARRANGEMENT 9

Construction of camshaft and cams - Gear drive – Chain drive - Roller chain construction – Chain tensioning and replacing procedure - Crank shaft – Types - Construction of various types - Materials used - Crankshaft alignment - Method of checking alignment - Crank shaft deflection – Purpose – Procedure of taking deflections and interpretation.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Fuel technology and combustion in I.C. Engines	3
2	Types and characteristics of Marine Diesel Engines	3
3	Construction of Large Marine Propulsion Engines	3
4	Cooling, Scavenging and Supercharging arrangements in Marine Diesel Engines	3
5	Camshaft, Crankshaft and their drive arrangements.	3

TEXT BOOKS:

1. Sanyal D.K, "Principle and Practice of Marine Diesel Engines", 4th Edition, Bhandarkar Publication, Mumbai, 2013.
2. Taylor D.A, "Introduction to Marine Engineering", 2nd Edition, Elsevier, India 2011.
3. REEDS Motor Engineering Knowledge for Marine Engineers by Thomas D Morton and Leslie Jackson published by Adlard Coles Nautical London, 2010.

REFERENCES:

1. Christensen, Stanley G "Lamb's Questions and Answers on The Marine Diesel Engine", 8th Edition, Butter Worth Publications, 2001.
2. Christen Knak, "Diesel Motor Ships Engines and Machinery", 1st Edition, Marine Management Ltd., London, 1990.
3. Marine Diesel Engines by Deven Aranha Shroff Publishers Pvt. Ltd., 2013.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	2		2			2					3	3	3	2
2.	3		3	1					1			3	3	3	
3.	3		3	3	2							3	3	3	
4.	3		3	2								3	3	3	
5.	3		3						2			3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22311 MARINE HYDRAULICS AND FLUID MACHINERY LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To impart knowledge on properties of fluid
- To understand fluid kinematics and dynamics
- Learn Laminar and Turbulent flow of fluid

LIST OF EXPERIMENTS

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

FLUID MACHINERY LAB Centrifugal pumps- Performance characteristics of a constant speed pump, specific speed. Performance characteristics of multistage pump. Characteristics of Impulse and Reaction Turbine - Specific speed and unit quantities. Positive displacement pumps. Performance characteristics of a submersible pump, Jet pump.

1. Flow measurement using Venturimeter
2. Flow measurement using Orificemetrer
3. Flow measurement using Flow nozzle
4. Flow through pipe- Friction factor
5. Flow through Rectangular notch
6. Flow measurement using Rota meter
7. Performance test on Pelton Wheel
8. Performance test on Reciprocating pump
9. Performance test on Centrifugal pump
10. Performance test on Jet pump
11. Performance test on Francis turbine
12. Performance test on Submersible pump
13. Buoyancy experiment- Meta centric height
14. Flow measurement using Pitot tube

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	To understand the flow behaviour of fluids	3
2	To Calculate the frictional losses and Cd of fluids when it passes through various obstructions	3
3	To calculate the performance characteristics of hydraulic pumps and turbines and air compressor	3

REFERENCES:

1. Anthony Esposito, "Fluid Power with Applications",7th Ed. Pearson, 2008
2. Schobeiri, "Fluid Mechanics for Engineers", 1st Ed. Springer, Indian Reprint 2013(Yesdee Publishings Pvt. Ltd.)
3. Shesha Prakash, "Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures", 1st Ed. PHI Learnings Pvt. Ltd., 2011

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1.	3	2										3	3	3	
2.	3	2		2		1						3	3	3	
3.	3	2		2								3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22312 **THERMAL ENGINEERING AND BOILER CHEMISTRY LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

1. To study the performance of IC Engines
2. To study the characteristics of fuels and Lubricants used in IC Engines
3. To study the Performance of steam generator and steam turbine
4. To perform the tests on boiler feed and fresh water

THERMAL ENGINEERING LABORATORY

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

List of Experiments

1. To conduct Performance test on steam turbine
2. To determine dryness fraction of steam using steam calorimeter
3. To conduct performance test on air blower
4. To determine CoP of refrigeration test rig
5. To conduct performance test on air conditioning test rig
6. To determine Flash and Fire point of given oil
7. To determine viscosity of oil using redwoods viscometer
8. To conduct performance test on Diesel engine with AVL setup
9. To conduct heat balance test on Diesel engine setup.

BOILER CHEMISTRY LABORATORY

- Determination of hardness content of the sample of boiler water in ppm in terms of CaCO3.
- Determination of hardness Chloride Content of the sample of water in ppm in terms of CaCO3.
- Determination of alkalinity due to Phenolphthalein, total alkalinity and Caustic alkalinity of the sample of water (in ppm).
- Determination of Phosphate Content of the sample of water.
- Determination of dissolved Oxygen content of the sample of water.
- Determination of sulphate content of given sample of water.
- Determination of pH-value of the given sample of water.
- Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
- Water Analysis (Fresh and sea water)- Chloride, sulphate, hardness
- Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.
- Waste water treatment by adsorption method.

List of Experiments

1. To determine the hardness content of the sample of boiler water in ppm in terms of CaCO3.
2. To determine the chloride content of the sample of water in ppm in terms of CaCO3.
3. To determine the alkalinity due to Phenolphthalein, total alkalinity and Caustic alkalinity of the sample of water (in ppm).

4. To determine the phosphate content of the sample of water.
5. To determine the dissolved Oxygen content of the sample of water.
6. To determine the sulphate content of given sample of water.
7. To determine the pH-value of the given sample of water.
8. Testing of boiler water - Dissolved oxygen, total-dissolved solids, turbidity.
9. Analysis of Water (Fresh and sea water) - To determine chloride, sulphate and hardness content.
10. To determine the Sludges and scale deposit - Silica, volatile and non-volatile suspendedmatter.
11. Waste water treatment by adsorption method.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO No	CO Statements	RBT Level
1	To perform various performance tests on IC engines	3
2	To analyse the characteristics of fuels and Lubricants used in IC Engines	3
3	To analyse the performance of steam generator and steam turbine	3
4	To perform various tests on boiler feed and fresh water and analyse the results	3

REFERENCES:

1. Thermal engineering and boiler chemistry laboratory Manuals
2. Skelly J.D **"**Water Treatment**",** Marine Engineering Practice**,** Vol-2, Part-14**,** IMarEST, London, 2004
3. Mathur, M.L., Sharma, R.P., "Internal Combustion Engines", 7th Ed. Dhanpat rai Publications, Reprint2002
4. Willard W. Pulkrabek, "Engineering Fundamentals of the Internal Combustion Engines", 1st Edition, PHI Learnings Pvt. Ltd., 2011
5. Flanagan, G.T.H, 'Marine Boilers", 3rd Edition, Elsevier, 2015.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3					3	3					3	3	3	
2.	3					3	3					3	3	3	
3.	3					3	3					3	3	3	
4.	3					3	3					3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22401 SOLID MECHANICS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

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

UNIT I CONCEPT OF STRESS 11

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

UNIT II SHEAR FORCE AND BENDING MOMENT 13

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

UNIT III STRESSES IN BEAMS 12

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

UNIT IV SLOPE, DEFLECTION AND TORSION 13

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

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

UNIT V COLUMNS, STRUCTS, CYLINDERS AND PRESSURE VESSELS 11

Columns and struts - long and short columns- Euler's formula for long column – equivalent length – slenderness ratio - Eccentric loaded long and short columns - Rankine Gordon formula, use of Strut

formulae. Thin cylinders and thin spherical shells under internal pressure - change in volume due to internal pressure. Thick cylinders – simple treatment of thick cylindrical walled pressure vessels. Lame's theory, compound cylinders. Thin curved bar, strain energy due to bending, Castiglione's theorem & its application to curved bar, strain energy due to twisting, applied problems.

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Predict the behaviour of the materials for different loading conditions	3
2	Analyse and design the beam based on shear force and bending moment.	3
3	Design the beam based on various stresses and Students will select suitable cross-sections for the beams under different loading conditions	3
4	Calculate the deflections that occurred in beams under different loading conditions, select suitable dimensional parameters for the shafts under torsional loads and design the springs	3
5	Design the column and pressure vessel	3

TEXT BOOKS:

1. Bansal R.K, "A textbook of Strength of Materials", 11th edition, Laxmi Publications (P) Ltd, New Delhi,2010
2. Rajput. R.K. "Strength of Materials", 6 th Edition, S. Chand &Co., New Delhi, 2006

REFERENCES:

1. Beer Johnston, Dewolf Mazurek, "Mechanics of Materials", 8th edition, McGraw Hill Education(India) Pvt.Ltd, New Delhi,2014
2. James M Gere, "Mechanics of Materials", 6th Edition, Cengage Learning India Pvt Limited, Delhi, 2006.
3. Jindal, U.C., "Strength of Materials", 1st edition., Pearson, 2011
4. Rattan S S, "Strength Of Materials", 3rd edition, McGraw Hill Education (India) Pvt.Ltd, New Delhi,2017

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3				3						3	3	3	
2.	3	3				3						3	3	3	
3.	3	3	3			3						3	3	3	
4.	3	3	3			3						3	3	3	
5.	3	3	3			3						3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22402 SHIP CONSTRUCTION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge on Ship terms and stresses built up in ships.
2. To acquaint the students with knowledge on Double bottom, solid floors and Watertight doors
3. To impart knowledge on Fore and aft end arrangements on-board the ships
4. To impart knowledge on Tonnage and Shipyard practice
5. To acquaint the students with knowledge on offshore vessels and Surveys during construction.

UNIT I SHIP TERMS 9

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

UNIT II BOTTOM & SIDE FRAMING 9

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

UNIT III FORE & AFT END ARRANGEMENTS 9

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

UNIT IV FREE BOARD AND TONNAGE 9

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

UNIT V OFFSHORE TECHNOLOGY 9

Drilling ships and Platforms – Supply vessels-DP systems-principle and operations – firefighting arrangement – Pipe laying ships – special auxiliary service ships– Surveys during construction – Periodical surveys for retention of class.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to

CO No	CO Statements	RBT Level
1	Understand the concepts of Ship terms and stresses on-board the ships	2
2	Apprehend the concepts of double bottom, ship floors and watertight doors to work on-board the ships.	2
3	Understand the concepts of Fore and aft end arrangements to work on-board the ships.	2
4	Apprehend the knowledge of Tonnage regulations, shipyard practice to work on-board the ships.	2
5	Understand the concepts of offshore technology to work on-board the ships.	2

TEXT BOOKS:

1. Vikram Gokhale &N.Nanda, "Naval Architecture and Ship construction"4th Edition,2004
2. E.A. Stokoe, "Reed's Ship Construction for Marine Engineers", 6th Edition, ThomasReed Publication, London, 2016.

REFERENCES:

1. A.J. Young, "Ship Construction sketch & Notes", Elsevier Indian edition, 2011.
2. D.J. Eyres "Ship Construction", 7th Edition, Brown Son & Ferguson Ltd. Glasgow Great Britain, 2012.
3. T.V.Ramakrishnan "Marine and Offshore Engineering" Gene-Tech books,2015

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3					3	3		3			3	3	3	
2.	3					3	3		3			3	3	3	
3.	3					3	3		3			3	3	3	
4.	3					3	3		3			3	3	3	
5.	3					3	3		3			3	3	3	

<1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)>

MR22403 MARINE DIESEL ENGINES-II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To make the students to learn about

1. the concept of Marine lubrication
2. the Maneuvering systems, indicator diagrams and power calculations
3. the Governors, medium-speed engines
4. the Engine systems, governors, forces and stresses on engines
5. the Developments in marine engines

UNIT I MARINE LUBRICATION 9

Refining of crude oil-properties and testing of Lubricating Oil-hydrodynamic (fluid film) lubrication - hydrostatic lubrication- boundary lubrication, properties of crankcase oil of large two-stroke engines and trunk type piston engines, bearing lubrication system for large two-stroke engines – cylinder lubrication, Selection of cylinder lubricating oil with appropriate TBN, bearing failures - Causes and remedies. Recent improvements in bearing to avoid failures.

UNIT II MANEUVERING SYSTEMS, INDICATOR DIAGRAMS AND POWER CALCULATIONS 9

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

UNIT III GOVERNERS, MEDIUM SPEED ENGINES 9

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

UNIT IV ENGINE SYSTEMS, GOVERNORS, FORCES AND STRESSES ON ENGINES 9

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

UNIT V DEVELOPMENTS IN MARINE ENGINES 9

Comparison in construction of Sulzer RND & RTA engines, Common rail fuel injection system, electronic injection systems, improvement in design of fuel valves and turbo charger RT-FLEX Camshaft less intelligent engines MAN – B&W ME type - engines, improvement in design of exhaust valves, Alfa-lubrication for increased

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the students will have knowledge of

CO No	CO Statements	RBT Level
1	Marine fuel injection pumps and its applications.	3
2	Maneuvering systems of various marine diesel engines.	3
3	Forces and stresses in slow speed and medium-speed engines.	3
4	Construction and operation of various Marine slow-speed engines.	3
5	New developments in marine diesel engines.	3

TEXT BOOKS:

1. C.C Pounder, "Marine Diesel Engines", 8th Edition, Butter worth – Heinemann, Scotland, 2004.
2. D.A. Taylor, "Introduction to Marine Engineering", 2nd Edition, Elsevier, India – 2011.
3. Christen Knak, "Diesel Motor Ships Engines and Machinery", 1st Edition, Marine Management Ltd., London, 1990.
4. John Lamb, "Marine Diesel Engines", 8th Edition, Butter worth – Heinemann, London, 2005.

REFERENCES:

1. S. H. Henshall, "Medium and High-Speed Diesel Engines for Marine Use", 1st Edition, Institute of Marine Engineers, Mumbai, 1998.
2. A.B. Kane, "Marine Internal Combustion Engines", 1st Edition, Shroff Publishers & Distributors, Mumbai, 1984.
3. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 4th Edition, Bhandarkar Publication, Mumbai, 2013.
4. VL Maleev, "Internal Combustion Engines", 2nd edition, McGraw-Hill book co., Singapore, 1987.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3		3										3	3	
2.		3	3										3	3	
3.			3										3	3	
4.	3			3									3	3	
5.		3	3										3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

EE22451 **MARINE ELECTRICAL MACHINES – II**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Acquire an insight on constructional and operational aspects of electrical measurements
2. Analyze the Alternator performance and its characteristics
3. Familiarize the concept on Principles of operation and construction of Synchronous motor
4. Understand Principles of operation and construction details of induction machines
5. Impart knowledge on Speed control and trouble shooting in induction machines.

UNIT I ELECTRICAL MEASUREMENTS AND CONTROL SYSTEM 8

Measurement of frequency and phase difference – measurement of resistance, inductance and capacitance by Bridge method – magnetic measurement - V-I , I-V, P-I and I-P convertors- location of cable faults - function, performance test and configuration - monitoring system - automatic control devices (process control and system control)

UNIT II ALTERNATORS 10

Alternators – construction of salient pole and cylindrical rotor types – e.m.f equation – Relation between frequency and number of poles and speed of a machine – armature reaction – voltage regulation – load characteristics – open circuit and short circuit tests – e.m.f and m.m.f. methods – synchronization - parallel operation of alternators – load sharing – brushless alternator – static excitation system.

UNIT III SYNCHRONOUS MOTORS 9

Principle of operation – torque equation – operation on infinite bus bars – V and Inverted V curves – power input and power developed equations – starting methods – current loci for constant power input, constant excitation and constant power developed – hunting – natural frequency of oscillations – damper windings- synchronous condenser – merits and limits of synchronous motor over others.

UNIT IV INDUCTION MACHINES 9

Three phase induction motor – construction and principle of operation – theory of rotating magnetic field – relation between slip, rotor e.m.f. and frequency - starting torque and maximum running torque - torque-speed characteristics – cogging and crawling – relationship between rotor copper loss and slip – equivalent circuit – effect of change in frequency and supply voltage of motor – induction generator – single phase induction motor – principle and constructional details.

UNIT V CONTROL OF INDUCTION MACHINES 9

Motor control and protection - speed control – voltage control, frequency control and pole changing – cascaded connection- V/f control – slip power recovery scheme - motor speed control by Insulated Gate Bipolar Transistor (IGBT) and thyristor – motor starting methodologies – need for starting – types of starters – DOL, rotor resistance, autotransformer and star- delta starters -starting of special high torque induction motors — design features and system configuration of operational control equipment for electrical motors- braking of three phase induction motor: plugging, dynamic braking and regenerative braking – failure and repairs of electrical machines.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Identify the measuring instruments and control system for marine application.	2
2	Analyze the performance characteristics of Alternators.	4
3	Understand the principles of operation and construction details of synchronous motor.	2
4	Analyze the principles of operation, construction details and performance of induction motor.	4
5	Analyze the speed control methods and trouble shooting in induction motor.	4

TEXT BOOKS:

1. W. Laws, 'Electricity applied to Marine Engineering', 4th edition, The Institute of Marine Engineers, London, 1998.
2. B L Theraja & A K Theraja, 'A Textbook of Electrical Technology Volume I &II' (Multicolour 23rd Edition), S. Chand Publishers, Delhi, 2005.

REFERENCES:

1. IHerman, 'Electrical Transformers and Rotating Machines', 3rd Ed. Cengage, First Indian Reprint, Yesdee Publishings Pvt. Ltd, 2012.
2. Edmund GR Kraallavers , 'Advanced Electro-technology For Marine Engineers', 2nd Edition, Reeds Vol 07, Adlard Coles Nautical, London,2010
3. J.B. Gupta, 'Theory and Performance of Electrical Machines', 15th Edition., S.K.Kataria and Sons, 2022.
4. Berde M.S., 'Electric Motor Drives', 1st Edition, Khanna Publishers, Mumbai, 1995.
5. Uppal S.L., 'Electrical Power', 13th Edition, Khanna publishers, Mumbai, 2002.
6. Charles, I. Hubert, 'Electric Machines', 2nd Edition, Pearson, 2009.
7. Ghosh, S., 'Electrical Machines', 2nd Edition, Pearson, 2012.
8. https://nptel.ac.in/courses/108105131
9. https://nptel.ac.in/courses/108106072
10. https://nptel.ac.in/courses/108102146

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3	1		1	1	1			1		3	3		1
2.	3	3	2	1	2	1	1			1		3	3		1
3.	3	3	2	1	2	1	1			1		3	3		1
4.	3	3	1		1	1	1			1		3	3		1
5.	3	3	2	1	2	1	1			1		3	3		1

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22404 MARINE AUXILIARY MACHINERY -II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart the knowledge on construction and working of oily water separator, Sewage treatment plant and Incinerator.
2. To impart the knowledge on construction and operation of Purifier, Air compressor and other deck machinery on board the ship.
3. To acquaint the students with knowledge on various shaft alignments and its methods, construction and operation of thrust block, stern tube, etc.
4. To impart the knowledge on Dry-docking techniques and maintenance of rudder, propeller, bow thruster, etc.
5. To introduce the importance of maintenance of machinery planned maintenance, troubleshooting of machineries etc.

UNIT I OPERATION AND MAINTENANCE 9

Construction and operation of oily water separator both manual and automatic bilge system. Maintenance to be carried on oily water separator, Construction and working of incinerator, sewage treatment plant, Maintenance to be cried on the incinerator and the STP. Discharge regulation on garbage, sewage and treated bilge water onboard the ship.

UNIT II THEORY OF OIL PURIFICATION, AIR COMPRESSOR AND DECK MACHINERY 9

Construction and operation of fuel and lubricating oil purifier. Difference between purifier and clarifier. Self desludging operation. Maintenance and Trouble shooting of the purifier. Construction and operation of air compressor on board the ship. Maintenance and operation of emergency air compressor. Regulation with respect to emergency air compressor manual type, Free air delivery, Bow thruster, maintenance and operation, maintenance of deck machinery, cargo winches, mooring winches, operation and maintenance of free fall davit launching lifeboat.

UNIT III METHODS OF SHAFT ALIGNMENT 9

Need for the shaft alignment and different methods to find the shaft alignment. Construction and operation of thrust block, Maintenance to carried on the thrust block, intermediate shaft, construction and operation of stern tube, Oil cooled and water cooled stern tube, Stern tube sealing glands, stresses in the shafting, i.e. intermediate shaft, thrust shaft, Screw shaft.

UNIT IV DRY DOCKING 9

Preparation and procedure to dry docking the vessel, maintenance of hull, underwater fitting and the machine maintenance and repair during the dry docking removal, Maintenance of the rudder and the Propeller, Removal and maintenance of tail shaft along with bearing. Methods of ship dry-docking eg. Slipways, Dry-docks, Ship lift system etc. Safe working practice during dry dock works. Purpose of dry- docking, Rules and regulation for the dry docking, Time interval.

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

Safe working practices and maintenance of the machinery, dealing with the wear and tear, both electrical and mechanical, alignment of components, temporary and permanent repairs. Identifying faulty machinery, Action to

prevent damage during machinery malfunction. Planned maintenance, preventive maintenance, condition monitoring, principles of tribology, risk assessment trials and safe working practices.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Know the construction and working of oily water separator, Sewage treatment plant and Incinerator.	2
2	Understand the construction and operation of Purifier, Air compressor and other deck machinery on board the ship.	2
3	Know various shaft alignments and its methods, construction and operation of thrust block, stern tube, etc.	2
4	Understand the purpose of Dry-docking and its techniques, maintenance of rudder, propeller, bow thruster, etc.	2
5	Understand the importance on machinery maintenance, planned maintenance, troubleshooting of machineries etc.	2

TEXT BOOKS:

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

REFERENCES:

1. Wood yard and Doug, "Pounders Marine Diesel Engine" 7th edition, Butterworth's Heinemann Publication, London 2001.
2. Vikram Gokhale, N. Nanda, "Advanced Marine Engineering Knowledge Vol. II", 2nd Edition, Engineer Enterprices, Mumbai, 2001.
3. MARPOL 73/78, IMO Publication, 2001.
4. Heinz P Bloch, Fred K Geitner," Machinery Component Maintenance and repair" 3rd edition, Elsevier, 2010.
5. "Pumping and Piping Diagram", IME Publication 1999.
6. DK Sanyal, "Principle and Practices of marine diesel engine" 2nd edition, Bhandarkar Publication, Mumbai, 1998.

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3	3	3	3							3	3	3	
2.	3	3	3	3	3							3	3	3	
3.	3	3			3							3	3	3	
4.	3			3	3							3	3	3	
5.	3	3	3	3	3							3	3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

GE22451	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To study the nature and facts about environment, energy flow in an ecosystem and biodiversity.
2. To study the various types, causes of pollution, its control and solutions to environmental problems.
3. To study and understand the various types of renewable sources of energy and its applications.
4. To know the importance of sustainability management and practices
5. To learn the importance of zero waste concept and green engineering for environmental management.

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and energy flow– food chains, food webs and ecological pyramids, ecological succession. Biodiversity- types- genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: fragmentation and habitat loss, poaching of wildlife, human-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition, causes, effects and preventive measures of air, water and soil pollution. Marine and thermal pollution - causes, effects and control measures. Nuclear pollution- Sources, effects and control measures. Disposal of radioactive wastes (Nuclear hazards). Pollution case studies. Role of an individual in prevention of pollution. Solid, hazardous and E-waste management. Occupational health and safety management system (OHASMS). Environmental protection, Environmental protection acts, categorization of spices according to IUCN.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy resources: Growing energy needs, Non renewable resources – types, uses. Energy management and conservation - New energy sources, Need of new sources - geo suitability of establishing renewable energy sources, different types new energy sources. Applications of hydrogen energy, ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Role of an individual in conservation of energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols, Sustainable Development Goals-targets, indicators and intervention areas - Principles of green chemistry,Climate change- Global,Regional and local environmental issues and possible solutions-case studies - Role of non-governmental organization,Concept of carbon credit, carbon footprint - Environmental management in

industry-A case study,

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, circular economy, ISO 18000 series, material life cycle assessment, environmental impact assessment. Wasteland reclamation,Sustainable habitat: green buildings, green materials, energy efficiency and energy audit, sustainable transports. Energy cycles, carbon cycle, emission and sequestration, Green engineering: sustainable urbanization- socio-economical and technological change. Rain water harvesting, watershed management environmental ethics: Issues and possible solutions.

TOTAL: 45

COURSE OUTCOMES:

CO	After completion of this course, the students will be able to	RBT LEVEL
1.	Describe the importance of ecosystems, biodiversity and its conservation.	3
2.	Classify the different types of pollution, their effects and controlmeasures.	4
3.	Implement the energy management and conservation.	4
4.	Describe the sustainable development, its importance and social issueslike climate change	3
5.	Recognize the importance of zero waste concept, circular economy, EIAand Green engineering for environmental management.	4

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 7th Edition, NewAge International Publishers, 2022.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, NewDelhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and CasE Studies, Prentice Hall.
4. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design anddevelopment, Cengage learning.
5. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
6. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House,Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, NewDelhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press,3rd edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 3rd edition, 2021.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**					**3**	**3**								
CO2	**3**					**3**	**3**								
CO3	**3**	**1**	**1**			**3**	**3**								
CO4	**3**					**3**	**3**	**3**				**1**			
CO5	**3**					**3**	**3**	**3**				**1**			

1-Weak; 2-Moderate; 3-Strong.

MR22405 MANUFACTURING TECHNOLOGY FOR MARINE ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The main learning objective of this course is:

1. To explain the working principles of various metal joining processes.
2. To provide the knowledge on the working principles of various metal casting processes.
3. To discuss the working principles of surface finishing processes.
4. To render the knowledge on the working principles of sheet metal forming process.
5. To get familiarize with the working principles various conventional machning processes.

UNIT I METAL JOINING PROCESSES 9

Classification plastic welding, fusion welding, solid phase welding and sub classification. Type of Gas welding – Flame characteristics- Study of power sources, electrodes, welding symbols - processes and applications: SMAW, GTAW, GMAW, electro gas welding and Electro Slag, resistance welding. Gas welding, brazing and soldering. Under water welding, Friction welding, Friction Stir welding, Plasma Arc welding, Cold Metal Transfer welding- Wire Arc Additive manufacturing- Defects and Inspection of welded joints- Applications of welding in ship building industry.

UNIT II CASTING PROCESSES 9

Sand casting, pattern and core making, moulding process - sand properties, melting furnaces – pit furnace and electric furnaces. Special casting processes – shell, investment, die casting – pressureand gravity types – squeeze casting - defects in casting - Plastic moulding – injection and blow moulding, and moulding – testing and inspection-Application of casting in shipping industry.

UNIT III SURFACE FINISHING PROCESSES 9

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

UNIT IV METAL FORMING PROCESSES 9

Hot and cold working processes – rolling, forging, drawing and extrusion processes, bending, hot spinning, shearing, tube and wire drawing, cold forming, shot peening. Sheet metal working – blanking, piercing, punching, trimming, bending – types of dies – progressive, compound and combination dies. High-energy rate forming processes- Applications of metal forming processes in ship building industry.

UNIT V MACHINING PROCESSES 9

Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning. Drilling and boring - classification, specification, cutters speed feed, machining time parts and description of parts parts-boring machines- jig boring machine– Milling - classification, principle, parts- specification milling cutters, selection of milling processes, milling processes and operations – Introduction to CNC machines and CAD/CAM- Introduction to 3D printing.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	To know the different welding process and select the appropriate process for different applications	3
2	To have the knowledge of different casting process and select the appropriate process for different applications.	3
3	To select the Grinding Wheel and process based on the surface finish required.	3
4	To have the depth understanding of various hot working and cold working process.	3
5	To select the appropriate machines or machines tools for different requirements .	3

TEXT BOOKS:

1. Jeffus, Welding and Metal fabrication",1st Ed. Cengage, Indian reprint-Yesdee PublishingsPvt.Ltd. 2012
2. Rao.P.N., "Manufacturing Technology, Metal Cutting and Machine Tools", Tata McGraw-Hill,2000.
3. Shan, H.S., " Manufacturing processes", Vol I, 1st Ed. Pearson, 2013
4. Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology (SI Edition), Pearson Publications, 2018.
5. A. K. Hajra Choudhury, Samir Kumar Hajra Choudhury, Elements of Workshop Technology: v., Media Publishers & Promoters,India

REFERENCES:

1. Jain K.C. Agarwal, L.N. "Metal Cutting Science and Production Technology",1st edition, Khanna Publishers, 1986.
2. Chapman W.A.J., "Workshop Technology", Vol. II, Arnold Publishers,1972
3. H.M.T., "Production Technology", Tata McGraw-Hill, New Delhi, 2000.
4. Timings, "Fabrication and Welding Engineering', Elsevier, Indian Reprint –Yesdee Publishings Pvt. Ltd. 2011
5. Kemp & Young, "Ship construction: Sketches and Notes", 1st Ed. Standfor Maritime Limited, 1982.

At the end of the course, add the course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	3									3			
2.	3	3	3									3			
3.	3	3	3									3			
4.	3	3	3									3			
5.	3	3	3									3			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22411 APPLIED AND SOLID MECHANICS LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

To supplement the theoretical knowledge gained in the strength of materials for marine engineers and Material Science and Engineering with practical testing for determining the strength of materials under externally applied loads.

STRENGTH OF MATERIALS LAB

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

APPLIED MECHANICS LAB

1. Impact test.
2. Double shear Test in U.T.M.
3. Load measurement using load indicator, load coils.
4. Fatigue test.
5. Strain measurement using Rosette strain gauge
6. Diameter measurement of natural fiber using optical microscopy

List of Experiments

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

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	Determine the various mechanical properties like hardness, strength (Tensile, Compressive, and impact), and endurance limit of the given material.	3
2	Evaluate the strain of a cantilever beam and verify the Maxwell theorem using a simply supported beam.	3
3	Evaluate the stiffness and spring index of alloy spring steel using compression and tension test	3
4	Calibrate the UTM using the load cell	3
5	Find out the diameter of the given natural fiber using optical microscopy.	3

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

COURSE ARTICULATION MATRIX

COs	POs												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	3				3							3	3	
2.	3	3				3							3	3	
3.	3	3				3							3	3	
4.	3	3				3							3	3	
5.	3	3				3							3	3	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MR22412 ADVANCED WELDING TECHNIQUES, LATHE AND SPECIAL MACHINE SHOP

L	T	P	C
0	0	6	3

OBJECTIVES

1. To develop the skills of the students in basic arc welding processes.
2. To develop the skills of the students in advance d welding process and wire arc additive manufacturing.
3. To develop the skill of the students in various machining techniques

WELDING TECHNIQUES **45**

WELDING - Exercises in Electric Arc welding, Metal Inert Gas (MIG) welding and Tungsten Inert Gas (TIG) Welding

Simple exorcises in Cold Metal Transfer (CMT) Welding and Wire Arc Additive Manufacturing Process.

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

List of Experiments

Welding Techniques

1. Studying of various welding methods
2. Butt joint in downward and horizontal position using Manual metal arc welding
3. Lap Joint in downward and vertical position using Manual metal arc welding
4. Lap Joint in vertical and horizontal position using Manual metal arc welding
5. Butt joint using Metal Inert Gas Welding
6. But Joint using Robotic Cold metal transfer welding
7. Simple exercises in Wire Arc Additive manufacturing exercises
8. Joining of pipe fittings using welding

LATHE & SPECIAL M/C SHOP **45**

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

List of Experiments

LatheandSpecialMachineShop

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

TOTAL : 90 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

CO No	CO Statements	RBT Level
1	To carry out repair of ship machinery and components by arc welding process	3
2	To operate advance d welding machines and carry out th eadvanced processes.	3
3	To make machine components using Lathes and Special machinessuch as milling, grindingand slotting machine etc.,	3

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	3									3			
2.	3	3	3									3			
3.	3	3	3									3			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

SEMESTER V

MR22501 METROLOGY, INSTRUMENTATION AND AUTOMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To acquaint the working of linear, angular, form measuring instruments.
2. To introduced the working principle and applications of devices for measurement of temperature, pressure, flow, level, speed and torque, etc.
3. To introduce to basics of control system
4. To acquaint the working of Control system equipment.
5. To acquaint knowledge about Automation and Controls fitted in ships

UNIT I LINEAR, ANGULAR AND FORM MEASUREMENT 9

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

UNIT II INSTRUMENTATION 9

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

UNIT III BASICS OF CONTROL SYSTEM 9

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

UNIT IV CONTROL SYSTEM EQUIPMENT 8

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

UNIT V APPLICATION OF CONTROLS ON SHIPS 10

Functions and mechanism of automatic control for main engines and auxiliary machinery - Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery. Design features and system configuration of automatic control equipment and safety devices for the following - General Requirements, Main Engine, Generator and distribution system, Steam boiler. Application of computers in ship.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Understand the principles behind and use linear, angular and form measuring instruments.

2. Understand the principles behind various devices for measuring temperature, pressure, flow, speed, torque, vibration, humidity etc.
3. Appreciate the Basics of control systems
4. Appreciate and understand the importance and use of Electrical, Electronics, Pneumatic and Hydraulic control systems and its equipment
5. Understand the applications of control systems on board ships.

TEXT BOOKS:

1. M. Mahajan, "A Text Book of Metrology", 2nd Edition, Khanna Publishers, New Delhi 2017.
2. Jain R.K. "Engineering Metrology",22nd Edition, Khanna Publishers, New Delhi, India 2022
3. B.G. Smith, "Application of Automatic Machinery and Alarm Equipment in Ships", Revised Edition, Marine Engineering Practice, Volume 1, Part 6, IMarEST, London 2022.

REFERENCES:

1. Bhattacharya, S.K., "Control System Engineering", 2nd Edition, Pearson, New Delhi 2015.
2. Bolton, "Control Systems", 1st Edition. Elsevier, Indian reprint 2012(Yesdee Publishing, Chennai, India)
3. L.F. Adams, "Engineering Instrumentation and Control", 1st Edition, English Language Book Society (ELBS), Hodder, Stoughton, Great Britain, 1984.
4. Peter Harriott, " Process Control", 26th reprint, Tata McGraw Hill Publishing Co. Ltd., 2005
5. Sinclair, "Sensors and Transducers", 3rd Ed. Elsevier, Reprint 2011 (Yesdee Publishing, Chennai, India)

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3	1										3	3	3	
2.	3	1										3	3	3	
3.	3	1										3	3	3	
4.	3	1										3	3	3	
5.	3	1										3	3	3	

MR22502 SHIP'S FIRE PREVENTION AND CONTROL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the basic concepts of SOLAS Chapter II/II with respective to fire safety construction on board the ship.
2. To enhance the knowledge on various modern principle methods to detect fire and knowledge them with respective to the fire safety alarm's and system.
3. To acquaint the student with various classes of fire extinguishing method breathing appliances, Fire suit etc.
4. To provide the knowledge on fire pump, extinguisher and extinguishing system fitted on board the ship.
5. To Knowledge the special safety measures to counteract fire in different kinds of ship.

UNIT I SOLAS AND GENERAL FIRE PREVENTION REQUIREMENTS 9

Fire triangle, various class of fire, SOLAS convention and its requirements with respect to construction and design of ships for the safety of ship from fire hazard, Bulk heads Class A, B types etc. Fire control plan, Fire signal, Muster station, Various classes of fire Various fire extinguishing systems fitted on board the ship, Fire test, and requirements of the Emergency Escape routes in the engine room, Electrical installations and Ventilation system, Statutory requirements for firefighting systems Various equipment's onboard the ship, Fire doors and fire zones.

9

UNIT II SAFETY PRECAUTION IN CARGO SHIPS AS PER SOLAS

Fire safety precautions to be taken at cargo ships, Fire safety precautions to be considered for tankers, Requirement for the fire safety systems in passenger ships, Types of heat detector, flame detector, smoke detector, Principle and working. Detectors and its SOLAS requirements to install the detectors onboard the ship. Selection of fire detectors and alarm systems - Commissioning the detector, periodic testing of detector sensors and detection system Sprinkler system on board the ship, Description of various systems fitted on ships and their operational limits as per SOALS

10

UNIT III CLASSES OF FIRE AND EXTINGUISHING METHODS, FIRE DRILLS

Significance of using suitable firefighting extinguisher during fire Control of class A, B, C and Class-D fires Combustion products & their effects on life safety. Action required for extinguishing fire in accommodation, machinery spaces, Action required to extinguish fire in Boiler rooms, cargo holds, galley etc. Firefighting system at port and dry dock, Tug boat acting as salvage, Thermal protective suit, EEBD, SCBA, SOLAS requirements -Donning of SCBA and EEBD. Procedure for re-entry after putting off fire, Rescue operations carried on affected compartments, First aid, Fire organization on ships, Shipboard organization for fire and emergencies, Combustion products and their effects on life safety, Fire drill- frequency, requirements, Duties of personnel on board the ship during fire, human behavior.

9

UNIT IV FIRE PUMP, EXTINGUISHER AND FIRE EXTINGUISHING SYSTEM

General Fire pumps, Emergency fire ump and its functional requirements, Fire Hydrants and fire hoses and their operational limits, international shore couplings and its dimensions, Fire nozzle and Fire Axe, Fire control equipment's, construction and Operation of different types of portable extinguisher and semi portable firefighting extinguishers. Different kinds of fixed fire extinguishers installed on board the ship, Advantages and disadvantages of various fixed firefighting extinguisher. Properties of chemicals used, Water mist fire suppression system, Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use.

8

UNIT V SPECIAL SAFETY MEASURES

Special safety measures for preventing, fighting fire in tankers, Special safety measures for preventing, fighting fire in chemical carriers, Special safety measures for preventing fighting fire in

oil rigs, Special safety measures for preventing, and fighting fire in supply vessels. Special safety measures for preventing, fighting fire in fire fighting ships Safe

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Acknowledge the basic concepts of SOLAS Chapter II/II with respective to fire safety construction on board the ship.
2. Understand the various modern principle methods to detect fire and knowledge them with respective to the fire safety alarm's and system.
3. Gain knowledge on various classes of fire extinguishing method breathing appliances, Fire suit etc.
4. Gain knowledge on fire pump, extinguisher and extinguishing system fitted on board the ship.
5. First aid procedure, safe working practice on board ship.

TEXT BOOKS:

1. Frank Rush Brook, "Fire Aboard", 3rd Edition, Brown, son & ferguson Ltd., Glassgow 1988. 2. M.G. Stavitsky, V.I. Vostryakov, M.F.Kortunov, V.I. Martynenko & V.M. Sidoryok.

2. "Fire Fighting Aboard ships", Vol. I & Vol. II, Structural Design and Fire Extinguishing System, 1st edition, published by Gulf publishing company, Houston, London, 1983. 3.

3. D.G. Shipping, Fire Fighting Appliances Rules (1969/1990), 3rd edition published by Bhandarkar Publications, Mumbai, 1996

REFERENCES:

1. IMO, SOLAS (Safety of Life At Sea) 3rd Edition, International Maritime Organization London, UK, 2001.

2. Leslie Jackson, Reed's General Engineering Knowledge for Marine Engineers Vol.8, 4th Edition, Thomas Reed publication, Great Britain, 1986 3. Gupta R.S.

3. "A Hand book of fire Technology" 2nd Ed, University press, 2011.

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO-2	PSO-3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3											3	3	3	3
2.	3		3			3						3	3	3	3
3.	3	3		3		3	3		3	3		3	3	3	3
4.	3	3	3	3		3			3			3	3	3	3
5.	3	3		3		3			3			3	3	3	3

MR22503 PROFESSIONAL ETHICS FOR MARINE ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce diverse ethical theories for students' analysis of marine engineering dilemmas.
2. To equip students with tools for ethical decision-making in real-world maritime scenarios.
3. To acquaint students' critical thinking, integrity, and responsibility for sound maritime engineering decisions.
4. To ensure students understand global and local regulations for ethical professional conduct in the maritime field.
5. To make understand ethical responsibility in students, empowering them for positive contributions to the maritime industry and society.

UNIT I INTRODUCTION TO PROFESSIONAL ETHICS IN MARINE ENGINEERING 9

Frameworks of deontology, utilitarianism, virtue ethics - Application in maritime dilemmas - Practical utilitarian approaches - Virtue Ethics in Maritime Sector - Addressing unique challenges role - Foundational ethical principle exploration - Concept of application in engineering - Respect in Maritime Profession - Development of norms, codes overview.

UNIT II ETHICAL ISSUES IN MARITIME OPERATIONS 9

Environmental Impact Assessment - Safety Protocol Adherence - Risk Management Strategies - Regulatory Compliance Review - Technological Innovation Ethics - Crew Welfare Considerations - Emergency Response Preparedness - Stakeholder Communication Ethics - Legal and Ethical Obligations.

UNIT III PROMOTING ETHICAL DECISION-MAKING 9

Critical Thinking Development - Ethical Framework Introduction - Case Study Analysis - Role-Playing Scenarios - Group Discussions Facilitation - Professional Responsibility Reinforcement - Ethical Dilemma Exploration - Decision-Making Practice - Reflective Debates and Analysis.

UNIT IV MARITIME ETHICAL REGULATIONS 9

Global Regulations Overview - Local Legislation Examination - Ethical Code Analysis - Compliance Training Sessions - Case Study Applications - Industry Standards Review - Legal Framework Assessment - Implementation Strategies Discussion - Ethics Policy Development.

UNIT V ETHICAL RESPONSIBILITY EMPOWERMENT 9

Introduction to Ethical Responsibility - Importance and Significance - Real-world Applications - Case Study Analysis - Industry Impact Discussion - Societal Contributions Exploration - Professional Development Strategies - Leadership in Ethical Practice - Positive Impact Reflection.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Analyse marine dilemmas using diverse ethical theories.
2. Provide tools for ethical decisions in maritime scenarios.
3. Foster critical thinking, integrity, and responsibility in engineering.
4. Ensure understanding of global maritime ethical regulations.
5. Empower positive maritime and societal contributions.

TEXT BOOKS:

1. "Ethics in Engineering" by Surendra Singh
2. "Professional Ethics and Human Values" by R.S. Naagarazan and S. Lakshmi Publications
3. "Engineering Ethics" by J. S. Rao

REFERENCES:

1. "Engineering Ethics: Concepts and Cases" by Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins
2. "Ethics, Technology, and Engineering: An Introduction" by Ibo van de Poel and Lambèr Royakkers
3. "Introduction to Engineering Ethics" by Mike W. Martin and Roland Schinzinger
4. "Marine Engineering Ethics and Etiquette" by J. K. Sharma
5. "Engineering Ethics: An Industrial perspective" by G. M. Misra

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	1							3						3	
2.		2						3						3	
3.								3	2	1				3	
4.	2							3					3	3	
5.							3	3					3	3	

<Foot Note has to be given about the strength of correlations here>

MR22711 MARINE PROPULSION AND AUXILIARY MACHINERY OVERHAULING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

1. The objective of the overhauling Laboratory is to acquaint the students with the basic safety precautions to be observed while working on various machinery.
2. The students should be able to select correct type and size of tools to be used for the dismantling of various marine equipment
3. The students should be able to carry out overhauling of main engine, auxiliary engine andauxiliary machinery
4. The students should be able to carry out overhauling of auxiliary engine
5. The students should be able to carry out overhauling of auxiliary machinery

MAIN ENGINE

1. Dismantle and assembly of plate type heat exchanger.

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

3. Inspection of crankcase and measurement of bearing clearance.

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

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

AUXILIARY ENGINE

1. Study of Turbo-charger.

2. Study of Cylinder Head construction.

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

AUXILIARY MACHINERY

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

2. Dismantle and assembly of Screw pump.

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

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

5. Dismantle and assembly of various valves and filters.

6. Study of Cargo-oil pump, Fresh water generator and Purifier.
7. Study of sewage treatment plant and Incinerator.

TOTAL: 60 PERIODS

OUTCOMES:

- At the end of the course, the students are expected to have the ability to dismantle, clean, repairand re-assemble the equipment associated with Main engine.

- At the end of the course, the students are expected to have the ability to dismantle, clean, repairand re-assemble the equipment associated with Auxiliary engine.

- At the end of the course, the students are expected to have the ability to dismantle, clean, repairand re-assemble the equipment associated with auxiliary machinery.

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

REFERENCE BOOKS:

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

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

REFERENCE MANUALS:

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

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

3. Operation, Maintenance manuals for various auxiliary machinery AIR COMPRESSOR—HV 2/220 DELIVERY 185m3/Hr , CENTRIFUGAL PUMP NIP125B-NLX CAPACITY 160 m3/Hr of the vessel MT TORM GUNHILD.

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	2					2						3	2	2	
2.	2					2						3	2	2	
3.	2					3						3	2	2	
4.	2					3						3	2	2	
5.	2					2						3	2	2	

<Foot Note has to be given about the strength of correlations here>

MR22512 MECHANICAL MEASUREMENTS & INSTRUMENTATION LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

To introduce the use of various measuring instruments and the method of measurements using the instruments.

A.MEASUREMENT LABORATORY

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

List of Experiments

1. Use of precision measuring instruments like micrometer, vernier, height and depth gauges, surface plate, etc.
2. Checking dimensions of a part using slip gauge.
3. Use of sine bar for measuring angles and tapers.
4. Measurement of angles of oblique drilled holes and V Block.
5. Measurement of tooth thickness by gear tooth vernier and profile projector.
6. Measurements of thread parameters using floating carriage micrometer.
7. Testing squareness of a try square using slip gauges.
8. Measurement of angles of Dovetail.
9. Use of pneumatic comparator
10. Checking straightness of a surface plate using autocollimator.
11. Bore measurement-using spheres
12. Angle measurement using Bevel Protractor
13. Measurement of surface roughness using roughness tester

B. INSTRUMENTATION LABORATORY

- Pressure measuring devices-pressure and vacuum gauge calibration.
- Temperature measuring devices like Platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
- Speed measuring devices like tachometer, stroboscope, etc.
- Force measuring devices, load cells and proving rings.
- Torque measuring devices

- Study and use of strain, displacement devices-strain gauge indicator, LVDT.
- Study and use of velocity and acceleration-accelerometer.
- Study and use of vibration devices-vibrometer

List of Experiments

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

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students will be able to:

- Use the different types of measuring equipment/ instruments
- Understand the method of measurements using the instruments

REFERENCES:

1. Lab manuals.
2. Jain R.K. "Engineering Metrology", 22nd Edition, Khanna Publishers, New Delhi, India 2022
3. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 7th edition 2018.

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3											3	3	3	
2.	3											3	3	3	

SEMESTER VI

MR22611 MARINE WORKSHOP PRACTICES AND AFLOAT TRAINING

L	T	P	C
0	0	16	16

COURSE OBJECTIVES:

1. To Understand the types and functions of valves, pipes, and pumps used in marine systems.
2. To Understand the operational aspects of navigating, maneuvering, and maintaining the hull integrity during various maritime activities.
3. To Understand the importance of preventive maintenance schedules and safety protocols for auxiliary machinery.
4. To understand the design and operation of ship power generation and distribution systems.
5. To Understand safety protocols and regulatory requirements related to electrical machinery operation onboard ships.

UNIT I Valves and Pipes, Pumps 240

Introduction to the valves, classification of valves, constructional details of Globe valves, Gate valves, Ball valves, Pneumatic control valve, Cock, Butterfly valve, Pickling, Pipe bending, Flange, Pipe cutting, Painting, internal galvanizing coating.

UNIT II Hull plates and Operation 240

Hull plating's, stowing, cutting – plasma cutting, gas cutting, CNC cutting, treatment, welding, bending of plates, plate preparation- blasting- sand blasting, water blasting, shot basting. Plates marking, safety precautions

UNIT III Auxiliary Machinery overhauling 240

Fresh water generator, Heat exchanger- shell and tube heat exchanger, plate type heat exchanger, air compressor - Tandem type compressor, reciprocating Multistage air compressor, Refrigeration air compressor, boiler overhauling and inspection, Purifier overhauling, inert gas system, oily water separator over hauling inspection.

UNIT IV Ship power system 240

Ship power system, Diesel engine auxiliary overhauling, propulsion, shafting, stern tube, Rudder, propeller, main engine, unit overhauling, crankcase inspection, crank shaft deflection, liner calibration, exhaust valve overhauling, tappet clearance, fuel injector, fuel injector testing, fuel pump, fuel pump testing, overhauling of duplex filter, back flush filter.

UNIT V Electrical Machines 240

Electrical power distribution system, Transformer, MCB, ACB, MSB, ESB, Insulation, Earthing, Generator – AVR, Rectifier, Alternator, Brushless alternator, Electrical generator with commutator, Synchronisation of generator.

TOTAL:1200 PERIODS

OUTCOMES:

1. Demonstrate a comprehensive understanding of the principles, components, and systems involved in marine engineering, including valves, pipes, pumps, hulls, auxiliary machinery, ship power systems, and electrical machines.
2. Apply analytical skills to assess and troubleshoot issues related to valves, pumps, hull structures, auxiliary machinery, power systems, and electrical machines onboard ships.
3. Develop proficiency in the maintenance, repair, and overhauling of various marine engineering systems, including conducting inspections, identifying faults, and implementing corrective measures.
4. Evaluate the operational efficiency of ship systems and machinery, identifying opportunities for optimization and enhancement to ensure smooth and reliable vessel operation.
5. Understand and adhere to safety protocols, regulations, and industry standards governing marine engineering practices to ensure compliance and mitigate risks associated with ship systems operation and maintenance.

TEXT BOOKS:

1. "Marine Engineering: Principles and Applications" by A. Cornell and M. J. Carlton
2. "Valve Selection Handbook" by Peter Smith and R. W. Zappe
3. "Marine Auxiliary Machinery" by H.D. McGeorge
4. "Marine Engineering Workbook" by A. W. Trevor
5. "Marine Electrical and Electronics Bible" by John C. Payne

REFERENCES:

1. "Electric Machinery Fundamentals" by Stephen J. Chapman
2. "Practical Marine Electrical Knowledge" by Dennis T. Hall
3. "Electrical Machines, Drives, and Power Systems" by John Hindmarsh and Alasdair Renfrew

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO -2	PSO -3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3		3	3							3	3	3	3
2.	3	3		3	3							3	3	3	3
3.	3	3		3	3							3	3	3	3
4.	3	3		3	3							3	3	3	3
5.	3	3		3	3							3	3	3	3

SEMESTER VII

MR22701 **STABILITY OF SHIPS**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

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

UNIT I HYDROSTATICS 8

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

UNIT II GEOMETRY AND SHIP FORM CALCULATION 10

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

UNIT III CALCULATION OF AREA, VOLUME, FIRST AND SECOND MOMENTS 12

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

UNIT IV TRANSVERSE, STABILITY AND HEEL 15

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

UNIT V LONGITUDINAL STABILITY 15

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

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to have knowledge in

1. Basic hydrostatics, Geometry of Ships
2. Calculations Viz. various coefficients
3. Calculating the Area of wetted Surface, Volume etc.,
4. Transverse Stability of ship and ship's heel
5. Longitudinal Stability of ship

TEXT BOOKS:

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

REFERENCES:

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

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO-2	PSO-3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3				3							3		3	3
2.	3	3	3		3							3	3	3	3
3.	3	3	3	3	3	3						3	3	3	3
4.	3	3	3	3	3	3						3	3	3	3
5.	3	3		3	3	3						3	3	3	3

EE22751	MARINE ELECTRICAL TECHNOLOGY	L T P C
		3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the concepts of marine distribution systems and regulation
- To understand the operation of generator protection and switchgear
- To familiarize with the requirement of cables and lighting systems
- To provide adequate knowledge on the electrical propulsion systems
- To understand the electrical characteristics of batteries and maintenance

UNIT I	POWER DISTRIBUTION AND REGULATIONS	9

The marine environment – Generators – Power supply commonly available – ships auxillary services – load analysis – electrical diagrams – active and passive safety measures – Do's and Don'ts – Electric shock- Selection of AC and DC generators for use on ships – merits and demerits – location and Installation of generator sets – Requirements & Regulations – safe electrical equipments for hazardous areas – Indian Standards. High voltage installations, Systems of AC distribution – general concept – specific systems for ship's service - primary power bus– need for emergency power supply– method of supply– passenger and cargo vessels requirements– shore supply –arrangement to ensure proper phase supply – remote switches to ventilating fans – fuel pumps – lubricating oil pumps and purifiers.

UNIT II	INSTRUMENTATION AND SWITCHGEAR	9

Insulated & Earthed neutral systems – introduction – circuit faults – causes –prevention – detection and clearance – alternators. AVR - excitation systems– carbon pile regulator– vibrating contact and static automatic regulator– transient voltage dip and alternator response– effect of kW and Kvar Loading – Panel instrumentation. Switchboards & Switchgear: Main and sub switchboard-Rating and Characteristics– instrumentation & controls – circuit breakers – fault protection devices - introduction– over-voltage-surge-transients– ripple– spikes – DC generator protection –alternator and system protection – protection through fuses – protection Discrimination -Motor Protection.

UNIT III	CABLES AND LIGHTING SYSTEMS	9

Electrical Cables: conductors – Wire Sizes-Current Rating – testing-codes- Practical tips. Insulation – Insulation classes - A, B, E, F, H Insulation for High temperatures – Insulating Materials – Cable insulation & Sheath– Cable gland – Degrees of Protection. Lighting Systems: Introduction – Incandescent Lamps – Discharge lamps - HCLPMF lamps– High pressure Mercury Fluorescent lamps– High and Low pressure sodium vapour lamps – Effect of voltage on lamp performance – Navigation & signal lights - Signals for a power driven ship under way (At night)– Emergency lighting – Alarm Indication Systems: Fire alarms and Detection - Heat detectors– Smoke detectors– Combustion detectors-Miscellaneous alarm indicator systems– Scanning type system – Sequential starting and cut outs for an automatic fired boiler incorporating safety devices and combustion control equipments.

UNIT IV	ELECTRICAL PROPULSION SYSTEMS	9

Propulsion Systems: Auxiliary propulsion systems – Layout and Optimizing storage space – Electrical Propulsion – Advantages & Disadvantages DC constant current systems – DC motor supplied from alternators – Turbo – electric propulsion – AC single speed and Induction motor drives – Fixed speed alternators – Cycloconverter device- Advanced Diesel-electric Propulsion Systems– Thruster and Water jet propulsion- Classification society's requirements for electrical equipment for steering gears, electrical control from wheel house for electro-hydraulic steering gear, all electrical steering gear circuit and control equipment.

UNIT V	AUXILLARIES AND MAINTENANCE	9

Batteries & Battery charging: Battery supplies – Lead-acid batteries – Electrical Characteristics – Nickel – Cadmium batteries – Sealed Ni-Cd batteries - Li-ion Batteries – Battery charging – Charging from AC and DC mains – Standby Emergency batteries – Voltage Regulators – Battery Management System- need,

operation, classification- Battery insulation & safety measures – First Aid treatment – Rotary generators. Maintenance &Troubleshooting- Maintenance of specific equipments- Generators- Main Circuit Breakers- Interlocks- Troubleshooting Battery-Powered Systems – Recommended list of spares, tools & Accessories.	
TOTAL PERIODS: 45	
TEXT BOOKS	
1.	Elstan.A. Fernandez., 'Marine Electrical Technology', 11th Edition, Shroff Publishers & Distributors Pvt. Ltd., Mumbai, 2020.
2.	Bowic C.T., 'Marine Electrical Practice', 5th Edition, Butter Worth, London, 1981.
REFERENCE BOOKS	
1.	Surinder Pal Bali., 'Electrical Technology Machines and Measurements', Vol II, 1st Edition, Pearson,2013.
2.	Law S.W., 'Electricity applied to Marine Engineering', 4th Edition, The Institute of Marine Engineers, London, 1998.
3.	H.D.Mc George., 'Marine electrical equipment and practice', 2nd edition, Butterworth-Heinemann, 2014.

COURSE OUTCOMES

Upon the successful completion of the course, the students will be able to

CO's	STATEMENTS	RBT LEVEL
1	Analyze the different types of electrical distribution systems and regulations observed onboard ships regarding electrical equipments	4
2	Explain the electrical Instruments and switch gear used, location and rectification of various kinds of faults onboard ships.	3
3	Understand the specification of cables and type of lighting systems fitted on board.	2
4	Analyze the various types of Electrical propulsion systems	4
5	Apply the Maintenance &Troubleshooting of electrical equipments, instruments and batteries	3

Bloom's Taxonomy (RBT) Level: Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**2**
1	3	3	1	1		1	1	2	1	2	3	3	3	2	1
2	3	3	1	1		1	1	2	1	2	3	3	3	2	1
3	3	3	1	1		1	1	2	1	2	3	3	3	2	1
4	3	3	1	1		1	1	2	1	2	3	3	3	2	1
5	3	3	1	1		1	1	2	1	2	3	3	3	2	1

3- High Mapping; 2-Moderate Mapping; 1-Low Mapping

EE22752	MARINE ELECTRONICS	L T P C
		3 0 0 3

COURSE OBJECTIVES

- To impart the knowledge about the basics of Operational Amplifier circuits.
- To learn the concepts of Combinational and Sequential Circuits in Digital Electronics.
- To study about theA-D and D-A converters and measuring instruments.
- To understand the working principle of power electronic devices and Satellite Communication.
- To study the architecture and assembly language programming of 8051 Microcontroller.

UNIT I	INTEGRATED CIRCUITS	9

IC Classification - Fundamental of Monolithic IC technology - Ideal OP-AMP characteristics - Feedback Amplifiers - Differential Amplifier - Basic applications of OP-AMP – Summer, Differentiator and Integrator-Instrumentation Amplifier - 555 Timer – Applications.

UNIT II	DIGITAL CIRCUITS	9

Logic Systems and Gates – Binary and BCD codes -Boolean algebra – Simplifications - Design of Adder, Subtractor, Comparators, Code Converters, Encoders, Decoders, Multiplexers and Demultiplexers - Function realization using Gates & Multiplexers – Flip – flops – Counters – Registers and Multiplexers - Digital integrated circuits – Semiconductor memories – ROM, PROM, EPROM, PLA, PLD, FPGA, Digital Logic Families: TTL, ECL,CMOS.

UNIT III	CONTROLLERS AND ELECTRONIC INSTRUMENTS	9

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

Electronic instruments: Cathode Ray Oscilloscope – Digital voltmeters – Multimeter – Signal Generators – Q – Meters - Data loggers.

UNIT IV	INDUSTRIAL ELECTRONICS	9

Operation and Characteristics of SCR – TRIAC - Power Transistor - MOSFET and IGBT -Power Converter /Inverter – Power Control-Filters, RPS –Photoelectric devices - RADAR – SONAR –Fiber Optic Gyroscope Sensor –Satellite Communication as applicable to GMDSS, GPS, Inmarsat - Introduction to ECDIS.

UNIT V	MICROCONTROLLERS	9

Introduction to Microcontrollers – Architecture of 8051 - Assembly Language Programming - Memory - Timers - Interrupts - Serial Ports – Interfacing and Control of Motors – Temperature Sensors - Humidity sensors - Comparison with advanced Microcontrollers.

TOTAL PERIODS: 45

TEXT BOOKS

1.	Ramakant.A. Geakwad, "Linear integrated circuits", 3rd edition, Prentice – Hall of India, New Delhi, 2001
2.	Sencer Yeralan, Helen Emery, 'Programming and Interfacing the 8051 Microcontroller', Rigel Corporation, 1st Edition, 2000

REFERENCE BOOKS

1.	P.S.Bimbhra, "Power Electronics", 3rd edition, Khanna Publisher, New Delhi, 2001.
2.	Ray choudhary & Shail B Jain, "Linear Integrated Circuits", New Age International publisher, 2015.
3.	John.C.Payne, "Marine Electrical and Electronics bible", Third edition, Sheridan House Publishers,2007
4.	Krishna Kant, 'Microprocessors and Microcontrollers, Architecture, Programming and

	System Design - 8085, 8086, 8051, 8096', Prentice Hall India Ltd Publications, 1st Edition, 2010

COURSE OUTCOMES

Upon the successful completion of the course, the students will be able to

CO's	STATEMENTS	RBT LEVEL
1	Describe the concepts of OP-AMPtheory and Applications.	3
2	Explain the Combinational and Sequential circuits	3
3	Identify Analog and Digital Converters and their applications	2
4	Select Electronic Instruments and the satellite communication as applicable to GMDSS, GPS, Inmarsat	2
5	Apply the different algorithm and write assembly language program for 8051 Microcontroller.	3

Bloom's Taxonomy (RBT) Level: Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2					1	2		3	3		1
2	3	2	2	2					1	2		3	3		1
3	3	2	2	2		2			1	2		3	3	2	1
4	3	2	2	2					1	2		3	3	2	1
5	3	2	2	2	2	1			1	2		3	3	2	1

3- High Mapping; 2-Moderate Mapping; 1-Low Mapping

MR22511 FIRE FIGHTING, CONTROLS AND SIMULATOR LABORATORY

L	T	P	C
0	0	2	2

COURSE OBJECTIVES:

1. To understand the fundamental principles of fire dynamics and behavior.
2. To understand the design and installation requirements for fire suppression systems.
3. To understand and practice various line diagram of engine room pipelines etc.
4. To understand the line diagram and operate of Hydraulic system.
5. To understand the line diagram and operate of pneumatic system.

UNIT I Introduction to Fire Fighting 10

Fire, Fire triangle, methods to supress fire, various classes of fire, Methods to extinguish the fire various ships, Various fire detection systems installed on board and principle operation, international shore coupling, Fire hose, Fire hydrants, Fire nozzle, Fire axe, Aluminium Fire protection proximity suit. Hydraulic and pneumatic symbols, Basic hydraulic and pneumatic power system.

UNIT II Fire Detection & Protection, Fire extinguishing system 14

SCBA, Donning of SCBA, Bellow type breathing apparatus, EEBD,

Portable fire extinguisher- Water type Extinguisher, Mechanical Foam type Extinguisher, CO_2 type fire extinguisher, Dry chemical powder fire extinguisher.

Semi portable fire extinguisher- Semi portable Foam type extinguisher, semi portable Dry chemical powder type extinguisher

Detectors- Fire detectors, Smoke detector, Flame detector operation and alarm systems

Fire protection system- Ship's Fire main line, Total CO_2 flooding system- Engine room and Cargo hold, Sprinkler system Diesel driven Fire pump

UNIT III Engine room simulation control 6

Ballast control system, Fuel oil transfer system, Starting the generator, starting of main engine, powering the ship from Dead.

UNIT IV Hydraulic control system 15

Hydraulic operations- Operation of double acting hydraulic ram cylinder with direction control valve, Pilot operating check valve circuit, Speed control of hydraulic ram cylinder with throttle valve, Meter in and meter out hydraulic circuit, Hydraulic motor operation using direction control valve and throttle valve, Hydraulic sequence control, Series and parallel operation of hydraulic circuits.

UNIT V Pneumatic control system 15

Pneumatic operations- Operation of single acting cylinder and pneumatic motor with Direction control valve, Quick exhaust valve operation in the pneumatic circuit, Impulse operation of single and double acting pneumatic cylinder with FRL circuit, pneumatic pressure switch operation, series and parallel connection on electro pneumatic system.

TOTAL: 60 PERIODS

OUTCOMES:

1. Demonstrate a thorough understanding of the fundamental principles governing fire dynamics and behaviour.
2. Exhibit proficiency in recognizing and implementing the design and installation requirements for fire suppression systems.
3. Apply knowledge and skills to interpret and practice various line diagrams of engine room pipelines and other related systems.
4. Demonstrate competence in interpreting line diagrams and operating hydraulic systems effectively.
5. Demonstrate competence in interpreting line diagrams and operating pneumatic systems effectively.

TEXT BOOKS:

1. "Hydraulics and Pneumatics: A Technician's and Engineer's Guide" by Andrew Parr
2. "Fire Protection Engineering in Building Design" by Jane I. Lataille
3. "Marine Simulation and Ship Maneuverability" by Nikolai Kornev
4. "Practical Ship Hydrodynamics" by Volker Bertram

REFERENCES:

1. "Hydraulic Control Systems" by Herbert E. Merritt
2. "Fire Protection Systems" by A. Maurice Jones
3. "Marine Engineering: Volume II - Practical Guidance on Shipboard Systems" by D.A. Taylor
4. "Introduction to Marine Engineering" by D.A. Taylor

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3											3	3	3	3
2.		2			3							3	3	3	3
3.		2		2	3							3	3	3	3
4.		2		2	3							3	3	3	3
5.		2		3	3							3	3	3	3

LIST OF EXPERIMENTS

List of Experiments

Hydraulic experiments:

1. Operation of double acting hydraulic ram cylinder with direction control valve
2. Pilot operating check valve circuit
3. Speed control of hydraulic ram cylinder with throttle valve
4. Meter in and meter out hydraulic circuit
5. Hydraulic motor operation using DCV and throttle valve
6. Hydraulic sequence control circuit
7. Series and parallel operation of hydraulic circuits.

Pneumatic Experiments:

1. Operation of single acting cylinder and pneumatic motor with Direction control valve,
2. Quick exhaust valve operation in the pneumatic circuit,
3. Impulse operation of single and double acting pneumatic cylinder with FRL circuit,
4. Pneumatic pressure switch operation
5. Series and parallel connection on electro pneumatic system.

Firefighting laboratory:

1. Donning of SCBA

2. **Portable fire extinguisher-**
   - **a.** Water type Extinguisher
   - **b.** Mechanical Foam type Extinguisher
   - **c.** CO_2 type fire extinguisher
   - **d.** Dry chemical powder fire extinguisher.

3. **Semi portable fire extinguisher**
   - **a.** Semi portable Foam type extinguisher,
   - **b.** semi portable Dry chemical powder type extinguisher

4. **Detectors-** **(i)** Fire detectors
   (ii) Smoke detector
   (ii) Flame detector
   (iv) Fire Alarm systems

5. **Fire protection system**
   - **a.** Ship's Fire main line
   - **b.** Sprinkler system
   - **c.** Total CO_2 flooding system-
     - **(i)** Engine room
     - **(ii)** Cargo hold

6. Diesel driven Fire pump

EE22761	ELECTRICAL , ELECTRONICS AND MICRO CONTROLLER LABORATORY	L T P C
		0 0 4 2

COURSE OBJECTIVES

- Familiarize the students with the Operation of Electrical Machines, Electronic equipment's and Microcontroller and equip them with experimental skills.

LIST OF EXPERIMENTS ELECTRICAL ENGG. LABORATORY	
1.	Load Test on D.C. Shunt Motor
2.	Load Test on D.C. Series Motor
3.	O.C.C. & Load characteristic of Self/Separately excited D.C. Generator
4.	Parallel operation of D.C. Shunt Generator
5.	(i) Speed control of D.C. Shunt Motor (ii) Speed control of D.C. Motor using thyristor
6.	(i) Load test on Single-Phase Transformer (ii) Open Circuit and Short Circuit tests on Single Phase Transformer
7.	Parallel operation of single-phase Transformers
8.	Load Test on Squirrel cage Induction Motor
9.	Load Test on Slip ring Induction Motor
10	Study of three Phase Transformer connections - (Y-Y, Δ-Δ, Δ-Y and Y-Δ)
11.	Synchronization of 3-phase Alternator
12.	Trouble shooting in Electric Motors and Transformers
LIST OF EXPERIMENTS ELECTRONICS / MICROCONTROLLER LABORATORY	
1.	Volt-Ampere characteristics of a Diode and Zener diode
2.	Half wave and Full wave rectification circuit without and with filter circuit
3.	Characteristics of Silicon Control Rectifier
4.	(i) Study of Basic Digital IC's (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND) (ii) Implementation of Boolean Functions, Adder/ Subtractor circuits
5.	Study of Inverting and Non inverting amplifiers
6.	Study of Op Amp based Summer and Subtractor
7.	Study of Integrator and Differentiator
8.	Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's
9.	Study of 4:1; 8:1 Multiplexer and Study of 1:4; 1:8 Demultiplexer
10	Arithmetic and logical operations using 8051
	TOTAL HOURS :60

	COURSE OUTCOMES Upon the successful completion of the course, the students will be able to	
CO	**STATEMENTS**	**RBT LEVEL**
1	Hands-on experience of conducting various tests on DC and AC Motors	5
2	Determine the performance characteristics of Transformers using Direct and Indirect tests.	4
3	Hands-on experience of Synchronization of three phase Alternators	5
4	Analyze the characteristics of Diodes ,SCR, Digital ICs, Op Amp and their applications	4
5	Understand and analyse the application of Microcontrollers	4
Bloom's Taxonomy (RBT) Level: Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6		

COURSE ARTICULATION MATRIX

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2					2	2	1	3	3	2	1
2	3	2	2	2					2	2	1	3	3	2	1
3	3	2	2	2					2	2	1	3	3	2	1
4	3	2	2	2					2	2	1	3	3	2	1
5	3	2	2	2					2	2	1	3	3	2	1

3- High Mapping; 2-Moderate Mapping; 1-Low Mapping

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS
ELECTRICAL

S.No	Description of Equipment	Quantity Required (R)
1.	DC Separately excited generator coupled with DC Shunt Motor	1
2.	DC Shunt generator Coupled with DC Shunt Motor	1
3.	DC Shunt Motor with loading Arrangement	1
4.	DC Series Motor with loading Arrangement	1
5.	Three Phase cage Induction Motor with loading Arrangement	2
6.	Three phase slip ring induction motor with loading arrangement	2
7.	Rotor resistance panel for slip ring induction motor	1
8.	DC Shunt Motor Coupled with Three phase cylindrical rotor alternator	2
9.	Dynamic braking panel for DC motor	1
10.	Single Phase Transformer	6
11.	Three phase Transformer	2
12.	Single Phase Resistive Loading Bank	2
13.	Three Phase Resistive Loading Bank	2
14.	Tachometer -Digital/Analog	8
15.	Single Phase Auto Transformer	5

16.	Three Phase Auto Transformer	1
17.	SPST switch	3
18.	Wattmeter	10
19.	Lamp loading arrangement	3
20.	Ammeters	20
21.	Voltmeters	20
22.	Rheostats	15
ELECTRONICS		
23.	IC Trainer kit	10
24.	IC Tester	4
25.	Bread board	10
26.	ICs - Logic gates, Flip-flops	Each 10
27.	Connecting wires	As required
28.	8085 Microprocessor Trainer with Power Supply	15
29.	8051 Micro Controller Trainer Kit with power supply	15
30.	8255 Interface board	5
31.	8251 Interface board	5
32.	8259 Interface board	5
33.	8279 Keyboard / Display Interface board	5
34.	8254 timer counter	5
35.	ADC and DAC card	5
36.	Regulated Power supply	15
37.	CRO 30MHz	6
38.	DSO	4
38.	Function Generator	5
40.	Digital Multimeter	10
41.	Bread board	10
42.	Resistors of various ranges	10
43.	Capacitors of various ranges	10

HS22511	INTERVIEW AND CAREER SKILLS LABORATORY (Common to all Barnches)	L	T	P	C
		0	0	3	2

OBJECTIVES:

1.	Build confidence and develop learners' language proficiency.
2.	Better learners' performance in competitive examinations.
3.	Improve learners' employability skills.
4.	Develop entrepreneurship skills.
5.	Expose learners to the use of professional English.

UNIT I	LISTENING AND SPEAKING SKILLS	12

Conversation Skills – types small talk, face to face and telephonic, formal and informal conversations – skills in presenting ideas and collating information during conference calls (one –to one and technical group / team) – academic and workplace situations – conversing with faculty/visiting faculty/guests/officials/employers and employees – group discussion – etiquette and dos and don'ts, turn taking – presentation skills – seminars and projects using digital tools; mock interview – etiquette and dos and don'ts – audio-visual interface for enhancement of listening and speaking skills. IELTS and TOEFL (Listening related exercises)

UNIT II	READING / SPEED READING, CRITICAL THINKING AND WRITING SKILLS	12

Reading Comprehension – general and scientific texts/articles/case studies from different or relevant fields of study for analysis and critical thinking; employability skills – writing job applications – cover letter accompanying résumé – types of business letters and email writing and etiquette; writing reports – statement of purpose – writing articles for publication style and format – creating blogs or company profiles – speed reading of voluminous reports / documents and exacting necessary information and abstract preparation including dissemination. IELTS and TOEFL(Reading related exercises)

UNITIII	ENGLISH FOR PROFESSIONAL EXAMINATIONS	12

Sentences, paragraphs and reading comprehension – vocabulary building – general and technical terms – contextual meaning – spelling – subject specific words – usage and user specific terminology. IELTS and TOEFL(Grammar and verbal exercises)

UNIT IV	ENTREPRENEURSHIP SKILLS	9

Introduction to entrepreneurship - fundamentals of entrepreneurial skills – developing leadership qualities and team work;– marketing strategies microcosmic and macrocosmic levels of product sales and survey – sector / industry appraisal and appreciation (review and understanding state of the nation / economy / environment / sector reports published) interaction and understanding the role of multilateral financial / institutional / industrial agencies such as World Bank, ADB, UNDP, CII - Influencing in Business Meetings - Active Listening and responding - Role-play -

Strengthening – Negotiating/ Argumentative and Persuasive Skills - Defend a character/idea or attack it. - Networking Skills - engaging strangers in a conversation - introducing themselves, making small talk.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO	After completion of this course, the students will be able to	RBT LEVEL
1.	Develop approaches for mastering international English language tests such as IETLS and TOEFL, as well as national-level competitive exams.	6
2.	Make presentations and participate in Group Discussions.	6
3.	Face interviews with confidence and develop strategies for negotiating job offers.	6
4.	Build effective resumes, cover letters and professional emails to enhance job application success.	6
5.	Explore strategies for scaling and growing entrepreneurial ventures.	6

REFERNCES:

1.	*Business English Certificate Materials*, Cambridge University Press.
2.	*Graded Examinations in Spoken English and Spoken English for Work* downloadable materials from Trinity College, London.
3.	*International English Language Testing System Practice Tests*, Cambridge University Press.
4.	*Interactive Multimedia Programs on Managing Time and Stress.*
5.	*Personality Development* (CD ROM), Times Multimedia, Mumbai.

WEB SOURCES:

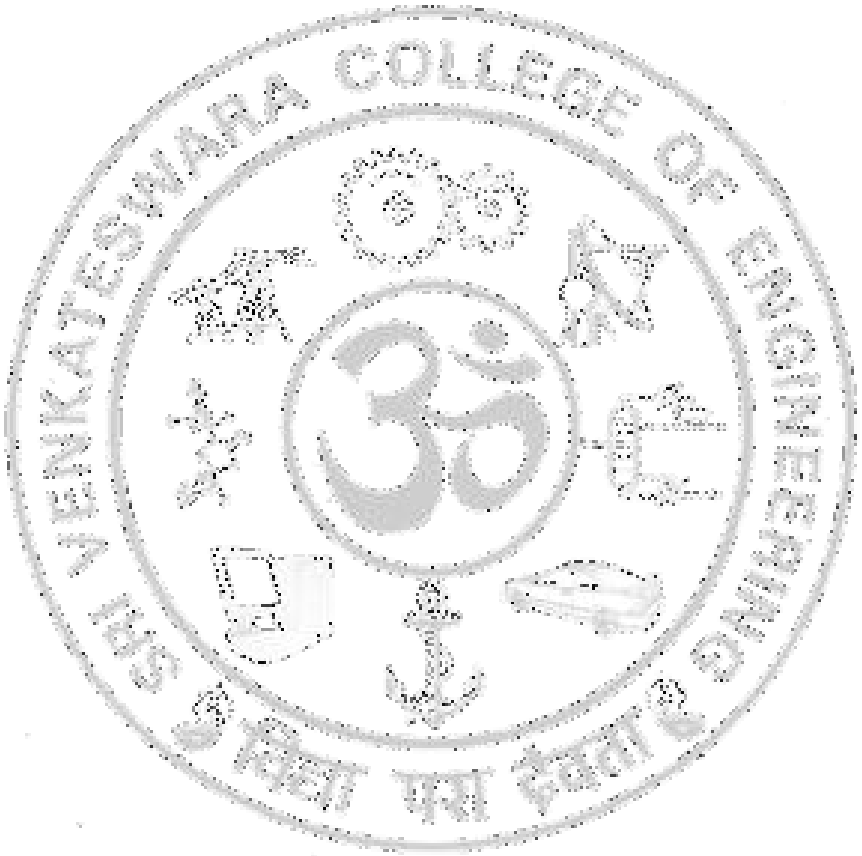
1.	http://www.slideshare.net/rohitjsh/presentationon group discussion
2.	http://www.washington.edu/doit/TeamN/present_tips.html
3.	http://www.oxforddictionaries.com/words/writingjobapplications
4.	http://www.kent.ac.uk/careers/cv/coveringletters.html
5.	http://www.mindtools.com/pages/article/newCDV_34.html

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1										**3**					
CO2										**3**					
CO3										**3**					
CO4										**3**					
CO5										**3**					

1-Weak; 2-Moderate; 3-Strong.



SEMESTER VIII

MR22801 **MARINE VEHICLES PERFORMANCE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge to students about types of resistance.
2. To impart knowledge about types of propellers and theory of propulsion.
3. To enable students, understand the rudder theory and types of rudders.
4. To impart basic knowledge about wave theory and anti-rolling devices.
5. To impact knowledge about sources of ship vibration, noise and its effects.

UNIT I RESISTANCE **9**

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

UNIT II PROPELLER THEORY **9**

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

UNIT III RUDDER THEORY **9**

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

UNIT IV WAVE THEORY **9**

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

UNIT V SHIP VIBRATION & NOISE **9**

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

TOTAL: 45 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:

1. Understand the Ship's resistance, Ships Model Tests and Sea Trials
2. Solve the problems theoretically with respective to Propellers
3. Address the rudder, turning radius of the ship theoretically with respective to Rudders
4. Get the knowledge of various kind of waves and its motions
5. Address the Ships Vibrations by various aspects

TEXT BOOKS:

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

REFERENCES:

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

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO -2	PSO -3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	3	3								3	3	3	3
2.	3	3	3	3								3	3	3	3
3.	3	3	3	3								3	3	3	3
4.	3	3	3	3								3	3	3	3
5.	3	3	3	3								3	3	3	3

MR22802 MARINE MANAGEMENT AND IMO REQUIREMENTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Gain students a concise understanding of shipping company's Administration & Registration of Ships.
2. Acquire students the foundational knowledge on the Preparation of voyage estimates & Types of chartering.
3. Familiarize the students with Marine Insurance and P & I Clubs.
4. Develop students with an understanding of the IMO, conventions, and legislations relevant to the maritime industry.
5. Obtain students the insights into the STCW (Standards of Training, Certification, and Watch keeping) and PSC (Port State Control) procedures.

UNIT I SHIPPING COMPANY'S ADMINISTRATION 9

Types of Marine vessels & cargo Ownership of vessels, Registration Flags of convenience, IMO Ship identification Number scheme. Shipping company – Profile and Structure Maritime Declarations and Health and the requirements of the International Health Regulations Maritime - Builder Certificate, carving note, certificate of survey, Certificate of registry.

UNIT II PREPARATION OF VOYAGE ESTIMATE 9

Voyage estimates Bunker calculations, Port charges and Cargo charges Conference Systems Time charter, Voyage charter, Bareboat charter Theory of freight rate &fares Bills of lading, ILO and MLC 2006 COLREG 1972 On hire &Off hire surveys, Note of protest

UNIT III MARINE INSURANCE AND P&I 9

Marine Insurance Under writing and loss adjusting principles as applied to Marine Industry Hull/Machinery Policy Particular average Particular average-case study General Average P&I Clubs

UNIT IV IMO CONVENTION 9

IMO, committees & Utility, legislations SOLAS, General Provisions Ch. I &Construction Ch. II LSA & FFA Ch. III, Radio telegraphy &Radio telephone Ch. IV, S safety of Navigation Ch. V, Carriage of Grain Ch. VI, Carriage of Dangerous Goods Ch. VII, and Management for the safe operation of Ships Ch. IX & Safety measures for High Speed crafts Ch. X, Special measures to enhance maritime safety XI & Additional measures for Bulk carriers Ch. XII, ISM ISPS codes, Vessel Security Assessment, Threat Identification and security actions etc., Load lines Convention 1966, Tonnage Convention 1969 Ballast water management MARPOL

UNIT V STCW AND PSC 9

International convention on STCW for seafarers, General Provisions-Regulations Engagement & Discharge of Ships Crew-Ships articles, Deck/Engine/Radio Departments Special Requirement for tankers Emergency, occupational safety, medical care and Survival functions Merchant Shipping act 1958 - Grounds for PSC inspection and criteria for detention Port state control, Mandatory certificate check list, Merchant Shipping Act 1958

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course,

1. Students will demonstrate a concise understanding of shipping company's Administration & Registration of Ships.
2. Students will be able to apply foundational knowledge in the Preparation of voyage estimates & Types of chartering.
3. Students will exhibit familiarity with Marine Insurance and P & I Clubs, enabling them to make informed decisions in related contexts.
4. Students will develop a comprehensive understanding of the IMO, conventions, and legislations pertinent to the maritime industry, allowing them to navigate regulatory frameworks effectively.
5. Students will possess insights into STCW and PSC procedures, enabling them to adhere to standards and regulations governing maritime operations and safety.

TEXT BOOKS:

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

REFERENCES:

1. Nilima, M.Chanidiramani, "Carriage of goods by Sea and Multimodal Transport", Ist Edition, Saptarang Publication, Mumbai, 1996.
2. SOLAS-1974 - International Maritime Organisation Publications
3. MARPOL-1973/78 - International Maritime Organisation Publications
4. STCW -1978/95 - International Maritime Organisation Publications
5. G.Raghuram, "Shipping Management", 1st Edition, Vasant J.Sheth Memorial Foundation, Delhi, 1992
6. Merchant Shipping Act, Govt. of India - 1958.
7. ISPS
8. Advanced Marine Engineering, Vol-IV, N. Nanda & Vikram Gokkale
9. Shipping and Law, Capt.S.Pullat & Capt.R.Venkat

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	1													3	
2.	2	2			1									3	
3.	3	2			1									3	
4.	1					3	3						3	3	
5.	1				1	2	2							3	

<Foot Note has to be given about the strength of correlations here>

SEMESTER VIII

MR22811	PROJECT WORK	L	T	P	C
		0	0	20	10

OBJECTIVES :

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 on a topic approved by the Head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by an external and internal examiner constituted by the Head of the Department.

TOTAL : 300 PERIODS

OUTCOMES

1. On completion of the project work, students will be in a position to summarize anychallenging practical problems and find solutions by adapting proper methodology.

VERTICAL I

MR22011 SURFACE ENGINEERING AND COATING TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce students to the field of surface engineering and its significance and to familiarize students with various surface preparation methods
2. To explore various surface modification techniques
3. To learn about the fundamentals, methodologies, and applications of chemical conversion coatings.
4. To examine the principles, methodologies, and applications of metallic coatings
5. To understand diffusion coating processes and its process parameters

UNIT I SURFACE ENGINEERING 9

Introduction to surface engineering-Scope of surface engineering for different engineering materials-Surface Preparation methods- Chemical, Electrochemical, Mechanical- Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing Coatings: Classification, Properties and applications of Various Coatings

UNIT II SURFACE MODIFICATION TECHNIQUES 9

Physical methods: thermal spraying, laser surface treatment, ion implantation. Chemical methods: electroplating, chemical vapor deposition (CVD), physical vapor deposition (PVD) Surface modification by Friction stir processing.

UNIT III CHEMICAL CONVERSION COATING 9

Chromating, Phosphating, Anodizing, Thermochemical processes: Methodology used, mechanisms, important reactions involved, Process parameters and applications.

UNIT IV METALLIC COATING 9

Hot Dipping, Galvanizing, Electrolytic and Electro less plating: Methodology used, mechanisms, important reactions involved, Process parameters and applications. Testing/ evaluation of metallic coatings.

UNIT V - DIFFUSION COATING 9

Carburizing, Carbonitriding, Siliconizing, Chromizing, Aluminizing, Boronizing, Boronitriding: Various Methods used, mechanisms, important reactions involved, Process parameters and applications

TOTAL: 45 PERIODS

OUTCOMES:

1. Students will demonstrate a comprehensive understanding of the field of surface engineering and able to identify and apply appropriate surface preparation methods for different engineering materials and applications.
2. Students will gain proficiency in various surface modification techniques, including physical and chemical methods, and understand their principles and applications
3. Students will acquire knowledge of the fundamentals, methodologies, and applications of chemical conversion coatings, enabling them to select and apply suitable coatings.
4. Students will develop an understanding of the principles, methodologies, and applications of metallic coatings.

5. Students will demonstrate a comprehensive understanding of diffusion coating processes, including the principles, mechanisms, and applications of techniques

TEXT BOOKS:

1. Rao, Srinivasa; Joghi, Shrikant , "Surface Engineering", Daya Publishing House,1st Edition,2010
2. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements",6th edition, Pearson Education India,2013

REFERENCES:

1. Cornelius Scheffer and Paresh Girdhar. "Practical Machinery Vibration Analysis and Predictive Maintenance", Newnes- Elsevier 1st Edition, 2004
2. Yong Bai and Wei-Chou Virgil Ping, "Marine Structural Design", Butterworth-Heinemann-Elsevier, Second Edition ,2016
3. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros,8th Edition, 2009

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3						3	3	3	
2.	3	3				3						3	3	3	
3.	3	3				3						3	3	3	
4.	3	3				3						3	3	3	
5.	3	3				3						3	3	3	

MR22012 **MARINE ENGINEERING EQUIPMENT DESIGN**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

At the end of the course, the students should have the knowledge about

1. Various marine engineering equipment and their uses
2. Design criteria for main propulsion equipment
3. Design criteria for electrical power generation equipment
4. Design criteria for steering gear equipment
5. Design criteria for steam generation equipment

UNIT I MARINE ENGINEERING EQUIPMENT AND THEIR USES **9**

Main engine- auxiliary engine-auxiliary machinery- steering gear- boiler- MARPOL equipment- fresh water generators- air conditioning and refrigeration equipment-cargo handling equipment

UNIT II DESIGN CRITERIA FOR MAIN PROPULSION EQIPMENT **9**

Classification of marine propulsive equipment- steam reciprocating engines- steam turbines- diesel reciprocating engines- gas turbines-nuclear propulsion- green energy ships

UNIT III DESIGN CRITERIA FOR ELECTRICAL POWER GENERATION EQUIPMENT **9**

Various methods of electrical power generation- turbo alternator- diesel alternator-shaft generator- number of generators- emergency generator - need of emergency generator-need of battery

UNIT IV STEERING GEAR EQUIPMENT **9**

Purpose of steering system- components of steering system- telemotor system-main and auxiliary steering systems-single failure criteria requirement for steering system- emergency steering system

UNIT V STEAM GENERATING EQUIPMENT **9**

Uses of steam onboard ships- main boiler and auxiliary boiler- exhaust gas boiler- composite boiler- - economizer- feed water system-boiler mountings- steam generating capacity- boiler firing sequence – precautions- pre purging and post purging

TEXT BOOKS:

1. Marine boilers by GTH Flagnan
2. Introduction to marine engineering by D A Taylor
3. A text book of marine boilers by Atul Kumar Gupta

REFERENCE BOOKS:

1. Heating boiler operator's manual: Maintenance, operation and Repair by Mohammed Malek
2. Marine steam boilers by James Hugh Milton
3. Marine boiler management and construction by C E Stromeyer

COURSE OUTCOMES:

At the end of the course the students should have knowledge about

1. Types and uses of marine machinery
2. Design criteria for marine propulsive machinery
3. Design criteria for marine electrical power generation machinery
4. Design criteria for steering gear machinery
5. Design considerations for steam generation equipment

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					2						3	2	2	
2	2					2						3	2	2	
3	2					3						3	2	2	
4	2					3						3	2	2	
5	2					2						3	2	2	

<Foot Note has to be given about the strength of correlations here>

EE22911	ELECTRICAL TECHNOLOGY FOR MARINE ENGINEERS	L T P C
		3 0 0 3

COURSE OBJECTIVES

- Impart a basic knowledge of AC and DC drives
- Study the Internal communication systems on board
- Learn basic concepts of Steering Systems and Deck Machineries
- Gain knowledge of miscellaneous marine equipment and alarm system
- Understand the trouble shooting of various electrical systems on board

UNIT I	CONVERTORS, INVERTORS AND DRIVES	9

Variable speed drives - Hardware development - Direct Current (DC) drives - Six thyristor full convertor- Dual - armature convertor - Thyristor DC drives - Alternating current devices - Slip energy recovery system - Load commutated inverter - Induction motor variable speed drives –Auto sequentially commutated current fed inverter- Computer based control of DC and AC Drive systems.

UNIT II	INTERNAL COMMUNICATION SYSTEMS	9

Operation of all internal communication systems on board and maintain Statutory communication Records - Ship's telephone system - Communication system between engine room and wheel house - Two-way communication system and public address systems - Operation and maintenance at respective control station for all alarms and indicators - Record keeping of all communication systems.

UNIT III	STEERING SYSTEMS AND DECK MACHINARIES	9

Steering Systems & Gyrocompasses: Fundamentals – Auto Navy steering Systems – Electro hydraulic Steering –Typical system configuration- Components – Types. Gyroscopes – Compass Considerations. Deck Machinery & Cargo Equipment: Electrically driven Anchor Windlass – Electrically driven mooring winches – General cargo ship deck machinery electric drives -Magnetic disc brakes.

UNIT IV	MISCELLANEOUS MARINE EQUIPMENT AND ALARM SYSTEM	9

Electrical engine room telegraph - Remote indicating revolution counter - Remote helm indicator - Salinity indicators - Mist detectors - Carbon di-oxide recorder - Electrical equipment for water tight door operation - 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 - Centralized alarm system in machinery space - Fire alarm system for engine room, holds and accommodation, high temperature alarms low and high level alarm - Starters for Miscellaneous electrical equipment for machinery space auxiliaries and centralized control of motors in machinery space.

UNIT V	TROUBLE SHOOTING OF ELECTRICAL AND ELECTRONIC CONTROL	9

Electrical safety - Logical six step trouble shooting procedure - Maintenance of electrical systems, fault finding and repair: Type of fault indications on Generator, Motor and Distribution systems, different testing equipments and meters (Multimeter / Megger, Clampmeter, etc) - Salvaging a motor - Electrical survey requirements - Calibrate and adjust transmitters and controllers - Control system fault finding - Function test of electrical, electronic control equipment and safety devices - Trouble Shooting of Monitoring Systems - Test and calibration of sensors and transducers - Programmable logic controllers (PLC) – Microcontrollers - Digital techniques.

TOTAL PERIODS: 45

TEXT BOOKS

1.	Elstan.A. Fernandez., 'Marine Electrical Technology', 11th Edition, Shroff Publishers

	Distributors Pvt. Ltd., Mumbai, 2020.
2.	Bowic C.T., Marine Electrical Practice, 5th Edition, "Butter Worth", London, 1981.
REFERENCE BOOKS	
1.	Surinder Pal Bali, 'Electrical Technology Machines and Measurements', Vol II, 1st Edition, Pearson,2013
2.	Law S.W., 'Electricity applied to Marine Engineering', 4th Edition, The Institute of Marine Engineers, London, 1998.
3.	H.D. Mc George, 'Marine electrical equipment and practice', 2nd edition, Butterworth-Heinemann, 2014.

COURSE OUTCOMES

Upon the successful completion of the course, the students will be able to

CO's	STATEMENTS	RBT LEVEL
1	Describe the working of various AC/DC Drive systems	3
2	Explain the operation of internal communication systems on board	3
3	Demonstrate different types of Steering systems and Deck machineries	2
4	Illustrate the working of various marine equipment and alarm system	3
5	Identify appropriate methods for trouble shooting of various electrical systems	2

Bloom's Taxonomy (RBT) Level: Remember-1; Understand-2; Apply-3; Analyze-4; Evaluate-5; Create-6

COURSE ARTICULATION MATRIX

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	1				1	2	1	3	3	2	1
2	3	2	2	2	1				1	2	1	3	3	2	1
3	3	2	2	2	1	2			1	2	1	3	3	2	1
4	3	2	2	2	1				1	2	1	3	3	2	1
5	3	2	2	2	1	1			1	2	1	3	3	2	1

3- High Mapping; 2-Moderate Mapping; 1-Low Mapping

MR22013 MARINE REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand the fundamental principles of basic refrigeration and air conditioning systems.
2. To gain knowledge of the components and operation of marine refrigerating plants, emphasizing safety measures and proper refrigerant charging procedures.
3. To explore the specialized aspects of refrigerated containers, including cargo types, maintenance, and the importance of maintaining specific environmental conditions.
4. To develop a comprehensive understanding of marine air conditioning systems, including psychrometric principles, comfort conditions, and ventilation system construction and operation.
5. To familiarize with HVAC components, including compressors, blowers, condensers, and expansion valves, focusing on their types, construction, maintenance, and troubleshooting techniques.

UNIT I BASIC REFRIGERATION AND AIR CONDITIONING 9

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

UNIT II MARINE REFRIGERATING PLANTS 9

Typical marine Refrigerating plants with multiple evaporator system – Construction and operation, Safety measures in Refrigeration plants, Refrigerant Charging procedure. Refrigeration in Liquefied gas carriers, Marine Refrigerants and their desirable properties, Ozone Depleting Potential (ODP) & Global Warming Potential (GWP).

UNIT III REFRIGERATED CONTAINERS 9

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

UNIT IV MARINE AIR CONDITIONING 9

Psychrometric and Principles of Air conditioning – Comfort conditions – Typical Marine Air Conditioning and Ventilation system – construction and working, Safe and efficient operation in UMS mode, heating ventilation and air conditioning in accommodation spaces: Single and dual ducting system

UNIT V - HVAC COMPONENTS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course students will

1. Demonstrate proficiency in analysing and evaluating different refrigeration cycles and calculating essential parameters such as refrigerating effect, coefficient of performance, and cooling capacity.
2. Apply knowledge of marine refrigerating plants to identify system components, understand their operation, and implement safety measures effectively.
3. Assess and address the unique challenges associated with refrigerated containers, ensuring proper temperature, humidity, and oxygen levels are maintained for cargo preservation
4. Demonstrate knowledge of safe and efficient operation of marine air conditioning systems.
5. Demonstrate competence in identifying, maintaining, and troubleshooting HVAC components.

TEXT BOOKS:

1. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd Edition, New Age International (P) Ltd., Publishers, Chennai, 2015
2. Stott J.R, "Refrigerating Machinery and Air Conditioning Plant", Marine Engineering Practice, Vol-1 P Part-04, IMarEST, London,1998.

REFERENCES:

1. Arora C.P., "Refrigeration & Air Conditioning", 3rd Edition, Tata McGraw-Hill, New Delhi, 2014.
2. Maheshwar.C, "Container Refrigeration", First Edition, Witherby Seamanship International, Livingston, UK, 2008
3. Mc George.H.D, "Marine Auxiliary Machinery", 7 th Edition, Butterworth Heinemann, Woburn, USA, 2015
4. Taylor. D.A , "Introduction to Marine Engineering", Second Edition, Butterworth Heinemann, Woburn, USA, 2011.
5. User manuals of the maker of the Refrigeration plant and Air Conditioning plant onboard Ship for further understanding of the system and for troubleshooting.

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3						3	3	3	
2.	3	3				3						3	3	3	
3.	3	3				3						3	3	3	
4.	3	3				3						3	3	3	
5.	3	3				3						3	3	3	

MR22014	MARINE MACHINERY DRAWING	L	T	P	C
		2	0	2	3

OBJECTIVES:

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

UNIT I EXPLANATION AND SKETCHING 5

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

UNIT II LIMITS, FITS AND TOLERANCES 5

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

UNIT III RIVETS AND JOINTS 11

Sketching screwed fastenings, rivets and riveted joints, cotter joints & pin joints.

UNIT IV MARINE MACHINERY PARTS 12

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

12

UNIT V MARINE COMPONENTS

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- To understand the fundamentals of Machine Drawing, the conventions, conventional representation, types of sectioning and to practice them.

- To understand the method of sketching to explain the limits, fits and tolerances arcs etc.,with respect to the marine machinery.
- To understand the method of sketching of various mechanical joints.
- To understand and practice the various parts of Marine Machinery and the generalMarine components
- To practice the assembled view & blueprint of Marine Machinery components.

TEXT BOOKS:

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

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

REFERENCES:

1. MacGibbon" "Pictorial Drawing Book for Marine Engineers-James", 8th Edition, G.Holburn & John J. Seaton, James Munro & Company Limited, Engineering and Nautical Publishers, Mumbai, 1978.
2. N.D.Bhatt, "Machine Drawing", 46th Edition, Charotar Publication, Mumbai, 2016.
3. Gill P.S., "A text book on Machine Drawing", S.K. Kataria & sons, Mumbai, 2000.
4. Junnarkar,N.D., "Machine Drawing",1st Ed. Pearson, 2004 Jindal, U.C., "MachineDrawing", 1st Ed. Pearson, 2010.
5. Jindal, U.C., "Machine Drawing", 1st Ed. Pearson, 2010.

MR22015 MARINE LOGISTICS AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge to students wrt. to Indian shipping history and economic regulations and EEZ
2. To provide more operational knowledge over the Charters and its function in the shipping industry.
3. To knowledge the students with the organisation of a shipping company
4. To educate the students with the commercial activities and operation of shipping industry
5. To make students understand the quality and the operations of ship activities

UNIT I INDIAN SHIPPING DEVELOPMENT 9

History of Indian shipping- sea rout and river routes, Inland Water Transportation's Growth and Integration with Shipping - The future of federal economic regulation, the development of Indian shipping after independence included trade operations, ports and port administrations, and sea fares and rates. The History of Documents' Origins, Expeditions Exclusive economic zone; historical transportation regulation; economic regulation (safety and social); contemporary interstate deregulation (water transport), port state control

UNIT II CHATERS AND ITS FUNCTIONS 9

Commodities - origin, characteristics, hazards and stowage requirements. - Institute warranty limits. CONTRACTS& MARKETS- Rights, responsibilities and liabilities of owners and charterers - Consecutive voyage contracts and Contracts of Affreightment – FONASBA, Time Charter Interpretation Code 2000 - Procedure of negotiations – Fixture note - The role of the post fixture department - Freight and Hire , lay time dead freight calculations - demurrage, dispatch, damages for detention and freight taxes - Time charter – late hire payment, payment for bunkers, performance claims, off-hire events, delivery, final voyage and redelivery. Ballast bonuses. Commissions and brokerage - The use of freight market derivatives.

UNIT III ORGANISATION OF A SHIPPING COMPANY 9

Departments in a Ship owning company - In-house vs. outsourcing of Ship Management functions. - Specifications of different types of ships viz. dry bulk cargo ships, general purpose ships, liners and tankers. Technical Management - Ship acquisition methods – Induction of a vessel in the fleet - Ship Registration, National vs. open registries. Ship Classification societies - Ship maintenance - PMS & emergency repairs, Dry-docking and annual / special surveys, management of ship spares. Manning regulations, international conventions viz. STCW, SOLAS, MLC - Crew management companies, Maritime training establishments – Maritime Training administration.

UNIT IV COMMERCIAL MANAGEMENT AND OPERATIONS 9

Commercial activities: Bunkering activities, post fixture matters, loading and unloading, voyage directions, and chartering - Port operations management: hiring agencies, supervising and managing port agents, and hiring and managing stevedores - Adherence to the T/C contract, include concerns about performance and speed.

UNIT V QUALITY SYSTEMS AND ISM CODE 9

International Safety Management (ISM) code, ISO 9001: 2015 Standard for Management Systems - Relationships between quality management practices and organizational performance in the shipping sector

TOTAL: 45 PERIODS

OUTCOMES:

TEXT BOOKS:

1. Ship Broking and Chartering Practice – 7thedition (2009), Lars Gorton.
2. Tanker Chartering – First edition (2000), Philip J. Wood, Published by Institute of Chartered Shipbrokers.
3. Ship Management – 2nd Edition (2005), Malcolm Willingale, Published by Informa Professional.

REFERENCES:

1. Professional Ship Management: Marketing and Strategy, Dr. Photis M. Panayides, Ashgate Publishing (2001).

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO -2	PSO -3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.		3				2						3	2	3	2
2.		3	1	3		3						3	2	2	2
3.		2	2	3		3						3	2	2	2
4.		3	1			2						3	2	3	2
5.		2	1	3		3						3	2	2	2

MR22016 SAFETY PRECAUTIONS AND WATCH KEEPING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge to the students in Watch-keeping of Engine Room in various types of ships and to prepare for Class IV MoT Examinations
2. To enable students to understand symptoms and to take correct remedial measures in Auxiliary machinery
3. To enable students to understand symptoms and to take correct remedial measures in main engine.
4. To impart knowledge to the students about the correct maintenance procedure of engine components.
5. To impart knowledge about the troubleshooting procedure and maintenance of electrical machineries.

UNIT I SAFE WATCH KEEPING 9

Definition of watch, operating principles, requirements of watch keeping, requirements of certification, duties of engineer officers – operation of engine room in general, log book writing – watch keeping under way – watch keeping at port – at unsheltered anchorage, fitness for duty, preparation of Diesel Engines for a long voyage – bad weather precautions, safe working practices – during overhauling at port, and during bad weather, change over from diesel oil to heavy oil and vice-versa, entering enclosed or confined spaces, permit to work systems. Trouble shooting during watch keeping: Emergency measures taken in case of – flooding of engine room, engine room bilge fire, and general fire, blackout, In case of any system failure or breakage of pipe lines, etc., rescue operations of injured persons.

UNIT II TROUBLE SHOOTING IN AUXILIARY MACHINERIES 9

Malfunctioning, partial or total failure of auxiliary machineries – such as, auxiliary engines purifiers, heat exchangers, air compressors, reefer and air conditioning compressors and systems boilers and accessories, soot blowing, fresh water generators, hydrophore tanks and systems, all pumps & systems. Repairs and maintenance of propeller, rudder, dry-docking methods, dry-docking inspection and repair works.

UNIT III TROUBLE SHOOTING IN MAIN ENGINE 9

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

UNIT IV MAINTENANCE OF ENGINE COMPONENTS 9

Checking of holding down bolts, resin chocking – Tie-rods tensioning, checking and tightening of 2stroke and 4-stroke bottom end bolts. Inspection and maintenance of crankshaft and cam shaft, dismantle inspection and reassemble of main bearings, cross head bearings & bottom end bearings, connecting rod, piston and piston assembly, stuffing box, cylinder head and all mountings, governor

and over speed trip – checking of all clearances, adjustments, effect of improper clearances, prevention and rectification. Cylinder liner and cylinder lubrication, thrust bearing, running gears inspection, engine alignment, chains drive adjustment and tensioning.

UNIT V TROUBLE SHOOTING AND MAINTENANCE OF ELECTRICAL MACHINERIES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to understand the

1. STCW standards of training, requirements of officers and ratings
2. Watch-keeping in various ships
3. Prevention, rectification and maintenance with respect to trouble shooting of machineries in the Engine Room.
4. Troubleshooting related to main engines
5. Troubleshooting related to Electrical components.

TEXT BOOKS:

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

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	1				1									3	
2.	1						2		1					3	
3.	2	3	2											3	
4.	2	3			2				2					3	
5.	2	3			3									3	

VERTICA
L II

IT22921 DATA SCIENCE FOR MARINE ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamental concepts of data science
2. Exhibit proficiency with statistical analysis of data
3. Learn the tools and packages in Python for data science
4. Acquire knowledge in visualization techniques
5. Build data science applications using Python based toolkits.

UNIT I INTRODUCTION 9

Need for data science - benefits and uses - facets of data - data science process - setting the research goal - retrieving data - cleansing, integrating, and transforming data - exploratory data analysis - build the models - presenting and building applications

UNIT II PYTHON DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode - values and types: int, float, boolean, string, and list - variables - expressions - statements - precedence of operators - comments - function definition and use - flow of execution - parameters and arguments – Local and Global Scope; Conditional Statements – Iterative Statements

UNIT III WORKING WITH DATA 9

Frequency distributions - Outliers - interpreting distributions - graphs averages - describing variability - interquartile range - variability for qualitative and ranked data Normal distributions - z scores - correlation - scatter plots - regression - regression line - least squares regression line - standard error of estimate.

UNIT IV PYTHON FOR DATA HANDLING 9

Basics of Numpy arrays - aggregations - computations on arrays - comparisons - masks - boolean logic - fancy indexing structured arrays. Data manipulation with Pandas – data indexing and selection - operating on data - missing data - hierarchical indexing - combining datasets - aggregation and grouping pivot tables.

UNIT V PYTHON FOR DATA VISUALIZATION 9

Visualization with matplotlib - line plots - scatter plots - visualizing errors - density and contour plots - histograms - binnings and density - three dimensional plotting – geographic data visualization with seaborn.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO No	CO Statements	RBT Level
1	Demonstrate the need and technical understanding of the data science concepts	U
2	Assess the proficiency of data with statistics	E
3	Use Numpy and Pandas to handle data	AP
4	Apply visualization Libraries in Python to interpret data	AP
5	Recommend models to devise solutions to data science tasks using Python	E

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4. Avrim Blum, John Hopcroft, Ravindran Kannan, “Foundations of Data Science”, Cambridge Press, 2020

REFERENCE BOOKS:

1. Shah, Chirag. A hands-on introduction to data science. Cambridge University Press, 2020.
2. Raina, Vineet, and Srinath Krishnamurthy. "Building an effective data science practice." Apress BerNeley, CA (2021).

MR22022 ADVANCES IN MARINE PROPULSION ENGINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To Understand the fundamental concepts and terminology related to marine propulsion systems.
2. To develop a comprehensive understanding of the principles governing the operation of diesel engines.
3. To analyze the components and operation of marine gas turbine engines.
4. To understand the concepts and principles of hybrid and electric propulsion in the context of marine vessels.
5. To explore the latest emerging trends in marine propulsion technology and their potential impact on the industry.

UNIT I Introduction to Marine propulsion system 9

Overview of marine propulsion systems, Historical development of marine engines, Classification of marine propulsion systems, Basic components and functions of marine propulsion engines, Introduction to different types of marine engines: diesel, gas turbine, steam turbine, electric propulsion

UNIT II Diesel Engine Technology 9

Principles of diesel engine operation, types of diesel engines used in marine applications, Components and subsystems of marine diesel engines, fuel injection systems and fuel injector types, combustion processes and emissions control, Advancements in diesel engine fuel technology, common rail injection, turbocharging, exhaust gas recirculation (EGR), selective catalytic reduction (SCR), RT-flex engines, Intelligent engines.

UNIT III Gas Turbine Propulsion 9

Fundamentals of gas turbine engines, Applications of gas turbines in marine propulsion, Comparison between diesel and gas turbine propulsion systems, Components and operation of marine gas turbine engines, Efficiency and performance characteristics, Recent advancements in gas turbine technology for marine applications

UNIT IV Hybrid and Electric Propulsion Systems 9

Introduction to hybrid and electric propulsion in marine vessels, Benefits and challenges of hybrid/electric propulsion, Types of hybrid propulsion configurations: series, parallel, series-parallel, Components of hybrid and electric propulsion systems, Integration of energy storage systems (batteries, supercapacitors) and power electronics, Case studies of vessels employing hybrid/electric propulsion technologies

UNIT V Emerging Trends and Future Developments 9

Overview of emerging trends in marine propulsion, Alternative fuels for marine engines: LNG, biofuels, hydrogen, Advanced propulsion concepts: fuel cells, solar, wind-assisted propulsion, Ammonia as fuel, blue hydrogen and green hydrogen Digitalization and automation in marine propulsion systems, Environmental considerations and regulations affecting marine propulsion, Future directions and challenges in marine propulsion technology

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course

1. Students will be able to demonstrate an understanding of fundamental concepts and terminology related to marine propulsion systems.
2. Students will be able to identify and classify different types of diesel engines commonly used in marine applications.
3. Students will compare and contrast gas turbine propulsion systems with traditional diesel propulsion systems.
4. Students will differentiate between various hybrid propulsion configurations and assess their suitability for different types of vessels.
5. Students will discuss the role of digitalization and automation in optimizing marine propulsion systems.

TEXT BOOKS:

1. "Marine Engineering: The Principles of Internal Combustion Engines and Turbines for Marine Engineers" by H. D. McGeorge
2. "Marine Propellers and Propulsion" by John Carlton
3. "Marine Diesel Engines: Maintenance, Troubleshooting, and Repair" by Nigel Calder
4. "Gas Turbine Handbook: Principles and Practices" by Tony Giampaolo
5. "Electric Ship Propulsion Systems" by Xiao-Hua Wang and Rajesh K. Mishra

REFERENCES:

1. "Hybrid Electric Ships and Autonomous Vessels" edited by Stefano Brizzolara and Michela Cigolini

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSO 1	PSO -2	PSO -3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	1	1									3	3	3	3
2.	3	2	2									3	3	3	3
3.	3		2	3								3	3	3	3
4.	3	1	2	3								3	3	3	3
5.	3	2	2	2								3	3	3	3

MR22023 MARINE PROPELLERS AND PROPULSION

L	T	P	C
3	0	0	3

OBJECTIVES:
To impart the knowledge on

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

UNIT I BASIC SHIP PROPULSION 9

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

UNIT II LAYOUT AND PROPULSION EQUIPMENT 9

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

UNIT III PERFORMANCE OF SHIP 9

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

UNIT IV PROPELLER THEORY 9

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

UNIT V RUDDER THEORY 9

Types of Rudder, Propeller and Rudder interaction, construction of Rudder, Pintle Bearing. Testing ofrudder.

TOTAL: 45 PERIODS

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					3	3								
2	2					3	3								
3	2					3	3								
4	2					3	3								
5	2					3	3								

CH22041	RENEWABLE ENERGY RESOURCES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

Understand energy scenario, energy sources and their utilization.
Explore society's present needs and future energy demands.
Study the principles of renewable energy conversion systems.
Exposed to energy conservation methods.

UNIT I	INTRODUCTION	9 Hours

Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

UNIT II	SOLAR ENERGY	9 Hours

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder.Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant. Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.

UNIT III	WIND AND BIOMASS ENERGY	9 Hours

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

UNIT IV	TIDAL AND OCEAN THERMAL ENERGY	9 Hours

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.

UNIT V	GREEN ENERGY	9 Hours

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H_2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

TOTAL: 45 PERIODS

REFERENCES:

1. D. Yogi Goswami & Frank Kreith, Energy Efficiency and Renewable Energy Handbook, Second Edition, 2016
2. Imene Yahyaoui, Advances in Renewable Energies and Power Technologies: Volume 1: Solar and Wind Energies, 2018.
3. John Twiddel & Tony Weir, Renewable Energy Resources, 2006.

Textbooks

4. Principles of Energy conversion, A. W. Culp Jr.,, McGraw Hill, 1996
5. Non-Convention Energy Resources, Shobh Nath Singh, Pearson, 2018

OUTCOMES		
Upon successful completion of the course, the students should be able to		
SL.NO	**STATEMENT**	**RBT LEVEL**
CO1	Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations.	**3**
CO2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation	**3**
CO3	Understand the conversion principles of wind and tidal energy	**2**
CO4	Understand the concept of biomass energy resources and green energy.	**2**
CO5	Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy	**3**

COURSE ARTICULATION MATRIX

CO	**POs**													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	2	2	2	2	2	2	1	2	3	2	3	3	3	3
2.	2	2	2	2	3	2	3	2	2	2	3	3	3	3
3.	2	2	2	2	2	3	3	2	3	3	2	3	3	3
4.	3	2	3	3	3	3	3	2	3	2	3	2	3	3
5.	3	3	3	3	3	3	3	3	3	2	3	3	3	3

MR22024 MECHANICS OF MARINE MACHINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To acquire knowledge regarding the fundamentals of mechanism and machine, as well as to be able to comprehend the diagrams of velocity and acceleration
2. To study and understand the various parameters of gears and their profiles
3. To analyse and evaluate the operation of control mechanisms such as governors and gyroscopes in aerospace and maritime systems, elucidating their significance in maintaining stability and control.
4. To comprehend the principles behind balancing of rotating and reciprocating masses in mechanical systems.
5. To gain a comprehensive understanding of free, forced, and torsional vibrations in single-degree-of-freedom systems.

UNIT I MECHANISMS **9**

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

UNIT II THEORY OF GEARING **9**

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

UNIT II CONTROL MECHANISMS **9**

Governors – gravity controlled, spring controlled, hydraulic and electronic governors – governor characteristics – Gyroscopes – gyroscopic forces and couple – gyroscopic effects on the movement of air planes and ships

UNIT IV BALANCING **9**

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

UNIT V VIBRATION **9**

Basic features of vibratory systems – Degrees of freedom – natural frequency of single degree freedom system — Free vibrations with viscous damping of single degree freedom system and solution – logarithmic decrement. Forced vibration of single degree freedom system with damping — vibration isolation and transmissibility -shaft with two rotors - torsional vibration of major components in Ships - problems.

TOTAL: 45 PERIODS

OUTCOMES:

1. Students will be able to demonstrate a solid understanding of the fundamentals of mechanisms and machines and they will proficiently interpret velocity and acceleration diagrams for various mechanical systems.

2. Students will acquire a thorough understanding of the parameters and profiles of gears, enabling them to select appropriate gear configurations for specific applications.
3. students will be able to analyze and evaluate the operation of control mechanisms like governors and gyroscopes
4. Students will comprehend the principles behind balancing rotating and reciprocating masses in mechanical systems
5. students will have a comprehensive understanding of free, forced, and torsional vibrations in single-degree-of-freedom systems.

TEXT BOOKS:

1. Rattan S.S., "Theory of Machines", 5th edition, Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2019.
2. Sandhu, Singh, "Theory of Machines", 3rd Edition, Pearson Education, 2012

REFERENCES:

1. Shingley, J.E. & John Joseph Uivker, Jr., "Theory of Machines and Mechanisms", 4th Ed., McGraw – Hill International Editions, London, 2014.
2. Francis. TSE. Ivan E-Morse Rolland T. Hinkle, "Mechanical Vibrations", 2nd Ed., CBS Publishers and distributer, India, 1983.
3. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros,8th Edition, 2009

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3						3	3	3	
2.	3	3				3						3	3	3	
3.	3	3				3						3	3	3	
4.	3	3				3						3	3	3	
5.	3	3				3						3	3	3	

MR22025 **OFFSHORE TECHNOLOGY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand the global distribution and estimation of offshore oil and gas reserves.
2. To understand the principles of structural design and load criteria for offshore platforms.
3. To understand the types and functions of drilling rigs and subsea production systems.
4. To understand the role and functions of offshore support vessels (OSVs) in offshore operations.
5. To understand the environmental impact assessment process for offshore projects.

UNIT I Introduction to Offshore Technology 9

Offshore oil and gas reserves and global distribution, Offshore industry sectors and their functions, Types of offshore structures and their characteristics, offshore environmental conditions and safety regulations, Health, Safety, and Environment (HSE) management systems, Offshore risk assessment and mitigation, Case studies of significant offshore incidents

UNIT II Offshore Structure Design and Analysis 9

Structural design principles and load criteria, Materials and corrosion protection for offshore structures, Analysis methods and types of offshore platforms, Stability and motion characteristics of floating structures, Reliability-based design approaches, Fabrication, installation, and commissioning processes, Case studies of successful platform designs

UNIT III Offshore production system 9

Overview of drilling operations and components, Types of drilling rigs and subsea production systems, Offshore production operations and facilities, Enhanced oil recovery techniques, Decommissioning and abandonment procedures

UNIT IV Offshore Support Vessels and Equipment 9

Role and functions of OSVs, Types of OSVs and dynamic positioning systems, Offshore lifting and handling equipment, Remotely Operated Vehicles (ROVs) and dive support vessels, Crew accommodation and safety features, Maintenance and repair practices, Emerging technologies in OSV design

UNIT V Offshore Environmental Considerations and Sustainable Practices 9

Environmental impact assessment process, Regulatory requirements for environmental protection, Oil spill response techniques and waste management, Marine habitat protection measures, Renewable energy sources in offshore environments, Carbon capture and storage technologies, Decommissioning strategies and sustainability integration

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course students will be able to

1. Students will demonstrate an understanding of the historical development and significance of offshore technology in the oil and gas industry.

2. Students will develop proficiency in structural design principles and materials selection for offshore platforms.
3. Students will evaluate production operations and facilities on offshore platforms.
4. Students will evaluate dynamic positioning (DP) systems and lifting equipment used on OSVs.
5. Students will assess habitat protection measures and renewable energy sources in offshore environments.

TEXT BOOKS:

1. "Offshore Structures: Design, Construction and Maintenance" by Mohamed A. El-Reedy
2. "Offshore Engineering: An Introduction" by Angus Mather and Chakrabarti
3. "Offshore Platforms and Pipelines: Selected Contributions from the Ocean Engineering International Symposium" edited by S. G. Gopalakrishnan
4. "Offshore Production Handbook: Practical Oil and Gas Production" by Joe Leimkuhler
5. "Offshore Drilling Operations: Equipment and Procedures" by William Lyons and Gary J. Plisga
6. "Offshore Engineering" by Subrata Chakrabarti

REFERENCES:

1. "Offshore Structural Engineering: Reliability and Risk Assessment" by Srinivasan Chandrasekaran
2. "Offshore Support Vessels: A Practical Guide" by Adrian D. Griffiths
3. "Introduction to Offshore Structures: Design, Fabrication, Installation, and Maintenance" by F. C. Udegbunam
4. "Offshore Production Operations: A Quick Guide to Best Practice" by Nicholas P. Cheremisinoff

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	1	1									3	3	3	3
2.	3	2	2									3	3	3	3
3.	3		2	3								3	3	3	3
4.	3	1	2	3								3	3	3	3
5.	3	2	2	2								3	3	3	3

MR22026 SHIPBOARD LEADERSHIP AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Equip students with leadership skills essential for effective shipboard management.
2. Enable students to understand principles of organizational behaviour and human resource management in maritime contexts.
3. Facilitate students in fostering communication and teamwork within shipboard environments.
4. Empower students to implement strategies for conflict resolution and crisis management on-board vessels.
5. Ensure students understand and comply with maritime regulations and safety protocols.

UNIT I DEVELOPING LEADERSHIP SKILLS FOR SHIPBOARD MANAGEMENT 9

Leadership fundamentals and Situational leadership - Communication skills - Decision-making - Team building - Conflict resolution - Cultural awareness - Crisis management - Maritime regulations - Case studies and simulations.

UNIT II UNDERSTANDING ORGANIZATIONAL BEHAVIOR AND HUMAN RESOURCE MANAGEMENT 9

Organizational behaviour basics - Leadership styles - Motivation theories - Team dynamics - Communication channels - Conflict resolution strategies - Recruitment and selection - Training and development - Performance appraisal and Diversity management.

UNIT III FOSTERING COMMUNICATION AND TEAMWORK 9

Effective communication - Verbal and non-verbal communication - Active listening and Feedback mechanisms - Team formation - Collaboration tools - Group dynamics - Conflict management - Cultural sensitivity - Virtual teamwork.

UNIT IV STRATEGIES FOR CONFLICT RESOLUTION AND CRISIS MANAGEMENT 9

Conflict identification and resolution techniques - Negotiation skills - Mediation and arbitration - Crisis anticipation - Crisis response planning - Emergency protocols - Decision-making under pressure - Risk assessment - Post-crisis evaluation.

UNIT V ENSURING COMPLIANCE WITH MARITIME REGULATIONS AND SAFETY PROTOCOLS 9

Maritime regulations overview - Safety protocols explanation - Compliance assessment - Regulatory compliance training - Safety drills and Risk management strategies - Emergency response procedures - Safety equipment usage - Incident reporting - Audit and inspection preparation.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Demonstrate leadership skills essential for shipboard management.
2. Apply principles of organizational behaviour and human resource management.
3. Facilitate effective communication and teamwork on-board.
4. Implement conflict resolution and crisis management strategies.
5. Ensure compliance with maritime regulations and safety protocols.

TEXT BOOKS:

1. "Maritime Management" by K. R. Chandran
2. "Leadership in Maritime Organizations" by S. S. Rana
3. "Maritime Human Resource Management" by S. K. Mukherjee
4. "Communication Skills for Maritime Professionals" by A. K. Gupta
5. "Crisis Management in Maritime Industry" by R. K. Sharma

REFERENCES:

1. "Teamwork and Leadership in the Maritime Industry" by Colin Clark
2. "Crisis Management in the Maritime Industry" by Michael P. Kirwan
3. "Maritime Safety: Current Problems of Use and Sustainable Development" by Adam Weintrit and Tomasz Neumann
4. "Organizational Behavior: Managing People and Organizations" by Ricky W. Griffin
5. "Human Resource Management in the Maritime Industry" by Paul Teague

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	2		2										2	3	
2.	2					2							2	3	
3.	2								3	3				3	
4.	1	3				3	2							3	
5.	2					3						1	3	3	

MR22027 BASIC CONCEPTS OF MARINE INSURANCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand the historical development and evolution of marine insurance.
2. To identify and analyze the difference between various types of marine insurance policies.
3. To Assess and manage marine insurance risks through effective underwriting practices.
4. To provide the vide knowledge on Investigating marine insurance claims to determine cause, extent, and validity.
5. To understand the marine insurance laws and regulations applicable in different jurisdictions.

UNIT I Introduction to Marine Insurance 9

Definition and scope of marine insurance, Historical development of marine insurance, Role and importance of marine insurance, Principles of marine insurance contracts, Parties involved in marine insurance transactions, classification of marine risks, international conventions and regulations, Role of marine insurance in trade and logistics, Emerging trends and challenges

UNIT II Types of Marine Insurance Policies 9

Overview of hull insurance, Cargo insurance: coverage and valuation, Freight insurance: coverage and claims, Liability insurance in the marine industry, War risk and terrorism coverage, Builder's risk insurance, Marine hull and machinery insurance, Specialized marine insurance products, Emerging coverage options

UNIT III Marine Insurance Underwriting 9

Basics of underwriting, Underwriting guidelines and criteria, Premium calculation methods, Loss prevention and risk management, underwriting process for different policies, Role of underwriters and brokers, Considerations for insuring vessels and cargoes, Underwriting audits and quality control, Technological innovations in underwriting

UNIT IV Marine Insurance Claims and Settlement 9

Procedure for filing claims, Claims investigation process, Loss adjustment techniques, Evaluation of losses, Settlement options, Subrogation rights and recovery actions, Dispute resolution mechanisms, Role of loss adjusters and legal advisors, Case studies of claims settlement

UNIT V Legal and Regulatory Aspects of Marine Insurance 9

Legal principles in marine insurance contracts, Laws and regulations in different jurisdictions, Marine insurance clauses and endorsements, Admiralty law and maritime jurisdiction, Arbitration and mediation in disputes, Role of insurance regulators, Compliance requirements for insurers and brokers, Emerging legal and regulatory trends, Case studies of notable disputes and court decisions

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course

1. Students will be able to define and explain the basic principles and concepts of marine insurance contracts.

2. Students will understand the coverage, risks, and exclusions associated with different types of marine insurance policies.

3. Students will apply underwriting guidelines and criteria to evaluate marine insurance applications effectively.
4. Students will understand the settlement options and procedures for marine insurance claims and assess their implications
5. Students will explore dispute resolution mechanisms in marine insurance, including arbitration and mediation, and understand their application in resolving insurance disputes.

TEXT BOOKS:

1. "Marine Insurance: Law and Practice" by Francis Rose
2. "Marine Insurance: Origins and Institutions, 1300-1850" by Adrian Leonard
3. "Principles of Insurance" by George E. Rejda and Michael J. McNamara

REFERENCES:

1. "Marine Insurance: Its Principles and Practice" by Alfred Charles Galpin
2. "Marine Insurance: A Comprehensive Guide" by John Dunt

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.		3	2			2		3		2		3	3	3	3
2.		3	2	3		2	2	3		2	3	3	3	3	3
3.		3	3	3		2	2	3		2	3	3	3	3	3
4.		3	3	3		2	2	3		2	3	3	3	3	3
5.		3	2	3		2	2	3		2	3	3	3	3	3

MR22028 SHIP SAFETY AND ENVIRONMENTAL PROTECTION

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

At the end of the course, the students will have the knowledge on
Ship management, drills, ship's certification, communication codes and conventions.Ship's safety and security, emergency operations and marine investigation.
Pollution prevention by oil, sewage and air.
IMDG, pollution prevention by waste, harmful substances in packaged form.

UNIT I PERSONNEL MANAGEMENT 9

Manning process, Drug and alcohol policy, Ship staff allocations, Communication on the ship- Ship Identification number, Continuous synopsis record, Muster and various drills , Ship safety management system, functions and responsibilities of SSO & CSO special operation & critical ship board operation, Ship certification and verification control, Conformity and Non conformity. Ship security alert system (SSAS) Automatic Identification system (AIS), Long range identification and tracking of ship, Alternate and equivalent security arrangements.

UNIT II RULES AND REGULATIONS 9

Merchant shipping act & Rules, Knowledge of Codes and Conventions, Classification society, port state and flag state control and their duties, MARPOL 73/78 and latest MARPOL amendments. Other country legislations like OPA90 MARPOL equipment, Training of staff for emergency duties, Safety management system- Ship certification and Verification, administrative duties at operational level.

UNIT III SURVIVAL TECHNIQUE AND MARINE CASUALITY 9

Emergency operations, Use of survival equipment's, Life boat and rescue boat, helicopter Rescue, pyrotechnique, Emergency medical Assistance, Radio medical advice, Threats to the ship, Marine causalities and investigation, Actions to be taken in case of accidents or illnesses that are likely tooccur on board Ships

UNIT IV SHIPBOARD POLLUTION PROTECTION 9

Prevention of Pollution by OIL- Pollution of the Marine environment during bunkering, loading/discharging oil cargo, Pumping out bilges, SOPEP, Equipment in engine room and on tankers, Prevention of Pollution by Sewage and its Discharge criteria, Ballast water management- outline. Prevention of Air pollution form the ship- NOx, SOx, Ozone depletion, Causes and effects, ECA & SECA, Sulphur 2020.

UNIT V POLLUTION PREVENTION BY DISPOSAL OF WASTE AND HARMFULL SUBSTANCES 9

IMDG-Classification, Markings and labelling of the dangerous goods, Packing, Securing, Documentation, Prevention of pollution by Garbage & Harmful substance in the packaged form from ships , Port state control over the safe operation of the ships.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Ship management, Drills, Ship certification.
2. Codes and Conventions, Ship safety and security, Communication.
3. Emergency operations and marine investigation.
4. Pollution prevention by Oil, Sewage, Air.
5. IMDG, Pollution prevention by Waste, Harmful substances in packaged form.

TEXT BOOKS:

1. International Convention on Standards of Training, Certification and Watch keeping for Seafarers, IMO Publication, 4th ed., 2017 edition, January 1, 2018.(Inc. STCW2010 amendments)
2. MARPOL 73/78 consolidated edition, International maritime organization- IMO publication, 2017.
3. Ship board operation, "H.I. LAVERY", Butterworth-Heinemann Routledge; Revised 2edition, 2017. 4. Ship's safety & Environmental protection, "Vikram Gokhale & N. Nanda", 8th edition,2017.

REFERENCES:

1. Bhandarkar V.K. "SOLAS Consolidated Edition 2018 with Commentary", Bhandarkar Publications;2017 edition, 2018.
2. IMDG Code - International Maritime Dangerous Goods, International Maritime Organization,2010.
3. ISM CODE, International Maritime organization, second edition,2002 4. ISPS CODE, International Maritime organization, 2003.
5. "Maritime Labor Convention", International Maritime organization, 2006.
6. Bhandarkar V.K. "MS & M Notices", 1st Edition, Bhandarkar Publishers, Mumbai, 1998.
7. IMO model course 7.03, Edition 2014.

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					3	3			3		3	2		
2	2					3	3			3		3	2		
3	2					3	3			3		3	2		
4	2					3	3			3		3	2		
5	2					3	3			3		3	2		

VERTICAL III

MR22031 SPECIAL DUTY VESSEL & TYPES OF OPERATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To impart knowledge to the students about

- Types of special duty ships.
- Cargo operations in oil tankers.
- Oil tanker routine operations.
- Handling dangerous cargoes like LNG/LPG.
- Classification society regulations.

UNIT I TYPES OF SPECIAL DUTY VESSELS 9

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

UNIT II CARGO OPERATIONS IN OIL TANKER 9

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

UNIT III OIL TANKERS ROUTINE OPERATIONS 9

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

UNIT IV INTRINSICALLY DANGEROUS CARGOES 9

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

UNIT V RULES AND REGULATIONS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

After the completion of the course the students will have knowledge on

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

TEXT BOOKS:

1. Lavery, "Ship board operation", 2nd Edition, Butter Worth- Heinemann, London, 1990
2. "Marine Auxiliary Machinery ",HD Mc George Butter Worth –Heinemann publication 1998
3. "Ship construction for Marine Engineers ",Paul A Rusell, Thomas Reeds 6thEdition 2016

REFERENCES:

1. Indian Register of Shipping Part1 to Part7, "Rules and Regulations for the construction andclassification of steel ships", 1st Edition, Indian Register of Shipping, Mumbai,1999.
2. International of Maritime Organization, "SOLAS consolidated Edition 1997", 2nd Edition SterlingBook House, Mumbai, 1997
3. V.K. Bhandarkar, "MS & M Notices to Mariners", 1st Edition, Bhandarkar Publications Mumbai,1998
4. D.J. Eyres, "Ship Construction", 4th Edition, Butter worth – Heinemann, Oxford, 1994

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					3	3			3		3			
2	2					3	3			3		3			
3	2					3	3			3		3			
4	2					3	3			3		3			
5	2					3	3			3		3			

MR22032 MARINE CORROSION AND PREVENTION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce mechanisms and types of corrosion.
2. To acquaint students with the various methods of hull preparation to prevent corrosion.
3. To introduce the students to the various modern paints used in ship structures.
4. To introduce the students to the types of corrosion that occur in boilers and marine diesel engines.
5. To acquaint the students with the different Methods of preventing the various types of corrosion.

UNIT I CORROSION MECHANISM **9**

Atoms & Ions, PH value, Electro-chemical corrosion. Mechanism of corrosion- Factors influencing corrosion-Electrochemical series, galvanic series-Eh-pH diagrams – fundamental aspects, Construction of Eh – pH diagrams. Fe- H2O-O2 diagram, Copper, Aluminum and general corrosion diagrams. Galvanic cell- chemical corrosion – Electro chemical corrosion–Direct chemical attack– Electro-Chemical attack – Reasons – Remedial measures. Various types of corrosion.

UNIT II HULL PLATE SURFACE PREPARATION **9**

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

UNIT III MODERN PAINTS **9**

Basic composition of paint - Alkyd – bitumen – chlorinated rubber – coal tar epoxy – Epoxy – Oleo-resinous – phenolic – polyurethane – primers – vinyl – self polishing copolymers . Shipboard paint systems- Underwater AF paints .Boot top anti-corrosive paints – Super structure paints.

UNIT IV CORROSION IN BOILER & MARINE DIESEL ENGINES **9**

Effect of salts & Grease in feed water. Effect of corrosion while boiler is not in service – preservation to avoid corrosion. Corrosive wear of cylinder liners – Reasons, remedies & effects – corrosion of Main Engine Jacket cooling spaces – Reasons and remedies – Corrosion in bearings.

UNIT V METHODS OF CORROSION PREVENTION **9**

Anodic & cathodic protection. Anodic control protection- Forms of metallic coatings –anodizing – phosphating, Physical vapour deposition technologies, ion plating, sputter deposition, reactive deposition, magnetron sputtering, and duplex treatments. Cathodic protection- sacrificial anodes, Impressed Current Cathodic protection. Design faults causing corrosion.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the successful completion of the course, students should be able to:

1. Identify the mechanisms behind corrosion
2. Apply correct method of prevention during operation
3. Select different anti-corrosive paints
4. Detect corrosion in boilers and IC Engines
5. Design and develop mechanisms against corrosion

TEXT BOOKS:

1. Mars G. F., "Corrosion engineering",3rd Edition, McGraw Hill 2017
2. Raj. B, Kamachi Mudali U., and Rangarajan S., "Corrosion Prevention and Control", Standard Edition, Narosa, New Delhi 2008
3. Schweitzer, 'Fundamentals of Corrosion", 1st Ed. Taylor & Francis, Indian Reprint 2012. (Yesdee Publishing Pvt. Ltd.)
4. M.E.P., "Corrosion for Marine & Offshore Engineers", Marine Engineering Practice, Vol.02, Part 11, IMarEST, London.
5. J.R. Davis, "Corrosion: Understanding the Basics", ASM International, 2000, 0-87170-641-5.

REFERENCES:

1. Pierre R. Roberge, "Corrosion Engineering Principles and Practice", 1st Ed., McGraw Hill, 2008
2. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control",1st Ed. Elsevier Ltd.,2006
3. Francis Laurence LaQue , " Marine corrosion: causes and prevention", 1st Ed., Wiley, 1975
4. Claire Hellio, Diego M. Yebra, Pinturas Hempel S.A., "Advances in Marine Antifouling Coatings and Technologies", Woodhead Publishing, 2009.
5. Lavery, H.I., "Shipboard operations" Institute of Marine Engineers Publication, 1990

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	3			2								3	3	3	
2.	3		3									3	3	3	
3.	3											3	3	3	
4.	3											3	3	3	
5.	3		3	2								3	3	3	

MR22033 MARINE ENVIRONMENT AND AIR QUALITY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

- Various sources of air pollution and their characteristics
- Behavior of pollutants dispersion
- Air quality index and their application
- Impacts of air pollution
- Methods and means of controlling air pollution

UNIT I Introduction to Air Pollution 9

Air and its composition, Air Pollution, Sources of air pollution and its classification, Major air pollutants and their characteristics, Specific group pollutants such as CFC, GHG etc. Air Pollutant from various industrial and marine sectors. Impact of air pollution on human health and vegetation.

UNIT II Pollutant Dispersion 9

Concept of atmospheric stability, Adiabatic and Environmental Lapse rate, Plume behavior, Effect of topography, terrain and structure on pollutant dispersion. Effect of wind on pollutant dispersion. Concept of maximum mixing depth and ventilation coefficient. Plumerise and effective stack height.

UNIT III Air Quality 9

Introduction to Air quality index and Comprehensive Environmental Pollution Index and its application.Sampling and measurement of air pollutants. Introduction to National Ambient Air Quality Standards, Clean air act. Air quality index ranking of various countries.

UNIT IV Impacts of Air Pollution 9

Extreme air Pollution scenarios: Acid Rain, Global Warming, Smog, Ozone layer depletion healthHazards to humans and other living organisms. Various treaties and protocols: Kyoto Protocol, Montreal Protocol and Montreal amendment.

UNIT V Air Pollution Control methods and equipment 9

Introduction to control methods and equipment for Particulate matter and gases. Design and working of scrubbers, Electrostatic Precipitator, Gravity settlers, Cyclone separator Filter bags. Othermechanisms of air pollution control such as Biochemical Processes catalytic processes. Selective catalytic reduction method.

TOTAL PERIODS: 45

OUTCOMES:

On completion of this course the students are expected to

- Know the sources of air pollution and their characteristics
- Be aware of the behavior of pollutants dispersion
- Comprehend the air quality index and their application

- Have knowledge on impacts of air pollution
- Be aware of methods and means of controlling air pollution

TEXT BOOKS:

1. Rao M.N.and Rao H. V. N., "Air Pollution", New Century Publications, 2001
2. De Nevers, Noel, "Air Pollution Control Engineering", Mc Graw-Hill, 2000
3. Trivedy, R.K; Goel, P.K. "An Introduction to Air Pollution", BSP Publications, 2012

REFERENCES:

1. International Maritime Organization, "Regulations for the Prevention of Air Pollution from ships and Technical Code", Sterling Book House, 2000
2. Punmia, B.C, Jain, Ashok Kumar, Jain, Arun Kumar "Waste Water Engineering: Including Air Pollution "Laxmi Publications, 2017
3. Garg, Santosh Kumar; Garg, Rajeshwari, Sewage Disposal And Air Pollution Engineering, Khanna Publishers, 2009

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					3	3					3	2		
2	2					3	3					3	2		
3	2					3	3					3	2		
4	2					3	3					3	2		
5	2					3	3					3	2		

MR22034 MARINE VIBRATION MEASUREMENT TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To provide a fundamental understanding of vibration principles and their relevance in engineering systems
2. To familiarize students with various sensors, transducers, and instrumentation used in vibration measurement.
3. To develop proficiency in designing, implementing, and calibrating vibration measurement systems.
4. To equip students with skills in analysing and interpreting vibration data using advanced signal processing techniques.
5. To prepare students for applying vibration measurement techniques in real-world engineering applications and problem-solving scenarios.

UNIT I FUNDAMENTALS OF VIBRATION 9

Introduction to vibration- definitions, terminology, and basic principles. Single-degree-of-freedom systems-mass-spring-damper systems, equations of motion. Multi-degree-of-freedom systems, natural frequencies, mode shapes. Free and forced vibration: response to external forces, resonance- Types of vibrations in marine environments- Importance of vibration measurement in marine engineering.

UNIT II SENSORS AND TRANSDUCERS 9

Sensors and transducers used in marine vibration measurement -Types of vibration sensors: accelerometers, velocity sensors, displacement transducers- Principles of operation and selection criteria for vibration sensors- Installation and mounting considerations for vibration sensors
Signal conditioning: amplification, filtering, and analog-to-digital conversion.

UNIT III INSTRUMENTATION AND MEASUREMENT SYSTEMS 9

Overview of vibration measurement systems: hardware and software components-Data acquisition systems: types, specifications, and interfaces- Calibration procedures for vibration measurement instruments- Real-time monitoring systems and remote data acquisition technique in marine environment

UNIT IV DATA ANALYSIS AND SIGNAL PROCESSING 9

Time-domain analysis: waveform analysis, peak detection, and transient response. Frequency-domain analysis: Fourier transform, power spectral density, frequency response functions. Statistical analysis techniques for vibration data: mean, standard deviation, probability density functions.

UNIT V - APPLICATIONS AND CASE STUDIES 9

Vibration measurement in engineering systems: Marine vessels, ship machinery and offshore structures. Case studies illustrating practical applications of vibration measurement techniques. Emerging trends and future directions in vibration measurement technology.

TOTAL: 45 PERIODS

OUTCOMES:

1. Students will demonstrate comprehension of the fundamental concepts of vibration, including single and multi-degree-of-freedom systems, free and forced vibration, and resonance phenomena.

2. Students will be able to identify different types of vibration sensors and transducers, understand their operating principles, and select appropriate sensors based on specific measurement requirements.
3. Students will gain practical experience in designing and implementing vibration measurement systems, including data acquisition hardware and software components, and conducting calibration procedures.
4. Students will demonstrate competence in analyzing and interpreting vibration data using time-domain and frequency-domain analysis techniques.
5. Students will be able to apply vibration measurement techniques to various engineering systems, understand their practical implications for condition monitoring and predictive maintenance

TEXT BOOKS:

1. Rao, S.S., "Mechanical Vibrations", Pearson Education, Sixth edition, 2018.
2. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements",6th edition, Pearson Education India,2013

REFERENCES:

1. Cornelius Scheffer and Paresh Girdhar. "Practical Machinery Vibration Analysis and Predictive Maintenance", Newnes- Elsevier 1st Edition, 2004
2. Yong Bai and Wei-Chou Virgil Ping, "Marine Structural Design", Butterworth-Heinemann-Elsevier, Second Edition ,2016
3. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros,8th Edition, 2009

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3				3						3	3	3	
2.	3	3				3						3	3	3	
3.	3	3				3						3	3	3	
4.	3	3				3						3	3	3	
5.	3	3				3						3	3	3	

MR22035 ENERGY EFFICIENT SHIP OPERATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To Understand the importance and significance of energy efficiency in maritime transportation.
2. To Evaluate the role of computational tools and simulations in assessing and optimizing ship performance.
3. To Implement best practices for optimizing engine performance, including load management and fuel-efficient operation.
4. To Understand the concept of hybrid propulsion systems and their role in achieving energy efficiency.
5. To provide the wide knowledge to Analyze the role of classification societies, flag states, and port authorities in enforcing energy efficiency regulations.

UNIT I Basic introduction to the ship operation 9

Overview of energy efficiency, Benefits and regulations, Key performance indicators, Technological advancements, Economic and environmental drivers, Energy management systems, Case studies, Challenges, Barriers.

UNIT II Ship Design 9

Principles and hull form, Propulsion system optimization, Engine efficiency and fuels, Alternative propulsion, Air lubrication and drag reduction, Materials and coatings, Computational analysis, Hydrodynamics, Innovations

UNIT III Energy Management in the ships 9

Ship energy management plans, Onboard practices, Voyage planning, Trim and ballast, Engine load optimization, Navigation techniques, Waste heat recovery, Crew training, Monitoring and analysis

UNIT IV Renewable Energy in shipping 9

Solar and wind power, Wind propulsion technologies, Hydrodynamic energy, Integration and systems, Hybrid propulsion, Energy storage, Case studies, Trends, Developments

UNIT V Regulations and Sustainability 9

IMO regulations, EEDI and SEEMP, Ballast water management, Air emissions regulations, Fuel quality, Environmental impact assessment, green initiatives, CSR and stakeholders, Long-term sustainability

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

1. Understand energy efficiency in maritime transportation.
2. Analyze ship design for improved energy efficiency.
3. Develop effective energy management strategies.
4. Evaluate renewable energy integration for sustainable operation.
5. Comply with regulations for environmental sustainability.

TEXT BOOKS:

1. "Energy Efficient Ships: Principles and Practice" by Adam J. Wittridge

2. "Marine Engineering: Energy Efficiency and Technology Integration" by Jin Wang and Xinping Yan
3. "Ship Energy Efficiency: Concepts and Applications" by Brij Bhushan Agrawal
4. "Introduction to Marine Engineering: Ship Energy Efficiency and Environmental Impact" by R. P. Tripathi and S. Rajesh
5. "Energy Management in Shipping: A Practical Approach" by Anthony Jennings and Trevor Weir

REFERENCES:

1. "Renewable Energy Technologies for Ships" edited by Young Joo Lee and Jin Wang
2. "Handbook of Maritime Energy Management" edited by Felix H. Hardisson and Nils Ehlers

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3						3					3	3	3	3
2.	3		3				3					3	3	3	3
3.	3	2	3				3					3	3	3	3
4.	3	2	3				3					3	3	3	3
5.	3	2	3				3					3	3	3	3

MR22036 FUEL AND LUBRICATION TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

1. Understand the classification of fuel, their sources and properties
2. Explore about the alternate and renewable fuels
3. Understand the properties and characteristics of lubricants used in the industry.
4. Learn about the various lubrication techniques and their suitability for different equipment
5. Analyze the importance of purification of fuel oil and lubrication oil and various methods of purification

UNIT I CLASSIFICATION OF FUELS AND THE PROPERTIES OF FUEL. 9

Definition of fuel- classification of fuels-importance of fuels in energy production-physical properties-chemical properties-fossil fuels-refining process for petroleum and natural gas- combustion process- air pollution from combustion of fossil fuels

UNIT II ALTERNATE AND RENEWABLE FUELS 9

Need of alternate fuels- renewable fuels-greenhouse gas emissions- biofuel production – hydrogen as fuel-solar energy- photovoltaic cells-wind energy- geothermal energy-sustainable fuel options- policy and regulatory aspects in the industry

UNIT III LUBRICANTS, THEIR USES AND PROPERTIES 9

Definition of lubrication-role of lubricants-friction reduction-wear reduction-corrosion protection-energy efficient-types of lubricants-lubricant properties-viscosity index- VI modifiers-additives and their requirements in lubricants-selection of correct lubricants and its compatibility

UNIT IV LUBRICATION ARRANGEMENTS IN VARIOUS TYPES MACHINERY 9

Types of lubrication- splash-pressure-mist-grease-hydro-dynamic lubrication- formation of oil wedge in hydrodynamic lubrication and its importance- pressure lubrication- importance of maintaining correct pressure- importance of proper clearance between the mating components

UNIT V CONDITION MONITORING, ANALYZIS & PURIFICATION OF FUEL AND LUBRICATING OILS 9

Simple tests conducted onboard to monitor the condition- laboratory tests- sampling procedure- filtration- types of filters- auto clean filters- purification- continuous purification- batch purification- micro biological growth

Text books:

1. "Introduction to Tribology" by Bharat Bhushan
2. " Fundamentals of Tribology" by B.B. Ahujha
3. "Elements of Fuel & Combustion Technology" by O.P. Gupta

OUTCOMES:

On completion of this course the students are expected to know the

1. Classification and properties of various fuels
2. Alternate fuels available and the importance of going for alternate fuels
3. Various lubricants and their desirable properties
4. Various lubrication arrangements for machinery
5. Condition monitoring of FO LO & tests carried out on them

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3					2	3					3	3	2	
2	3					2	3					3	3	2	
3	3					2	3					3	3	2	
4	3					2	3					3	3	2	
5	3					2	3					3	3	2	

VERTICAL
IV

MR22041 **SHIP RECYCLING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to provide students with a

1. Comprehensive understanding of Ship Recycling
2. Wide knowledge on the environmental aspects of the ship recycling etc.
3. Comprehensive knowledge on ship recycling regulations and laws associated with recycling
4. High knowledge on safety aspect of the Ship recycling etc.
5. Basic knowledge on the operation aspect of the ship recycling etc.

UNIT I Introduction to Ship Recycling **9**

Ship Recycling- Importance, advantages and disadvantages of Ship Recycling, Current trends and challenges in the Ship Recycling industry, A brief history of Ship Recycling, Difference between Shipbreaking and Ship Recycling, Environmental impact of Ship Recycling, Social impact of Ship Recycling, Economic impact of Ship Recycling, Laws and regulations governing Ship Recycling

UNIT II Ship Recycling Processes and Methods **9**

Important steps in ship dismantling and cleaning, Different methods of Ship Recycling (dry dock, wet dock, beach), How to handle oil residue and chemicals during Ship Recycling, Disposal of hazardous waste, Reusing and recycling ship materials, Safety precautions during Ship Recycling, Environmental considerations during Ship Recycling, ensuring safety and environmental standards are met

UNIT III Ship Recycling Laws, Regulations, and Certification **9**

International regulations like the Basel and Hong Kong Conventions, Guidelines from the International Maritime Organization (IMO), National and regional laws regarding Ship Recycling, the role of certification organizations, Liability policies for Ship Recycling, Monitoring and auditing of Ship Recycling processes, financial aspects of Ship Recycling, Legal recourse for victims of Ship Recycling, Ensuring compliance with regulations and standards.

UNIT IV Technical and Safety Aspects of Ship Recycling **9**

Common hazards in Ship Recycling, Safety measures for workers, Personal protective equipment (PPE) use, Worker health monitoring, Quality control during Ship Recycling, Emergency preparedness and response, Fire safety protocols, Environmental protection measures, ensuring worker safety and minimizing risks

UNIT V Operational Aspects of Ship Recycling **9**

Selling old ships: strategies and considerations, financial factors to think about during Ship Recycling, Role of marine insurance, Influence of politics on Ship Recycling, Relationship between ship owners and recycling yards, Contracts and agreements involved in Ship Recycling, Building infrastructure for Ship Recycling, Economic impact on local communities, Technological advancements in Ship Recycling

TOTAL: 45 PERIODS

OUTCOMES:

1. Students will be able to understand the definition, advantages, and challenges of Ship Recycling
2. At the end of the course the student will identify the ship recycling process and methods, analyse the regulatory requirements
3. Students will be able to understand the certification process of the ship recycling and ship building
4. Students will be able to understand the evaluate technical and safety aspects
5. Students will be able to understand the operational and economic aspects of Ship Recycling

TEXT BOOKS:

1. Shipbreaking and Recycling by Nikos Mikelis, Apostolos Belokas & Shashank Bhatia (2018)
2. The Ship Breaking and Recycling Industry in Bangladesh and Pakistan: A Comparative Study of Conditions, Capacities and Capabilities by Anurag Mishra & Md. Moarref Hossain (2019)
3. Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists by Ernst Worrell, Markus A. Reuter & Martina P. F. Bertau (2014)
4. Hazardous Materials Regulations Guide by J.J. Keller & Associates (updated annually)
5. Sustainable Shipyards: The Role of Environmental Management in Shipbuilding and Ship Repair by Terri R. Norton (2011)

REFERENCES:

1. Guidelines on Ship Recycling by International Maritime Organization (2019)
2. Studies on Shipping Industry, Ship Scrapping and Ship Recycling by Dr. Ram Karan, Dr. L.S. Chauhan & Dr. V. Vijayalakshmi (2016)
3. Encyclopaedia of Occupational Health and Safety by Jeanne Mager Stellman (2011)
4. Maritime Safety, Security and Piracy by Mary Brooks & Dalal Siam (2012)
5. Ship Recycling: Risk Assessment in a Social Perspective by Siti Masfufah Wardah & Khairulmaini Osman Salleh (2018)

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3	3	1			3						3	3	3	3
2.	3	2	1	2		3		1				3	3	3	3
3.	3	3	2	2	1	3		1				3	3	3	3
4.	3	2	3	2	1	3		1				3	3	3	3
5.	3	2	3	2	1	3		1				3	3	3	3

MR22403 MATERIAL HANDLING EQUIPMENT

L	T	P	C
3	0	0	3

COUSE OUTCOMES:

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

1. To identify different types of material handling equipment and their application
2. To select a particular type of equipment for handling of the material
3. To emphasize the importance of safety in material handling operations
4. On the maintenance and repair of the equipment used for handling the materials
5. On the proper storage of the materials for their easy identification and usage

Unit I Different types of handling equipment **9**

Importance of the handling equipment in manufacturing, ware housing and logistics- types of material handling equipment-chain blocks-conveyors-forklifts-cranes-automated guided vehicles (AGV)-pallet jacks-hoists- significance of efficient material handling in improving the productivity and reducing costs

Unit II Selection of the material handling equipment **9**

Load capacity-lift height- reach-maneuverability-various sources of power- electrical, hydraulic, and pneumatic-safe working load (SWL)-automated material handling systems (AMHS)

Unit III Importance of safety in material handling equipment **9**

Safe working practices to be followed- common hazards with handling materials-manual handling of materials precautions-explosive materials-corrosive materials-chemicals-personal protective equipment (PPE)-alarm and trips provided in the equipment- arrangement in case of power failure in power operated equipment

Unit IV Maintenance and repair on material handling equipment **9**

Importance of maintenance-maintenance schedule-preventive maintenance-safety keeping and storing of lifting equipment- safety keeping of storage premises-signs of wear-

Unit V Storage and identification of stored materials **9**

Unit load formation equipment-storage equipment-warehousing- warehouse types and their uses-storage containers- securing of stored materials- procedure for marking-stacking of materials

Course outcomes:
At the end of the course, the students should

1. Have knowledge about various handling equipment
2. Select a particular material handling equipment for the given requirement
3. Appreciate the various hazards associated with handling equipment
4. Understand the importance of maintenance and repair of handling equipment
5. Demonstrate the various methods of storage and identification methods

Text books:

1. Material handling: Repair and maintenance of equipment by Sanjivan Saini Kindle edition
2. Material management and materials handling by S C Sharma Khanna publications 1995 4th edition
3. Introduction to material handling by Ray, Siddhartha, New Age International (P) Ltd., Publishers II edition
4. Material handling and identification technology

Books for reference:

1. Design and Selection of Bulk Material Handling Equipment and Systems: Volume I: Mining, Mineral Processing, Port, Plant and Excavation Engineering" by Peter Hilgraf

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					2						3	2	2	
2	2					2						3	2	2	
3	2					3						3	2	2	
4	2					3						3	2	2	
5	2					2						3	2	2	

<Foot Note has to be given about the strength of correlations here>

MR22044 DRY DOCKING AND SHIP REPAIRS

L	T	P	C
3	0	0	3

COUSE OBJECTIVES:

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

1. Purpose and process of dry docking
2. Types of dry docking- advantages and disadvantages of each method
3. Dry docking procedures
4. Various ship repair activities taken up in dry docking
5. Other ship repairs, emergency repairs, lay off

UNIT I INTRODUCTION TO DRY DOCKING 9

Definition of dry docking-purpose of dry docking- importance of regular maintenance- importance of dry docking- periodicity of dry docking- works taken up during dry docking- survey and presence of classification society in dry dock period-cost & budget preparation for dry docking

UNIT II DRY DOCKS-TYPES AND COMPARISON 9

Grave dock- construction of grave dock- flooding and pumping out arrangements - floating dry dock-construction of floating dry dock – restriction for the use of floating dry dock-cradle dock-

UNIT III- DRY DOCKING PROEDURES 9

Procedure for dry docking the ship- dock preparation- docking version I & II its importance- preparation of ship for dry docking- entering the dock- pumping out of the dock- critical period- actions to be taken immediately after the ship has got dry docked-jobs taken up in dry dock- coordination between shipyard and ship's crew- emergency preparedness in dry dock

UNIT IV SHIP REPAIR ACTIVITIES TAKEN UP IN DRY DOCKING 9

Structural repairs-preparation for plate renewal- preparation of the area for plate renewal- safety precautions – qualification of welders- mechanical repairs- repair and testing of rudder – propeller withdrawal – tail shaft withdrawal-hull preparation- sand blasting- water blasting – a comparison- painting scheme- anti fouling paints- latest regulations regarding usage of antifouling paints

UNIT V OTHER TYPES OF SHIP REPAIRS 9

Emergency repairs-repairs carried out whilst floating-layoff activity- repairs before and after dry docking & its importance- structural plate renewal in afloat condition- repair activity taken up during sailing- sailing squad- safety measures to be taken up whilst sailing

Course outcomes:

After the completion of the course the students will have knowledge on
Various requirements for dry docking a ship
Types of dry docks the merits and demerits of each type
Procedures to be followed for dry docking prior to docking and post dry docking
Actions taken in emergency repairs

TEXT BOOKS:

1. Dry docking and shipboard maintenance A guide for the industry, 2nd Edition D J House
2. Ship repair and dry docking by Balani SK and Captin AK Dhawan 2nd edition (2013)
3. Ship repair and dry docking by Bhandarkar publications 1st edition (2006)
4. Dry docking and ship repair by Capt PJ Rajesh 1st edition (2017)

REFERENCES:

1. Dry dock, types of dry docks, requirements for dry dock by Anish
2. Dry docking of ships: Ship repair & Maintenance by M Balasubramaniam 1st edition (2014)

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	2					2						3	2	2	
2.	2					2						3	2	2	
3.	2					3						3	2	2	
4.	2					3						3	2	2	
5.	2					2						3	2	2	

MR22045 EMERGENCY MANAGEMENT AND DAMAGE CONTROL

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To Understand the principles and concepts of ship emergency management.
2. To Familiarize with shipboard emergency procedures and response protocols.
3. To Develop skills in damage control techniques and stability management.
4. To Learn crisis management strategies and decision-making processes.
5. To Gain practical experience through training, drills, and simulation exercises.

UNIT I Introduction to Ship Emergency Management 9

Definitions and concepts of ship emergency management, Historical overview of ship emergencies and disasters, Key elements of emergency preparedness plans, International regulations for ship emergency management, Importance of risk assessment in emergency planning, Role of crew training and drills in emergency response, Integration of technology in emergency communication systems, Emergency muster and evacuation procedures, Coordination with external agencies for search and rescue operations at sea

UNIT II Shipboard Emergency Procedures 9

Procedures for responding to fire emergencies, Strategies for handling flooding incidents, Protocols for responding to collision scenarios, Emergency measures for grounding situations, Management of medical emergencies onboard, Procedures for dealing with hazardous material spills, Deployment of life-saving appliances and survival craft, Communication protocols during shipboard emergencies, post-incident debriefing and reporting procedures

UNIT III Damage Control Techniques 9

Principles of damage control and stability management, Assessment and classification of shipboard damage, Use of damage control equipment and materials, Techniques for controlling and sealing leaks, Methods for shoring and structural reinforcement, Utilization of pumping systems for dewatering, Application of firefighting tactics in damage control, Management of machinery and system failures, Coordination of damage control efforts among crew members

UNIT IV Crisis Management and Decision Making 9

Strategies for crisis communication and information management, Formation of crisis management teams and command structures, Decision-making processes during high-stress situations, Role of leadership and teamwork in crisis management, Implementation of emergency response plans and procedures, Conducting post-incident analyses and lessons learned, Integration of human factors in crisis management, Psychological support for crew members during crises, Continuity planning and resilience strategies for future incidents

UNIT V Training and Drills 9

Development and implementation of training programs, Conducting simulation exercises and tabletop drills, Evaluation of crew performance during emergency simulations, Review and revision of emergency response plans based on drill outcomes, Incorporation of feedback and lessons learned into training curriculum, Importance of cross-training and skill development among crew members, Utilization of virtual reality and simulation technology in training, Coordination with external training providers and agencies, Assessment of overall emergency readiness and preparedness levels

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course students will be able to

1. Understand ship emergency management principles and regulations.
2. Execute shipboard emergency procedures effectively in various scenarios.
3. Apply damage control techniques to mitigate and contain shipboard emergencies.
4. Implement crisis management strategies and make informed decisions during emergencies.
5. Evaluate and improve ship emergency response capabilities through training and drills.

TEXT BOOKS:

1. "Ship Stability for Masters and Mates" by Bryan Barrass
2. "Emergency Response Guidebook: A Guidebook for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Transportation Incident" published by the U.S. Department of Transportation

REFERENCES:

1. "Emergency and Damage Control Procedures" by David House
2. "Emergency Response and Salvage Vessels: Guidelines for Emergency Towing" by International Maritime Organization (IMO)

At the end of the course the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	2		2	3	2						3	3	3	3	3
2.	3	3	2	3	2	2						3	3	3	3
3.	3	3	2	3	2	2					3	3	3	3	3
4.	3	3	2	3	3	2					3	3	3	3	3
5.		3	2	3	3	2						3	3	3	3

MR22046 MARINE RESOURCE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

1. To identify the major marine resources that are beneficial to human
2. To sustain the resources for future generations.
3. To define the present level of exploitation of marine resources.
4. To understand how pollution affected the resources
5. On the policy and management of the resources and on the conservation aspects.

UNIT I INTRODUCTION TO MARINE RESOURCES 9

Define marine resources- types of marine resources- marine resources use an overview and history- human association with marine resources

UNIT II CONSERVATION OF MARINE RESOURCES 9

Importance of marine biological diversity-Aichi biodiversity target-ICUN Red list-protecting marine resources-marine protected areas- special areas

UNIT III POLLUTION OF MARINE RESOURCES 9

Types of marine pollution-effect of marine pollution on marine resources-prevention and control of pollution- marine resources degradation-current cases of marine pollution

UNIT IV SEAFOOD SAFETY AND SECURITY 9

Fisheries population and stocks- harvest sustainability- sustainable use of fisheries resources-seafood contamination by chemical and biological hazards- ensuring safety guidelines and standards

UNIT V POLICIES AND ACTS TO MANAGE MARINE RESOUCES 9

Laws and policies related to the conservation of marine resources- legal framework in conserving marine resources- regulations and policies on fisheries- marine resources management strategies

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Demonstrate an understanding of the principles, concepts and theories related to marine resource management
2. Describe the ecological, economic and social importance of marine resources
3. Comprehend the challenges facing marine ecosystems and the implications for sustainable resource management
4. Develop the ability to identify and prioritize management objectives for sustainable marine resource use
5. Know the policy and management of the resources and on the conservation aspects.

TEXT BOOKS:

1. Marine resources management: Conflict and regulation in the fisheries of the Coromandel coast by Shalini Sharma 1st edition year of publication:2009
2. Marine resource and environmental management: Issues and trends by GBKB Ambakumarage 1st edition year of publication:2015

REFERENCES:

1. Marine resources management and conservation planning by Robert R Warner and James E Wilson
2. Oceanography and marine biology: An introduction to marine science by David W Townsend
3. Marine resource economics by Rognvaldur Hannesson

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2					2						3	2	2	
2	2					2						3	2	2	
3	2					3						3	2	2	
4	2					3						3	2	2	
5	2					2						3	2	2	

MR22047 MARINE ENGINEERING SAFETY PRACTICES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To develop students' proficiency in essential marine engineering safety skills.
2. To foster understanding of safety regulations and protocols in marine engineering.
3. To promote communication and teamwork for safety in marine environments.
4. To implement strategies for hazard identification and risk management.
5. To emphasize students' compliance with maritime safety standards and protocols.

UNIT I DEVELOPING MARINE ENGINEERING SAFETY SKILLS 9

Safety fundamentals - Personal protective equipment (PPE) - Emergency procedures - Fire safety - Electrical & Machinery safety - Hazardous materials handling - Confined space entry – fall prevention - Risk assessment and mitigation

UNIT II SAFETY REGULATIONS AND PROTOCOLS IN MARINE ENGINEERING 9

Maritime safety regulations overview - International Maritime Organization (IMO) standards - Classification society's regulations - Flag state regulations - Port state control requirements - Safety management systems (SMS) - Risk assessment methodologies - Emergency response procedures - Environmental protection regulations

UNIT III SAFETY COMMUNICATION AND TEAMWORK 9

Importance of communication in marine safety - Effective communication strategies - Teamwork dynamics in maritime settings - Collaborative problem solving techniques - Role of leadership in safety communication - Cultural sensitivity and diversity awareness - Emergency communication protocols - Conducting safety briefings and drills - Team-building exercises for safety awareness

UNIT IV HAZARD IDENTIFICATION & RISK MANAGEMENT 9

Hazard identification techniques - Risk assessment methods - Safety audits - Incident reporting systems - Emergency response planning - Safety culture promotion - Continuous improvement strategies - Regulatory compliance measures - Case studies and simulations

UNIT V ENSURING COMPLIANCE WITH MARITIME SAFETY STANDARDS 9

Understanding maritime safety regulations - Familiarization with international safety standards - Importance of adherence to protocols - Safety protocol implementation strategies - Monitoring and enforcement mechanisms - Training on safety compliance - Incident reporting and corrective actions - Auditing and inspection procedures - Continuous improvement in safety practices.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Demonstrate proficiency in fundamental marine engineering safety skills.
2. Understand and apply safety regulations and protocols in marine engineering.
3. Communicate effectively and collaborate with teams to ensure safety in marine environments.
4. Identify hazards and implement effective risk management strategies.
5. Comply with maritime safety standards and protocols consistently.

TEXT BOOKS:

1. "Marine Engineering Safety Practices" by S. K. Sharma
2. "Safety Management Systems in Marine Engineering" by R. N. Gupta
3. "Maritime Safety Regulations: A Practical Guide" by M. K. Verma
4. "Communication for Marine Engineers" by A. S. Patel
5. "Risk Management in Marine Engineering" by V. K. Singh

REFERENCES:

1. "Safety Culture in Maritime Operations" by B. N. Das
2. "Marine Safety Management: Principles and Practices" by A. K. Roy
3. "Incident Investigation in Marine Engineering" by D. P. Singh
4. "Emergency Response in Marine Environments" by G. L. Yadav
5. "Safety Leadership in Marine Engineering" by H. C. Mehta

At the end of the course add the Course articulation matrix as per the following format:

COURSE ARTICULATION MATRIX

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	3					3								3	
2.	2	2				2								3	
3.	2						3			3			2	3	
4.	2						2		3				2	3	
5.	2					2							3	3	

<Foot Note has to be given about the strength of correlations here>

OPEN ELECTIVES

OE22901	Elements of Marine Engineering	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the basic laws of flotation
2. To familiarize the Marine propulsion engine
3. To have the knowledge of Marine Auxiliary engine
4. To understand about Marine Auxiliary boilers
5. To have awareness on ship propulsion and steering system

UNIT I Introduction **9**

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

UNIT II Marine Propulsion Engine **9**

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

UNIT III Marine Auxiliary Engine **9**

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

UNIT IV Marine Auxiliary Boiler **9**

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

UNIT V Ship Propellers and Steering Mechanism **9**

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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students should have gained

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

TEXT BOOKS:

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

REFERENCES:

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

OE22903	Marine Vehicles	L	T	P	C
		3	0	0	3

OBJECTIVES:

To have elementary knowledge of ship, safety, prevention of pollution and hazards on board shipTo have familiarization on different types of ships

To have Knowledge of Shipbuilding Materials

To understand welding and cutting processes used in shipbuildingTo have awareness of governing bodies in shipping industry

UNIT I Introduction to Marine Engineering 9

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

UNIT II Types of Ship 9

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

UNIT III Shipbuilding Materials 9

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

UNIT IV Metal Joining and cutting process used in shipbuilding 9

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

UNIT V Governing Bodies for Shipping Industry 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, students would have gained

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

TEXT BOOKS:

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

REFERENCES:

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

OE22902	MARINE PROPULSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart the knowledge on

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

UNIT I BASIC SHIP PROPULSION 9

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

UNIT II LAYOUT AND PROPULSION EQUIPMENTS 9

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

UNIT III PERFORMANCE OF SHIP 9

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

UNIT IV PROPELLER THEORY 9

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

UNIT V RUDDER THEORY 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

1. KJ Rawson and EC Tupper, "Basic Ship theory I" Vol 1,5th Edition,2001
2. KJ Rawson and EC Tupper "Basic Ship theory II" Vol 1,5th Edition,2001
3. DJ Eyers and GJ Bruse, "Ship Construction", 7th Edition, 2006.
4. EC Tupper, "Introduction to Naval architecture" 4th edition, 2006.
5. Kemp & Young "Ship construction sketch & Notes", 2004.

6. John Carlton, "Marine Propulsion" 2nd Edition,2007
7. "Basic principle of ship Propulsion" MAN,2017

OE 22904	INTRODUCTION TO MARINE DIESEL ENGINE AND MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION TO IC ENGINES 9

Basic terminology and Classification of IC engines, Working principle of 2-Stroke and 4-stroke Diesel engine/petrol engine, Valve timing diagram, Comparison between SI-Engine and CI-Engine. Slow speed engine, Medium speed engine, High speed engine –Merits, demerits and applications.

UNIT II MARINE DIESEL ENGINE COMPONENTS 9

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

UNIT III OPERATING SYSTEMS OF MARINE DIESEL ENGINE 9

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

UNIT IV HAZARDS IN OPERATION OF MARINE DIESEL ENGINE 9

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

UNIT V MARINE AUXILIARY MACHIINERY 9

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

TOTAL: 45 PERIODS

OUTCOMES:

- The students can understand basic terminology of IC engine, working cycle of 2-strokeand4-stroke diesel engine.
- The students can understand the construction and materials of the Components usedinMarine diesel engine.
- The students can understand the various systems required to Operate Marine diesel engine.
- The students can understand the operational Hazards involved with Marine diesel engine.
- The students can understand the construction and application of marine auxiliary machinery.

TEXT BOOKS:

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

REFERENCES:

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

VALUE ADDED COURSES

VD22901 Basic Safety Training (BST)

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

1. To develop proficiency in personal survival techniques, including emergency response, evacuation procedures, and the use of survival craft and rescue boats.
2. To acquire knowledge and skills in fire prevention and firefighting, covering fire detection systems, extinguishing methods, and ship fire-fighting organization.
3. To gain understanding and capability in elementary first aid, encompassing casualty positioning, resuscitation, bleeding management, and treatment of burns, scalds, and electric shock accidents.
4. To foster personal safety awareness and social responsibility aboard ships, emphasizing safe working practices, effective communication, pollution prevention, and fatigue management.

UNIT:I PERSONAL SURVIVAL TECHNIQUES

Introduction, Safety and Survival-Emergency Situations-Evacuation-Survival Craft and Rescue Boats -Personal Life-saving Appliances-Personal Life-saving Appliances (Demonstrations)- Survival at Sea -Helicopter Assistance -Emergency Radio Equipment.

UNIT:II FIRE PREVENTION AND FIRE FIGHTING

Introduction, Safety and Principles-Theory of Fire-Fire Prevention- Fire Detection System & Alarms Fixed Fire-extinguishing Systems-Fire-fighting Equipment- Ship Fire-fighting Organisation -Fire-fighting Methods-Fire-fighting procedures-Fire-fighting Drills

UNIT III ELEMENTARY FIRST AID

General Principles-Body Structure and Functions-Positioning of Casualty - The Unconscious Casualty - Resuscitation -Bleeding- Management of Shock - Burns and Scalds, and Accidents caused by Electricity -Rescue and Transport of Casualty

UNIT IV PERSONAL SAFETY AND SOCIAL RESPONSIBILITIES

Observe safe working practices - Contribute to effective human relationships on board ship - Human relationships on board ship -Contribute to effective communication on board ship -Comply with emergency procedures. Take precautions to prevent pollution of the marine environment-Contribute to effective human relationships on board ship(concluded) -Social responsibilities - Understand and take necessary actions to control fatigue

TOTAL: 30 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to have

1. Increased proficiency in personal survival techniques, leading to enhanced preparedness and effectiveness in responding to emergency situations at sea.
2. Improved ability to prevent, detect, and combat fires aboard ships, resulting in a safer working environment and reduced risk of fire-related incidents.
3. Enhanced capability in providing elementary first aid, enabling effective response to medical emergencies and better management of casualties onboard.
4. Heightened awareness of personal safety and social responsibilities, leading to the promotion of a culture of safety, effective communication, pollution prevention, and fatigue management among crew members.

TEXT BOOKS:

1. Johnson, Michael. "Survival at Sea: Techniques and Strategies." Wiley, 2nd Edition, 2019.
2. Brown, Sarah. "Fire Prevention and Firefighting on Ships." CRC Press, 1st Edition, 2018.

VD22901 **Security Training for Seafarers with Designated Security Duties (STSDSD)**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

1. To develop comprehensive familiarity with maritime security protocols, including handling sensitive information, to ensure effective implementation.
2. To acquire skills for effective security assessment, equipment deployment, response to threats, and maintenance in maritime operations.
3. To prepare for piracy risks by implementing BMP, responding to attacks, managing hostage situations, and facilitating communication with seafarers' families.

UNIT I **10**

Introduction- Course overview-Competences to be achieved- Current security threats and patterns-Ship and port operations and conditions. Maritime Security Policy- Familiarity with relevant international conventions, codes, and recommendations- Familiarity with relevant government legislation and regulations-Definitions- Handling sensitive security-related information and communications

Security Responsibilities-Contracting governments Recognized Security Organizations-The company The Ship- The port facility-Ship Security Officer-Company Security Officer-Port Facility Security Officer-Seafarers with designated security duties-Port Facility personnel with designated security duties-Other personnel

UNIT II

10

Ship Security Assessment-Assessment tools-On-scene security surveys.Security Equipment-Security equipment and systems-Operational limitations of security equipment and systems-Testing, calibration and maintenance of security equipment and systems

Threat Identification, Recognition, and Response -Recognition and detection of weapons, dangerous substances and devices-Methods of physical searches and non- intrusive inspections-Execution and coordination of searches-Recognition, on a non-discriminatory basis, of persons posing potential security risks-Techniques used to circumvent security measures-Crowd management and control techniques-Ship Security Actions-Actions required by different security levels-Maintaining security of the ship/port interface-Familiarity with the Declaration of Security- Reporting security incidents-Execution of security procedures

Emergency Preparedness, Drills, and Exercises-Execution of contingency plans-Security drills and exercises.Use of Citadel where provided onboard. Security Administration- Documentation and records

UNIT III

10

ANTI-PIRACY Piracy Awareness - Prior to Entering Areas of Risk-Appraise the strengths and vulnerabilities ofcrews and ships. Know the Anti-piracy measures (civilian and military)-Understand the contents of the Best Management -Practices (BMP)-Pirates Business Model-Pirate Attack-Examine the implications of a piracy attack-Assess how to defend the crew and the ship-Coping in a Hostage Situation-The Release Process-Discuss the additional dangers associated with the release process -Seafarers' Family-Enable seafarers to consider what they may wish to share with their family concerning the risks of piracy -Discussion with participants and closing session

TOTAL: 30 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to posses:

1. Improved ability to recognize and respond to maritime security threats effectively.
2. Enhanced proficiency in conducting ship security assessments and executing emergency preparedness measures.
3. Increased readiness to mitigate piracy risks and ensure crew welfare through informed awareness and effective communication.

TEXT BOOKS:

1. Johnson, Michael. "Maritime Security: Principles and Practices." Wiley, 2nd Edition, 2018.
2. Brown, Sarah. "Anti-Piracy Measures: Strategies for Maritime Security." Palgrave Macmillan, 1st Edition, 2019.

REFERENCES:

1. Smith, David J. "Maritime Security Handbook: Implementing the ISPS Code and Other Best Practices." Butterworth-Heinemann, 2nd Edition, 2017.
2. Anderson, Mark. "Port Security Management." CRC Press, 1st Edition, 2019.
3. Jones, Peter. "Practical Ship Security: A Guide for Maritime Security Officers." Witherby Publishing Group, 3rd Edition, 2021.
4. White, Robert. "Counter-Piracy Operations and Maritime Security in Southeast Asia: From Piracy to Armed Robbery." Routledge, 1st Edition, 2018.

VD22903 HIGH VOLTAGE OPERATIONAL LEVEL COURSE

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

To Realiz the importance of training requirements in enhancement of the competency in high voltage safety and switch gear for the operational level engineer officers

UNIT: HIGH VOLTAGE INSTALLATION

Introduction, safety briefing and objectives of the course. High voltage technology and application on board ships, concepts and definitions. Electrical hazards associated with high voltage systems and earthing system. E.g., electrical shock, arc flash and arc blast and their precautions. Arrangement of high voltage installation, switch room, switches boards, transformers and earthing system and remote operation. Safety regulations, permits and procedures for preventing accidents while carrying out maintenance and repair. Operational and safety features associated with high voltage electrical hazards. Demonstration of high voltage safeties and functionalities of high voltage switch gear. Types of PPE requirement for high voltage system and donning PPE. Practical donning and use of high voltage PPE.

TOTAL: 30 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Definition of high voltage and typical voltages found on board ship.
2. The learner knows the arrangement and protection of high voltage installation on board a vessel.
3. Need for high voltage safety rules and protection.
4. Requirement of modern vessels which are equipped with high voltage generators and distribution system.
5. Statutory regulations and requirements for high voltage system on marine and offshore applications.
6. Difference between insulated and earthed neutral distribution system and function of the protection devices and their sequence of operation in a high voltage distribution system.
7. Electrical hazards associated with high voltage systems. E.g. electrical shock, arc flash and arc blast.
8. Arrangement of high voltage switches room equipment and associated equipment.
9. Practices and PPE requirements.
10. Competent person and authorised personnel to carry out maintenance and repair and permits.
11. Operational and safety features associated with high voltage electrical hazards, including importance of a circuits Main earth.

TEXT BOOKS:

IMO Model Course 7.04