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**	-	-

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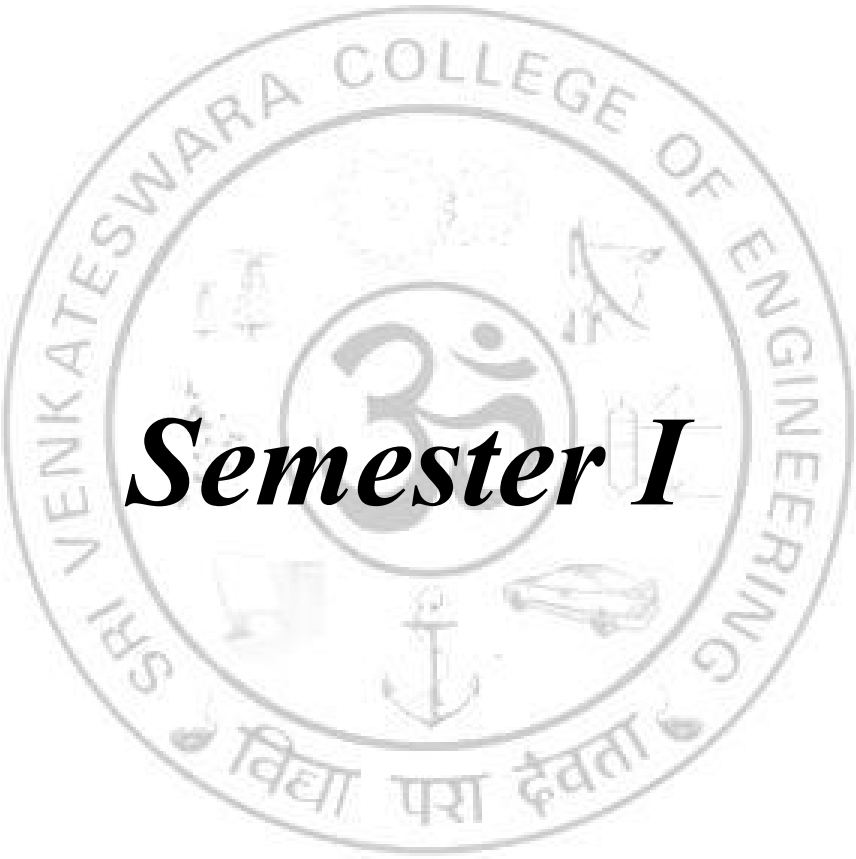
SEMESTER IV

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 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 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.**

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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.

.

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

MR22101 INTRODUCTION TO MARINE ENGINEERING

3	0	0	3

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

HS 22251	அறிவியல் மற்றும் தொழில் நுட்பத்தில் தமிழ் Science and Technology in Ancient Tamil Society *(Common to all branches)*	L	T	P	C
		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' a**s 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)

SRI VENKATESWARA COLLEGE OF ENGINEERING
विद्या परा देवता

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)

SRI VENKATESWARA COLLEGE OF ENGINEERING विद्या परा देवता

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)

SRI VENKATESWARA COLLEGE OF ENGINEERING
विद्या परा देवता

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)

MR22XXXX 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,3rdedition, 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 advanced 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

Lathe and Special Machine Shop

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

TOTAL : 90 PERIODS

OUTCOMES:

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 advanced welding machines and carry out theadvanced 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)