SEMESTER I

S.No	Course code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	246EN1A12TC	HS	English and Communication	3	3	0	0	3	
2	246MA1A11TA	BS	Ordinary Differential Equations and Difference Equations	3	2	1	0	2	
3	246PH1A01TB	BS	Material Physics	3	2	1	0	2	
4	241ME1A11TC	BS	Basics of Electrical and Electronics Engineering	3	3	0	0	2	
5	241ME1A11TD	BS	Engineering Mechanics	4	3	1	0	3	
6	241ME1A11TE	BS	Workshop Technology	4	1	1	2	3	
7	241ME1A19TA	VAC	Aptitude and Personality development training-I	2	2	0	0	0	
8	241ME1A18PA	MC	Universal Human Values (3 Weeks)						
PRACTICAL									
9	246EN1A12PC	HS	English and Communication Laboratory	2	0	0	2	1	
10	246PH1A01PB	BS	Material Physics Laboratory	2	0	0	2	1	
11	241ME1A23PA	ES	Engineering Graphics	4	0	1	3	2	
12	241ME1A11PC	BS	Basics of Electrical and Electronics Engineering Laboratory	2	0	0	2	1	
13	241ME1A18PB	MC	PT/PARADE/GAMES - I	2	0	0	0	0	
Total				**32**	**16**	**5**	**11**	**20**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER II

S.No	Course code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241MA1A21TE	BS	Calculus	3	3	0	0	2	
2	241ME1A23TA	ES	Marine Electronics	3	2	1	0	3	
3	241ME1A23TB	ES	Marine Electrical Machines - I	3	2	1	0	3	
4	241ME1A21TF	BS	Marine Thermodynamics	3	2	1	0	3	
5	241CH1A21TG	BS	Engineering Chemistry	2	2	0	0	2	
6	242CS1A53TK	ES	Fundamental of Computer and Python Programming	3	2	1	0	2	
PRACTICAL									
7	241CH1A21PB	BS	Engineering Chemistry Laboratory	2	0	0	2	1	
8	241ME1A23PB	ES	Marine Electronics lab	2	0	0	2	1	
9	241ME1A23PC	ES	Marine Electrical Machines Laboratory	4	0	0	4	2	
10	241ME1A24PA	PC	Marine Workshop – I	6	0	1	5	3	
11	242CS1A53PK	ES	Python Program Laboratory	2	0	0	2	1	
12	241ME1A28PA	MC	PT/PARADE/GAMES - II	2	0	0	0	0	
Total				**33**	**13**	**5**	**15**	**23**	

LLecture; T-Tutorial; P-Practical; C-Credit

SEMESTER III

S.No	Course code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A34TB	PC	Marine Deck Machinery and Equipment	3	3	0	0	2	
2	241ME1A34TD	PC	Marine Refrigeration & Air Conditioning	3	2	1	0	3	
3	241ME1A31TH	BS	Basic Ship Construction	3	3	0	0	2	
4	241ME1A33TC	ES	Marine Electrical Machines - II	3	2	1	0	3	
5	241ME1A33TD	ES	Marine Thermal Engineering	3	2	1	0	3	
6	241ME1A31TI	BS	Fluid Mechanics and Marine Hydraulics	3	2	1	0	2	
7	241ME1A32TB	MC	Gender Sensitivity	2	2	0	0	0	
8	241ME1A34TE	PC	Marine Pumping and piping systems	3	2	1	0	3	
PRACTICAL									
9	241ME1A33PE	PC	Marine Refrigeration & Air Conditioning Laboratory	2	0	0	2	1	
10	241ME1A33PD	ES	Marine Thermal Engineering Lab	2	0	0	2	1	
11	241ME1A31PI	BS	Fluid Mechanics and Marine Hydraulics Laboratory	2	0	0	2	1	
12	241ME1A34PF	PC	Marine Workshop – II	4	0	0	4	2	
13	241ME1A37PA	IP	Internship – I						
14	241ME1A38PA	MC	PT/PARADE/GAMES - III	2	0	0	0	0	
Total				**33**	**18**	**5**	**10**	**23**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER IV

S.No	Course code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A43TE	ES	Marine Electrical Measurements and Instrumentation	3	2	1	0	3	
2	241ME1A43TF	ES	Marine Materials	3	2	1	0	3	
3	241ME1A43TG	ES	Mechanics of Machines	3	2	1	0	2	
4	241ME1A41TJ	BS	Naval Architecture-I	3	3	0	0	2	
5	241ME1A44TG	PC	Marine Boilers	3	2	1	0	3	
6	241ME1A42TB	HS	Marine Environmental Protection	3	3	0	0	3	
7	241ME1A44TH	PC	Marine Internal Combustion Engine- I	3	3	0	0	3	
8	241ME1A49TA	VAC	Aptitude and Personality development training-2	1	1	0	0	0	
PRACTICAL									
9	241ME1A44PI	PC	Marine Workshop –III	4	0	0	4	2	
10	241ME1A44PJ	PC	Marine Engineering Equipment Drawing – I	4	0	0	4	2	
11	241ME1A43PF	ES	Marine Materials Laboratory	2	0	0	2	1	
12	241ME1A48PA	MC	PT/PARADE/GAMES - IV	2	0	0	0	0	
Total				**32**	**18**	**4**	**10**	**24**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER V

S. No	Subject Code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A53TH	ES	Marine Electrical Technology	3	3	0	0	2	
2	241ME1A54TK	PC	Marine Auxiliary Machinery – I	3	3	0	0	3	
3	241ME1A54TL	PC	Marine Internal Combustion Engines – II	3	2	1	0	3	
4	241ME1A54TM	PC	Ship Fire Prevention and Control	3	2	1	0	3	
5	241ME1A55TA	PE	Professional Elective-I (Marine steam engineering & Turbines)	3	3	0	0	3	
6	241ME1A52TD	HS	Constitution of India and Merchant Shipping Act	1	1	0	0	0	
7	241ME1A59TA	VAC	Aptitude and Personality development training-3	2	2	0	0	0	
8	241ME1A55TB	PE	Professional Elective-II (Marine Power Generation and Distribution)	3	3	0	0	2	
PRACTICAL									
9	241ME1A53PH	ES	Marine Electrical Technology Laboratory	2	0	0	2	1	
10	241ME1A54PO	PC	Marine Equipment Drawing – II	3	0	0	3	2	
11	241ME1A54PN	PC	Marine steam plant Laboratory	2	0	0	2	1	
12	241ME1A54PL	PC	Marine Internal Combustion Engine Laboratory	3	0	0	3	2	
13	241ME1A57PB	IP	Internship – II	0	0	0	0	0	
14	241ME1A58PA	MC	PT/PARADE/GAMES - V	2	0	0	0	0	
Total				**31**	**19**	**2**	**10**	**22**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER VI

S. No	Subject Code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A64TQ	PC	Marine Electro Technology	3	3	0	0	2	
2	241ME1A64TR	PC	Marine Auxiliary Machinery – II	3	2	1	0	3	
3	241ME1A64TS	PC	Marine Internal Combustion Engines – III	2	1	1	0	2	
4	241ME1A65TA	PE	Professional Elective-III (Marine Pollution Prevention and Safety)	3	3	0	0	3	
5	242CS1A63TI	OEC	Advanced Computing Science	**3**	**3**	**0**	**0**	**3**	
6	241ME1A64TP	PC	Power electronics and electrical Propulsion	3	2	1	0	3	
7	241ME1A61TL	BS	Naval Architecture-II	3	3	0	0	2	
8	241ME1A64TT	PC	Marine Safety Emergency Practices – I	3	3	0	0	3	
9	241ME1A69TA	VAC	Aptitude and Personality development training-4	2	2	0	0	0	
PRACTICAL									
10	241ME1A64PV	PC	Marine high voltage and Automation lab	2	0	0	2	1	
11	241ME1A65PP	PC	Power electronics and electrical Propulsion Lab	2	0	0	2	1	
12	241ME1A64PM	PC	Fire Fighting Laboratory	2	0	0	2	1	
13	241ME1A68PA	MC	PT/PARADE/GAMES - VI	2	0	0	0	0	
Total				**31**	**22**	**3**	**6**	**24**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER VII

S. No	Subject Code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A75TES	PE	Professional Elective-IV(Marine Control Engineering and Automation)	3	2	1	0	3	
2	241ME1A74TW	PC	Marine Safety Emergency Practices - II	3	3	0	0	2	
3	241ME1A79TA	VAC	Aptitude and Personality development training-5	1	1	0	0	0	
PRACTICAL									
4	241ME1A74PX	PC	Marine Hydraulics, Pneumatics and Electrical Control System Laboratory	1	0	0	1	1	
5	241ME1A77PC	IP	Project work Phase – I	6	0	0	6	3	
6	241ME1A77PD	IP	Ship-in-Campus – I	18	0	0	18	9	
7	241ME1A77PE	IP	Internship – III						
	241ME1A78PA	MC	PT/PARADE/GAMES - VII	2	0	0	0	0	
Total				**32**	**6**	**1**	**25**	**18**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

SEMESTER VIII

S. No	Subject Code	Category	Course Title	Contact Hours	L	T	P	C	Remarks
THEORY									
1	241ME1A82TE	HS	International Maritime Organization and International Convention	2	2	0	0	2	
2	241ME1A84TY	PC	Marine Alternate Fuels and Energy Sources.	2	2	0	0	2	
3	241MEIA89TA	VAC	Orientation of competency exams	2	2	0	0	0	
PRACTICAL									
4	241ME1A87PF	IP	Project work Phase - II	6	0	0	6	3	
5	241ME1A87PG	IP	Ship-in-Campus - II	20	0	0	20	10	
	241ME1A88PA	MC	PT/PARADE/GAMES - VIII	2	0	0	0	0	
Total				**32**	**6**	**0**	**26**	**17**	

L- Lecture; T-Tutorial; P-Practical; C-Credit

Program	B.E. – Marine Engineering				
Course code 246EN1A12TC	Course Name **English and Communication**	L	T	P	C
		3	0	0	3
Year / Semester	I/I		Contact hours/Week 3		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	✓				

Course objectives	1	To improve reading skills of students in different types of texts (K1)
	2	To enhance their communicative skills in real life situations. (K2)
	3	To help learners improve their maritime vocabulary. (K2)
	4	To enable learners develop their listening skills. (K2)
	5	To develop students professional writing skills. (K2)
	6	To develop their language competency (K2)
Course outcomes	CO1	Enumerate good reading and writing skills (K1)
	CO2	Outline the importance of English in reading and writing with proper tense and prepositions (K1)
	CO3	Identify common errors in tenses and sentences (K1)
	CO4	Demonstrate reading and writing skills for effective presentation. (K3)
	CO5	Acquire good reading, writing and listening skills (K3)
	CO6	Apply the correct pause and pronunciation competence necessarily required in various life (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	3	3	-	2	2	-	3	-	-	-
CO3	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO4	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO5	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO6	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
Average						2.5	2.5		2.7	2.7		2.8			

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

Unit-I	News Article	Hours 10
Reading – Comprehension: Shipping Industry by Muralikrishnan, **Writing**: Paragraph Writing, **Speaking**: Introducing oneself, SWOC Analysis, **Listening:** Types of Listening. **Grammar**: Parts of speech, **Vocabulary**: Prefixes and Suffixes, **SMCP**: IMO Standard Maritime Communication Phrases – General: Procedure - Ambiguous words.		
Competency Numbers	2.1	
Unit-II	**Motivation**	**Hours 11**
Reading: Skimming: Marine Pilot Reshma: A Chennai Ponnu is India's First Marine River Pilot by Roshne Balasubramanian, **Writing:** Description, Process description **Listening:** Identifying main and secondary Points, **Speaking:** Asking questions, **Grammar:** Tense Forms - WH/Yes or No Questions, **Vocabulary:** Maritime phrases**, SMCP** – IMO Standard Maritime Communication Phrases - General Terms.		
Competency Numbers	2.1	
Unit-III	**Poem**	**Hours 11**
Reading: Scanning: Sea Fever by John Masefield, **Writing:** Narration, Technical Report Writing **Listening:** Taking notes from a discussion, **Speaking:** Critical appreciation, **Grammar:** Subject-Verb Agreement **Vocabulary:** Nominal compounds, SMCP – IMO Standard Maritime Communication Phrases – VTS Special Terms.		
Competency Numbers	2.1	
Unit-IV	**Movie Review**	**Hours 11**
Reading: Decoding: Captain Phillips Movie Review from Times of India Newspaper, **Writing:** Email etiquette and email writing, **Listening:** Listening for specific information and identifying parts from a description, **Speaking:** Impromptu speech, **Grammar**: Articles, **Vocabulary:** Idiomatic expressions, **SMCP** – IMO Standard Maritime Communication Phrases – External Communication Phrases – Fire, Explosion, Flooding, Collision.		
Competency Numbers	2.1	
Unit-V	**Case Study**	**Hours 11**
Reading: Analysing: Case Study: The Indian Ocean Observing System by Juliet Hermes and Roxy Mathew, **Writing:** Gadget review, **Listening:** Listening to a documentary and making notes, **Speaking:** Expressing preferences, **Grammar:** Modals, **Vocabulary:** Connectives, **SMCP:** IMO Standard Maritime Communication Phrases – Grounding, Capsizing, Adrift, Piracy, Abandoning.		
		Total hours:54

Text Books:

M. Subha et al. (Ed). A General English Course Book for the Maritime Learners. (2023). Cape Comorin Publishers: India.

References:

1. Practical English Usage – Michael Swan. Oxford University Press, 1980.
2. S.P.Dhanavel, English and Communication Skills, Chennai: Orient Blackswan, 2010.
3. Essential Grammar in Use- Raymond Murphy, London: Cambridge, 2007.
4. https://www.usingenglish.com/
5. https://learnenglish.britishcouncil.org/grammar

Program	B.E. (Marine)				
Course code **246MA 1A 11TA**	Course Name **Ordinary Differential Equations and Difference Equations**	L	T	P	C
		3	1	0	2
Year / Semester	I / I		Contact hours/Week 4		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives		
	1	To state the basic relations of difference operators.
	2	To introduce the method which involvesinterpolation formula which is applied in numerical differentiation and integration.
	3	To introduce the functions of differential derivatives and to solve ordinary differential equations.
	4	To introduce the techniques in solving first order and higher order differential equations.
	5	To introduce method of variation of parameters and simultaneous equations in symmetrical form.
Course outcomes (On completion of the course, Learners will be able to)	CO1	Construct the formation and relationship of finite difference operators and difference equations.
	CO2	Interpret Newton's Forward & Backward Interpolation formula, Sterling Interpolation formula and Lagrange's Interpolation.
	CO3	Identify homogeneous equations with constant coefficients, exact and linear differential equations and solve them.
	CO4	Develop the solutions of first order and higher order differential equations.
	CO5	Interpret method of variation of parameters and simultaneous equations in symmetrical form.
	CO6	Apply differential equation and difference equation techniques in their marine subjects.

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	-	1	-	-	-	-	-	-	-	-	-	1	-
CO4	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	-	2	-	-	-	-	-	-	-	-	-	1	-
CO6	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-
Average	2.2	1.2	-	1.2	-	-	-	-	-	-	-	-	-	1	-

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

Unit-I	Finite Differences Equations	9 Hours
Finite difference operators - Relation between operators – Algebra of finite difference operators – Difference equation: formation and solution – linear difference equation with constant coefficients		
Competency Numbers	4	
Unit-II	**Interpolations Numerical Differentiations and Integrations**	**9 Hours**
Newton's forward and Newton's backward interpolation formulae –Sterling interpolation formula-Lagrange's interpolation formula. Numerical differentiation: First derivative and second derivative-Numerical integration: trapezildal, Simpson's 1/3 and ,Simpson's 3/8.		
Competency Numbers	4	
Unit-III	**Basics of Ordinary Differential Equations**	**12 Hours**
Formation differential equation by eliminating arbitrary constant –Solution of first order first degree equations: variable separable and homogeneous equations other substitutions – Equation reducible to homogeneous and exact differential equations (First two type)- Equations reducible to exact Differential equations.		
Competency Numbers	4	
Unit-IV	**Applications of Ordinary Differential Equations**	**12 Hours**
Integrating factor (IF)-Problem involving with IF linear differential Equation of first order and first degree-reducible to linear-Second order Linear differential equation with constant coefficients (Exponential, Trigonometric, Polynomial) –Application in deflection of beam, struts and column electrical circuits and orthogonal trajectories.		
Competency Numbers	4	
Unit-V	**Linear Differential Equations with Variable Coefficients**	**12 Hours**
Methods of variation of parameter – Cauchy's homogeneous LDE (Exponential) and Legendre's equation (Exponential) –System of an ordinary differential equation RHS is Zero)		
Competency Numbers	4	
		Total hours: 54

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2016.

Unit-I: Chapter 29 Section 1-5; Chapter 31 Section 1-6.
Unit-II: Chapter 29 Section 6, 7, 9, 10; Chapter 30 Section 1,2,4,5,6,7,8.
Unit –III: Chapter 11 Section 1-8, 11.
Unit- IV: Chapter 11 Section 9-10; Chapter 12 Section 3, 5; Chapter 13 Section 1-6.
Unit-V: Chapter 13 Section 8,9,11.

2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2016.

Reference Books:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

2.Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th

Reprint, 2010.
3.H.K.DASS "Advanced Engineering Mathematics", 15th Revised Edition ,S.Chand & Co. Ltd., New Delhi, 2006
4. Kandaswamy,Thilagavathy and Gunavathy, "Numerical Methods",S.Chand & Co. Ltd., New Delhi, 2008

PROGRAM	B.E, Marine Engineering					
Course Code: 246PH1A01TB	Course Name: **Material Physics**		L	T	P	C
			2	1	0	2
Year and Semester	I Year (I Semester)		Contact hours per week 3 Hrs			
Prerequisite course	Nil					
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					
Course Objective	1. To understand the concepts of atomic structure and different types of Materials (K1) 2. To understand the mechanical properties of materials (K1) 3. To Attain a basic idea about structural materials (K3) 4. To Attain the knowledge of different treatment of metals (K2) 5. To Identity the testing methodology of materials (K1)					
Course Outcome	After successful completion of the course, the students should be able to 1. Summarize the postulates of atomic structure and types of materials (K1) 2. Illustrate the properties of materials (K2) 3. Compare the different structural materials and their properties (K2) 4. Explain the Annealing and hardening concepts of the materials (K2) 5. Infer the knowledge of nondestructive testing methods for various materials (K2) 6. To apply postulates of physics of materials for device applications and characterization (K3)					

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	2	2	2	2

CO5	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**2**
CO6	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**2**
Avg	**2.3**	**2.2**	**2.2**	**1.7**	**2.3**							**2.2**	**2.0**	**2.3**	**2.2**
CORRELATION LEVELS				**1. SLIGHT (LOW)**				**2. MODERATE (MEDIUM)**				**3. SUBSTANTIAL (HIGH)**			

UNIT I - Fundamentals of Materials [12 Hours]

Atomic bonding-Atomic Structure-The ionic bond-The covalent bond-Metallic bond-Vanderwaals bond-Bonding. Classification **Types of Materials**-Metals-Ceramics-Glasses-Polymers-Composites-Semiconductors-Nanomaterials-2-D materials-metamaterials-Properties and applications - Selection of materials for different engineering applications

UNIT II- Mechanical properties of materials [12 Hours]

Hooke's law- bending moment and twisting moment- Torsion pendulum; Moment curvature relationship for pure bending of beams - Cantilever; non uniform bending and uniform bending- theory and experiment. Stress versus strain-in metals, ceramics, and glasses, polymers-Elastic and Plastic deformations.

Elasticity-plasticity- Hardness, Strength, Toughness, Stiffness, Ductility, Malleability, Hardening ability, creep and fatigue

UNIT III- The Structural Materials [12 Hours]

Electron conduction – Free electron theory of metals-Thermal conductivity-effect of temperature and impurity on electrical resistivity of metals-high resistivity metals and alloys. Magnetic parameters- Bohr magneton- classification of magnetic materials-applications. Alloys-Ferrous, alloys-Carbon steels-low alloy steels -High alloy steels-Cast Iron-Rapidly solidified ferrous alloys-Applications in Marine engineering.

UNIT IV - Treatment of Metals [9 Hours]

Diffusional transformation-Diffusion less transformation-Tempering-Annealing-Normalizing-Case hardening- cementing-cyaniding -Nitriding-Aging-stress relieving- carburization-Purpose of heat treatments

UNIT V - Material Testing [9 Hours]

Impact energy - Fracture Toughness-Fatigue - Tensile testing, compression testing, Impact Testing, Hardness test, Jominy end quench test for harden ability of steel. Non-destructive testing methods - X-Ray Radiography - Ultrasonic Testing-Failure analysis and prevention.

TOTAL : 54 Hours

***Innovation**

Debate/group discussion of possibilities novel materials-video making/animation

Text Book:

1. Introduction to Material Science for Engineers, James S Shackelford, 8^{9h} edition, Pearson, 2022.
2.The Fracture of Brittle Materials: Testing and Analysis, by Stephen W. Freiman , John J. Mecholsky Jr. second edition, Wiley-American Ceramic Society,2019
3. Composite Materials Design and Testing, by Stephen W. Tsai, Jose Daniel D. Melo,First edition,2015.
4. Physics of Materials: Essential Concepts of Solid-State Physics, Pratap Haridoss, Wiley, 2019.

References:

1. Material Science, V Rajendran, Tata McGRaw Hill Education Private Limited, 2012.
2. Physics of Materials: Essential Concepts of Solid-State Physics, Wiley, 2015.
3. The Fracture of Brittle Materials: Testing and Analysis, by Stephen W. Freiman , John J. Mecholsky Jr. second edition, Wiley-American Ceramic Society, 2019.
4. Composite Materials Design and Testing, by Stephen W. Tsai, Jose Daniel D. Melo,First edition, 2015.

Online Source:

1. NOC: Fundamentals of material processing Prof. Shashank Shekhar, Department of metallurgical and materials engineering IIT Kanpur. https://nptel.ac.in/courses/113104073
2. NOC: Nature and Properties of Materials, Prof. Bishakh, Department of mechanical engineering, IIT Kanpur. https://archive.nptel.ac.in/courses/112/104/112104203
3. NOC: Basics of Material Engineering, Prof. Rathan Kumar, Department of mechanical engineering, IIT Madras. https://archive.nptel.ac.in/courses/112/106/112106293.
4. NOC – Principles of Physical Metallurgy, Prof. N.R. Ghosh, Department of metallurgical and materials engineering IIT Kharagpur. https://archive.nptel.ac.in/courses/113/105/113105024

E-books:

1. https://drive.google.com/file/d/1LzdR6HsKPV8gAcYFiHfTsmzLyovXIo2L/view

2. https://drive.google.com/file/d/1CY5hEyhUUmJQKjUWPs6rhq8NVu6QlnBy/view

JOURNAL

1. Nadeem Baig et al, Nanomaterials: A review of synthesis methods, properties, recent progress, and challenges, Mater. Adv., 2021,2, 1821-1871
2. N. Suresh Kumar et al A Review on Metamaterials for Device Applications, *Crystals* 2021, *11*(5), 518

Program	B.E. – Marine Engineering					
Course code 241ME1A11TC	Course Name Basics of Electrical and Electronics Engineering		L	T	P	C
			3	0	0	2
Year / Semester	I year / I Semester		Contact hours/Week 3 Hrs			
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					

Course objectives		
	1	Explain the importance of Electrical Engineering in everyday life. (K2)
	2	Apply Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) equations in circuit analysis. (K3)
	3	Analyze single-phase AC circuits using phasor diagrams and power calculations. (K3)
	4	Analyze three-phase AC circuits with balanced and unbalanced voltage sources. (K3)
	5	Understand the characteristics and applications of semiconductor devices such as diodes, transistors, and MOSFETs. (K2)
	6	Explain of communication devices and modulation techniques in wireless communication systems. (K2)
Course outcomes	At the end of the course the students will be able to	
	CO1	Outline KCL, KVL and related methods to solve DC circuits. (K1)
	CO2	Illustrate the operation of single phase AC Circuits. (K2)
	CO3	Explain the principle of operation of three phase AC Circuits. (K2)
	CO4	Infer the performance characteristics of Semiconductor Devices. (K2)
	CO5	Demonstrate the working principle of Communication system. (K2)
	CO6	Apply the knowledge of electric circuits and electronic devices for Marine engineering applications. (K3)

POs/COs	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	-	-	-	3	2	3	3			
CO2	3	2	2	3	-	-	-	3	2	2	2			
CO3	3	3	2	2	-	-	-	2	2	3	2			
CO4	3	2	2	2	-	-	-	3	2	2	3			
CO5	2	2	3	2	-	-	-	3	3	3	2			
CO6	3	3	2	2	-	-	-	3	3	3	3			
Average	2.7	2.5	2.2	2	-	-	-	3	3	2	2.50			

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	DC CIRCUITS	11 Hours
Importance of Electrical Engineering in day-to-day life - Electrical elements and their classifications - KCL and KVL equations - Loop current and node voltage method - Steady state analysis with independent and dependent sources - parallel and series circuits and star delta conversion.		
Competency Numbers	6.1.1.e	
UNIT-II	ANALYSING SINGLE PHASE AC CIRCUITS	11 Hours

Common Signals - Wave Form - RMS Value - Average Value - Form Factor and Peak Factor - Single Phase A.C Series Circuits - Phasor Diagram - Power Factor – Impedance - Power Triangle - Single Phase A.C Parallel Circuits- Phasor Diagram - Power Factor - Power Triangle.		
Competency Numbers	6.1.1.e	
UNIT-III	ANALYSING THREE PHASE AC CIRCUITS	11 Hours
Three Phase Balanced and Unbalanced Voltage Sources – Analysis of Three Phase 3-Wire and 4-Wire Circuits with Star and Delta Connected Loads– Phasor Diagram of Voltages and Currents – Power and Power Factor Measurements in Three Phase Circuits.		
Competency Numbers	6.1.1.a	
UNIT-IV	SEMICONDUCTOR DEVICES	11 Hours
Characteristics of PN Junction Diode - Zener Diode and its Characteristics - Voltage regulation- Bipolar Junction Transistor - CB, CE ,CC Configurations and Characteristics- Basic Construction of 'N' channel & 'P' channel JFET-MOSFET - Half wave and Full wave rectifiers - Cathode Ray Oscilloscope.		
Competency Numbers	6.1.2..a, , 6.1.3.a	
UNIT-V	COMMUNICATION ENGINEERING	10 Hours
Communication devices -Modulation and Demodulation - circuit explanation. AM, FM, Wireless communication - Radio Transmitters and Receivers - Radar Communication - GPS - Inmarsat - Introduction to ECDIS- Satellite communication as applicable to GMDSS.		
Competency Numbers	6.1.2..a, 6.1.3.a	
		Total hours: 54
Text Books:		
1.	Arumugam and Prem Kumar, Electric Circuit Theory, Khanna Publishers, 2002.	
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003	
3.	R.S.Sedha, A Textbook of Applied Electronics, 3rd revised Edition, 2008.	
4	A.K.Sawhney-A Course in Electrical and Electronics Measurements and Instrumentation, 19th Revised Edition 2011	
Reference Books:		
1.	Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.	
2.	Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, 2007.	
3.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2008	

Program	B.E. – Marine Engineering				
Course code 241ME1A11TD	Course Name Engineering Mechanics	L	T	P	C
		3	1	0	3
Year / Semester	I Year / I Semester	Contact hours/Week 4			

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
	✓			

Course objectives		
	1	To Explain the analytical techniques for analyzing forces in statically determinate structures (K1)
	2	To understand the importance of centroids and center of gravity of curves, areas and composite shapes and methods of finding centroids and moment of inertia of various standard and composite shapes. (K1)
	3	To understand the applications of various types of lifting machines. (K1)
	4	To Understand the friction in plane and ladder, the relationship between mechanical advantage, velocity ratio, and efficiency. (K1)
	5	To understand the basic parameters of SHM, Virtual work, Energy-Potential energy, Kinetic energy of translations, Newton's Law of motion. (K1)

Course outcomes		
	On completion of the course the students will be able to	
	CO1	Illustrate the analytical techniques for resolving system of forces and static Structures. (K2)
	CO2	Calculate center of mass, center of gravity and the properties of distributed forces. (K3)
	CO3	Explain the laws of lifting, reversible machines and irreversible machines. (K1)
	CO4	Determine the friction and the effects by the laws of friction. (K2)
	CO5	Explain the phenomena of Virtual work, Energy-Potential energy, Kinetic energy of translations, Newton's Law of motion. (K1)
	CO6	Analyze the rigid bodies in equilibrium, distributed forces and determine friction. (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	2	1	
CO2	3	3	2	2	2							2	2	1	
CO3	3	2	2	2	2							2	2	1	
CO4	3	3	2	2	2							2	2	1	
CO5	3	3	2	2	2							2	2	1	
CO6	3	3	2	2	2							2	2	1	
Average	3	2.83	2.16	2	2							2	2	1	
Correlation level			1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)			

UNIT-I	STATICS OF PARTICLES	12 Hours

Introduction to statics – system of forces – resolution and composition of forces, Forces in Space Truss, types of trusses, assumptions for truss analysis, Analysis of truss (method of joints).

Competency Numbers	4.5, 9.5	
UNIT-II	**DISTRIBUTED FORCES**	**15 Hours**
Centroid, center of mass and center of gravity, analytical expressions of centroids, centroids of composite shapes, Pappus-Guldinus theorems, second moment of area, radius of gyration, perpendicular axis theorem for second moment of area, parallel axis theorem, moment of inertia of composite sections.		
Competency Numbers	4.5, 9.5	
UNIT-III	**SIMPLE LIFTING MACHINES**	**15 Hours**
Introduction to Simple machines- law of lifting machine– Graphics of load effort and load efficiency– velocity ratio, mechanical advantage and their relationship, reversible machines, irreversible machines.		
Competency Numbers	4.5	
UNIT-IV	**FRICTION AND ITS APPLICATION**	**15 Hours**
Friction, Coefficient of friction, Friction in inclined plane, Ladder friction, mechanical advantages and efficiency of the following machines: Wheel and Axle, Differential Wheel and Axle, Rope Pulley blocks, Differential Pulley blocks, Warwick screw, worm-driven chain blockof and single and double purchase crab winches.		
Competency Numbers	4.5, 9.5	
UNIT-V	**DYNAMICS OF PARTICLES**	**15 Hours**
Virtual work, Energy-Potential energy, Kinetic energy of translations, Newton's Law of motion, Conservation of Momentum. Centrifugal force and its application to conical pendulum, Unloaded governor (Watt governor) Basic parameters of SHM, beats, resonance, simple pendulum, compound pendulum.		
Competency Numbers	4.5, 9.5	
Total hours: 72		
Text Books:		
1. I B Prasad, " Applied Mechanics" , Khanna Publishers, 14th Edition, 2018..		
2. R.S Khurmi , "A textbook of Engineering Mechanics", S.Chand & Co. Ltd., New Delhi, 2016		
3. Dr. R. K Bansal , "A textbook of Engineering Mechanics", Lakshmi Publishers, 18th Edition, 2019.		
Reference Books:		
1.Reed Volume 2: Applied Mechanics for Engineers; By William Embleton; Revised by J.T. Gunn; Publisher Sunderland Tyne and Wear) Thomas Reed.1983: ISBN0900335874.		
2. Applied Mechanics, J. Hannah and M.J. Hiller, Longman,1998, ISBN:9780582256323		
3. Engineering Mechanics Statics and Dynamics by Rajasekaran S and Sankarasubramanian G.		

Program	B.E. – Marine Engineering				
Course code 241ME1A11TE	Course Name **Work Shop Technology**	L	T	P	C
		1	1	2	3
Year/Semester	I Year/ I semester	Contact hours/Week 04 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			☒		

Course objectives	1	To summarize metal joining processes. (K1)
	2	To identify casting processes. (K2)
	3	To summarize surface finishing techniques. (K2)
	4	To analyze metal forming techniques. (K3)
	5	To select machining processes. (K2)
Course outcomes	CO1	Identify metal joining techniques effectively. (K1)
	CO2	Examine high-quality castings through proficient application of casting processes. (K1)
	CO3	Demonstrate mastery in achieving desired surface finishes using appropriate surface finishing techniques. (K2)
	CO4	Summarize metal forming techniques to produce components with precision and desired properties. (K2)
	CO5	Identify machining operations through the application of advanced skills and techniques. (K2)
	CO6	Examine the quality of welded joints and castings through proficient inspection methods (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	3	-	-	-	2	2	-	-
CO2	2	2	2	-	-	-	-	3	-	-	-	3	3	3	-
CO3	3	2	2	-	-	-	-	3	-	-	-	3	3	3	-
CO4	3	3	3	2	-	-	-	3	-	-	-	3	3	3	-
CO5	3	3	3	3	-	-	-	2	-	-	-	3	3	3	-
CO6	3	3	3	3	3	-	-	3	-	-	-	3	3	3	3
Average	2.67	2.50	2.50	2.50	3.00			2.83				2.83	2.83	3.00	3.00

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	**USE OF HAND TOOLS AND POWER TOOLS AND MEASURING INSTRUMENTS**	14 Hours
Familiarization with following, enumerate types available. Describe the care necessary for a) surface plates b) vee blocks c) Scorners d) dividers e) odd leg calipers. List the processes for which powered hand tools can be used and name the different types of power, Demonstrate the use of powered tools. State the practical maximum and minimum capacities of an electric powered hand drill and state the care necessary for supply cable of powered hand tools Use of Micrometer, Vernier caliper, Marking table, Tri Square, Dial gauge. Use of appropriate specialized tools and measuring instruments_ 24 V battery testing, Purpose ammeter, KW meter, frequency meter etc.		
Competency Numbers	8.1	
UNIT-II	**METAL JOINING PROCESS**	10 Hours
Metal joining processes – flexible and permanent, Principles of welding – Fundamentals of arc welding,safety precautions before welding, gas welding, gas cutting and Under water welding, Brazing and Soldering. Classification plastic welding, fusion welding, solid phase welding and sub classification. Study of power sources, electrodes, processes and applications: SMAW, SAWM, GTAW, GMAW, PAW, electro gas welding and Electro Slag, resistance welding. Defects and Inspection of welded joints.		
Competency Numbers	8.2	
UNIT-III	**FINISHING PROCESS, FITTING AND PLUMBING**	10 Hours
Surface finishing processes: grinding processes, various types of grinders, work holding devices, grinding wheels and specification, selection of grinding wheels for specific applications –Fine Finishing Process: Lapping, honing, and super finishing process, ship hull finishing. Fitting-tools and operations. Plumbing tools and applications.		
Competency Numbers	8.3	
UNIT-IV	**METAL FORMING PROCESS**	10 Hours
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.		
Competency Numbers	8.5	
UNIT-V	**MACHINING PROCESS**	10 Hours
Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning machining time and power required for cutting, Drilling and boring - classification, specification. Shaper and Slotting Machines-simple operations-boring machines- jig borer – description, types and hole location procedures – milling - classification, principle, parts- specification milling cutters indexing, selection of milling m/c fundamentals of inches processes, milling processes and operations– CNC machines.		
Competency Numbers	8.3	
Total: 54 Hours		
Text Books:		
1. Jeffus, Welding and Metal fabrication",1st Ed. Cengage, Indian reprint-Yesdee Publishings Pvt. Ltd. 2012		

2. Rao.P.N., "Manufacturing Technology, Metal Cutting and Machine Tools", Tata McGraw-Hill, 2000.

Reference Books:

1. Venugopal K., Basic Mechanical Engineering, Fourth Edition, Anuradha Agencies, Chennai, Year 1994

2. Jain K.C. Agarwal, L.N. "Metal Cutting Science and Production Technology",1st edition, Khanna Publishers, 1986.

3. Chapman W.A.J., "Workshop Technology", Vol. II, Arnold Publishers,1972

4. H.M.T., "Production Technology", Tata McGraw-Hill, New Delhi, 2000

5. Serope Kalpakjian , Steven,R. Schmid, "Manufacturing Engineering and Technology,"4th Ed. Pearson, 2011

6. Timings, " Fabrication and Welding Engineering', Elsevier, Indian Reprint -Yesdee Publishings Pvt. Ltd. 2011

7. Kemp & Young, " Ship construction : Sketches and Notes", 1st Ed. Standfor Maritime Limited, 1982

Program	**B.E. Marine Engineering**					
Course code 246EN1A12PC	Course Name **English and Communication Laboratory**	L	T	P	C	
		0	0	2	1	
Year / Semester			Contact hours/Week:2			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
	✓					
Course objectives	1	To listen conversation and motivational speeches. (K1)				
	2	To enable students speaking effectively in real life situations and soft skills. (K1)				
	3	To equip them with employability skills to enhance their prospect of placements. (K2)				
	4	To enable learner speak effortlessly in formal situations. (K2)				
	5	To develop students professional speaking skills. (K1)				
	6	To enable learners acquire English. (K2)				
Course outcomes	CO1	Communicate with others in practical, business-oriented situations (K3)				
	CO2	Identify the proper tone of language required in writing and speaking in business communication. (K2)				
	CO3	Relate between letters and memos and various forms of Business Communication. (K2)				
	CO4	Display knowledge on grammar and other linguistic features in writing various forms of business communication. (K3)				

	CO5	Write business reports, minutes, proposals etc., (K3)
	CO6	Present the report and memos in front of an audience. (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO2	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO3	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO4	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO5	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO6	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
Average						2.5	2.0	2.0	3.0	3.0		3.0			

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

Unit-I	**Fundamentals of Communication**	**Hours 7**
Communication Process, types of communication; Verbal and Non-verbal communication - Levels of communication; Flow of communication; Communication networks; General and Technical Communication – barriers to communication.		
Competency Numbers		
Unit-II	**Listening and Speaking**	**Hours 7**
Process of Listening – listening versus hearing; Barriers to listening - types of listening - Listening to lectures, dialogues from TV/radio/Podcast – motivational speeches – Self-introduction – JAM.		
Competency Numbers		
Unit-III	**Reading and Writing**	**Hours 7**
Reading Comprehension tests ranging from magazine and newspapers – strategies of reading – reading speed – reading types - summarize a text. Writing – the process of writing – Resume writing.		
Competency Numbers		
Unit-IV	**Soft Skills**	**Hours 7**
Human values – intercultural communication – learning strategies – lateral thinking - career planning.		
Competency Numbers		
Unit-V	**Interview Skills**	**Hours 8**
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- FAQ- Online Interview- Panel Interview - Video samples.		
Competency Numbers		
		Total hours:36

Software: ORELL TALK & English Wordsworth Lab. (EWL)

References:

6. Business English Certificate Materials, Cambridge University Press
7. *Communication Skills*. Sanjay Kumar and Pushpa Latha, Oxford University Press, 2011
8. *Exercises in Spoken English* Part – I – III, Hyderabad, Oxford University Press.
9. http://www.oxforddictionaries.com/words/writing-job-applications
10. https://www.esl-lab.com/

Program	**B.E. – Marine Engineering**					
Course code 241ME1A23PA	Course Name **Engineering Graphics**		L 0	T 1	P 3	C 2
Year / Semester	I Year / II Semester		Contact hours/Week 4 Hours			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				
Course objectives	This course's primary objective for learning is to prepare students for:					
	1	Drawing engineering curves. (K2)				
	2	Drawing freehand sketch of simple objects. (K2)				
	3	Drawing orthographic projection of solids and section of solids. (K2)				
	4	Drawing development of solids(K2)				
	5	Drawing isometric and perspective projections of simple solids. (K2)				
Course outcomes	Upon completion of the course the cadets will be able to:					
	CO1	Construct the conic curves, involutes and cycloid. (K2)				
	CO2	Solve practical problems involving projection of lines. (K2)				
	CO3	Draw the orthographic, isometric and perspective projections of simple solids. (K2)				
	CO4	Draw the development of simple solids. (K2)				

	CO5	Draw the projection of sectioned solids and development of surfaces in various position. (K2)
	CO6	Develop student's imagination and ability to represent the shape size and specifications of physical objects. (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2					3		2			2
CO2	3	2	2		2					3		2			2
CO3	3	2	2		2					3		2			2
CO4	3	2	2		2					3		2			2
CO5	3	2	2		2					3		2			2
CO6	3	2	2		2					3		2			2
Average	3	2	2		2					3		2			2
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

CONCEPTS AND CONVENTIONS **2 Hours**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-I	**UNIT I PLANE CURVES AND LIMIT ,FITS ,TOLERENCE**	**10 Hours**
Dimensioning – lettering-Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid construction of involutes of square and circle — Drawing of tangents and normal to the above curves.- Limts and their types – Types of fits – Tolerances		
Competency Numbers	9.6	
UNIT-II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**15 Hours**
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		
Competency Numbers	9.6	

UNIT-III	**PROJECTION OF SOLIDS AND FREEHAND SKETCHING**	**15 Hours**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.- - Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination) - views of flange coupling and machine vice		
Competency Numbers	9.6	
UNIT-IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**15 Hours**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)		
Competency Numbers	9.6	
UNIT-V	**ISOMETRIC AND ASEMMPLY DRAWING**	**15 Hours**
Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination) Screw jack – Gib and cotter joint –Knuckle joint – Tail stock		
Competency Numbers	9.6	**Total : 72 Hours**
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. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015		
Reference Books:		
1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.		
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore,27th Edition,2017.		
3. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi,2015.		

PROGRAM	B.E, (All Courses)					
Course Code: 241PH1A11PA	Course name: Material physics laboratory		L	T	P	C
			0	0	2	1
Year and Semester	I Year (I Semester)		Contact hours per week			
Prerequisite course	Nil		2 Hrs			
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					

Course Objective

1. To apprehend the effect of torsional stress in solid wire (K1)
2. To understand the effect of bending moments solid rod (K1)
3. To explain about various material testing techniques. (K2)
4. To understand the electrical properties of materials(K1)
5. To explain about thermal properties of materials (K1)

Course Outcome

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

1. Interpret and validate the measured parameters. (K2)
2. Apply the basic concepts of physics to find the stress and strain in materials (K3)
3. Justify the values of measurements and wear and tear (K3)
4. Determine the viscosity and surface tension of liquids (K2)
5. Use of screw gauge, vernier calliper and travelling microscope (K3)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
Avg	2.3	2.2	2.2	1.7	2.3							2.2	2.0	2.3	2.2

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

Course contents:

1. Torsion pendulum – Rigidity modulus of a given wire
2. Joules law of heating-Determination of thermal conductivity
3. Air wedge – Thickness of a given wire
4. Material testing using screw gauge and vernier calliper
5. Determination of conductivity of given wire using Ohms Law
6. Determination of thermal conductivity using Lees Disc
7. Characteristics of Junction diode
8. Newton's rings – Determine the thickness of a thin film
9. Non uniform bending – Young's modulus of elasticity of a bar
10. Uniform bending - Young's modulus of elasticity of a bar

TOTAL: 36 PERIODS

Text Books:

1. D.S. Mathur, P.S.Hemne, 2000, Mechanics, S. Chand & Company Ltd, New Edition, New Delhi, 1-848
2. Ghatak, 2017, Optics, McGraw Hill Education, 6th Edition, New Delhi, 1-632.
3. R. Murugesan, Electricity & Magnetism, 2017, S. Chand & company Ltd, 10th edition, New Delhi, 1-478.
4. H.S. Hans, S.P. Puri, 2009, Mechanics, Tata McGraw Hill Publishing Company Ltd, 2nd edition, New Delhi, 1-551.

Reference Books:

1. M. Narayanamurthi and N. Lakshminarayan, 1997, Electricity and Magnetism, The National Publishing Company, 3rd edition.
2. Hugh D. Young and Roger A. Freedman, 2011, Sears and Zemansky's University Physics: Electricity and Magnetism, Vol-II, Pearson Education Limited, 12th edition, Chennai, Delhi, 1-452.
3. Halliday, Resnick and Walker, 2009, Fundamentals of Physics, Wiley India, extended 8th edition, New Delhi, 1-1279.
4. Brijlal & Subramanian, 2001, Principles of Physics, S. Chand & company Ltd, revised edition.

Reference Videos:

1. https://www.youtube.com/watch?v=0GAdMAm1-3o
2. https://www.youtube.com/watch?v=XuXUtGN928U

Website:

1. https://www.gopracticals.com/physics/physics-calibrate-voltmeter-potentiometer/
2. https://www.brainkart.com/article/Newton-s-rings---Experiment,-Theory_566/

E-books:

1. https://www.kopykitab.com/Engineering-Physics-Practicals-ebook
2. https://www.amazon.in/Engineering-Physics-Practicals-Srinivasa-Rao-ebook/dp/B075R377VW
3. https://www.kobo.com/in/en/ebook/engineering-physics-practicals

Course Code 241ME1A11PC	Course Name Basics Electrical and Electronics Engineering Laboratory		L 0	T 0	P 2	C 1
Year / Semester	I Year / I Semester		Contact hours per week 2Hrs			
	Basic Science	Engineering Science	Open Elective	Mandatory		
	✓					

Course Objective	1	To summarize the students with hands on experience on various electrical engineering practices.(K3)
	2	To summarize the students with the design, analyze and application of electronic devices.(K3)
	At the end of the course the student will be able to:	
Course Outcome	CO1	Demonstrate Ohm's law, Kirchhoff's law (K3)
	CO2	Make different soldering circuits (K2)
	CO3	Measure the various electrical quantities (K3)
	CO4	Inspect Earth resistance (K3)
	CO5	Design a prototype of a charger (K3)
	CO6	Inspect the faults in various electrical machines. (K3)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	3	3	3	_	_	2	3	2	3	2			
CO2	3	3	2	3	3	_	_	2	3	2	2	2			
CO3	3	3	2	3	2	_	_	2	2	2	3	2			
CO4	2	3	2	3	2	_	_	2	3	2	2	3			
CO5	_	3	3	3	2	_	_	2	3	3	3	3			
CO6	3	2	3	2	2	_	_	2	3	3	3	3			
Average	3	3	3	2	2	_	_	2	3	3	2	3			

Correlation Levels	1. Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

List of Experiments: Total Hours : 36

1. Verification of Ohm's law
2. Verification of Kirchhoff's laws
3. Measurement of electrical quantity using RLC circuit (series and parallel)
4. Power measurement in single phase circuits using two wattmeter method.
5. Measurement of energy (using single phase energy meter)
6. Characteristics of PN Junction Diode.
7. Characteristics of Zener Diode
8. Characteristics of JFET
9. Study of Half wave and Full wave Rectifiers
10. Study of Earthing and Measurement of Earth resistance.
11. Study of trouble shooting of electrical equipments (fan, iron box, mixer grinder, etc.)
12. Study of CRO and measurement of AC signals.

Text Books:

1.	Arumugam and Prem Kumar, Electric Circuit Theory, Khanna Publishers, 2002.
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003
3.	R.S.Sedha, A Textbook of Applied Electronics, 3rd revised Edition, 2008.
4	A.K.Sawhney-A Course in Electrical and Electronics Measurements and Instrumentation, 19th Revised Edition 2011

Reference Books: Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.

Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, 2007.
Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2008

V Program	**B.E. (Marine)**				
Course code **246MA 1A 21TD**	Course Name **Calculus**	L	T	P	C
		3	1	0	4
Year / Semester	I / II		Contact hours/Week 4		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	√				

Course objectives	1	To introduce the different method for differentiation and Successive differentiation
	2	To know the concepts and application of Functions of Several Variables.
	3	To apply integration techniques in area and volume by single integrals.
	4	To apply double and triple integration techniques in area and volume.
	5	To apply integration in Physical Quantities of Marine Engineering.
Course outcomes (On completion of the course, Learners will be able to)	CO1	Differentiate some standard function and Successive derivative.
	CO2	Calculate the limit of a function by L'Hospitals rule and application of maxima and minima.
	CO3	Determine the evaluation of single integrals and its applications.
	CO4	Determine the evaluation of multiple integrals and its applications.
	CO5	Calculate the Moment of inertia and centroid.
	CO6	Find the solution for differential calculus and Integral calculus related problems.

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	-	1	-	-	-	-	-	-	-	-	-	1	-
CO4	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-

CO5	3	2	-	2	-	-	-	-	-	-	-	-	-	1	-
CO6	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-
Average	2.2	1.2	-	1.2	-	-	-	-	-	-	-	-	-	1	-
Correlation level	1.Slight (Low)					2. Moderate (Medium)					3. Substantial (High)				

Unit-I	**Differentiation**	**11 Hours**
Differentiation: Algebraic, circular, exponential and logarithmic function, products, quotients functions and simple implicit functions- Successive differentiation- n^{th} order derivative: trigonometric Identities, standard functions, partial fractions, Leibnitz's Theorem-Maclaurin's Theorem, Taylor's theorem for standard functions (sinx ,cosx, tanx. log(1- x), log(1+x))-Curve tracing of Cartesian and Polar curves.		
Competency Numbers	4	
Unit-II	**Functions of Several Variables**	**12 Hours**
Indeterminate forms and L'Hospital rule- Limits and continuity- Partial derivatives-Geometrical interpretation and rules of partial differentiation-Higher order partial derivatives-Homogeneous functions and Euler's theorem-Total derivative and chain rules-implicit function and composite functions- Errors and approximations-Maxima and minima using Lagrange's multipliers.		
Competency Numbers	4	
Unit-III	**Integration**	**10 Hours**
Basic of integration-Integration of standard functions by substitution and by parts-Definite integral as the limits of a sum- Application of integration to the area under curve and volume of revolution.		
Competency Numbers	4	
Unit-IV	**Applications of Multiple Integrals**	**12 Hours**
Double and Triple integrals- Region of integration-Change of order of integration: spherical and polar coordinates-Applications in area and volume-Mass of wire and solid-Centre of gravity of wire, Lamina-Moment of inertia using multiple integrals.		
Competency Numbers	4	
Unit-V	**Applications of Integration in Physical Quantities**	**9 Hours**

First moment of area and the position of a centroid of an area- work done by variable force- mean values and RMS values of sin nx and Cos nx -Rules of Guldinus- Parallel and perpendicular axis theorem-Second moment of area and M.I of rectangular and circular laminas.	
Competency Numbers	4 **Total hours: 54**
Text Books:	
1. Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014. **Unit I:** Chapter 4 Section 1-4. **Unit-II:** Chapter 4 Section 5, 15; Chapter 5 Section 1-5, 11, 12. **Unit-III:** Chapter 6 Section 8-10, 12. **Unit-IV:** Chapter 7 Section 1-10, 12.	
2. Statics-Engineering Mechanics-I, Dietmar Gross, Wolfgang Ehlers, Peter Wriggers, Jorg Schroder, Ralf Muller, Springer-2017. **Unit V:** Chapter 2,7,9.	
Reference Books:	
1.Embleton, W. and Jackson, L., "Mathematics for Engineers", Vol - I, 7th Edition, Reed's Marine Engineering Series,	
2. Thomas Reed Publications, 1997. 2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3 rd Edition,	
3. Narosa Publishing House Pvt. Ltd., 2007. 3. James, G., "Advanced Engineering Mathematics", 7 th Edition, Pearson	
4. Education, 2007. 4. Ramana, B.V, "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.	

Program	B.E. – Marine Engineering					
Course code 241ME1A23TA	Course Name Marine Electronics	L	T		P	C
		2	1		0	3
Year / Semester	I year II Semester			Contact hours/Week		3 Hrs
	Basic Science	Engineering Science		Open Elective	Mandatory	
		✓				
Course objectives	1	To explain the fundamental principles of Boolean algebra and combinational circuits, including logic gates, truth tables, and Boolean expressions. (K1)				
	2	Explain the number of clock cycles and enable timing and sequencing functions. (K1)				
	3	To classify and differentiate the instruction sets and addressing modes of the 8085 microprocessor (K2)				
	4	Analyze the various types of interfacing in the 8085 microprocessor, including their characteristics, applications, and challenges. (K3)				

	5	Discuss functional block diagram, addressing modes, and data transfer operations of the 8085 microprocessor. (K2)
Course outcomes	On completion of the course, students will be able to	
	CO1	Explain the fabrication of IC's and op-Amp. (K1)
	CO2	Illustrate the concept of counter, flip flop and Memory (K2)
	CO3	Solve the concept of Boolean algebra and combinational circuits. (K3)
	CO4	Discuss the functional block diagram, Addressing modes and data transfer of 8085 microprocessor (K2)
	CO5	Compare the functions of various advanced microprocessor and microcontroller architecture. (K3)
	CO6	Apply the programming knowledge of microprocessor and control the speed of stepper motor. (K3)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO3
CO1	2	2	2	2	2	-	-	2	2	-	-	-			
CO2	2	2	2	2	2	-	-	2	2	-	-	-			
CO3	3	2	2	2	2	-	-	2	3	-	-	-			
CO4	3	3	2	2	2	-		3	2		-	-			
CO5	3	3	2	2	2	-		2	2		-	-			
CO6	3	2	1	1	2	-		2	2		-				
Average	3	2	2	2	2	-		2	2		-	-			
Correlation level			1.Slight (Low)				2. Moderate (Medium)				3. Substantial (High)				

UNIT-I	INTEGRATED CIRCUITS	11 Hours
IC classification - fundamental of monolithic IC technology - Ideal OP-AMP characteristics - feedback amplifiers - differential amplifier - Power Amplifiers circuit diagram and explanation - Class A, B amplifier - Basic applications of OP-AMP – summer and Subtractor - Instrumentation amplifier - PCB design.		
Competency Numbers	6.1.2.	
UNIT-II	DIGITAL CIRCUITS	11 Hours
Logic Systems and Gates – Number systems – Boolean algebra – Simplifications – Flip – flops - SR, D, JK and T – Counters-2 bit Asynchronous up,down– Registers and multiplexers -- Semiconductor memories – ROM – RAM and PROM.		
Competency Numbers	6.1.2.	
UNIT-III	INDUSTRIAL ELECTRONICS	11 Hours
Power rectification –Structure - operation and characteristics of SCR – TRIAC - power transistor - MOSFET - Photoelectric devices - regulated power supply and application of Power electronics circuits.		
Competency Numbers	6.1.2.	
UNIT-IV	MICROPROCESSORS BASED SYSTEMS DESIGN	11 Hours
Architecture of 8085 – Instruction set- addressing modes– Interfacing and Control of motors -Temperature/Speed control - Closed loop control of servo motor - stepper motor control.		
Competency Numbers	6.1.2.	

UNIT-V	MICROCONTROLLER AND ITS APPLICATION	10 Hours
Architecture of 8051 — Special Function Registers (SFRs) — I/O Pins Ports and Circuits — Instruction set — Addressing modes — Comparison of Microcontroller, PIC and ARM processors		
Competency Numbers	6.1.2.	
Total hours: 54 Hours.		
Text Books:		
Ramakant.A. Geakwad, "Linear integrated circuits", 3rd edition, Prentice – Hall of India, New Delhi, 2001		
Malvino Leach, "Digital principles and applications", 5th edition, Tata McGraw-Hill, Publishing co., New Delhi, 1995.		
Hofmann, "Global Positioning System", 5th Ed.,Springer, Indian reprint 2007 (Yesdee Publishings Pvt. ltd.)		
Reference Books:		
P.S.Bimbhra, "Power Electronics", 3rd edition, Khanna Publisher, New Delhi, 2001.		
Ramesh Gaonkar, "Microprocessors and Microcomputers", 4th edition, lhasthatak, India, 1999.		
Ray choudhary & Shail B Jain, "Linear Integrated Circuits", New Age International publisher, 2015		
Rashid, " Power Electronics Handbook",3rd Ed. Elsevier, Indian Reprint 2013(Yesdee Publishings Pvt. Ltd.)		

Course code 241ME1A23TB	Course Name Marine Electrical Machines – I		L	T	P	C
			2	1	0	3
Year / Semester	I Year/ II semester		Contact hours/Week – 3 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		X				
Course objectives	1	To describe the electromechanical energy conversion in electrical apparatus. (K1)				
	2	To demonstrate an understanding of the constructional details of DC generators. (K2)				
	3	To Explain the basic principles and characteristics of DC motors and their operation. (K1)				
	4	To Create an informative description of the physical components and design features of transformers. (K3)				
	5	To describe the key performance parameters of motors and their significance in practical applications. (K1)				
	6	To apply knowledge of electrical machines and control systems to design an efficient and reliable ship propulsion system. (K1)				
Course outcomes	On completion of the course, students will be able to					
	CO1	Identify the construction and characteristics of D.C. Machines in general. (K2)				

	CO2	Explain the constructional details of DC Generators (K1)
	CO3	Explain the Operation and characteristics of DC Motors (K1)
	CO4	Explain the Constructional Details of Transformers (K1)
	CO5	Identify the fault finding techniques in electrical apparatus. (K2)
	CO6	Describe the structure and functioning of electrical generation and distribution systems with safety precautions. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	3	3	3				3	2	
CO2	3	2	2	2	2	3	3	3	3				3	2	
CO3	3	3	2	2	2	3	3	3	3				3	2	
CO4	3	2	2	2	2	3	3	3	3				3	2	
CO5	3	2	2	2	2	3	3	3	3				3	2	
CO6	3	2	2	2	2	3	3	3	3				3	2	
Average	3	3	2	2	2	3	3	3	3				3	2	
Correlation level		1.Slight (Low)				2. Moderate (Medium)				3. Substantial (High)					

UNIT-I	ELECTROMECHANICAL ENERGY CONVERSION	1
Fundamentals of Magnetic circuits – Statically and dynamically induced EMF – Principle of electromechanical energy conversion forces and torque in magnetic field systems – co-energy in singly excited and multi excited magnetic field system – Winding Inductances – magnetic fields in rotating machines- magnetic saturation and leakage fluxes.		
Competency Numbers	6.1 , 6.1.1c	
UNIT-II	DC GENERATORS	11 Hours
Principle of operation, constructional details, armature windings and its types, EMF equation – armature reaction – demagnetizing and cross magnetizing ampere turns – compensating winding – commutation – inter poles – OCC and load characteristics of different types of DC Generators. Parallel operation of DC Generators, equalizing connections- applications of DC Generators.		
Competency Numbers	6.1.1.a , 6.1.1c	
UNIT-III	DC MOTORS	11 Hours
Principle of operation – significance of back e.m.f – torque equations and power developed by armature – speed control of DC motors – starting methods of DC motors – load characteristics –losses and efficiency – condition for maximum efficiency. Testing of DC Machines: Brake test, Swinburne's test, Hopkinson's test, Field test, Retardation test, Separation of core losses-applications of DC motors.		
Competency Numbers	6.1 , 6.1.1c	
UNIT-IV	TRANSFORMERS	11 Hours
Construction and principle of operation – equivalent circuit – phasor diagrams – voltage regulation –losses and efficiency – all day efficiency – applications of single-phase transformer. Construction and working of auto transformer – comparison with two winding transformers – applications of autotransformer. Three Phase Transformer – Construction – types of connections and their comparative features–Scott connection, applications of Scott connection.		
Competency Numbers	6.1.1..b , 6.1.1c	
UNIT-V	FAULT FINDING TECHNIQUES FOR GENERATOR	10 Hours
Types of fault in main generator, Emergency generator, Fault finding techniques of main generator, Essential requirements for fault prevention and fault location in Generators Fault Rectification and actions to be taken on detection of fault in Main Generator and Emergency Generator.		
Competency Numbers	7.1 , 7.3	
		Total hours: 54

Text Books:

1. Theraja A. K, A Textbook of Electrical Technology: - AC and DC Machines (Volume - 2) Publisher S. Chand;

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

3. I.J Nagrath and D.P Kothari, "Basic Electrical Engineering", 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.

Reference Books:

1. Hughes Edward, "Electrical technology", 2nd edition, "ELBS with DP Publications", USA, 1996.

S. No	COURSE CODE	SUBJECT TITLE	L	T	P	C
1	241CH1A21TG	ENGINEERING CHEMISTRY	2	0	0	2

Course Objectives	1. Learn the problems associated water treatment methods and boiler water chemistry (K1) 2. Understand the concept of corrosion and its control (K2) 3. Classify the types of materials and their applications (K2) 4. Understand the engineering materials, necessity and its utilization (K2) 5. Recognize the need of fuel and energy sources for present and future (K2)
Course Outcomes	The Students will be able to 1. Understand the water technology and its treatment importance (K2) 2. Appraise the boiler chemistry and its protection (K2) 3. Identify the problems associated with corrosion with its control measures (K1) 4. Understand the engineering materials, necessity and its utilization (K2) 5. Recognize the need of fuel and energy sources for present and future (K2) 6.Utilize the knowledge of engineering chemistry in real time engineering applications (K3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	2	-	-	-	-	2	1	2	3
CO2	2	2	-	-	-	-	3	-	-	-	-	2	2	2	2
CO3	2	2	-	-	-	-	3	-	-	-	-	2	-	-	-
CO4	2	2	-	-	-	-	3	-	-	-	-	2	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	2	-	-	-
CO6	3	2	3	-	2	-	3	-	-	-	-	2	2	2	2
AVERAGE	2.3	2	3	-	2	-	2.8	-	-	-	-	2	2	2	3

Enter correlation levels as 1,2,3

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

UNIT I WATER TECHNOLOGY **10 Hrs**

Water and it's impurities - Domestic Water treatment - Purification – Sterilization and disinfection: UV treatment- Ozone treatment-Chlorination, Break point chlorination Introduction to boiler feed water- Requirements of boiler feed water- Purpose of water treatment in boilers, scale and sludge formation and prevention, priming and foaming- chemical and mechanical deareation – methods of chemical and mechanical deareation – Boiler treatment methods. Zeolite process and ion exchange (demineralization) - caustic soda treatment - condensate lime treatment - Desalination of water - reverse osmosis and electrodialysis.

Competency No. : 4.1.9

UNIT-II CORROSION SCIENCE **12Hrs**

Corrosion:- Definition – Theories of Corrosion (chemical & electrochemical) – concentration cell corrosion, differential aeration and waterline corrosion – Passivity of metals – Pitting corrosion - Galvanic series – Factors which influence the rate of corrosion - Protection from corrosion – Design and material selection – Cathodic protection - Protective coatings: – Surface preparation – Metallic (cathodic and anodic) coatings - Methods of application on metals (Galvanizing, Tinning, Electroplating, Electroless plating).

Competency No. : 4.1.9

UNIT III LUBRICATION & ENERGY SOURCES **12 Hrs**

Lubricants – Mechanism and Classification of lubricants - Solid, semisolid and liquid lubricants with examples- Type of lubrications – hydrodynamic and boundary lubrication with illustrative diagrams. Properties of lubricants: Physical properties- viscosity, viscosity index, cloud and pour point, flash and fire point, oiliness. Chemical properties - TAN, emulsification, aniline point and iodine value.

Greases, graphite, cooling liquids and cutting fluids and their applications. Alternative and non-conventional sources of energy – solar, wind, geo, hydro-power and biomass. Advantages and disadvantages. Nuclear energy, reactors and nuclear waste disposal. Safety measures for nuclear reactors. Primary and secondary batteries - Battery technology. Rechargeable batteries - Alkaline batteries – Lead acid, Ni – Cd and Li ion batteries, Sodium and Zinc based batteries Fuel cells – Hydrogen, Photovoltaics.

Competency No. : 4.1.9

UNIT IV POLYMER ENGINEERING MATERIALS **10 Hrs**

Introduction – Classification of polymerization –addition, condensation polymerization – Plastics as engineering materials: advantages and limitations – Thermoplastics and Thermosetting plastics – Preparation, properties and applications of polyethylene, PVC, Bakelite, Teflon and Polycarbonates – Elastomers: Natural rubber and Synthetic rubbers – compounding and vulcanization – Reinforced plastics – Biodegradable polymers – Conducting polymers – Applications

Competency No. : 4.1.9

UNIT V NANOCHEMISTRY **10Hrs**

Introduction, Types- Nanoparticle, nanocluster, nanorod, nano wire and nano tube, particulate (metal/metal oxide), tubular/fiber (CNT/CNF), layered (Nanoclays, Graphene Oxide) and its properties. Preparation of

nanomaterials – Ball milling, CVD, Self-assembly, sol–gel, solvothermal and laser ablation. Characterization of nanomaterials. Applications- electronics, medicine, agriculture and catalysis.

Competency No. : 4.1.9

REFERENCE

Text Books:

1. V. Balasubramanian, G. Ramachandran, S. Sreedevi, Engineering Chemsitry, Cars Publishers, 2010.
2. A Textbook of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
3. Engineering Chemistry by Jain and Jain, 17th Edition, Dhanpat Rai Publishing Company, New Delhi, 2021.
4. Milton and Leech, "Marine Boilers", Butter Worth Publishers, UK
5. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2021

Reference Books:

1. L. Jackson and T.D. Morton, "Reed's General Engineering Knowledge for Marine Engineers", Vol. 8, 2020.
2. Jain & Jain, Engineering Chemistry, Dhanpat rai Publishing company, 16th Edition, 2015
3. Vairam S., Murugavel S.C. and Chelladurai C, "Engineering Chemsitry-I & II", Gems Publishers, 2021.
4. V.K. Ambasta, Engineering Chemistry, Laxmi publication, 2008.

Program	**B.E. – Marine Engineering**					
Course code 241ME1A21TF	Course Name **Marine Thermodynamics**		L	T	P	C
			2	1	0	3
Year / Semester	I Year/ II semester		Contact hours/Week		3 hrs	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					
Pre requisite	Fundamentals of Physics, Chemistry and Mathematics					
Course objectives	1	Explain the first law of thermodynamics to closed and open systems, analyzing internal energy, specific heats, and enthalpy. (K1)				
	2	Illustrate the second law of thermodynamics, including irreversibility, entropy, Carnot cycles, and availability. (K2)				
	3	Infer principles of gas mixtures and thermodynamics to solve complex problems in chemical engineering processes. (K2)				

	4	Interpret steam formation, properties, and thermodynamic cycles to optimize power generation in engineering systems. (K2)
	5	Summarize psychrometric principles to solve problems in air conditioning and ventilation systems. (K2)
	6	Apply thermodynamic principles and concepts to analyze and solve problems in engineering systems. (K3)
Course outcomes	On completion of the course, students will be able to	
	CO1	Apply thermodynamic principles to analyze and solve problems related to closed and open systems. (K3)
	CO2	Explain the concepts of irreversibility, entropy, and the second law of thermodynamics. (K2)
	CO3	Analyze gas mixture properties, calculate thermodynamic quantities, and predict phase change processes using appropriate equations and methods. (K4)
	CO4	Analyze and interpret p-v, p-T, T-v, T-s, and h-s diagrams, calculate steam properties using Steam Table and Mollier Chart. (K4)
	CO5	Calculate psychrometric properties and analyze processes for practical applications in HVAC systems. (K2)
	CO6	Analyze thermodynamic properties, processes, and cycles, and calculate properties of gas mixtures, pure substances, and air vapor mixtures for practical applications. (K4)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO2	2	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO3	3	3	3	3	-	-	2	3	-	-	-	2	2	2	-
CO4	3	3	3	3	-	-	2	3	-	-	-	2	2	2	-
CO5	3	3	3	3	-	-	2	3	-	-	-	2	2	2	-
CO6	3	3	3	3	-	3	2	3	-	-	-	2	2	2	-
Average	3.00	3.00	2.50	2.50	-	3.00	2.00	3.00	-	-	-	2.00	2.00	2.00	-

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	**BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS**	**12 Hours**

Thermodynamic systems, concepts of continuum, thermodynamic properties, equilibrium, processes, cycle, work, heat, temperature, Zeroth law of thermodynamics. Thermodynamics and its application to various Processes, Energy Balance, Energy Change of a System, Mechanisms of Energy Transfer; Steady-Flow Energy Equation; Non-Flow Energy Equation; Basic Problems. Various thermodynamic processes P-V Diagram for Work Transfer in Reversible Processes; Steady Flow Process and Non-flow Process; Energy Conversion Efficiencies.

Competency Numbers	4.5

UNIT-II	**BASIC CONCEPTS OF SECOND LAW OF THERMODYNAMICS**	**12 Hours**

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.

Competency Numbers	4.5

UNIT-III	**PROPERTIES OF GAS MIXTURES AND THERMODYMIC RELATIONS**	**10 Hours**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function - Simple calculations. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes- Simple Calculations.		
Competency Numbers	4.5	
UNIT-IV	**PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE**	**10 Hours**
Formation of steam and its thermodynamic properties – Flow diagram p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface of water and other substance Calculation of steam properties using Steam Table and Mollier Chart – Dryness fraction determination - Simple calculations Ideal and actual Rankine cycles, Cycle - Improvement Methods - Reheat and Regenerative cycles – Simple calculations.		
Competency Numbers	4.5	
UNIT-V	**PSYCHROMETRY**	**10 Hours**
Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications.		
Competency Numbers	4.5	
		Total: 54 Hours

Text Books:

1. Nag, P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill Publishing Company Limited New Delhi, 2017.
2. Russel, "Engineering Thermodynamics", 1st Edition, Oxford University Press, 2007

Reference Books:

1. Holmann, "Thermodynamics", 4th Edition, McGraw-Hill Book Company,New York,1888.
2. Rao, Y.V.C., "Thermodynamics",4th Edition,Wiley Eastern Ltd.,New Delhi,1993.
3. Wlliam Embleton obe., "Applied Heat for Engineers", Reed's Marine Engineering Series, Vol.3, Thomas Reed Publication, Reprint 1999.
4. Yunus. A Cengel and Michael A Boles, "Thermodynamics – An Engineering Approach, 8th Edition", Tata McGraw Hill-Education, New Delhi, 2015.
5. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., *Fundamentals of Thermodynamics 2003*, 6th Edition, *s*, John Wiley and Sons.

PROGRAM	BE -Marine Engineering					
Course Code 241ME1A23PB	Course Name: Marine Electronics Laboratory		L	T	P	C
			0	0	2	1
Year and Semester	II Year (II Semester)		Contact hours per week 2 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course Objective		
	1	To apply the Op-Amp- Inverting and non-inverting amplifier, Integrator and Differentiator (K3)
	2	To apply the truth table of logic gates and verify. (K3)
	3	To identify the characteristics of Triac,SCR (K2)
	4	To build the program to sum of 2 -8 bit nos. using 8085 processor (K1)

	5	To build the program to sum of 2 -8 bit nos. using 8051 microcontroller. (K1)
Course Outcome	After the successful completion of this course students shall be able to	
	CO1	Examine with the Op-Amp- Inverting and non-inverting amplifier, Integrator and Differentiator (K2)
	CO2	Experiment with Verify of all Logic Gates (K3)
	CO3	Experiment with the characteristics of Triac,SCR. (K3)
	CO4	Experiment with sum of 2 8bit using 8085 microprocessor (K3)
	CO5	Experiment with subtraction of 2 8bit using 8051 microcontroller. (K3)
	CO6	Demonstrate with stepper motor using 8051 microcntroller. (K3)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	2	3	2	-	2			
CO2	3	2	1	1	2	2	-	2	2	2	-	1			
CO3	3	3	2	2	2	2	-	2	3	2	-	2			
CO4	3	3	3	2	2	2	-	2	3	2	-	3			
CO5	3	2	1	1	2	2	-	2	2	2	-	1			
CO6	3	3	3	2	2	2	-	2	3	2	-	3			
verage	3.00	2.67	2.00	1.67	2	2	-	2.00	2.67	2.00	-	2.00	2.67	2.17	3.00
Correlation Levels				1. Slight (Low)				2. Moderate (Medium)				3. Substantial (High)			

Text Books:

Ramakant.A. Geakwad, “Linear integrated circuits”, 3rd edition, Prentice – Hall of India, New Delhi, 2001

Malvino Leach, “Digital principles and applications”, 5th edition, Tata McGraw-Hill, Publishing co., New Delhi, 1995.

Hofmann, “Global Positioning System”, 5th Ed.,Springer, Indian reprint 2007 (Yesdee Publishings Pvt. ltd.)

Reference Books:

P.S.Bimbhra, “Power Electronics”, 3rd edition, Khanna Publisher, New Delhi, 2001.

Ramesh Gaonkar, “Microprocessors and Microcomputers”, 4th edition, lhasthatak, India, 1999.

Ray choudhary & Shail B Jain, “Linear Integrated Circuits”, New Age International publisher, 2015

Rashid, “ Power Electronics Handbook”,3rd Ed. Elsevier, Indian Reprint 2013(Yesdee Publishings Pvt. Ltd.)

List of Experiments:

Competency Number:6.1.1e+6.1.2+6.1.2a

1. Application of Op-Amp-I: Inverting and non-inverting amplifier
2. Application of Op-Amp-I: Integrator and Differentiator
3. Verification of Logic Gates
4. Study of JKFF, RS FF, DFF
5. Characteristics of TRIAC
6. Characteristics of SCR
7. Addition of two 8 bit numbers using 8085 processor
8. Subtraction of two 8 bit numbers using 8085 processor.
9. Addition and Subtraction of two 8 bit numbers using microcontroller 8051.
10. Stepper motor control using microcontroller 8051

TOTAL: 36 HOURS

Program	B.E. – Marine Engineering					
Course code 241ME1A23PC	Course Name Marine Electrical Machines Laboratory		L	T	P	C
			0	0	4	2
Year/Semester	I Year/ II semester		Contact hours/Week – 4 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course objectives	1	To explain the functioning and key properties of DC generators for understanding their practical application in electrical systems. (K2)
	2	To analyze different techniques for starting DC motors and their resulting performance characteristics. (K3)
	3	To analyze the construction and working of transformers, and understand their principles of operation and applications. (K3)
	4	To understand the load characteristics of synchronous motors and its behaviour under varying load conditions. (K1)
	5	To formulate an understanding of induction motor losses and their variations during no-load and blocked rotor conditions. (K1)
	6	Inference of DC and AC machines (K2)
Course outcomes	CO1	Analyze the Operation and characteristics of DC Generators (K3)
	CO2	Examine various methods of starting of DC Motors and its characteristics (K3)
	CO3	Analyze the Construction and working of Transformers (K3)
	CO4	Analyze load characteristics of synchronous motors (K3)
	CO5	Examine the losses in the induction motor under the condition of no load and blocked rotor. (K2)
	CO6	Analyze the various load characteristics and improve the performance of synchronous motor. (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2	2	3	3	3	3				3		
CO2	3	2		2	2	3	3	3	3				3		
CO3	3	3		2	2	3	3	3	3				3		
CO4	3	2		2	2	3	3	3	3				3		
CO5	3	2		2	2	3	3	3	3				3		
CO6	3	2		2	2	3	3	3	3				3		
Average	3	3		2	2	3	3	3	3				3		
Correlation level		1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)				

List of Experiments — Total Hours : 54

1. Load Test on D.C. Shunt Motor 2. Load Test on D.C. Series Motor 3. O.C.C. & load characteristic of self/separately excited D.C. Generator. 4. Speed control of D.C. Shunt Motor. 5. Load O.C. & S.C. test on single-phase transformer. 6. To connect similar single-phase transformers in the following ways. Y-Y, Δ-Δ, Δ-Y and Y-Δ. 7. Load Test on Squirrel cage induction motor 8. Load Test on Slip ring induction motor 9. Synchronization of 3-phase alternator. 10. Trouble shooting in Electric Motors and Transformers. Exercises in Power Wiring and earthing.	
Competency Numbers	6.1 , 6.1.1c
Text Books:	
1. Theraja A. K ., A Textbook of Electrical Technology: - AC and DC Machines (Volume - 2) Publisher S. Chand;	
2. Edmund GR Kraallavers , "Advanced Electro-technology For Marine Engineers", 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London,2010	
3. I.J Nagrath and D.P Kothari, "Basic Electrical Engineering", 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.	
4. W. Laws, "Electricity Applied To Marine Engineering", 4th edition, The Institute Of Marine Engineers, London, 1998.	
Reference Books:	
1. Uppal S.L., "Electrical Power Systems", 13th Edition, Khanna publishers, Mumbai, 2002	
2. Berde M.S., "Electric Motor Drives", 1st Edition, Khanna Publishers, Mumbai, 1995.	

Program	B.E. – Marine Engineering				
Course code 241ME1A24PA	Course Name **Marine Workshop - I**	L	T	P	C
		0	1	5	3
Year / Semester	I Year/ II semester	Contact hours/Week 06 hrs.			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives		
	1	Perceive the safety precautions and procedures involved in Workshop (K1)
	2	Identify the various tools and equipment used (K2)
	3	Explain the basic manufacturing processes (K2)
	4	Develop hands-on training given in fitting , plumbing and machining sections (K2)
	5	Develop hands-on training given in arc welding sections (K2)
	6	Develop hands-on training given in gas welding sections (K2)

Course outcomes		
	On completion of the course, student will be able to	
	CO1	Demonstrate plumbing operations, joints and tools used (K2)
	CO2	Demonstrate fitting operations, various joints and tools used (K2)
	CO3	Demonstrate machining operations performed in lathe (K2)
	CO4	Demonstrate Arc welding operations and perform joints in multiple positions (K2)
	CO5	Demonstrate Gas welding operations and perform joints in multiple positions (K2)
	CO6	Explain operation of various machines, tools and different types of welding machines(K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO2	2	2	-	-	-	2	2	2	3	3	-	2	-	-	-
CO3	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO4	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO5	2	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO6	3	3	3	3	-	2	2	2	3	3	-	2	-	-	-
Average	2.67	2.17	2.20	2.20		2.00	2.00	2.00	3.00	3.00		2.00			
Correlation level			1.Slight (Low)			2. Moderate (Medium)						3. Substantial (High)			

LIST OF EXPERIMENTS

I) Plumbing 28 Hrs

1) Study of Safety precautions and Safety procedures to be followed
2) Study of plumbing components of a vessel, Safety aspects, Tools etc.
3) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows
4) Study of pipe connections requirements for pumps and turbines.

II) **Fitting** 20 Hrs

1) Study of Safety precautions and safety procedures to be followed
2) Study of tools and equipment used
3) Exercises – Preparation of V fitting
4) Dove tail fitting models

III) Machining: 20 Hrs

1) Safety precautions and safety procedures to be followed
2) Study of lathe and its specifications
3) Step turning
4) Taper turning and threading (dies&tap)

IV) Electric Arc Welding 20 Hrs

1) Safety precautionary measures, tools and accessories
2) Study of Arc Welding
3) Striking and maintaining the arc
4) Straight line bead deposit in flat position
5) Square butt joint in flat position

V) Oxy - Acetylene Welding 20 Hrs

1) Safety precautionary measures, tools and accessories
2) Study of Gas welding
3) Fusion run without filler rod in flat position
4) Fusion run with filler rod in flat position
5) Square butt joint in Flat Position

Competency Numbers : 8.2, 8.5 ,8.6,9.8

Text Books:

1. Workshop Technology V [I], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.
2. Workshop Technology V [II], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.

Reference Books:

1. A Text Book of Workshop Technology, R.S. Khurmi& J.K. Gupta. S. Chand& company Pvt. Ltd.
2. Workshop Technology, W.A.J. Chapman Vol I & Vol II, Published by Routledge (1972).
3. Elements of Manufacturing processes, B.S. Nagendra Parashar& R.K Mittal. PHI Learning Pvt. Ltd.

Program	B.E. – Marine Engineering				
Course code 241ME1A34TB	Course Name **Marine Deck Machinery And Equipment**	L	T	P	C
		3	0	0	2
Year / Semester	II Year/ III Semester	Contact hours/Week			3 Hrs

Course category				
Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
		✓	
Basic Science	Engineering Science	Open Elective	Mandatory

Course objectives		
	1	To summarize basic navigation and contribution to safe watch (K2)
	2	To explain life saving appliances (K3)
	3	To explain layout of deck machinery, communication system and ship security (K3)
	4	To discuss mooring and anchors (K2)
	5	To summarize life boat davits, deck crane and air motors (K2)
	6	To summarize types of Knots, practice of knot formation, Rope strength care and maintenance, use of mooring lines, heaving line, rat guards, canvas and uses, Pilot ladder. (K2)

Course outcomes		
	On completion of the course the student will be able to:	
	CO1	Demonstrate basic navigation and contribution to safe watch. (K2)
	CO2	Explain life saving appliances. (K2)
	CO3	Explain layout of deck machinery, communication system and ship security (K2)
	CO4	Discuss mooring and anchors. (K2)
	CO5	Discuss life boat davits, deck crane and air motors (K1)
	CO6	Use small lifting tools, Rope work, Tackles, ladders, Deck Equipment. (K3)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
CO2	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
CO3	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
CO4	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
CO5	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
CO6	3	2	2	2	3	2	-	-	-	-	-	3	3	3	1
Average	3.00	2.00	2.00	2.00	3.00	2.00						3.00	3.00	3.00	1.00

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	BASIC NAVIGATION AND CONTRIBUTION TO SAFE WATCH	08 Hours
Keep lookout duties, recognize the lights of lighthouse, buoys and ship navigation lights. Identify signals used for indicating distress and describe procedures to use them- ROR and other signals. Operation of all internal communication systems onboard. Take bearing of terrestrial objects using an azimuth mirror. ROR- Elementary stage and Bouyage. Reporting and sighting of objects to OOW. Relieving the look-out man. Take readings of dry and wet bulb thermometer, Psychrometer. Plot position on chart (Lat and long). Understand modern ship's bridge equipment. Weather and tide data reading from the book – Basic. Identify the MOB marker		
Competency Numbers	4.1.10, 9.10 & 13.1.1	
UNIT-II	**LIFE SAVING APPLIANCES**	14 Hours
Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats,their launching appliances and arrangements and their equipment, including radio life saving appliances, satellite EPIRBs, SARTs, Immersion suits, and thermal protective aids. Discuss principles of survival. Use of survival equipment. Method of helicopter rescue. Launching and handling of survival crafts in rough weather. Describe and show different survival crafts and rescue boats, their launching appliances and arrangements and their equipment, including radio life saving appliances, satellite EPIRBs, SARTs, Immersion suits, and thermal protective aids.		
Competency Numbers	13.1,13.1.1	
UNIT-III	**LAYOUT OF DECK MACHINERY,COMMUNICATION SYSTEM & SHIP SECURITY**	08 Hours
Classification of different deck machinery knowledge of security documentation, knowledge enabling recognition of potential security threads, knowledge enabling recognition of weapons dangerous substance and devices and awareness of the damage they can cause crowd management and control techniques handling security related information and security related communications methods for physical searches and non-intrusive inspections. Knowledge of techniques for monitoring restricted areas knowledge of controlling access to the ship and to restricted areas onboard. Classification & operation of various communication system onboard internal and external,		
Competency Numbers	3.1,18.2,18.3,4.1.10	
UNIT-IV	**MOORING AND ANCHORS**	12 Hours
Deck Machinery Construction and operation of typical electric/hydraulic windlass/mooring winches. Explain the speed control mechanism of mooring/windlass. Explain Anchor with chain locker arrangements.		
Competency Numbers	4.1.10	
UNIT-V	**LIFEBOAT DAVITS, DECK CRANES AND AIR MOTORS**	12 Hours
Different types of life boat davits construction and operation of boat winch. Construction and operation of Winches for gangway, pilot ladder etc. Materials used in construction of this machinery. Construction and operation of Deck cranes, gantries and other types of cargo handling equipment.		
Competency Numbers	4.1.10	
		Total: 54 Hours

Text Books:

1. Graham Danton, "The theory and practice of seamanship", 11th Edition, Routledge, New york, USA and Canada, 1996.

1. MC George 'Marine auxiliary machinery' 7th edition

Program	B.E. – Marine Engineering					
Course code 241ME1A34TD	Course Name **Marine Refrigeration and Air Conditioning**		L 2	T 1	P 0	C 3
Year / Semester	II Year/ III Semester		Contact hours/Week		3 Hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core ✓		Professional Elective	

Course objectives	1	To Explain theory of Carnot, Reverse Carnot's and vapour compression cycles. Refrigerant properties environment concern. (K2)
	2	To outline single and multi-stage refrigeration plant principle design, construction. Vapour compression, Liquification of Gas cargoes (K2)
	3	To understand principles of Air conditioning Psychometry –temperature – Humidity control- Types of air conditioning plants- equipment- components. (K1)
	4	To analyze maritime refrigeration plants-maintenance of equipments and components. (K3)
	5	To discuss Refrigerated cargo vessel and refrigerated container vessels-maintenance, classification society –requirements/survey-Certifications; controlled atmosphere in refrigerated spaces . (K2)
Course outcomes	On completion of the course the student will be able to	
	CO1	Summarize the fundamentals of Carnot and Reversed Carnot principles to solve Refrigeration problems (K3)
	CO2	Explain the salient features in the design construction of refrigeration plant equipment and components (K2)
	CO3	Discuss various psychrometric concepts to design various refrigeration and AC Systems (K2)
	CO4	Analyze the marine AC and refrigeration systems. (K3)
	CO5	Explain the fundamentals of refrigerated cargos and containers (K3)
	CO6	Demonstrate real life case studies on refrigeration systems. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	2	2	3	2	3	2	3	3	3	-
CO3	2	2	2	2	2	2	3	3	-	3	2	3	3	3	-
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	3	-	-
CO6	3	2	3	2	-	3	3	3	1	3	2	2	3	3	-

Average	2.50	2.33	2.60	2.40	2.50	2.50	2.75	3.00	1.67	3.00	2.25	2.60	3.00	3.00	
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

UNIT-I	**BASIC REFRIGERATION AND AIR CONDITIONING**	11 Hours
Reversed Carnot cycle – Vapour compression cycle – Refrigerating effect – Co-efficient of performance – Cooling capacity – Refrigerants and secondary refrigerant used in marine practice and their justification– Rating of Refrigeration plant – Methods for improving C.O.P. – use of vapour Tables – Applied Problems.		
Competency Numbers	4.1.6, 4.1.8, 4.3.4	
UNIT-II	**MARINE REFRIGERATING SYSTEMS**	12Hrs
Design and constructional details of various equipment used for refrigeration in marine practice, operation and maintenance. Safety practices regarding refrigerant and equipments. Typical marine Refrigerating plants with multiple compression and evaporator system – heat pump cycles – Refrigeration in Liquefied gas carriers.		
Competency Numbers	6.4	
UNIT-III	**MARINE AIR CONDITIONING**	10 Hours
Principles of Air conditioning – Psychometric charts- various processes- Psychometric properties of air – comfort conditions – control of humidity – airflow and A.C. Capacity – Calculation for ships plants, types of A/C system, Humidification and de-humidification. Design and constructional details of various equipment for air conditioning used in marine practice, their justification and steam heating. Control of temperature and humidity, central A/C system. Safety practices in Air conditioning concerning compressor, blower and refrigerant.		
Competency Numbers	4.1.6, 4.3.4	
UNIT-IV	**REFRIGERATION AND A/C COMPONENTS**	11Hours
Operation, maintenance and trouble-shooting of Compressors and its unloader-lubrication system for different compressors – properties of lubrication for refer compressors. Evaporators Condensers - Expansion Devices - thermostatic switches - solenoid valves - low pressure and high pressure cut out switches, Refrigerant recovery bottle and recovery systems. Gas leak detection – rectification and charging of gas. Safety practices in the A/C system.		
Competency Numbers	4.1	
UNIT-V	**REFRIGERATED CARGO VESSEL AND REFRIGERATED CONTAINER**	10 Hours

Refrigerated cargo vessel- hold arrangements-air ventilation and circulation system – insulation- precooling, classification society requirement, survey and certification guidelines, refrigerated containers –guide lines, duties responsibility of marine engineers - ventilation system- controlled atmosphere - carriage of fruit cargoes, hazardous cargo viz., radioactive cargoes. IMDG code explanation regarding dangerous cargo. Safety practices regarding cargo loading/unloading.	
Competency Numbers	4.3.4
	Total: 54 Hours
Text Books:	
1. Arora C.P. "Refrigeration & Air Conditioning", 1st Edition, Sri Eswar Enterprises, Chennai, 1993.	
2. Stoecker, Wilbert .F Jones, Jerold. W., "Refrigeration and Air Conditioning", 2nd Edition, Tata McGrawHill, Delhi 1985	
3. Refrigeration and Air Conditioning – Domkundwar.	
Reference Books:	
4. D.A.Taylor, "Introduction to Marine Engineering", 2nd Edition, Butter Worth, London, 1993.	
5. J.R.Stott, "Refrigerating Machinery and Air Conditioning Plant", 1st Edition, The Institute of Marine Engineers, London, 1974, Reprint 1998.	

PROGRAM	BE-Marine Engineering					
Course Code 241ME1A31TH	Basic Ship Construction		L	T	P	C
			3	0	0	2
Year and Semester	II Year (semester IV)		Contact hours per week (3Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					
Course Objective	1. Understand the principles and practices of ship construction.(K2) 2. Learn about ship structural components and regulatory standards.(K2) 3. Analyze hull structures and their functions. (K3) 4. Assess fore and aft end structures, including the stern frame and rudder. (K3) 5. Interpret midship sections and functions of structural components. (K2)					
Course Outcome	After completion of the course, the students will be able to: 1. Explain the evolution and types of ships. (K2)					

	2. Describe materials used and tonnage/load line regulations. (K2) 3. Analyze hull structures and their functions. (K3) 4. Assess fore and aft end structures, including the stern frame and rudder. (K3) 5. Interpret midship sections and functions of structural components. (K2) 6. Apply knowledge of shipyard operations and maintenance techniques. (K3)

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	3	2
CO3	3	2	2	2	2	-	-	-	-	-	-	2	3	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	2	3	3	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	3	3	2
CO6	3	2	2	2	-	-	-	-	-	-	-	2	3	3	2
AVERAGE	3	2	2	2	2	-	-	-	-	-	-	2	3	3	2

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT 1: INTRODUCTION TO SHIP CONSTRUCTION **10 Hrs.**

History and evolution of ship construction, Types of ships and their functions, Basic ship terminology, Materials used in shipbuilding, Tonnage, Gross Tonnage (GT), Net Tonnage (NT), Plimsoll Line and load line regulations

UNIT 2: HULL STRUCTURES AND STRUCTURAL COMPONENTS **10 Hrs.**

Bottom structure (keels, floors, and double bottoms, Side shell plating and frames), Decks (deck beams and deck plating), Bulkheads (watertight and non-watertight bulkheads), Hatches and hatch covers, Superstructures (bridge, accommodation, and other deckhouses)

UNIT 3: FORE AND AFT END STRUCTURES **10 Hrs.**

Fore end structures (stem, bulbous bow, bow thrusters), Aft end structures (stern frame, transom, skeg, rudder and rudder post), Functions of stern frame and rudder, Propeller and shafting arrangements.

UNIT 4: MIDSHIP SECTIONS AND STRUCTURAL FUNCTIONS **12 Hrs.**

Midship section design and structural layout, Midship sections of various types of ships (e.g., tankers, bulk carriers, container ships), Functions of structural components (Deck beams, Shell plating, Bulkheads and pillars).

UNIT 5: SHIPYARD OPERATIONS **12 Hrs.**

Ship design and planning process, Shipbuilding stages: from keel laying to launching, Shipyard layout and infrastructure, Safety and environmental regulations in shipyards, Corrosion prevention and control methods.

Total: 54 Hours

TEXTBOOKS:

1. **"Ship Construction" by David J. Eyres and George J. Bruce -** A comprehensive guide on ship construction covering design, materials, and processes.

2. **"Introduction to Naval Architecture" by E.C. Tupper -** Provides a broad understanding of naval architecture principles, including ship stability and design.

REFERENCES:

1. **International Maritime Organization (IMO) - www.imo.org -** Access to international conventions and regulations on ship construction and safety.

Designed by	" Department of Naval Architecture & Offshore Engineering"

Program	B.E. – Marine Engineering					
Course code 241ME1A33TC	Course Name Marine Electrical Machines – II		L	T	P	C
			2	1	0	3
Year / Semester	II Year/ III Semester		Contact hours/Week		3 Hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
	Basic Science	Engineering Science	Open Elective	Mandatory		
		✓				

Course objectives		
	1	To understand the Electrical, electronic & Control Engineering at the operational and management level (K1)
	2	To Explain the design features and system configurations of generator and distribution system. (K2)
	3	To explain the maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment. (K2)
	4	To discuss the electric malfunction, location of faults and measures to prevent damage. (K2)
Course outcomes	On completion of the course the student will be able to	
	CO1	Illustrate the design features of Alternators, their construction, operation and associated controls. (K2)
	CO2	Explain the principles of operation and construction details of synchronous motors. (K2)
	CO3	Explain the principles of operation and construction details of induction machines. (K2)
	CO4	Analyze the speed control and trouble shooting in induction machines. (K3)
	CO5	Examine the fault in generator and motors. (K3)
	CO6	Describe the structure and functioning of electrical transmission and distribution systems (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	3	3	3				3	2	
CO2	3	3	2	2	2	3	3	3	3				3	2	
CO3	3	3	2	2	2	3	3	3	3				3	2	
CO4	3	3	2	2	2	3	3	3	3				3	2	
CO5	3	3	2	2	2	3	3	3	3				3	2	
CO6	3	3	2	2	2	3	3	3	3				3	2	
Average	3	3	2	2	2	3	3	3	3				3	2	

Correlation level	1.Slight (Low)	2.Moderate (Medium)	3. Substantial (High)

UNIT-I	ALTERNATORS	11 Hours
Alternators – general arrangement – construction of salient pole and cylindrical rotor types – types of stator windings – e.m.f equation – armature reaction – voltage regulation – load characteristics – open circuit and short circuit tests . Starting, parallel operation and changing of alternators. Synchronizing methods. Load sharing. Parallel operation of Diesel Generator and Shaft Generator. Maintenance required on Alternators and motors and paralleling equipment.		
Competency Numbers	6.1.1.b & 6.1.1c	
UNIT-II	SYNCHRONOUS MOTORS	11 Hours
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 – damper windings- synchronous condenser.		
Competency Numbers	6.1 & 6.1.1c	
UNIT-III	INDUCTION MACHINES	11 Hours
Three phase induction motor –Principle of operation and theory of action – slip speed–rotor to stator relationship – rotor frequency– equivalent circuit– torque/slip characteristics – starting torque and maximum running torque - Effect of change in supply voltage on Torque-Induction generator.		
Competency Numbers	6.1 & 6.1.1c	
UNIT-IV	CONTROL OF INDUCTION MACHINES	11 Hours
Reversing – speed control of induction motor-Electronic methods of speed control of Induction Motor(IGBT, Thyristors) – starting of induction motor – method of starting – Direct on-line starters –Star – delta starter – auto-transformer starter – starting of special high torque induction motors –single phase induction motor – principle and operational characteristics – starting control –constructional details – Failure and repairs of electrical machine.		
Competency Numbers	7.1 & 7.3	
UNIT-V	FAULT FINDING TECHNIQUES FOR MOTORS	10 Hours
Faults in single phase in single phase and three phase induction motor, Fault finding techniques related to rotor and stator insulation failure in induction motor, Fault prevention and fault rectification in induction motor, Classification of overloaded condition, Detection of electrical malfunction, Actions to be taken on detection of fault, Essential requirements for fault location and measure to be taken to prevent damage. Rectification methods for different faults.		
Competency Numbers	7.1 & 7.3	
		Total hours: 54
Text Books:		
1. A Textbook of Electrical Technology: - AC and DC Machines (Volume - 2) (English, Paperback, Theraja A. K.); Publisher S. Chand; ISBN:		
2. Edmund GR Kraallavers , “Advanced Electro-technology For Marine Engineers”, 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London,2010		
3. I.J Nagrath and D.P Kothari, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.		
4. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.		
Reference Books:		
1. Uppal S.L., “Electrical Power”, 13th Edition, Khanna publishers, Mumbai, 2002		
2. Berde M.S., ”Electric Motor Drives”, 1st Edition, Khanna Publishers, Mumbai, 1995.		

Program	B.E. – Marine Engineering					
Course code 241ME1A33TD	Course Name **Marine Thermal Engineering**		L	T	P	C
			2	1	0	2
Year / Semester	II Year / III Semester		Contact hours/Week 03			
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				
Pre requisite	Thermodynamics					
Course objectives	1	Explain about gas power cycles.				
	2	Interpret IC engine and its performance.				
	3	Outline about steam nozzles, turbines, .				
	4	Summarize about compressors and its principles				
	5	Infer about various types of heat exchangers				
	6	Compare gas power cycles.				
Course outcomes	CO1	Apply gas power cycle knowledge.				
	CO2	Evaluate engine performance.				
	CO3	Assess steam nozzle and turbine systems.				
	CO4	Analyze the performance of Air compressors				
	CO5	Outline the working of heat exchangers.				
	CO6	Demonstrate gas power cycle knowledge.				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	2	3	-	-	-	2	2	2	-
CO2	3	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO3	3	3	1	1	-	-	2	3	-	-	-	2	2	2	-
CO4	2	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO5	2	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO6	3	2	2	1	-	3	2	3	-	-	-	2	2	2	-
Average	2.67	2.33	1.33	1.00	-	3.00	2.00	3.00	-	-	-	2.00	2.00	2.00	-

UNIT-I	IC ENGINES AND ITS PERFORMANCE	12 Hours
Classification, Components of IC Engines and their function. Working of two stroke and four stroke engine, Valve timing diagram and port timing diagram – actual and theoretical p-V diagram of four stroke and two stroke engines. Carburetor, fuel pump and injector system, Battery coil ignition system, magneto coil ignition system, CDI system– Lubrication - types of lubrication - Cooling systems and its types. Performance test- Measurement of brake power – Indicated power – Fuel consumption – Air consumption; Heat balance test and Morse test on IC engines – Standard testing procedure of IC engines –Effect of various parameters on the performance of the engines – simple problems.		
Competency Numbers	4.1.1,4.5	
UNIT-II	**GAS POWER CYCLES**	10 Hours
Gas power cycles – basic considerations, Carnot cycle and its importance, air standard assumptions. Otto cycle Diesel cycle, Dual combustion cycle, Joule Brayton cycle. Derivation for Air standard efficiency, mean effective pressure- Problems related.		
Competency Numbers	4.5	
UNIT-III	**STEAM NOZZLES AND TURBINES**	10 Hours
Flow of steam through nozzles, types of nozzles, effect of friction, critical pressure ratio, Supersaturated flow. Impulse and Reaction principles, Rankine cycle-compounding. Problems related- speed regulations – Governors.		
Competency Numbers	4.1.2, 4.5,	
UNIT-IV	**AIR COMPRESSORS**	12 Hours
Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor.		
Competency Numbers	4.1.6,4.5	
UNIT-V	**FUNDAMENTALS OF HEAT TRANSFER**	10 Hours
Basic concepts and review of thermodynamics of heat transfer, Heat transfer mechanisms, Conduction, Convection and Radiation. Types of heat exchangers, Application of heat transfer in Marine Heat Exchangers like Coolers, Condensers, Heaters and Evaporators. The Overall heat transfer coefficient, LMTD/NTU Method, Sizing and Selection of Heat Exchangers.		
Competency Numbers	4.1.6, 4.5	
		Total: 54 Hours

Text Books:

1. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, 2000.
2. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., “A course in thermal Engineering", Fifth Edition, ” Dhanpat Rai & sons , 2002

Course code 241ME1A31TI	Course Name **Fluid Mechanics and Marine Hydraulics**		L	T	P	C
			2	1	0	2
Year /Semester	II Year/ III Semester		Contact hours/Week 3 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					

Course objectives	1	Infer knowledge on fluid properties and pressure exerted by fluid on different surfaces. (K2)
	2	Illustrate about flow rate and continuity equation. (K2)
	3	Summarize the loss of energy in fluid flow due to major and minor losses. (K2)
	4	Explain the working principles and performance analysis of fluid pumps. (K2)
	5	Interpret the working of different components of major systems (K2)
Course outcomes	On completion of the course the student will be able to	
	CO1	Analyze various fluid properties & governing equations for fluid flow (K3)
	CO2	Analyze the volume rate of flow and continuity equation (K3)
	CO3	Analyze the losses occur in a flow through pipes (K3)
	CO4	Select a suitable pump for a given application and evaluate the operating characteristics of Hydraulic pumps (K2)
	CO5	Apply the concept of different components of major systems. (K3)
	CO6	Categorize the characteristics of various hydraulic machines used for real time applications (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	-	2	2	-	2	-	2	1	1	1	1
CO2	3	3	1	2	-	2	2	-	2	-	2	1	1	1	1
CO3	3	2	1	2	1	2	2	-	2	-	2	1	1	1	1
CO4	2	2	1	2	-	2	2	-	2	-	2	1	1	1	1
CO5	2	2	1	2	-	2	2	-	2	-	2	1	1	1	1
CO6	2	2	1	2	-	2	2	-	2	-	2	1	1	1	1
Average	2.5	2.33	1	2	1	2	2	-	2	-	2	1	1	1	1
Correlation level				1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)			

UNIT-I	**FLUID PROPERTIES AND FLUID PRESSURE**	12 Hours
Fluid flow- Newton's law of viscosity- Newtonian and Non-Newtonian Fluid- Ideal and Real fluids-Properties of Fluids- mass density, weight density and specific gravity. Dynamic viscosity-kinematic viscosity-Properties of pressure-atmospheric pressure, vacuum, partial vacuum, absolute zero pressure, gauge pressure-Pascal's law-Buoyancy and Floatation – Meta- centric height – stability of floating and submerged bodies.		
Competency Numbers	5.1	
UNIT-II	**FLUID KINEMATICS AND DYNAMICS**	10 Hours

Kinematics: Types of fluid flow – Types of flow lines – rate of flow – continuity equation Dynamics: Euler's Equation of motion – Bernoulli's equation – applications – venturimeter, orifice meter, pilot tube- Force exerted by jet on stationary and moving flat plates.		
Competency Numbers	5.1	
UNIT-III	**LAMINAR AND TURBULENT FLOWS**	10 Hours
Reynold's experiment – critical Reynolds number – Rotating Viscometer –Full- bore flow of liquids under a constant head. Flow through an orifice. Flow through pipes-major and minor energy losses – pipes in series and parallel – power transmission through pipes– total drag due to laminar and turbulent layer – boundary layer separation and its control.		
Competency Numbers	9.5	
UNIT-IV	**PUMPS**	10 Hours
Classification of pumps -Centrifugal pumps-Working principle of centrifugal pump -Volumetric efficiency, hydraulic efficiency, mechanical efficiency and overall efficiency-Priming of centrifugal pump. Reciprocating pump –Classification -Construction and working principle-Discharge through a reciprocating pump.		
Competency Numbers	5.1/5.2	
UNIT-V	**FLUID FLOW AND CHARACTERISTICS OF MAJOR SYSTEMS**	12 Hours
Diesel Engine Propulsion Plant -fluid flow of lubricating oil system- fluid flows of cooling sea water system- Steam Engine Propulsion Plant- fluid flows of main steam. Pipes and Fittings- different types - characteristics appeared in each piping system- materials used for the construction pipes carrying the fluids. Valves- different types of valves- globe valve- screw-lift valve, a screw-down non-return valve and a non-return valve- applications of quick-closing valve		
Competency Numbers	5.4	
	Total hours:54 Hours	
Text Books:		
1. Joy, "Hydraulic Power Transmission In Marine Machinery", Marine Engineering Practice Vol-1, Part-07 , IMarEST, London,2002		
2. Gupta, S.C.," Fluid Mechanics and Hydraulic Machines" 1st Ed. Pearson, 2011.		
3. John F.Douglas, Janusz M. Gasiorek, John A. Swaffield and Lynne B. Jack, " Fluid Mechanics", 1st Ed. Pearson, Sixth Impression, 2011		
Reference Books:		
1. R K Rajput, "Fluid Mechanics and Hydraulic Machines" 2nd revised Edition, S.Chand & Company Ltd., New Delhi, 2002		
2. R. K. Bansal. "A Textbook of Fluid Mechanics and Hydraulic Machines ", Laxmi Publications Pvt Ltd,9th Edition 2010.		
3. Narayana Pillai,N,"Principles of Fluid Mechanics and Fluid Machines",3rd Edition, University Press, 2013		
4. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016		
5. Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House (p) Ltd. New Delhi, 2016.		

Program	B.E. – Marine Engineering					
Course code 241ME1A32TB	Course Name **Gender sensitivity**		L 2	T 0	P 0	C 0
Year /Semester	I Year/ II Semester		Contact hours/Week 2 Hrs			
Prerequisite course						
	Basic Science	Engineering Science	Open Elective	Mandatory ✓		

Course objectives	1	To provide an overview of gender sensitivity (K1)
	2	To provide basic understanding about contemporary gender related perspectives (K1)
Course outcomes	On completion of the course the student will be able to	
	CO1	Illustrate the fundamental principles of gender sensitivity (K2)
	CO2	Explain biological, sociological and psychological conditioning (K2)
	CO3	Demonstrate Gender based division of labour. (K2)
	CO4	Explain contemporary perspectives of gender sensitivity. (K2)
	CO5	Illustrate about justice, human rights and legal perspectives with reference to gender. (K2)
	CO6	Discuss emerging issues and challenges of the gender sensitivity. (K2)

UNIT-I	**FUNDAMENTALS OF GENDER SENSITIVITY**	7 Hours
Gender: definition, nature, evolution, cultural, traditional and historical perspective.		
UNIT-II	**GENDER SPECTRUM**	7 Hours
Gender: An overview of Biological, sociological and psychological conditioning.		
UNIT-III	**DIVISION OF LABOUR**	7 Hours
Gender based division of labour-domestic work and use value;		
UNIT-IV	**GENDER - CONTEMPORARY PERSPECTIVE**	7 Hours

Gender justices and human rights, international perspective, constitutional and legal perspectives, Gender, Human Rights and Parity (parallel progress of both genders).		
UNIT-V	**MEDIA AND EMERGING ISSUES IN GENDER**	8 Hours
Print and Electronic Media and Gender Inequalities; Gender-Emerging issues and challenges; Case study on real life gender issues.		
Total: 36 Hours		
Text Books:		
1. Rajya Lakshmi Kalyani et al. 2017. Gender Sensitisation. Himalaya Publishing House		
Reference Books:		
2. Gender, School And Society - B.Ed 2nd Year Book (English, Paperback, Dr. S.C.Oberoi), Laxmi Publishers		

Program	B.E. – Marine Engineering				
Course code 241ME1A34TE	Course Name **Marine Pumping & piping system**	L	T	P	C
		2	1	0	3
Year / Semester	II Year/ III Semester	Contact hours/Week: 3 Hours			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		

Course objectives		
	1	To understand the operation of pumping systems. (K1)
	2	To explain operational characteristics of pumps and piping systems, including control systems. (K2)
	3	To summarize the operation of pumping systems. (K2)
	4	To classify the operation of bilge, ballast and cargo pumping systems. (K2)
	5	To explain the maintenance of pumps and piping system. (K2)
	6	To apply the knowledge gained on various pumps and pumping systems. (K3)

Course outcomes	On completion of the course students will be able to	
	CO1	Describe the pumping system principle.(K2)
	CO2	Compare the different types of pump.(K2)
	CO3	Explain the major system components and features.(K2)
	CO4	Summarize the operation of pumps.(K2)
	CO5	Analyze system faults. (K3)
	CO6	Identify the various applications of various types of pumps in real time applications.(K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	2	3	-	-	-	-	2	-	1	2
CO2	2	1	2	2	1	1	1	-	-	-	-	2	-	1	2
CO3	2	2	3	2	3	1	2	-	-	-	-	2	-	1	2
CO4	2	2	2	2	2	1	1	-	-	-	-	2	-	1	2
CO5	3	1	2	2	3	2	2	-	-	-	-	2	-	1	2
CO6	3	2	3	2	2	2	2	-	-	-	-	2	-	1	2
Average	2.33	1.67	2.50	1.83	2.17	1.50	1.83					2.00		1.00	2.00
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

UNIT-I	**Pumping System Principles**	**8 Hours**
Classification of various types of pumps, various layout and pumping operations(Ballast, Bilge, Cargo oil, Hydrophore, cooling sea water, cooling fresh water), Various types of valves using in pipe line system		
Competency Numbers	5.1,5.2,5.4	
UNIT-II	**Pump Types**	**10 Hours**
Understand working principles of various pumps on board with Sketch-centrifugal pump, positive displacement pumps(Reciprocating, screw, Gear, Rotary vane), axial flow pump, materials used, types of shaft seals, types of impeller, Wear ring , characteristics of performance, bearings, couplings and safety precautions.		
Competency Numbers	5.1,5.2,5.4	
UNIT-III	**Major System Components & Features**	**10 Hours**
Understand piping layouts requirements, fittings, pressure ratings of pipes, materials used for sealing joints to join lengths of pipes together, pipe color coding and constructional feature, applications and materials of valves used onboard.		
Competency Numbers	5.1,5.2,5.4	
UNIT-IV	**Operation Of Pumping Systems**	**12 Hours**
Operation of pumps- starting and stopping of positive displacement pumps, axial- flow pumps and centrifugal pumps and performance loss of pumps, necessity for priming in centrifugal pump and working of air ejector (vacuum pump)		
Competency Numbers	5.1,5.2,5.4	
UNIT-V	**Operating Faults And Maintenance**	**14 Hours**
Understand precautions and procedures for cooling sea water system and lubrication system with respect to air ingress and dirty filters. Dismantle and Reassemble: centrifugal pump, Reciprocating pump, Gear pump and screw pump.		
Competency Numbers	5.1,5.2,5.4	
Total: 54 Hours		

Text Books:

1. Pumps : Principles & Practice, Jaico Publishing House.
2. Pipes & Pipelines: Principles & Practice, Jaico Publishing House.

Reference Books:

1. A. Nourbakhsh, A. Jaumotte, C. Hirsch & H. B. Parizi: Turbo-pumps & Pumping Systems, Springer.
2. H. D. McGeorge: Marine Auxiliary Machinery, Butterworth-Heinemann.
3. T. L. Henshaw: Reciprocating Pumps, OSTI, USA.
4. A. J. Stepanoff: Centrifugal & Axial Flow Pumps, Krieger Publishing Company.
5. Crawford, J. (2016). Marine and Offshore Pumping and Piping Systems. United Kingdom: Elsevier Science.
6. Flow of fluids through valves, fittings and pipe, Metric Edition – SI Units, CRANE Co., New York (1982), Technical Paper No. 410M.
7. Pumps, S. (2013). Sulzer Centrifugal Pump Handbook. United Kingdom: Elsevier Science.
8. Marine Engineering – by group of authorities, Editor: Roy L Harrington, ISBN: 0-939773-10-4, SNAME (USA)

Program	B.E. – Marine Engineering					
Course code 241ME1A33PE	Course Name **Marine Refrigeration and Air Conditioning Laboratory**		L 0	T 0	P 2	C 1
Year/Semester	II Year / III Semester		Contact hours/Week		2 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
			✓			
	Basic Science	Engineering Science	Open Elective		Mandatory	
Pre requisite	Thermodynamics, Thermal Engineering					
Course objectives	1	To explain theory of Carnot, Reverse Carnot's and vapor compression cycles. Refrigerant properties environment concern (K2)				
	2	To demonstrate single and multi-stage refrigeration plant principle design, construction. Vapour compression, Liquification of Gas cargoes (K2)				
	3	To understand principles of Air conditioning Psychometry –temperature – Humidity control- Types of air conditioning plants- equipment- components (K1)				
	4	To analyze maritime refrigeration plants-maintenance of equipments and components. (K3)				
Course outcomes	CO1	Explain the performance of Parallel and counter flow heat exchangers (K2)				
	CO2	Demonstrate the working of a Refrigeration system (K2)				
	CO3	Demonstrate the working of Air conditioning system (K2)				
	CO4	Determine the co-efficient of performance of a refrigeration system (K3)				
	CO5	Determine the co-efficient of performance of air conditioning system (K3)				
	CO6	Analyze various types of refrigeration systems (K3)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	2	3	-	-	-	2	2	2	-

CO2	3	2	1	1	-	-	2	3	-	-	-	2	-	-	-
CO3	3	3	1	1	-	-	2	3	-	-	-	2	2	2	-
CO4	2	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO5	2	2	1	1	-	-	2	3	-	-	-	2	2	2	-
CO6	3	2	2	1	-	3	2	3	-	-	-	2	2	2	-
Average	2.50	2.17	1.33	1.00		3.00	2.00	3.00				2.00	2.00	2.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXERCISES **TOTAL HOURS : 36**

1. To find out heat transfer rate in parallel & counter flows – Parallel & counter flow heat exchanger.
2. To determine the coefficient of performance of the given refrigeration test rig.
3. To determine the coefficient of performance of the given air-conditioning test rig.
4. To study the performance of refrigerating system.
5. To study the performance of air-conditioning system.
6. To determine the coefficient of performance of window air conditioning test rig.

Com petency	Numbers 4.1,4.1.6,4.3.4

Program	B.E. – Marine Engineering					
Course code 241ME1A33PD	Course Name **Marine Thermal Engineering Laboratory**		L	T	P	C
			0	0	2	1
Year/Semester	II Year / III Semester		Contact hours/Week		2	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				
Pre requisite	Thermodynamics, Thermal Engineering					
Course objectives	1	Explain viscosity measurement principles. (K2)				
	2	Determine flash point of fuels. (K2)				
	3	Analyze flue gases using the Orsat apparatus. (K3)				
	4	Determine fuel calorific value with Bomb Calorimeter. (K2)				
	5	Determine thermal conductivity of materials. (K2)				
	6	Perform tests on diesel engines. (K2)				
Course outcomes	On completion of the course the student will be able to					
	CO1	Apply accurate viscosity measurement techniques. (K3)				
	CO2	Determine flash point of samples safely. (K3)				
	CO3	Analyze flue gases for CO2, CO, and O2 content. (K4)				
	CO4	Determine accurate calorific value using Bomb Calorimeter. (K2)				
	CO5	Determine thermal conductivity of materials precisely. (K2)				
	CO6	Demonstrate the performance and pollution tests on diesel engines (K2)				

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	2	2	3	-	-	-	2	2	2	-
CO2	3	2	1	1	-	2	2	3	-	-	-	2	-	-	-
CO3	3	3	1	1	-	2	2	3	-	-	-	2	2	2	-
CO4	2	2	1	1	-	2	2	3	-	-	-	2	2	2	-
CO5	2	2	1	1	-	2	2	3	-	-	-	2	2	2	-
CO6	3	2	2	1	-	2	2	3	-	-	-	2	2	2	-
Average	2.67	2.33	1.33	1.00	-	2.00	2.00	3.00	-	-	-	2.00	2.00	2.00	-
Correlation level			1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)			

LIST OF EXERCISES	Total Hours: 36
HEAT TRANSFER ANALYSIS 1. Determine the Thermal Conductivity of a conducting material 2. Determine the Thermal Conductivity of a Insulating material **IC ENGINE ANALYSIS** 1. Draw the Port timing diagram of the given 2 stroke engine cut-sectional model 2. Draw the valve timing diagram of the given 4 stroke engine cut-sectional model 3. Performance test on a single cylinder 4-stroke diesel Engine 4. Heat balance test on a single cylinder 4-stroke diesel engine. 5. Retardation test on a slow speed diesel Engine 6. Pollution test on a diesel engine using alternate fuels	
Competency Numbers	4.1, 4.1.1, 4.3.1, 4.4, 4.5

Program	B.E. – Marine Engineering				
Course code 241ME1A31PI	Course Name **Fluid Mechanics and Marine Hydraulics Laboratory**	L	T	P	C
		0	0	2	1
Year/Semester	II Year/ III Semester	Contact hours/Week	2 Hrs		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	✓				

Course objectives	1	Outline the flow measurements using different devices. (K1)
	2	Explain the factors affecting the flow through pipes. (K2)
	3	Illustrate the characteristics curves for various experiments related to fluid mechanics. (K2)
	4	Infer the competency towards preventive maintenance of hydraulic machine. (K2)
	5	Explain the working principle and performance of centrifugal pumps. (K2)
	6	Relate the principles and working of fluid systems (K3)
Course outcomes	On completion of the course the student will be able to	
	CO1	Understand the basic properties of fluids and apply Newton's Law of Viscosity in solving practical problems. (K1)
	CO2	Explain the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures. (K2)
	CO3	Explain the principles of kinematics with specific emphasis on application of continuity equation (K2)
	CO4	Apply the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems. (K3)
	CO5	Relate friction loss in laminar and turbulent flows. (K3)
	CO6	Demonstrate the working of pumps. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	2	1	2	2	1	-	2	1	1	1
CO2	3	2	-	-	1	2	1	2	2	1	-	2	1	1	1
CO3	3	3	2	1	1	2	1	2	2	1	-	2	1	1	1
CO4	3	3	-	1	1	2	1	2	2	1	-	2	1	1	1
CO5	3	1	-	-	1	2	1	2	2	1	2	2	1	1	1
CO6	3	1	-	-	1	2	1	2	2	1	2	2	1	1	1
Average	3	2.2	2	1	1	2	1	2	2	1	2	2	1	1	1

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXPERIMENTS **Total:36 Hours**

1. Determine coefficient of discharge of a given venturimeter using experimental setup.
2. Determine coefficient of discharge of a given orifice meter using experimental setup.
3. Determine coefficient of friction of given pipe using experimental setup.
4. Determine operational characteristics of a given centrifugal pump using experimental setup.
5. Determine coefficient of discharge of Triangular Notch using experimental setup.
6. Determine coefficient of velocity of flow using a pitot tube.
7. Determine the metacentric height of the given apparatus.
8. To verify the Bernoulli's theorem.
9. Study design and working of a hydraulic lifting machine.
10. Study design and performance of any one hydraulic system considering its important components, pipes and fittings, valves, hydraulic power.

Competency Numbers	5.1,5.2.1,9.5

Program	B.E. – Marine Engineering				
Course code 241ME1A34PF	Course Name **Marine Workshop - II**	L	T	P	C
		0	0	4	2
Year / Semester	II Year / III Semester	Contact hours/Week		04 hrs	
Prerequisite course	Marine workshop-I , II				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives		
	1	To demonstrate the safety precautions and procedures involved in Workshop (K2)
	2	Illustrate the various tools and equipment used (K2)
	3	Demonstrate the basic manufacturing processes (K2)
	4	Develop hands-on training given in fitting , plumbing and machining Sections (K2)
	5	Develop hands-on training given in arc welding sections (K2)
	6	Develop hands-on training given in gas welding sections (K2)

Course outcomes	On completion of the course the student will be able to	
	CO1	Demonstrate plumbing operations, joints and tools used (K2)
	CO2	Demonstrate fitting operations, various joints and tools used (K3)
	CO3	Demonstrate machining operations performed in lathe (K2)
	CO4	Demonstrate Arc welding operations and perform joints in multiple positions(K2)
	CO5	Demonstrate Gas welding operations and perform joints in multiple positions(K2)
	CO6	Explain operation of various machines, tools and different types of welding Machines (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	2	2	2	3	3	-	2	2	2	-
CO2	2	2	-	-	-	2	2	2	3	3	-	2	2	2	-
CO3	3	2	2	2	-	2	2	2	3	3	-	2	2	2	-
CO4	3	2	2	2	-	2	2	2	3	3	-	2	2	2	-
CO5	2	2	2	2	-	2	2	2	3	3	-	2	2	2	-
CO6	3	3	3	3	-	2	2	2	3	3	-	2	2	2	-
Average	2.67	2.17	2.20	2.20		2.00	2.00	2.00	3.00	3.00		2.00	2.00	2.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXPERIMENTS **Total Hours : 90**

I) Plumbing and Adhesives 10 Hrs

1) Hands-on-exercise. Basic pipe connections – Mixed pipe material connection – Pipe Connections with different joining components
2) Use of various types of adhesives, sealants, packing materials in carrying out temporary repairs.
3) Demonstration of plumbing requirements of high-rise decks

II) Fitting 20 Hrs

1) Rectangular fiting
2) T - fitting

III) Machining Operations 20 Hrs

1) Turning,Milling,Drilling,Shaping,Thread cutting, Grinding
2) Reaming

IV) Electric Arc Welding 20 Hrs

1) Single V Butt joint in flat position
2) Lap fillet joint in fillet position
3) TEE fillet joint in fillet position

V) Oxy Acetelyne Welding 20 Hrs

1) Outside corner joint in flat position
2) TEE fillet joint in flat position
3) Square butt joint in horizontal position

Competency Numbers : 8.2, 8.5 ,8.6,9.8

Text Books:

1. Workshop Technology V [I], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.
2. Workshop Technology V [II], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.

Reference Books:

1. A Text Book of Workshop Technology, R.S. Khurmi& J.K. Gupta. S. Chand& company Pvt. Ltd.
2. Workshop Technology, W.A.J. Chapman Vol I & Vol II, Published by Routledge (1972).
3. Elements of Manufacturing processes, B.S. Nagendra Parashar& R.K Mittal. PHI Learning.

PROGRAM	B..E. – Marine Engineering				
Course Code: 241ME1A43TE	Course Name Marine Electrical Measurements and Instrumentation	L 2	T 1	P 0	C 3
Year / Semester	II Year / IV Semester	Contact hours/Week: 3			

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Program	Engineering Science	Open Elective	Mandatory
		✓		

Course objectives		
	1	To explain the students an insight into the constructional details and working principles of various measuring instruments (K2)
	2	To explain the use of different types of analog and digital meters for measuring electrical and physical quantities. (K2)
	3	To demonstrate various Bridges for the measurement of resistance, inductance and capacitance. (K2)
	4	To understand and apply different types of sensors for the measurement of physical quantities such as speed, torque, pressure, displacement, temperature, etc. (K2)
	5	To discuss the basics of instrumentation and control involved in marine engineering field (K3)
	6	To develop a sound knowledge of Alarm circuits and monitoring system. (K2)
Course outcomes	CO1	Demonstrate knowledge on the characteristics of measuring instruments and their classification.(K2)
	CO2	Explain the construction, working of AC / DC meters and their proficient use. (K3)
	CO3	Classify bridge comparison methods for R, L and C measurement. (K4)
	CO4	Compare construction and working principle of various types of transducers and sensors(K4)
	CO5	Demonstrate the various types of monitoring system and alarm circuits (K2)
	CO6	Explain the concepts of measuring instruments (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	1	1	1	1	1	-	1	2	3	3
CO2	3	2	2	2	1	1	1	1	1	1	-	1	2	3	3
CO3	2	2	2	2	1	1	1	1	1	1	-	1	2	3	3
CO4	2	2	2	2	1	1	2	1	1	1	-	2	2	3	3
CO5	2	2	2	2	1	1	2	1	1	1	-	2	2	3	3
CO6	2	2	2	2	1	1	2	1	1	1	-	2	2	3	3
Average	2	2	2	1.7	1	1	1.5	1	1	1	-	1.5	2	3	3

Correlation Level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	INTRODUCTION TO MEASUREMENT	10 Hours
Functional elements of Generalized measurement system - Types of measurement - Classification of instruments - Static and Dynamic characteristics of instruments - Mean, Standard deviation - error - Accuracy, Precision, Sensitivity, Linearity, Resolution, Hysteresis, Threshold, Input impedance - loading effects - Probability of errors- Errors in Measurements - Systematic and random errors, propagation of errors, Limiting errors of instruments.		
Competency Numbers	7.5	
UNIT-II	ELECTRICAL INSTRUMENTS	12 Hours
Essential requirements of an instrument - Ammeter and voltmeter - Moving coil - Moving Iron - Extension of voltmeter and ammeter range - Electro dynamo meter type Wattmeter - Induction type Energy meter - Instrument Transformers- Power factor meter-Frequency meter- Construction, Phasor diagrams, testing, application of current transformer and potential transformer – Multimeter – Insulation tester, Continuity tester, Tong tester- Introduction to Megger.		
Competency Numbers	7.2, 7.3,7.4	
UNIT-III	BRIDGES AND DISPLAY DEVICES	12 Hours
Bridges: Measurement of low and high resistances – D.C potentiometer - Wheat stone, Kelvin and Kelvin Double bridge - A.C bridges for measurement of L and C - Maxwell, Anderson bridge and Heavy side Campbell bridges for inductance, Wein bridges for capacitance - Measurement of earth resistance - localization of cable faults by Murray and Varley loop test - Wagner Earthing Device. Display Devices: CRT display, Analog and digital CRO, LED, and LCD.		
Competency Numbers	6.1.2, 6.1.2A	
UNIT-IV	TRANSDUCERS AND SENSORS	10 Hours
Transducers - Definition and classification - Displacement: Resistive Potentiometers, strain gauge, LVDT, Capacitive Piezoelectric – Force: Strain gauge – Torque: magneto-stricitive – Speed: Magnetic and photo electric pickup transducer - Pressure: Manometers, Bourdon – Temperature: Thermistors, Thermocouple, RTD – Flow: Electromagnetic, Ultrasonic – Level: Differential Pressure cell, Ultrasonic – Density: Hydrometer - Voltage, Current and Power: Hall Effect transducer, Smart Transmitters, RPM Sensors, Photo Sensors, Torque Sensors, Vibration Sensors, Water Salinometer.		
Competency Numbers	6.1.2A, 6.1.2C,6.1.3.A	
UNIT-V	MONITORING SYSTEM AND ALARM CIRCUITS	10 Hours
Integrated automation control and monitoring system- Requirements of a Basic Fire Alarm System - Fire Detection System - Rise-type Fire Detector-Combustion Detector- Fire Alarm Control Panel - Alarms for Engine Room and Pump Room Systems - Alarm and Trip circuit for various machinery, simple fire alarm, dead man alarm, Important UMS alarms – Mist Detector - operation of fire detection unit using Ionization chamber type detector - Pneumatic, Electrical transducers and receivers I/P,P/I,V/I,I/V converters.		
Competency Numbers	6.1.3A, 7.5.1	
Total hours: 54		
Text Books:		

A.K. Sawhney, “A Course in Electrical & Electronic Measurements and Instrumentation”, Dhanpat Rai and Co., New Delhi, 19th Edition, 2015.

2. J. B. Gupta, “A Course in Electronic and Electrical Measurements”, S. K. Kataria & Sons, Delhi, 12th Edition, 2009.

E. O. Doebelin and D. N. Manik, “Measurement Systems – Applications and Design”, Tata McGraw Hill Education Pvt. Ltd., Special Indian Edition, 2007.

Reference Books:
David Bell, “Electronic Instrumentation and Measurements”, Oxford University Press, 1st Edition, 2013.
H.S. Kalsi, “Electronic Instrumentation”, Tata McGraw Hill Education, 4th Edition, 2019.
C.S. Rangan, G.R. Sharma and V. S. V. Mani, “Instrumentation Devices and Systems”, Tata McGraw Hill Book Co., New Delhi, 1st Edition, 2004.

Program	**B.E. – Marine Engineering**

Course code 241ME1A43TF	Course Name **Marine Materials**		L	T	P	C
			2	**1**	**0**	**3**
Year/Semester	II Year /III Semester		Contact hours/Week:		**3Hrs**	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				
Pre-requisite	Engineering Mathematics, Engineering Mechanics, Material Science					
Course objectives	1	To understand the concept of stress strain relationship (K1)				
	2	To draw shear force and bending moment diagrams of beams under different loads and the theory of simple bending (K1)				
	3	To learn about the deflections of beams (K1)				
	4	To understand the concept of torsion of shafts (K1)				
	5	To study about the stresses on shells due to internal pressure (K1)				
	6	To Study about spring and its applications (K1)				
Course outcomes	CO1	Summarize the stress, strain, tension, compression and shear for various materials. (K1)				
	CO2	Discuss the shear force, bending moment and draw shear force diagram & bending moment diagram for various types of beam and loads. (K2)				
	CO3	Analyze deflections of beams and Strain Energy. (K3)				
	CO4	Analyze torsion of shaft to find the power. (K3)				
	CO5	Determine the stresses and deformations induced in thin and thick shells. (K2)				
	CO6	Apply the knowledge of stress and strain for designing the machine components. (K3)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	2	-	-	-	-	2	-	-
CO2	2	1	-	-	-	-	-	2	-	-	-	-	2	-	-
CO3	2	1	-	-	-	-	-	3	-	-	-	1	3	-	-
CO4	2	1	-	-	-	-	-	3	-	-	-	-	3	-	-
CO5	3	2	2	-	-	-	-	3	3	3	-	3	3	2	-
CO6	3	2	-	-	-	-	-	2	3	3	-	2	3	2	-
Average	2.33	1.33	2.00	-	-	-	-	2.50	3.00	3.00	-	2.00	2.67	2.00	-
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

UNIT-I	**STRESS, STRAIN AND DEFORMATION OF SOLIDS**	10 Hours
Strength, Stress and Strain – Direct Stress and Strain, Shear stress and shear strain. Elastic constants. Factor of safety. Deformation of simple and Compound bars. Thermal stress and strain. Iron Carbon Equilibrium Diagram.		
Competency Numbers	4.4 and 4.5	
UNIT-II	**BEAMS AND STRESSES IN BEAMS**	12 Hours

Beam – Types – Loads. Shearing force and bending moment diagram for cantilever beam, simply supported beam with concentrated or uniformly distributed loads. Theory of simple bending, bending stress, neutral axis, Relation between bending stress and radius of curvature, relation between bending moment and radius of curvature, bending stress in symmetric section, bending stress in unsymmetrical section.		
Competency Numbers	4.5	
UNIT-III	**DEFLECTION OF BEAMS AND COLUMN**	12 Hours
Elastic curve – Governing differential equations – Deflection of Built-in beams and Continuous beams by Double integration method – Macaulay's method - Area moment method. Clapeyrons three moment theorem. Column – types – effective length of column - Struts - Euler's formula, Slenderness ratio. Rankine's Formula.		
Competency Numbers	4.5	
UNIT-IV	**TORSION AND SPRINGS**	10 Hours
Strength and stiffness of solid or hollow shafts, Stress due to torsion, Power transmitted by shafts and coupling bolts. Springs – types – Closed and Open Coiled helical springs – springs in series and parallel. Stress with axial load, calculation of mean diameter of springs, wire diameter and no. of coils.		
Competency Numbers	4.5	
UNIT-V	**THIN SHELLS, THICK SHELLS AND STRAIN ENERGY**	10 Hours
Thin shells – Circumferential and longitudinal stress in thin cylindrical shells subjected to internal pressure. Thick Shells - Lame's equations, The Lame Line, Shrinkage allowance. Strain energy – due to direct stress, bending and twisting.		
Competency Numbers	4.5	
Total hours: **54 Hours**		
Text Books:		
1. Reed Volume 2: Applied Mechanics for Engineers; By William Embleton; Revised by J.T. Gunn; Publisher Sunderland Tyne and Wear) Thomas Reed.1983: ISBN0900335874		
2. Strength of Materials, R S Khurmi, S.Chand & company Ltd., New Delhi, 7th edition, 2019.		
3. Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.		
Reference Books:		
1. Strength of Materials, G. H. Ryder, Macmillan Pub, India.		
2. Strength of Materials, Ramamrutham S, Dhanpat Rai Publishing, New Delhi.		
3. Strength of Materials, Rajput R.K, S. Chand Publishing, New Delhi.		
4. NPTEL online course: strength of material by Prof. Sriman Kumar Bhattacharyya.		
5. https://onlinecourses.nptel.ac.in/noc20_ce34/preview.		

Program	**B.E. – Marine Engineering**					
Course code 241ME1A43TG	Course Name **Mechanics of Machines**		L 2	T 1	P 0	C 2
Year / Semester	II Year / IV Semester		Contact hours/Week**: 3 hrs**			
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				
Prerequisite Course	Engineering Mechanics, Engineering Materials					

Course objectives	1	To understand the basic components and layout of linkages in the assembly of a system/machine. (K1)
	2	To understand the basic concepts of belt and chain drives. (K1)
	3	To understand the motion resulting from a specified set of linkages, (K1)
	4	To understand the basic concepts of Turning Moment, Flywheel & toothed gearing. (K1)
	5	To discuss the basic concepts of toothed gearing and kinematics of gear trains. (K2)
	6	To Analyzing the undesirable effects of unbalances resulting from prescribed motions.(K4)
Course outcomes	CO1	Explain the basic mechanisms and links used in machines (K1)
	CO2	Discuss various belt and machine drives (K2)
	CO3	Discuss the functioning of cams and followers (K2)
	CO4	Discuss the working of flywheel and gear systems(K2)
	CO5	Discuss the need of balancing, functioning of governors and effect of vibration (K2)
	CO6	Demonstrate the knowledge of Mechanisms and links for the efficient operation. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	-	-	-	-	-	2	3	1	-
CO2	3	3	3	2	-	2	2	2	-	-	-	1	3	2	-
CO3	3	3	-	-	-	-	-	2	-	-	-	-	3	-	-
CO4	3	3	2	2	-	2	2	2	-	-	-	2	3	2	-
CO5	3	3	2	-	-	2	2	-	-	-	-	2	3	2	-
CO6	3	3	3	3	-	3	3	3	2	-	-	3	3	3	2
Average	2.83	2.67	2.20	2.33		2.20	2.25	2.25	2.00			2.00	3.00	2.00	2.00

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	KINEMATICS OF MACHINES, MECHANISMS, AND MARINE ENGINE DYNAMICS	10 Hours

Introduction to basic mechanisms, kinematic pairs, links and chain Inversions and variants of kinematic chains.
Degrees of freedom. GrUBler's criterion, four link mechanism, Grashoff's law. Determination velocities and accelerations of Piston, Connecting Rod inertia forces of piston, connecting rod, crank by analytical method.
Dynamically equivalent system of connecting rod.

Competency Numbers	4.1.5, 4.1.6 and 4.1.7

UNIT-II	BELT AND CHAIN DRIVES	10 Hours

Types of belt drives – materials used for belts – velocity ratio of belt drive – length of an open belt drive – length of a cross belt drive – power transmitted by a belt – centrifugal tension – maximum tension in belt –
condition for transmission of maximum power – initial tension in the belt – chain drive – relation between pitch and pitch circle diameter – classification of chains.

Competency Numbers	4.1.5, 4.1.6 , 4.1.7 ,9.5	
UNIT-III	**CAM AND FOLLOWER MECHANISMS**	**12 Hours**
Types and Classification Cam and Follower mechanisms used in different machineries on board, Kinematics and Dynamics of Cam and Follower mechanisms and determination of cam profile for specified follower motions like uniform velocity, SHM, uniform acceleration and retardation, cycloidal motion.		
Competency Numbers	4.1.5, 4.1.6 , 4.1.7	
UNIT-IV	**TURNING MOMENT & FLYWHEEL, TOOTHED GEARING COMPETENCY NUMBER**	**9 Hours**
Function of a flywheel. Crank effort diagrams. Fluctuation of speed and Energy-Simple problems. Types of gears. Gear Trains - Types of gear trains- Transmission of power by gear trains on parallels shafts- Simple Problems, Steering gear and Telemotor system.		
Competency Numbers	4.1.5, 4.1.6, 4.1.7 , 9.5	

UNIT-V	**BALANCING, GOVERNORS, GYROSCOPE**	**13 Hours**
Balancing of rotating masses- In same plane and different Planes - Problems. Balancing of engines - Primary and Secondary. Governors – Types - Characteristics, Stability, Speed Control. Hunting of governors – governors with sleeve friction (Theory only).Introduction, Processional Angular Motion, Gyroscopic couple and its determination, Effect of Gyroscopic Couple on a Plane and Naval ship, Stability of a Four-Wheel Drive Moving in a Curved Path, Stability of a Two Wheel Vehicle Taking a Turn, Effect of Gyroscopic Couple on a Disc Fixed Rigidly at a Certain Angle to a Rotating Shaft, Rudder and Supports		
Competency Numbers	4.1.7,4.5 ,9.5	
		Total hours: **54 hours**
Text Books:		
1. Theory of Machines, R. S. Khurmi, J. K. Gupta. S Chand Publishing		
2. P L Ballaney, Theory of Machines, Khanna Publishers, New Delhi.		
Reference Books:		
1. S. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company, New Delhi.		
2. J. Hannah and R.C. Stephens, Advanced Mechanics of Machines, Viva publications, New Delhi.		
3. Kenneth J. Waldron / Gary L Kinzel, Kinematics Dynamics and Design of machinery, John Wiley and Sons.		
4. Thomas Bevan, The Theory of Machines, CBS Publishers and Distributors, New Delhi.		
5. J. S. Rao, The Theory of Machines, New Age International Publishers.		
6. Theory of Machines, Kinematics and Dynamics, Sadhu Singh, Pearson Publications,2013, Third Edition.		

PROGRAM	BE-Marine Engineering				
Course Code 241ME1A41TJ	Naval Architecture-I	L	T	P	C
		3	0	0	2
Year and Semester	II Year (semester IV)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	✓				
Course Objective	1. Understand principles and calculations for ship stability. (K1) 2. Understand practical skills for evaluating ship stability under various conditions. (K1)				
Course Outcome	After completion of the course, the students will be able to: 1. Explain principles of ship stability, including density and buoyancy. (K2) 2. Calculate areas, volumes, and moments using Simpson's rules. (K2) 3. Determine transverse stability, BM, and metacentric height. (K3) 4. Evaluate longitudinal stability and factors affecting trim. (K4) 5. Assess damage stability and impact of flooding. (K3) 6. Apply IMO, MARPOL, and SOLAS guidelines for ship stability. (K3)				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO5	3	3	3	3	2	-	2	-	-	-	-	2	3	3	3
CO6	3	-	-	-	-	-	3	-	-	-	-	2	3	3	3
AVERAGE	3	3	3	3	2	-	2.5	-	-	-	-	2	3	3	3
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL (HIGH)			

UNIT 1: PRINCIPLES OF SHIP STABILITY **12 Hrs.**

Density, relative density. Archimedes principle, Displacements, deadweight, meaning of buoyancy, reserve buoyancy. Tonnes per centimetre (TPC), Lines plan of ships, coefficients of form, Offset table, Effects of weight shifting and suspended weight on centre of gravity.

Competency No. : 11.1 ,11.2

UNIT 2: CALCULATION OF AREA, VOLUME AND MOMENTS **10 Hrs.**

Simpson's 1st, 2nd and 3rd rules for areas and volumes calculation, 1st moments and centroids, 2nd moments of area (Area moment of Inertia), Use of half-spaced ordinates.

Competency No. : 11.1 ,11.2

UNIT 3: TRANSVERSE STABILITY **10 Hrs.**

Static stability at small angles of heel, calculation of BM and meta centric height, meta centric diagram, inclining experiment, free surface effect, stability at large angles of heel, curves of static stability, cross curves of stability, angle of loll.

Competency No. : 11.1 ,11.2

UNIT 4: TRIM AND LONGITUDIONAL STABILITY **10 Hrs.**

Longitudinal BM – MCT1 cm – Change of trim, change of LCB with change of trim, alteration of trim by adding or removing weights, factors affecting trim and stability, necessary measures to preserve trim and stability.

Competency No. : 11.1 ,11.2

UNIT 5: DAMAGE STABILITY AND WATERTIGHT INTEGRITY **12 Hrs.**

At woods and wall sided formula, Dynamic stability, Assessment of ship conditions after flooding – Permeability, Lost Buoyancy, margin line, sub division. Change in mean draught due to bilging of amidships, side and end compartments, floodable length calculation, IMO code of intact stability, MARPOL & SOLAS guidelines for damage stability.
Competency No. : 11.1 ,11.2

Total: 54 Hours

TEXTBOOKS:

1. **"Ship Stability for Masters and Mates" by D.R. Derrett and C.B. Barrass -** Essential guide covering principles and calculations for ship stability.

2. **"Introduction to Naval Architecture" by E.C. Tupper -** Comprehensive resource on naval architecture, including ship stability and design.

REFERENCES:

2. **International Maritime Organization (IMO) - www.imo.org -** Access to international conventions and regulations on ship construction and safety.

Designed by	" Department of Naval Architecture & Offshore Engineering"

Program	B.E. – Marine Engineering					
Course code 241ME1A44TG	Course Name **Marine Boilers**		L	T	P	C
			2	1	0	3
Year/Semester	II Year / IV Semester		Contact hours/Week		3 hrs.	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
			✓			

Course objectives	1	To Understand marine boiler fundamentals. (K1)
	2	To Understand marine boiler mountings. (K1)
	3	To Understand operation care and maintenance of boilers. (K1)
	4	To Understand feed water system and boiler water treatment. (K1)
	5	To Understand fuel and combustion system. (K1)
Course outcomes	CO1	Summarize various marine boiler fundamentals. (K2)
	CO2	Discuss various boiler mountings and combustion systems (K2)
	CO3	Summarize the operation care and maintenance of boilers. (K2)
	CO4	Summarize operation procedures for boiler and feed water systems. (K2)
	CO5	Summarize fuel and combustion system. (K2)
	CO6	Summarize the automation in boiler, ACC and PMS. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	3	2	3	-	-	3	3	3	3	3
CO2	3	3	3	3	-	3	2	3	-	-	-	3	3	3	3
CO3	3	3	3	3	-	3	2	3	-	-	3	3	3	3	3
CO4	3	3	3	3	-	3	2	3	-	-	-	3	3	3	3
CO5	3	3	3	3	-	3	2	3	-	-	-	3	3	3	3
CO6	3	3	3	3	-	3	2	3	-	-	-	3	3	3	3

Average	2.83	2.83	2.83	2.83			2.00	3.00			3.00	3.00	3.00	3.00	3.00
Correlation level		1.Slight (Low)				2. Moderate (Medium)				3. Substantial (High)					

UNIT-I	MARINE BOILER FUNDAMENTALS	11 Hours
Steam- Generation & properties of steam. Uses of steam on board ships. Types of marine boilers. Comparison of smoke tube and water tube boilers. Boiler construction methods; destructive and non-destructive tests on plates, rivets, welded seams; classification society's requirements for boiler construction. **SMOKE TUBE BOILERS:** Various types of smoke tube boilers in marine use; constructional details and principal dimensions; staying of flat surfaces of multi tubular cylindrical boilers, vertical auxiliary boilers. **WATER TUBE BOILERS:** General description with sketches of principal types of boilers in marine use; super heater, economizer, headers and other parts of water tube boiler. Circulation and use of unheated down comers in highly rated boilers; superheat temperature control; function of attemperators, de- super heaters, double evaporation boiler.		
Competency Numbers	4.1, 4.1.4	
UNIT-II	**BOILER MOUNTINGS**	14 Hours
List of boiler mountings and their functions - Classification society requirements of different mountings. Safety valves-Improved high lift, full lift and full bore type, Gauge glass-Ordinary plate type and remote indicator, automatic feed water regulator, high and low water level alarms, retractable type soot blower etc.		
Competency Numbers	4.1.4,4.3.2	
UNIT-III	**OPERATION CARE AND MAINTENANCE OF BOILERS**	10 Hours
Start up, shut down of boilers, hydraulic tests, steam raising and operating procedures, action in the event of shortage of water, oil in the boiler ; blowing down of boiler, laying up a boiler, general maintenance, inspection and survey of boiler, plugging of tubes and their renewal. Safety measure: Alarm, Trips and Furnace explosion, blowback. Automation in boiler and ACC.		
Competency Numbers	4.1.4,9.1, 9.4	
UNIT-IV	**FEED WATER SYSTEM AND BOILER WATER TREATMENT**	10 Hours
Feed water systems; Corrosion and scaling in boilers. Importance of boiler water treatment, and effect of same on boiler, oil in boiler.		
Competency Numbers	4.1.4,9.4	
UNIT-V	**FUEL AND COMBUSTION SYSTEM**	09 Hours
Fuel systems including pumps, heaters, burners, and types of burners. Air heaters and air registers. Combustion control. Maintenance of combustion equipment. Waste Heat Boilers: Lamont exhaust gas boiler, Cochran exhaust gas and composite boiler etc., forced water circulation boilers and associated systems.		
Competency Numbers	4.1.4,4.4	
		Total: 54 Hours
Text Books:		
1.Marine Boilers 3rd Edition - GTH Flanagan, Butterworth – Heinemann Ltd.		
Reference Books:		
1.Marine Steam Boilers – J.H. Milton, 4th edition, Butterworth – Heinemann Ltd.		

Program	B.E. – Marine Engineering				
Course code 241ME1A42TB	Course Name **Marine Environmental Protection**	L	T	P	C
		3	0	0	3
Year/Semester	II Year / IV Semester	Contact hours/Week	3 Hrs		

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	✓			
	Basic Science	Engineering Science	Open Elective	Mandatory

Course objectives		
	1	To discuss the negative impacts of marine pollution on the environment, sea Organisms and human health. (K2)
	2	To explain the procedures required to effectively implement the MARPOL conventions (K2)
	3	To summarize the safety characteristics and bunkering (K2)
	4	Summarize of the essential features of COW, IG systems, and safety devices, (K2)
	5	To Discuss the corrective actions necessary to control SOX and NOX emissions, (K2)
Course outcomes	CO1	Summarize the ill effects of marine pollution (K2)
	CO2	Explain the procedures to implement the MARPOL conventions (K2)
	CO3	Summarize the safety characteristics , bunkering plan for bunkering operations (K2)
	CO4	Summarize the important features of COW , IG SYSTEMS and safety devices (K2)
	CO5	Explain the corrective actions to control SOX and NOX pollutions and other air Pollution (K2)
	CO6	Analyze and take measures to control marine environmental protection (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	3	3	3	-	-	-	3	3	1	-
CO2	2	1	1	-	-	-	-	3	-	-	-	-	3	-	-
CO3	3	3	2	2	-	3	1	2	-	-	-	-	3	2	-
CO4	2	2	1	1	-	2	3	1	-	-	-	2	3	1	-
CO5	2	2	-	-	-	2	3	3	-	-	-	3	3	1	-
CO6	3	3	2	1	-	3	3	3	1	2	-	3	3	2	-
Average	2.33	2.17	1.40	1.25		2.60	2.60	2.50	1.00	2.00		2.75	3.00	1.40	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	INTRODUCTION	10 Hours
Definition of marine environment, Reasons for protection of sea life, Ecological consequences of marine pollution, Causes of marine pollution, General information of products and cargo moved on ships.		
Competency Numbers	16.1, 16.2, 16.3	
UNIT-II	**POLLUTION PREVENTION CONVENTIONS**	**10 Hours**
Marpol 73/78, convention for preventing polluting by discharge of oil, Chemicals, sewage and garbage, Oil record book, both electronic and manual, SOPEP, SMPEP and the differences between them, Other conventions.		
Competency Numbers	10.1.1,10.1.2	
UNIT-III	**EQUIPMENT FOR POLLUTION PREVENTION**	**12 Hours**
Measuring and detection systems and equipment, Limits of discharge of oil in restricted areas. Specialized tanks and equipment onboard ships, Remedial actions after resulting in pollution. Control of waste discharge from different types of ships. Bunkering safety, bunker check list, Calculating bunker, BDN, sample collection, retention, ORB entry (Part I – machineries).		
Competency Numbers	10.1.1,10.1.2	
UNIT-IV	**OIL TANKER OPERATIONS**	**10 Hours**
A typical voyage of a tanker, Various cargo related operations, Equipment, Tank cleaning, Crude oil washing, use of slop tanks, double hull tankers, Pollution prevention on chemical tankers, Pollution prevention on tankers and their regulations. Safety devices fitted in pump room, IG Safety system. ORB entry (Part II – Cargo operations)		
Competency Numbers	10.1.2,10.1.3	
UNIT-V	**AIR POLLUTION**	**12 Hours**
Ozone depleting substances, NOX, SOX, Volatile organic compounds, IMO Incinerator, Bunker regulation, Air pollution measurement(EEXL, CII) and recording. Greenhouse gases, Energy efficient design index, Ship energy efficient management plan, energy efficient operation indicator. Ballast water management, Ballast water treatment and regulation, Anti-pollution paints, regulation for anti-pollution paints, Ship re-cycling (Ship breaking & Recycling, Hong-Kong convention), Noise pollution SOLAS regulations, Port state inspection.		
Competency Numbers	10.1,16.1,16.2	
		Total: 54 Hours

Text Books:

1. Revised MARPOL Annex VI 2009. 2nd illustrated, IMO Publication

Reference Books:

1. MARPOL 2006, ISBN-10 8175980702, IMO Publication.

Program	B.E. – Marine Engineering				
Course code 241ME1A44TH	Course Name **Marine Internal Combustion Engines –I**	L	T	P	C
		3	0	0	3
Year / Semester	II Year / IV Semester	Contact Hours / Week		3 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		

Course objectives		
	1	To explain the design features and differences between 2-stroke and 4- stroke marine diesel engines for reliable and efficient propulsion and auxiliary power on board ships. (K2)
	2	To summarize the constructional details of an IC engine for a better understanding of its design, operation, and maintenance. (K2)
	3	To explain the principles and implementation of scavenging and supercharging in IC engines for improved engine performance and efficiency. (K2)
	4	To analyze the combustion phenomenon in marine IC engines and its impact on engine performance, emissions, and reliability. (K3)
	5	To summarize of the different types of marine engine fuel systems, including their components, functions, and applications, in a clear and informative manner (K2)

Course outcomes		
	CO1	Explain the design features of a 2, 4 Stroke marine diesel engines (K2)
	CO2	Summarize the constructional details of a IC engine (K2)
	CO3	Explain the scavenging and supercharging of IC engines (K2)
	CO4	Analyze the combustion phenomenon in marine IC engine (K3)
	CO5	Summarize various Marine Engine Fuel systems. (K2)
	CO6	Apply the knowledge of IC engines to find a solution for emergency Breakdown (K2)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	-	-	-	2	3	-	-	-	-	-	3	-	-
CO4	3	3	1	1	-	2	3	3	-	-	-	-	3	-	-
CO5	2	2	-	-	-	2	-	-	-	-	-	-	3	-	-
CO6	3	3	2	2	-	2	3	3	-	-	-	3	3	3	-
Average	2.33	2.40	1.50	1.50		2.00	3.00	3.00				3.00	3.00	3.00	
Correlation level			1.Slight (Low)			2. Moderate (Medium)						3. Substantial (High)			

UNIT-I	**COMPARATIVE STUDY OF MARINE DIESEL ENGINES: DESIGN FEATURES, DEVIATIONS FROM IDEAL CONDITIONS, AND TIMING DIAGRAMS**	**12 Hours**
Design Features of marine diesel Engine 2-stroke and 4-stroke cycles, deviation from ideal condition in actual engines. Timing diagrams of 2-stroke timing diagrams of 4-stroke.Marine diesel engine of MAN/B&W/Sulzer make etc, Comparative study of Cross head type, trunk type, slow speed, medium speed and high speed diesel engines.		
Competency Numbers	**4.1.1, 4.3.1**	
UNIT-II	**KEY COMPONENTS AND CONSTRUCTIONAL DETAILS OF IC ENGINES**	**10 Hours**
Constructional Details of IC Engines Principal components, Bed plates, A frames, Welded construction of bed plates and frames, Tie rods, Foundation Bolts, Jackets and liners, cylinder heads, Pistons, cross heads, connecting rods, Bearings, Crank Shaft, Exhaust Valves, etc.		
Competency Numbers	**4.1.1 , 4.3.1**	
UNIT-III	**SCAVENGING AND SUPERCHARGING SYSTEMS IN 2-STROKE ENGINES**	**10 Hours**
Scavenging and Supercharging System Scavenging arrangements in 2-stroke engines, Various types of scavenging, their merits and demerits, Turbocharger and its details, Pulse type and constant pressure type turbo charging, air cooled - water cooled turbocharger casing. Centrally supported and end supported shaft bearings and types, sealing arrangements and lubrication arrangements.		
Competency Numbers	**4.1.1 , 4.3.1 , 4.4**	
UNIT-IV	**OPTIMIZING FUEL COMBUSTION IN IC ENGINES: DESIGN AND PREPARATION CONSIDERATIONS**	**10 Hours**
Combustion of fuels in IC engines. Preparation of fuels for efficient combustion, Fuel atomization, Requirements for fuel injectors, high pressure pipes and jacketing arrangement, provision of fuel leak off alarms. Design aspect for combustion chambers. Design aspect of modern injectors, Ignition delay, Injection delay etc.		
Competency Numbers	**4.1.1, 4.3.1 , 4.4**	
UNIT-V	**MARINE DIESEL ENGINE FUEL SYSTEM**	**12 Hours**
Fuel pumps and metering devices, Jerk and common rail system, fuel injection system, helical groove and spill valve type fuel pumps, Pump timing of different marine diesel engines.		
Competency Numbers	**4.1.1 ,**	
		Total: 54 Hours

Text Books:

1. D.A. Taylor, "Introduction to Marine Engineering", 2nd Edition, Butter worth – Heinemann, London, 1999
2. Wood yard, Doug, "Pounder's Marine Diesel Engines", 7th Edition, Butter Worth Heinemann Publishing, London, 2001.

3. Leslie Jackson, Thomas D Morton, Paul A Russe**l**, "Motor Engineering Knowledge For Marine Engineers", 3rd Ed. Reeds Vol 12, Adlard Coles Nautical, London, 1994

Reference Books:

6. Marine Diesel Engines Vol I &Vol II. Notes by Prof K Venkatraraman
7. M.E.P., "Low Speed Diesel Engines New", Marine Engineering Practice, Vol-2 Part- 17,, IMarEST, London, 2004 2. S. H. Henshall, "Medium and High Speed Diesel Engines for Marine Use", 1st Edition, Institute of Marine Engineers, Mumbai, 1996.
8. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai, 1998.
9. Mathur, M.L., Sharma, R.P., " Internal Combustion Engines", 7th Ed. Dhanpat rai Publications, REPRINT 2002

Program	B.E. – Marine Engineering				
Course code 241ME1A44PI	Course Name **Marine Workshop - III**	L	T	P	C
		0	0	4	2
Year / Semester	II Year / IV Semester	Contact hours/Week 04 hrs			
Prerequisite course	Marine workshop-I &II				
Course category	Humanities and Social Sciences	Management Courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives		
	1	Perceive the safety precautions and procedures involved in Workshop (K1)
	2	Identify the various tools and equipment used (K2)
	3	Explain the basic manufacturing processes (K2)
	4	Develop hands-on training given in fitting , plumbing and machining Sections (K1)
	5	Develop hands-on training given in arc welding sections (K1)
	6	Develop hands-on training given in gas welding sections (K1)
Course outcomes	CO1	Demonstrate plumbing operations, joints and tools used (K2)
	CO2	Demonstrate fitting operations, various joints and tools used (K2)
	CO3	Demonstrate machining operations performed in lathe (K2)
	CO4	Demonstrate Arc welding operations and perform joints in multiple positions (K2)
	CO5	Demonstrate Gas welding operations and perform joints in multiple positions (K2)
	CO6	Explain operation of various machines, tools and different types of welding machines (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO2	2	2	-	-	-	2	2	2	3	3	-	2	-	-	-
CO3	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO4	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO5	2	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO6	3	3	3	3	-	2	2	2	3	3	-	2	-	-	-
Average	2.67	2.17	2.20	2.20		2.00	2.00	2.00	3.00	3.00		2.00			

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXPERIMENTS

I) **Fitting:** 12 Hrs

1) H - fitting
2) Square fitting

II) Machining: 10 Hrs

1) Bearing Housing
2) Bearing Plug

III) Arc Welding 20 Hrs

1) Out side corner joint in flat position
2) Straight line bead in horizontal position
3) Butt joint in horizontal position

IV) Gas Welding 20 Hrs

1) Square butt joint in vertical position
2) TEE fillet joint in vertical position
3) Butt joint brazing in flat position

V) Use of hand tools, machine tools and measuring instruments 10 hrs

1)Safety measure for using hand tools, powered hand tools, measuring instruments
2)Safety measure for using machine tools (Center lathe,soldering,arc welding,gas welding,thermal cutting)
3) Properties and parameters considered in fabrication and repair of systems and components

Competency Numbers : 8.2, 8.5 ,8.6,9.8

Text Books:

1. Workshop Technology V [I], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.
2. Workshop Technology V [II], S.K. Hajra Chaudhary. Media promoters & publishers Pvt. Ltd.

Reference Books:

1. A Text Book of Workshop Technology, R.S. Khurmi& J.K. Gupta. S. Chand& company Pvt. Ltd.
2. Workshop Technology, W.A.J. Chapman Vol I & Vol II, Published by Routledge (1972).
3. Elements of Manufacturing processes, B.S. Nagendra Parashar& R.K Mittal. PHI Learning Pvt. Ltd.

Program	B.E. – Marine Engineering				
Course code 241ME1A44PJ	Course Name **Marine Engineering Equipment Drawing - I**	L	T	P	C
		0	0	4	2
Year / Semester	II Year / IV Semester	Contact hours/Week		04	
Prerequisite course	Marine workshop-I &II				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives	1	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of stop, check, and safety valves (K1)
	2	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of valve actuators for various industrial applications (K1)
	3	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of automatic valves for industrial automation systems. (K2)
	4	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of starting air valves used in marine diesel engines. (K2)
	5	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of burner carriers and related components used in industrial furnaces and boilers (K2)
Course outcomes	CO1	Develop skills to draw 2D drawings and acquire knowledge on the assembly of stop, check and safety valves (K2)
	CO2	Develop skills to draw 2D drawings and acquire knowledge on the assembly of valve actuators (K2)
	CO3	Develop skills to draw 2D drawings and acquire knowledge on the assembly of automatic valve (K2)
	CO4	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Starting air valve (K2)
	CO5	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Burner carrier (K2)
	CO6	Develop skills to draw 2D drawings and acquire knowledge on the assembly of various components of a boiler. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	1	-	3	-	3	-	-	3	2	-
CO2	3	3	3	2	-	1	-	3	-	3	-	-	3	2	-
CO3	3	3	3	2	-	1	-	3	-	3	-	-	3	2	-
CO4	3	3	3	2	-	1	-	3	-	3	-	-	3	2	-
CO5	3	3	3	2	-	1	2	3	-	3	-	-	3	2	-
CO6	3	3	3	2	-	1	2	3	1	3	-	-	3	2	-
Average	3.00	3.00	3.00	2.00	-	1.00	2.00	3.00	1.00	3.00	-	-	3.00	2.00	-

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	ORTHOGRAPHIC PROJECTION	10 Hours
Introduction to machine drawing with orthographic diagram. Concepts of projections, orthographic projections in first and third angle quadrants. Exercises in orthographic projections, Sectioning and sectioning components.		
Competency Numbers	9.6	
UNIT-II	**ASSEMBLY ON SIMPLE MACHINERY COMPONENTS**	10 Hours
Assembly drawing on hexagonal bolt, Screw threads and nut fasteners. Assembly drawing on screw jacks with orthographic projection. Assembly drawing on stuffing box.		
Competency Numbers	9.6	
UNIT-III	**ASSEMBLY OF DIFFERENT MACHINERY JOINTS**	12 Hours
Assembly drawing on simple orthographic projection. Assembly drawing on cotter joint with orthographic projection. Assembly drawing on knuckle joint with orthographic projection.		
Competency Numbers	9.6	
UNIT-IV	**ASSEMBLY DRAWING ON VALVES AND PLUG**	10 Hours
Assembly drawing on return valve. Assembly drawing on Non return valve. Assembly drawing on cock and plugs.		
Competency Numbers	9.6	
UNIT-V	**ASSEMBLY ON CYLINDER RELIEF AND MARINE ENGINE CONNECTING ROD**	12 Hours
Assembly drawing on cylinder relief valve. Assembly drawing on control valve. Assembly drawing on marine engine connection rod.		
Competency Numbers	9.6	
		Total: 54 Hours

Text Books:

1. Engineering Drawing for Marine Engineers Volume 11 by Reed's marine engineering series.

Reference Books:

1. Machine Drawing by N.D. Bhatt, V.M. Panchal. Charotar publication, ISBN-10 9380358636.
2. Mac Gibbon's Pictorial Drawing Book for Marine Engineers by James G. Holburn & John, James Monroe & company, 1959.

Program		B.E. – Marine Engineering					
Course Code	Course Name		L	T	P		C
241ME1A43PF	**Marine Materials Laboratory**		0	0	2		1
Year / Semester	II Year / IV Semester			Contact hours/Week: **2 Hrs**			
	Basic Science	Engineering Science	Open Elective		Mandatory		
		✓					
Pre-requisite		Strength of Materials					
Course objectives	1	To impart knowledge and skill relevant to the mechanical properties of materials subjected to different types of loading. (K2)					
	2	To determine experimental data include universal testing machines and torsion equipment. (K2)					
	3	To determine experimental data for spring testing machine, compression testing machine, impact tester, hardness tester. (K2)					
	4	To determine stress analysis and design of beams subjected to bending and shearing loads using several methods. (K2)					
	5	To determine Flexural strength of a beam. (K2)					
Course outcomes	CO 1	Apply the knowledge of testing steel rod subjected to tension and torsion. (K3)					
	CO 2	Explain the hardness of different metals. (K2)					
	CO 3	Demonstrate the practical knowledge about the deflection of the beam. (K2)					
	CO 4	Demonstrate the knowledge about the testing of helical spring and carriage spring. (K2)					
	CO 5	Acquire the knowledge about double shear test on metal and impact test on metal. (K2)					
	CO 6	Apply the knowledge of various material properties testing for selection of materials in marine components. (K3)					

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	2	-	3	2	3	-	-	3	2	-
CO2	3	3	2	-	-	2	-	3	2	3	-	-	3	2	-
CO3	3	3	3	-	-	2	-	3	2	3	-	-	3	2	-
CO4	3	3	-	-	-	2	-	3	2	3	-	-	2	2	-
CO5	3	3	3	-	-	2	-	3	2	3	-	-	2	2	-
CO6	3	3	3	-	-	2	-	3	2	3	-	-	3	2	-
Average	3	3	3	-	-	2	-	3	2	3	-	-	3		2

LIST OF EXPERIMENTS	Total hrs=36
1. Test on Ductile Materials: Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel. 2. Hardness Test: Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminum. 3. Beam Deflection Test: Deflection test on Mild steel and Aluminum– relation between load and deflection. 4. Impact test: Finding the resistance of materials to impact loads by Izod test and Charpy test. 5. Tests on springs of circular section: Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring) 6. Shear test: Single or double shear test on M.S. bar to finding the resistance of material to shear load. 7. Compression Test: Finding Compressive strength of a concrete block. 8. Fatigue Test: Finding Number of cycles to failure of a given specimen. 9. N.D.T Test: To finding surface crack, internal cracks, blow holes of a given given specimen	
Competency Numbers	**8**

Reference Books:

1. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.

2. IS 432(Part I) – 1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement

3. Rajput.R.K. Strength of Materials, S.Chand & Company Ltd., New Delhi 2014.

Program	B.E. – Marine Engineering					
Course code 241ME1A53TH	Course Name Marine Electrical Technology		L	T	P	C
			3	0	0	2
Year / Semester	III year / V semester		Contact hours/Week - 3			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course objectives	1	Identify and explain alternative sources of power and battery and their specifications for maritime applications. (K2)
	2	Analyze the purpose and importance of marine protection and switchgear on ships. (K3)
	3	Demonstrate the different types of cables and lighting systems on board ship. (K3)
	4	Evaluate steering systems and deck machineries. (K3)
	5	Discuss the maintenance requirements for auxiliary machinery and electrical safety. (K2)
	6	Identify safe electrical practices and equipment for hazardous areas on ships. (K2)
Course outcomes	CO1	Demonstrate knowledge of alternative sources of power and their selection criteria for maritime applications. (K2)
	CO2	Investigate the importance of marine protection and switchgear. (K4)
	CO3	Distinguish types of cables and lighting systems on board ship. (K3)
	CO4	Explain about steering systems and deck machineries (K3)
	CO5	Implement maintenance procedures for auxiliary machinery and electrical safety (K2)
	CO6	Apply safe electrical practices and select suitable equipment for hazardous areas on ships. (K2)

POs /COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
CO2	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
CO3	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
CO4	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
CO5	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
CO6	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1
Average	3	3	2	2	2	3	3	3	3	2	1	1	3	1	1

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	ALTERNATE AND EMERGENCY POWER SUPPLY	11 Hours
Alternative Source of Power: Safety devices on emergency switch board – Specifications as per Voltage / Frequency, precautions while taking shore supply – Selection of AC and DC generators for use on ships – merits and demerits – location and Installation of generator sets. Purpose of emergency power supply. Emergency Generator & Different Starting methods including auto start. Emergency batteries construction and its different types (Lead acid and alkaline battery) & duties. Location of emergency power. Maintenance required on all the above equipment. Safe electrical equipment for hazardous areas.		
Competency Numbers	7, 7.5	
UNIT-II	MARINE PROTECTION AND SWITCHGEAR	11 Hours
Maintenance of electrical systems, fault finding & repair: Type of faults & indications on Generator, motor & distribution systems - different testing equipment & meters - Salvaging a motor. Detection of faults on electrical circuits – Indications & corrective arrangements - Necessary precautions and care while fault finding and repair - preventive maintenance, periodic surveys, spares requirement. Safe Electrical practice: Safe watch – keeping, points to check on electrical machineries, switch gears & equipment, microprocessor control and maintenance – electrical fire fighting, precautions against electric shock and related hazards.		
Competency Numbers	6.3, 7, 7.5	
UNIT-III	CABLES AND LIGHTING SYSTEMS ON BOARD SHIP	11 Hours
Electrical Cables: Cables- conductors – Wire Sizes-Current Rating – Testing of Cables-Codes and Practical tips. Cable insulation and Sheath– Cable gland – Degrees of Protection – Temperature Ratings – Temperature Rise – Determination of Hot temperature. Types of Insulating Materials. Lighting Systems: Introduction – Ship's lighting – Effect of voltage on lamp performance – Navigation & signal lights – Signals for a power driven ship under way (At night) – Emergency lighting – Requirement of lighting of Deck and pump house of oil tankers.		
Competency Numbers	7, 7.5	
UNIT-IV	STEERING SYSTEMS AND DECK MACHINARIES	11 Hours
Steering Systems & Gyrocompasses: Fundamentals – Auto Navy steering Systems – Electro hydraulic Steering –Typical system configuration- Components – Types. Gyroscopes – Compass Considerations. Deck Machinery & Cargo Equipment: Electrically driven Anchor Windlass – Electrically driven mooring winches – General cargo ship deck machinery electric drives -Magnetic disc brakes.		
Competency Numbers	7, 7.5	
UNIT-V	AUXILLARIES AND MAINTENANCE	10 Hours
Electrical systems for operation in flammable areas- Special electrical practice for oil, gas and chemical tankers -Tanker classification - Hazardous zones - Temperature class - maintenance of apparatus. Miscellaneous Marine electrical equipment Alarm System: Alarm system (types, supply) on board watertight doors, bow-doors, oxygen analyzer, High & low level alarms, navigational lights, emergency radio operation, main engine telegraph, steering gears, Electrical Deck Cranes. Fire alarms and Detection – Heat detectors – Smoke detectors – Combustion detectors –Bilge oil separators. Maintenance routine of all the above equipment, including circuit breakers– active and passive safety measures – Do's and Don'ts – Electric shock – first aid – conditions of shock risk.		
Competency Numbers	7, 7.1	
	Total hours: 54	

Text Books:
1. Elstan.A. Fernandez., “Marine Electrical Technology”, 4th Edition, “Shroff Publishers & Distributors Pvt. Ltd.,Mumbai, 2007.
2. BOWIC C.T., Marine Electrical Practice, 5th Edition, “Butter Worth”, London, 1981.
2. LAW S.W., “Electricity applied to Marine Engineering”, 4th Edition, “The Institute of Marine Engineers”, London, 1998.
Reference Books:
1. Practical Marine Electrical Knowledge by Dennis .T. Hall.
2. Marine Electro Technology and Electronics by Gokhale & Nanda.

Program	B.E. – Marine Engineering				
Course code 241ME1A54TK	Course Name **Marine Auxiliary Machinery-I**	L	T	P	C
		3	0	0	3
Year / Semester	III Year / V Semester	Contact Hours / Week 3 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives	1	Explain the piping arrangements of various systems in the engine room, Including steam, fuel oil, lubricating oil, cooling water, and air systems. (K2)
	2	Explain the Valves, Cocks and fittings used in pipeline construction. (K2)
	3	Discuss the construction and operation of air compressor. (K3)
	4	Discuss the construction and operation of purifier and clarifier. (K2)
	5	Evaluate the efficiency of Heat exchanger and implement methods to improve their performance. (K3)
	6	Analyze the fault findings of operational problems associated with purifiers, air compressor and Heat exchanger. (K2)
Course outcomes	CO1	Demonstrate knowledge of piping arrangements for various systems in the engine room. (K2)
	CO2	Identify appropriate materials and standards in construction of valves, cocks and fittings. (K2)
	CO3	Plan and maintain Air compressor ensuring efficient. (K3)
	CO4	Plan and maintain Purifier and Clarifier ensuring efficient performance. (K3)
	CO5	Identify maintenance works, fault finding, and conditional assessment of heat Exchangers. (K3)
	CO6	Identify the problems and their solutions associated with purifier, air compressor and heat exchanger. (K3)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	2	3	-	-	-	2	3	1	-
CO2	2	2	-	-	-	-	2	3	-	-	-	2	3	1	-
CO3	3	3	2	-	-	-	2	3	-	-	-	3	3	2	-
CO4	2	2	-	-	-	-	2	3	-	-	-	2	3	1	-
CO5	3	3	2	-	-	-	2	3	-	-	-	3	3	3	-
CO6	3	2	2	2	-	1	2	3	1	1	-	3	3	3	-
Average	2.67	2.50	2.00	2.00			2.00	3.00	1.00	1.00		2.50	3.00	1.83	
Correlation level			1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)			

UNIT-I	**ENGINE ROOM VARIOUS PIPING ARRANGEMENTS**	**12 Hours**
Piping arrangement of steam, fuel oil, lubricating oil cooling water, starting and service air systems, with fittings in the system. Pipeline materials and pipeline standards. Domestic fresh water and sea water hydrophore systems. Layout of machines in engine room. Location of stores and workshop, water tight doors, emergency escapes.		
Competency Numbers	**5.1, 5.4**	
UNIT-II	**VALVES, COCKS & FILTERS**	**12 Hours**
Understand construction and basic maintenance of valves and cocks .Globe valves, gate valves, Butterfly valves, Non return valves, Quick closing valves and pressure reducing valves, Solenoid control spool valves, Remote operation for shutting down low sea and high sea suction valves. Construction & operation of Simplex & Duplex Filters, auto clean filters and		
Competency Numbers	**5.4`**	
UNIT-III	**AIR COMPRESSORS**	**10 Hours**
Design consideration, construction & operation of multistage reciprocating air compressors, rotary and screw air compressors, use of inter coolers and aftercoolers, emergency air compressor on ships, uses of compressed air, requirements of control air. Mountings of main and emergency air reservoirs, dehumidifiers, filters, pressure reducing valve.		
Competency Numbers	**4.1.6**	
UNIT-IV	**PURIFIER AND CLARIFIER**	**10 Hours**
Principle of separation in gravity and centrifuge, purifier and clarifier operation, Factors affecting purification, selection of gravity disc, Basic components of purifier and clarifier, Working of purifier and clarifier, Operation problems and their remedies.		
Competency Numbers	**4.1.6**	
UNIT-V	**HEAT EXCHANGERS**	**10 Hours**
Construction & operation of Tubular Heat Exchangers, Plate type heat exchangers. Materials used in their construction. Expansion arrangement provided and their purpose. Maintenance works to be carried out. Fault finding and conditional assessment of heat exchangers.		
Competency Numbers	**4.1.6**	
		Total: 54 Hours

Text Books:

1. Marine auxiliary machinery - H.D GEORGE, 7th edition, Butterworth-Heinemann Ltd, ISBN-10 0750643986
2. Reeds Marine Engineering Series Vol 8, General Engineering Knowledge – Thomas D Morton, Leslie Jackson. Thomas Reed Publication.

Program	B.E. – Marine Engineering				
Course code 241ME1A54TL	Course Name **Marine Internal Combustion Engines - II**	L	T	P	C
		2	1	0	3
Year / Semester	III Year / V Semester	Contact hours/Week	3 hrs		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
Pre requisite					

Course objectives		
	1	To explain safe practices in marine engine staring and reversing operation, including maintenance, troubleshooting, and emergency procedures, in a clear and informative manner. (K2)
	2	To explain safe practices in marine engine operation, including maintenance, Troubleshooting, and emergency procedures, in a clear and informative manner. (K2)
	3	To Assess marine engine performance, lubrication, components, maintenance, and impact succinctly (K2)
	4	To explain marine diesel engine crankcase and governor procedures succinctly (K2)
	5	To explain basic construction and operation of smart engines (K2)
Course outcomes	CO1	Explain safe practices in marine engine starting and reversing operation (K3)
	CO2	Explain safe practices in marine engine operation (K2)
	CO3	Analyze marine engine performance and lubrication system. (K3)
	CO4	Explain the inspection and maintenance procedure for marine diesel engine crank case and governor. (K2)
	CO5	Analyze the construction and operation of smart engines(K3)
	CO6	Summarize the developments in the design of smart marine engine. (K2)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO2	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO3	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO4	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO5	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO6	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
Average	3.00	3.00	3.00					2.00	2.00				3.00	2.00	2.00

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	MARINE DIESEL ENGINE MANEUVERING SYSTEM	10 Hours
.Starting and reversing system of different marine diesel engines with safety provisions.		
Competency Numbers	4.1.1	
UNIT-II	**AUXILIARY DIESEL ENGINES, MEDIUM SPEED ENGINE, GEARING SYSTEMS, CLUTCHES AND EXHAUST VALVE**	**12 Hours**
Auxiliary diesel Engines, medium Speed engine, Gearing systems and Clutches: Types, couplings, and reduction gears used in conjunction with medium speed engines. Development in exhaust valve design, V- type engine details		
Competency Numbers	**4.1.1**	
UNIT-III	**PERFORMANCE CHARACTERISTICS OF DIESEL ENGINE AND INDICATOR CARDS & LUBRICATING SYSTEM**	**10 Hours**
Performance Characteristics of diesel Engine and indicator Cards & Lubricating System Constructional details of indicator instruments, Indicator diagrams and power calculations. significance of power diagram calculations and fault detection, simple draw card , light spring cards and out of phase diagram, power balancing, Load diagrams, performance characteristics curve, test bed and sea trails of diesel engines. Lubrication arrangement in diesel engines including Cooling System, Merits and demerits of different cooling mediums, cylinder lubrication, liner wear and preventive measures.		
Competency Numbers	4.1.1	
UNIT-IV	**GOVERNORS AND CRANKCASE INSPECTION**	**12 Hours**
Governors and their Operation with PID Controller, Over speed arrangement and over speed safety. Electronic Governors with constant speed arrangement. Marine diesel engine Crank Case Inspection, depth gauge and crankshaft deflection and alignment.		
Competency Numbers	4.1.1	
UNIT-V	**Basic Construction and Operation of Smart Engines**	**10 Hours**
Difference between convention and smart engines. Introduction to engine control system, Engine Hydraulic Oil Loop, Hydraulic cylinder unit, Fuel Oil Pressure Booster, Fuel Oil Injection working principle, Exhaust valve, Fiva Valve, ME Tacho-system		
Competency Numbers	4.1.1	
		Total: 54 Hours

Text Books:

1. D.K. Sanyal, "Principle & Practice of Marine Diesel Engines", 2nd Edition, Bhandarkar Publication, Mumbai, 1998.

Reference Books:

1. FSS Code, 2015 Edition, IMO Publication.
2. International Safety Guide for Oil Tanker and Terminals (ISGOTT), 6th edition, Witherby Seamanship International Ltd. ISBN-10 1856099180

Program	B.E. – Marine Engineering					
Course code 241ME1A54TM	Course Name **Ship Fire Prevention & Control**		L 2	T 1	P 0	C 3
Year / Semester	III Year / V Semester		Contact Hours / Week			3 hrs
Course category	Humanities and Social Sciences	Management courses	Professional Core ✓		Professional Elective	

Course objectives		
	1	To explain the potential fire hazards on board ships and the necessary measures for preventing and combating fire to ensure the safety of the vessel, cargo, and Crew (K2)
	2	To explain the various fire protection systems installed on ships and their proper use to prevent and combat fire and ensure the safety of the vessel, crew, and Cargo (K2)
	3	To summarize the different types of fire detection and safety systems used on ships and their role in preventing and responding to fires to maintain a safe shipboard environment (K2)
	4	To identify the various types of fire-fighting equipment and match them to the type of fire that may occur onboard ships (K2)
	5	To explain the fire control procedures that should be followed onboard vessels to ensure prompt response, effective containment, and extinguishing of fires to prevent loss of life and damage(K2)
Course outcomes	CO1	Explain fire hazard on board ships (K2)
	CO2	Explain the Fire Protection built in the Ships (K2)
	CO3	Summarize the fire detection and Safety Systems (K2)
	CO4	Identify the Fire Fighting Equipment based on the type of fire onboard (K1)
	CO5	Explain the fire control procedures on board vessel (K2)
	CO6	Explain the SOLAS convention for the safety of life at sea (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	2	3	-	-	-	3	2	-	-
CO2	2	2	1	-	-	3	2	3	-	-	-	3	2	-	-
CO3	2	2	-	-	-	3	2	3	-	-	-	3	2	-	-
CO4	3	2	2	1	-	3	2	3	-	-	-	3	3	2	-
CO5	2	2	1	-	-	3	2	3	-	-	-	3	2	2	-
CO6	-	-	-	-	-	3	2	3	-	-	-	-	2	-	-
Average	2.20	1.80	1.33	1.00		2.83	2.00	3.00				3.00	2.17	2.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	FIRE HAZARD ON BOARD SHIPS	10 Hours
Fire triangle, spontaneous combustion, limits of inflammability, advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ships use. Control of class A, B and C fires. Fire prevention and fire-fighting appliances. IMO approved model course. Explain classes and chemistry of Fire		
Competency Numbers	**12.1**	
UNIT-II	**FIRE PROTECTION BUILT IN THE SHIPS**	**9 Hours**
Requirements in respects of materials of construction and design of ships, fire detection and extinction systems, escape means, electrical installations, ventilation system and venting system for tankers, statutory requirements for firefighting systems and equipment on different Vessels.		
Competency Numbers	**12.1.1**	
UNIT-III	**DETECTION AND SAFETY SYSTEMS**	**14 Hours**
Fire safety, precaution on cargo ships and tankers during working. Types of detectors, selection of detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Fire safety action required for Crank case explosion, and scavenge fire, boiler back fire, main engine exhaust fire, paint locker fire. Inert gas system construction and operation including deck seal (IGG & N2)		
Competency Numbers	**12.1.2**	
UNIT-IV	**FIRE FIGHTING EQUIPMENTS**	**11 Hours**
Knowledge of Fire-fighting systems, Fire pumps, hydrants and hoses, couplings, nozzles and international shore connections, construction, operation and merits of different types of portable and non- –portable fire extinguishing installations for ships. Properties of chemicals used. Fixed Fire Fighting System Co2 systems and inert gas systems Foam system, Dry powder system, Halon system Fireman's outfit its use and care. Maintenance testing and recharging of appliances. Preparation for safety equipment and other surveys. High pressure localized water mist and SOLAS requirements, Uses of foam monitor, foam applicator.		
Competency Numbers	**12.1.3**	
UNIT-V	**FIRE CONTROL**	**10 Hours**
Action required and practical techniques adopted for extinguishing fires in accommodation, including fires involving Oil systems, machinery spaces, boiler rooms, and cargo holds, galley etc. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, Rescue operations from affected compartments. First aid, Fire organization on ships. Fire signal and muster. Fire drill. Leadership and duties. Bunkering operation, safety and fire, pollution prevention, oxygen, acetylene cylinder safety, welding safety. **Various Check List / Work Permits** Cold wok permit, hot work permit, enclosed space entry permit, working loft, bunkering check list, electrical isolation certificate, lifting gear check list, poor visibility check list, arrival / departure check list, Risk Assessment**.**		
Competency Numbers	**12.1.4**	
		Total: 54 Hours
Text Books:		
1. SOLAS 2009, IMO Publication.		
Reference Books:		

1. FSS Code, 2015 Edition, IMO Publication.
2. International Safety Guide for Oil Tanker and Terminals (ISGOTT), 6th edition, Witherby Seamanship International Ltd. ISBN-10 1856099180
3. Marine Auxiliary Machinery by H D Mc. George. 7th ed, Butterworth Heinemann Ltd.
4. Frank Rush Brook, "Fire Aboard", 3rd Edition, Brown, son & Ferguson Ltd., Glassgow 1988.
5. Victory.G, Owen.I.H, "Fire Fighting Equipment And Its Use In Ships", Marine Engineering Practice, Vol 1, Part 05, IMarEST, London, Reprint 1998
6. Marine Engineering. D A Taylor, Revised Second edition, Butterworth Heinemann Ltd.

Program	B.E. – Marine Engineering				
Course code 241ME1A55TA	Course Name **Marine Steam Engineering and Turbines**	L	T	P	C
		3	0	0	3
Year / Semester	III Year / V Sem	Contact hours/Week		3 Hrs.	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
				✓	
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives	1	To Explain Various steam systems on board ships, waste heat recovery systems (K2)
	2	To outline thermal oil, condensate and feed systems, operation of thermal oil heater, automation and controls. (K2)
	3	To understand construction and design principles of marine steam turbine. (K1)
	4	To understand operative mechanism and safety of marine steam turbines. (K3)
	5	To discuss the operation of Gas turbines for marine applications. (K2)
Course outcomes	On completion of the course the student will be able to	
	CO1	Summarize the Steam systems and steam utilization principles. (K2)
	CO2	Explain the thermal oil systems, safety and environmental aspects of thermal oil use. (K2)
	CO3	Analyze the material selection for design of steam turbines. (K3)
	CO4	Discuss turbine systems, operation of main propulsion turbine. (K2)
	CO5	Explain the working and operation of Gas turbines. (K2)
	CO6	Demonstrate the operative mechanism: Gearing system & Lubricating system, Fuel system, Starting system, Mounting and control system. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	-	-	-	2	3	-	-	-	-	-	3	-	-

CO4	3	3	1	1	-	2	3	3	-	-	-	-	3	-	-
CO5	2	2	-	-	-	2	-	-	-	-	-	-	3	-	-
CO6	3	3	2	2	-	2	3	3	-	-	-	3	3	3	-
Average	2.33	2.40	1.50	1.50		2.00	3.00	3.00				3.00	3.00	3.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	Marine Steam systems and steam utilization	14 Hours
Thermodynamics of steam, steam cycle and losses, various steam services and pipeline distribution of services. Selection of material for pipeline, waste heat recovery in steam plants, construction and mountings on super-heated boilers		
Competency Numbers	4.3.2, 4.1.6	
UNIT-II	**Thermal oil, Condensate and Feed Systems**	**8 Hours**
Introduction to thermal oil systems, Thermal oil properties, requirements, selection, Controls and pipeline components of thermal oil systems, Operation of thermal oil heater, automation and controls, Safety and environmental aspects of thermal oil use. Condensate and Drains System, Layout of condensate return lines, Drain lines to steam traps, Distilled Water Transfer and feed water systems and deaerator		
Competency Numbers	4.1.4	
UNIT-III	**Basic Construction and design principles of marine steam turbine**	**12 Hours**
Layout of a main propulsion turbine, construction and PV diagram of impulse turbine and reaction turbine, Construction of Blades/roots, gland sealing arrangement, blade tip clearance of reaction turbine, Operation of main propulsion turbine, Material selection and design features of steam turbines: Nozzles and nozzle boxes, Turbines impulse and reaction, Pressure and velocity compounding, Material of blades.		
Competency Numbers	4.1.2	
UNIT-IV	**Basic operation and maintenance of marine steam turbines**	**10 Hours**
Warming up and operation of main turbine. Emergency operation of main turbine. Lubrication system of main turbine and reduction gear. Alarm & Trips, Shutdown procedures, Critical speed.		
Competency Numbers	4.1.2	
UNIT-V	**Gas Turbines**	**10 Hours**
Flow of air and gas through a simple Gas turbine. Material of compressor, combustion system, turbine. Types of Gas turbine, Turbo shaft type of Gas turbine for marine applications, Pressure/temperature diagrams, Lubrication system. Material selection and design features of marine gas turbine: Layout, operation, and study of gas turbine components. Operative mechanism: Gearing system & Lubricating system, Fuel system, Starting system, Mounting and control system. Application of gas turbine to free piston engine.		
Competency Numbers	4.1.3	
	TOTAL	**54 Hours**

Text Books:

1. Marine Engineering – by group of authorities, Editor: Roy L Harrington, ISBN: 0-939773-10-4
2. Thomas D. Morton, "Steam Engineering Knowledge for Marine Engineers", 3rd Edition, Thomas Reed Publications, London 1979.

Program	B.E. – Marine Engineering					
Course code 241ME1A52TD	Course Name **Constitution of India and Merchant Shipping Act**		L	T	P	C
			1	0	0	1
Year / Semester	II Year / IV Semester		Contact Hours / Week: 1			
Prerequisite course						
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory ✓	

Course objectives	1	Understand the Constitution's meaning, importance, and salient features. (K2)
	2	Analyze the significance of the Preamble in guiding the governance of the country. (K3)
	3	Describe the concept of fundamental rights, including their meaning, limitations, and enforcement. (K2)
	4	Explore the directive principles of state policy and fundamental duties, and their relevance in shaping the nation's progress. (K3)
	5	Summarize of the Union Government's structure, including the roles and powers of the President, Vice-President, Prime Minister, Council of Ministers, Parliament, and Supreme Court. (K2)
	6	Understand the structure and functions of state and local governments, including the State Executive, State Legislature, State Judiciary, Panchayat Raj system, and Urban Local Self-Government. (K2)
Course outcomes	CO1	Demonstrate understanding of the Constitution, its significance, and the salient features of the Indian Constitution. (K2)
	CO2	Analyze and interpret the Preamble of the Constitution, recognizing its importance in guiding the country's governance. (K3)
	CO3	Evaluate the concept of fundamental rights, including their limitations and the mechanisms for their enforcement. (K2)
	CO4	Recognize the importance and relevance of directive principles of state policy and fundamental duties in shaping the nation's progress. (K3)
	CO5	Describe the structure, roles, and powers of the Union Government, including the Executive, Legislature, and Judiciary. (K2)
	CO6	Understand the functioning of state and local governments, including their executive, legislative, and judicial components. (K2)

UNIT-I	INTRODUCTION TO CONSTITUTION	4 Hours
Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance.		
UNIT-II	**UNION GOVERNMENT**	**3 Hours**
Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India –composition and powers and functions.		
UNIT-III	**STATE AND LOCAL GOVERNMENTS**	**3 Hours**
State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to74th Amendment.		
UNIT-IV	**ELECTION PROVISIONS, EMERGENCY PROVISIONS, AMENDMENT OF THE CONSTITUTION**	**4 Hours**
Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.		
UNIT-V	**THE MERCHANT SHIPPING ACT, 1958**	**4 Hours**
Select Provisions of the Merchant Shipping Act- Establishment and functions of National Shipping Board, Process of registration of Indian Ships, Certificates of Officers. Provisions related to seamen, Functions of National Welfare Board for Seafarers.		
		Total: 18 Hours

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005
2. Durga Das Basu(DD Basu) , "Introduction to the constitution of India",(Student Edition),19th edition,Prentice-Hall EEE, 2008.

Reference Books:

1. Merunandan, "Multiple Choice Questions on Constitution of India", 2 nd Edition,Meraga publication,2007.

Program	B.E Marine Engineering, ECE and Mechanical Engineering				
Course Code 242CS1A53TK	Course Name Fundamental of Computer and Python Programming		L	T	P	C
			2	1	0	2
Year and Semester	I year, I semester		Contact hours per week Hrs.3			
Prerequisite course						
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course Objective	1	To understand the fundamental of computer, algorithm and flow chart.
	2	To learn the basic programming constructs in Python.
	3	To practice various computing strategies for Python-based solutions to real world problems.
	4	To use Python data structures - lists, tuples, dictionaries.
	5	To do input/output with files in Python.
Course Outcome	CO1	computer components and flow chart, Develop algorithmic solutions to simple computational problems.
	CO2	Read, write, execute by hand simple Python programs.
	CO3	Structure simple Python programs for solving problems.
	CO4	Decompose a Python program into functions.
	CO5	Represent compound data using Python lists, tuples, and dictionaries.
	CO6	Read and write data from/to files in Python Programs.

CO-PO ATTAINMENT

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	-	1	2	1	1
CO2	3	3	2	2	3	-	-	-	-	2	-	1	2	1	1
CO3	3	3	3	2	2	-	-	-	-	2	-	1	2	1	1
CO4	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO5	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1

CO6	3	3	3	2	3	-	-	-	-	2	-	1	2	1	1
Average	**2.5**	**2.5**	**2.33**	**2**	**2.67**	-	-	-	-	**2**	**-**	**1**	**2**	**1**	**1**
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I COMPUTER FUNDAMENTALS 9

Definition, Block Diagram along with its components, characteristics & classification of computers, Applications of computers in various fields. Memory: Concept of primary & secondary memory, RAM, ROM, types of ROM, flash memory, Secondary storage devices: Sequential & direct access devices viz. magnetic tape, magnetic disk, CD, DVD- Algorithms - building blocks of algorithms (statements, state, control flow, functions) – Flow chart.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9 Hours

Python interpreter and interactive mode - values and types: int, float, boolean, string, and list – variables – expressions – statements - tuple assignment - precedence of operators – comments - modules and functions - function definition and use - flow of execution - parameters and arguments - Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9 Hours

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else) - Iteration: state, while, for, break, continue, pass - Fruitful functions: return values, parameters, local and global scope, function composition, recursion - Strings: string slices, immutability, string functions and methods, string module, other built-in libraries.

UNIT IV LISTS, TUPLES, DICTIONARIES 9 Hours

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, advanced list processing, list comprehension - Tuples: tuple assignment, tuple as return value Application: Queue processing using list, vector processing using tuples.

UNIT V FILES, MODULES, PACKAGES 9 Hours

Files and exception: text files, reading and writing files, format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Illustrative programs: word count, copy file.

TOTAL: 45 HOURS

Text Book:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, O‘Reilly Publishers, 2016.

2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python –Revised and updated for Python 3.2, Network Theory L., 2011.

Reference Books:

1. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press, 2013.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

Reference web site:

Program	B.E. – Marine Engineering														
Course code 241ME1A55TB	Course Name Marine Power Generation and Distribution														
	L		T		P		C								
	3		0		0		2								
Year / Semester	III Year / V Semester														
	Contact hours/Week - 3														
Course categofire ry	Humanities and Social Sciences														
	Management courses														
	Professional Core														
	Professional Elective														
	✓														
	Basic Science														
	Engineering Science														
	Open Elective														
	Mandatory														
Course objectives	1	Understand the Electrical Power generation and protection of generator. (K1)													
	2	Discuss the design features and system configurations of power distribution and switchgear (K2)													
	3	Describe High Voltage and Low Voltage Cargo Switchboard Distribution (K2)													
	4	Identify causes and hazards of high voltage.(K1)													
	5	To summarize safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment. (K2)													
	6	Discriminate suitable electrical, Safety equipment for marine power distribution systems(K2)													
Course outcomes	CO1	Implement the Electrical Power generation and protection of generator (K2)													
	CO2	Create the design features and system configurations of power distribution and switchgear. (K4)													
	CO3	Demonstrate High Voltage and Low Voltage Cargo Switchboard Distribution (K3)													
	CO4	Derive the Solutions and rectify the problems due to the Hazards of High Voltage. (K2)													
	CO5	Inspect the working of different types of Breakers (K3)													
	CO6	Infer all Electrical, Safety equipment of marine power distribution systems (K3)													
POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
CO2	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
CO3	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
CO4	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
CO5	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
CO6	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2
Average	3	3	2	2	1	1	3	3	1	1	1	1	3	2	2

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	POWER GENERATION ON BOARD SHIPS	12 Hours
Specification of electric power for shipboard installations- generation of electric power and its various uses. The diesel-electric power generator and its configurations on ships- Turbo-electric power generation, shaft power generator, emergency generators, shore power supply and batteries. Various conditions of ships operation and power requirements. Governor droop characteristics and load sharing. AVR droop characteristics - Testing of generator protection devices - Generator Preventive Maintenance.		
Competency Numbers	6.1.1a & 7.5	
UNIT-II	MARINE ELECTRICAL POWER CIRCUITS	12 Hours
Ships' electrical power distribution – Single line diagrams - Definitions – General Information on reference standards, diagram, and graphic symbols and ratings connections of different instruments used. Schematic diagrams layout, connecting lines, junctions and crossovers, mechanical linkages. Schematic diagrams for power switchgear and industrial control –Schematic circuits.		
Competency Numbers	6.1.1a	
UNIT-III	MARINE POWER DISTRIBUTION SYSTEM	10 Hours
System diagram of a typical distribution system. Ship's Specific Layout Explanation - Diesel Generator starting and group indicator control cabinet - Emergency Diesel Generator Control Panels - Emergency Generator Fuel system - Main Electrical Network - Breaker Identification – Circuit Breaker Interlock System – Power Management Unit Mechanical Interlock Procedures - HV Main Switchboard Control Location Flow Charts - Emergency Generator Switchboard and Local Control Panels - Main Switchboard Distribution. High Voltage and Low Voltage Cargo Switchboard Distribution. Insulated Neutral and earthed system, Fault finding, Neutral earthing system in Main power distribution system, Protective devices on Distribution board.		
Competency Numbers	6.1.1a & 7.5	
UNIT-IV	CAUSES AND HAZARDS OF HIGH VOLTAGE	10 Hours
Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Protection against over voltages. Properties of Dielectric materials – Gaseous breakdown in uniform and non-uniform fields –Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipment.		
Competency Numbers	6.1.1.d ,7.3	
UNIT-V	HIGH VOLTAGE SAFETY AND PRECAUTIONS	10 Hours

Circuit Breakers - Physics of arcing phenomenon and arc interruption — DC and AC circuit breaking — Types of circuit breakers — air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers. Relays – working principle- types. Lightning Arrester's- working and types. High voltage safety checklist- Definitions of Safety terms in on board ship- Working procedures with high voltage.	
Competency Numbers	6.1.1.d, 7.1
	Total hours: 54
Text Books:	
1. A Textbook of Electrical Technology: - AC and DC Machines (Volume - 2) (English, Paperback, Theraja A. K.); Publisher S. Chand; ISBN:	
2. Marine Electrical Technology 11th Edition; By Elstan A. Fernandez; Publisher: Shroff Publishers and Distributors; Year: 2020; ISBN: 9789352139514	
Reference Books:	
1. Practical Marine Electrical Knowledge by Dennis .T. Hall.	
2. Marine Electro Technology and Electronics by Gokhale & Nanda.	

Program	B.E. – Marine Engineering					
Course code 241ME1A53PH	Course Name Marine Electrical Technology Laboratory		L	T	P	C
			0	0	2	1
Year / Semester	III Year / V Semester		Contact hours/Week – 2			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
	Basic Science	Engineering Science	Open Elective	Mandatory		
		✓				

Course objectives		
	1	Analyze marine electrical systems. (K4)
	2	Evaluate safety procedures for shipboard electrical equipment. (K4)
	3	Apply fault finding techniques in marine electrical circuits. (K4)
	4	Demonstrate knowledge of shipboard electrical regulations. (K3)
	5	Maintain electrical systems in hazardous areas. (K4)
	6	Assess electrical protective devices for safe operation. (K4)
Course outcomes	CO1	Identify marine electrical systems. (K2)
	CO2	Follow safety procedures for electrical equipment. (K2)
	CO3	Troubleshoot marine electrical circuits. (K3)
	CO4	Comply with shipboard electrical regulations. (K2)
	CO5	Maintain electrical systems in hazardous areas. (K3)
	CO6	Utilize electrical protective devices for safety. (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	3	3	3	1		1	3	2	2
CO2	3	3	2	2	2	3	3	3	3	1		1	3	2	2
CO3	3	3	2	2	2	3	3	3	3	1		1	3	2	2
CO4	3	3	2	2	2	3	3	3	3	1		1	3	2	2
CO5	3	3	2	2	2	3	3	3	3	1		1	3	2	2
CO6	3	3	2	2	2	3	3	3	3	1		1	3	2	2
Average	3	3	2	2	2	3	3	3	3	1		1	3	2	2

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXPERIMENTS	36 Hours

1. Study of different symbols used in electric/electronic circuit diagrams, reading block diagram, specifications shown on diagrams, flowcharts and detailed wiring diagrams, locating components in actual circuits and PCBs by referring circuit diagrams.
2. Study and use of: Insulation tester, Continuity tester, Multimeter, Clamp meter, Analog and digital tachometers, Analog and digital Power factor meters.
3. Test of Battery Charging, Maintenance and Checking.
4. Test of Motor Winding Insulation, Open Circuit & Short Circuit Checking using Megger.
5. Study of Dismantling & Reassembling of Induction Motor.
6. Test of Bilge Alarm.
7. Test of Paralleling of Alternator.
8. Study of fault Finding Exercise on Ship Wiring Circuit.
9. Test of D.O L Starter, Auto Transformer Starter.
10. Test of Star Delta Starter, Soft Starters.
11. Test and calibration of Pressure Sensors, Temperature Sensors, Level Sensors.
12. Test and calibration of RPM Sensors, Photo Sensors, Water Salinometer.
13. Study of Periodic and Breakdown maintenance of Generators, Electric motors, Switch Board, Starters, Circuit Breakers, Distribution system, DC Electrical systems.
14. Study of Alarm system (types, supply) on board for
    1. Watertight doors & Bow-doors,
    2. Oxygen analyzer,
    3. High & low level alarms, Navigational lights,
    4. Steering gears
    5. Electrical Deck Cranes.

Competency Numbers	6.1.1a Operate electrical, electronic and control systems , generator and distribution systems (Table A-III/ 1) 7. Maintenance and repair of electrical and electronic equipment 7.1 Safety requirements for working on shipboard electrical systems. 7.3 Detection of electric malfunction, location of faults and measures to prevent damage

Total hours:36

Text Books:

1. Marine Electrical Technology by Eltsan Fernandez.

Reference Books:

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

Web Source:
https://www.youtube.com/watch?v=LvEqLof7fUE
https://www.youtube.com/watch?v=AoDTdThc074

Program	B.E. – Marine Engineering														
Course code 241ME1A54PO	Course Name **Marine Equipment Drawing - II**												L 0	T 0	P 3	C 2
Year / Semester	III Year / VI Semester												Contact hours/Week 3			
Course category	Humanities and Social Sciences							Management courses					Professional Core		Professional Elective	
													✓			
	Basic Science							Engineering Science					Open Elective		Mandatory	
Course objectives	1	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of stop, check, and safety valves (K2)														
	2	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of valve actuators for various industrial applications (K2)														
	3	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of automatic valves for industrial automation systems. (K2)														
	4	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of starting air valves used in marine diesel engines. (K2)														
	5	To develop proficiency in 2D drawing techniques and acquire knowledge on the assembly of burner carriers and related components used in industrial furnaces and boilers (K2)														
Course outcomes	CO1	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Four Stroke Piston, Oil Fuel Strainer. (K2)														
	CO2	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Starting Air Pilot Valve (K2)														
	CO3	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Full Bore Safety Valve (K2)														
	CO4	Develop skills to draw 2D drawings and acquire knowledge on the assembly of High Lift Safety Valve. (K2)														
	CO5	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Automatic Valve. (K2)														
	CO6	Develop skills to draw 2D drawings and acquire knowledge on the assembly of Starting Air Valve, Gear Pump. (K2)														

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

CO1	3	-	-	-	-	-	2	2	-	3	-	-	-	-	2
CO2	3	-	-	-	-	-	2	2	-	3	-	-	-	-	2
CO3	3	-	-	-	-	-	2	2	-	3	-	-	-	-	2
CO4	3	-	-	-	-	-	2	2	-	3	-	-	-	-	2
CO5	3	-	-	-	-	-	2	2	-	3	-	-	-	-	2
CO6	3	-	-	-	-	-	2	2	-	3	-	-	-	3	2
Average	3.00	-	-	-	-	-	2.00	2.00	-	3.00	-	-	-	3.00	2.00

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	**FOUR STROKE PISTON & OIL FUEL STRAINER**	**10 Hours**
Four Stroke Piston, Oil Fuel Strainer.		
Competency Numbers	9.1	
UNIT-II	**STARTING AIR PILOT VALVE**	**10 Hours**
Starting Air Pilot Valve.		
Competency Numbers	9.1	
UNIT-III	**FULL BORE SAFETY VALVE.**	**10 Hours**
Full Bore Safety Valve.		
Competency Numbers	9.1	
UNIT-IV	**HIGH LIFT SAFETY VALVE & AUTOMATIC VALVE**	**12 Hours**
High Lift Safety Valve, Automatic Valve.		
Competency Numbers	9.1	
UNIT-V	**STARTING AIR VALVE & GEAR PUMP.**	**12 Hours**
Starting Air Valve, Gear Pump.		
Competency Numbers	9.1	
Total: 54 Hours		

Text Books:

1. Engineering Drawing for Marine Engineers Volume 11 by Reed's marine engineering series – H.G.Beck, Reeds Publication 2019.

Reference Books:

1. N.D.Bhatt, "Machine Drawing", 18th Edition, Charotar Publication, Mumbai, 2001
2. MacGibbon's "Pictorial Drawing Book for Marine Engineers-James", 8th Edition, G.Holburn & John J. Seaton, James Munro & Company Limited, Engineering and Nautical Publishers, Mumbai, 1978.

Program	**B.E. – Marine Engineering**				
Course code 241ME1A54PN	Course Name **Marine Steam Plant Laboratory**	L	T	P	C
		0	0	2	1
Year / Semester	II Year / IV Semester	Contact hours/Week 02hrs			
Prerequisite course	Marine workshop-I &II				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course objectives	1	Perceive the safety precautions and procedures involved in Workshop. (K1)
	2	Identify the various pipe line diagram. (K1)
	3	Explain the basic of burners and inspection of combustion space. (K2)
	4	Explain the condenser cleaning , inspection and maintenance. (K2)
	5	Explain the boiler automation, safety and shutdown system. (K2)
	6	Explain the boiler operation and Turbine operation. (K2)
Course outcomes	CO1	Explain the tracing of various pipeline diagram. (K2)
	CO2	Demonstrate the burner maintenance and inspection. (K2)
	CO3	Demonstrate condenser cleaning, repair and maintenance. (K2)
	CO4	Demonstrate boiler automation , safety and shutdown system. (K2)
	CO5	Demonstrate boiler operation. (K2)
	CO6	Explain steam turbine operation. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO2	2	2	-	-	-	2	2	2	3	3	-	2	-	-	-
CO3	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO4	3	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO5	2	2	2	2	-	2	2	2	3	3	-	2	-	-	-
CO6	3	3	3	3	-	2	2	2	3	3	-	2	-	-	-

Average	2.67	2.17	2.20	2.20		2.00	2.00	2.00	3.00	3.00		2.00			
Correlation level			1.Slight (Low)			2. Moderate (Medium)						3. Substantial (High)			

Practical Laboratory Exercises
List of Experiments

Section	Study of Steam Systems	Hours (P)
1	Tracing pipelines of ships steam plant & boiler feed water system – Main and Auxiliary	2
2	Tracing pipelines of boiler condensate, drain system, fuel oil supply and change over	2
3	Industrial standards / pipe line and component specifications	1
4	Types of boiler burners – maintenance routines	1
5	Inspection of combustion spaces	1
6	Isolation of subsystems and safe maintenance practices	1
7	Energy loss in steam systems – maintenance of steam traps, insulation.	1
8	Condenser cleaning, repairs and maintenance Condensate line steam traps and filters maintenance	2
9	Boiler automation – measurement, operation, safety and shutdown systems	2
10	Turbines operation	3
Total		**18**

Competency Numbers:4.1.2,4.1.3,4.1.4

Text Books:

1. Practical Handouts.
2. Marine engineering- by group of authorities, Editor: Roy L Harrington.

Reference Books:

4. John B Woodward (1980) Analysis of steam propulsion plants.
5. Steam: Its Generation and Use(2005). United States:Babcock & Wilcox.
6. Hunt.E.C(1999). Modern Marine Engineers manual

Program	B.E. – Marine Engineering					
Course code **242CS1A53PK**	Course Name: **Python Programming Laboratory**		L 0	T 0	P 2	C 1
Year / Semester	II Year / IV Semester		Contact hours/Week: **2 Hrs**			
Prerequisite course						
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
	Basic Science	Engineering Science	Open Elective	Mandatory		
		✓				
Pre-requisite	Strength of Materials					
Course objectives	1	To write, test, and debug simple Python programs.(K1)				
	2	To implement Python programs with conditionals and loops.(K3)				
	3	Use functions for structuring Python programs.(K3)				
	4	Represent compound data using Python lists, tuples, and dictionaries(K1)				
Course outcomes	CO1	Write, test, and debug simple Python programs.(K1)				
	CO2	Implement Python programs with conditionals and loops.(K3)				
	CO3	Develop Python programs step-wise by defining functions and calling them.(K3)				
	CO4	Use Python lists, tuples, dictionaries for representing compound data.(K3)				
	CO5	Use String Functions and Slices.(K3)				
	CO6	Solve real time problem using python.(K3)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO6	2	3	1	1	2	-	-	-	-	-	-	-	-	-	-
Average	2.5	1.8	2.1	2.1	1.4	-	-	-	-	-	-	-	-	-	-

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXPERIMENTS	36 Hours
1. Operators and Expressions 2. Problems involving if-then-else structures 3. Compute the GCD of two numbers. 4. Find the square root of a number 5. Exponentiation (power of a number) 6. Find the maximum of a list of numbers. 7. List: Cloning, Comprehension, Processing 8. Tuples: Vector processing using tuples 9. Dictionary operations 10. String functions, slices 11. Linear search and Binary search 12. Selection sort, Insertion sort 13. Multiply matrices.	
Competency Numbers	**6.2 & Annexure**
Text Books:	
1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.	
2. John C. Lusth, "The Art and Craft of Programming in Python", The University of Alabama, 2016	
Reference Books:	
1. Mark Lutz, Learning Python, O'Reilly, Fifth Edition, 2013.	
2. PovelSolin, Martin Novak, "Introduction to Python Programming", NCLab Public Computing, 2013	

PROGRAM	**B.E. Marine Engineering**				
Course Code 241ME1A54PL	Course Name: Marine Internal combustion engine laboratory		**L** 0	**T** 0	**P** 3	**C** 2
Year and Semester	III Year (V Semester)		Contact hours per week 3 Hrs		
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**
			✓		
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**

Course Objective	**1**	
	2	Knowledge about different starting arrangements, Modern engines starting methods, safety features, safe handling of machinery's (K1)
	3	To gain knowledge about how to obtain indicator diagrams and computer power, fault analysis, properties of lubricant and understand about cylinder liner lubrication and wear preventive measures (K1)
	4	To understand about construction, operation of high speed engines used for propulsion, different types of coupling and gearing arrangements used (K1)
	5	To understand about general construction and operation of Gas turbines. Understand about free piston arrangements and conventional air stream combustion chamber (K1)
	After the successful completion of this course students shall be able to	
Course Outcome	**CO1**	Understand the operational principles and construction features of cross head type-2S diesel engines, including slow speed, medium speed, and high-speed variants. (K1)
	CO2	Identify and describe the components of the engine assembly, such as cylinder heads, liners, pistons, piston rods, and connecting rods, and their respective functions. (K1)

	CO2	Analyze the significance and functionality of critical engine bearings, including cross head bearings and bottom end bearings, as well as the role of connecting rod bolts and crankshafts in engine operation. (K3)
	CO3	Demonstrate comprehension of engine support structures, including bed plates, holding down arrangements, tie rod choking mechanisms, resin chocks, and overall engine structure. (K2)
	CO4	Evaluate the cooling systems integrated into the engine design, including jacket cooling arrangements in cylinder heads and liners, as well as piston cooling arrangements, to ensure efficient heat dissipation and optimal performance. (K4)
	CO5	Explain the operation and maintenance requirements of essential engine components and systems, such as starting air valves, air distributors, fuel pumps, fuel injectors, exhaust valves, relief valves, turbochargers, scavenging systems, supercharging systems, gearing systems, and lubrication systems, to ensure safe and reliable engine operation. (K3)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	3	2	2	2	-	2	3	1	-
CO2	3	3	-	-	-	-	2	2	2	2	-	2	3	2	-
CO3	3	3	-	-	-	-	2	2	2	2	-	2	3	2	-
CO4	3	3	-	-	-	-	2	2	2	2	-	2	3	2	-
CO5	3	3	-	-	-	-	2	2	2	2	2	2	3	2	-
CO6	3	3	-	-	-	-	-	2	2	2	1	2	3	1	-
Average	3.00	3.00	-	-	-	-	2.20	2.00	2.00	2.00	1.50	2.00	3.00	1.67	-

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

		(54 Hours)

List of Experiments:

Study of:

1. Cross head type-2S diesel engine, Trunk type/ 4Stroke, slow speed, medium speed, high speed engines
2. Cylinder head, liner, piston, piston rod and connecting rod
3. Cross head bearing, bottom end bearing, Crank shaft, connecting rod bolts
4. Bed plate, holding down arrangements, Tie rod choking, resin chocks and Engine structure
5. Jacket cooling arrangements in cylinder head liner, Piston cooling arrangements

6. Starting air valve, air distributor
7. Fuel pump, Fuel injectors
8. Exhaust valve, relief valve, Turbo charger
9. Scavenging system, Types of super charging system
10. Gearing system and Lubrication system

Program	B.E. – Marine Engineering					
Course code 241ME1A64TQ	Course Name Marine Electro Technology		L 3	T 0	P 0	C 2
Year / Semester	III year / VI semester		Contact hours/Week 3			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
	Basic Science	Engineering Science	Open Elective	Mandatory		
Course objectives	1	Analyze the operation of electrical, electronic, and control systems. (K4)				
	2	Evaluate the control systems used for propulsion and auxiliary machinery. (K3)				
	3	Demonstrate proficiency in operating generators and distribution systems. (K4)				
	4	Apply knowledge of marine internal communication systems. (K2)				
	5	Apply maintenance and repair techniques to deck machinery and cargo handling equipment. (K3)				
	6	Utilize effective maintenance and repair strategies for hotel equipment's control and safety systems. (K3)				
Course outcomes	CO1	Assess and monitor the operation of electrical, electronic, and control systems. (K4)				
	CO2	Construct the control systems used for propulsion and auxiliary machinery. (K3)				
	CO3	Categorize proper procedures for starting, paralleling, and changing over generators. (K4)				
	CO4	Compare protective measures for generators and switchboards. (K4)				
	CO5	Demonstrate proficiency in operating and troubleshooting internal communication systems on board. (K3)				
	CO6	Perform maintenance and repair tasks on deck machinery and cargo handling equipment. (K3)				

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2
CO2	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2
CO3	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2
CO4	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2
CO5	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2

CO6	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2
Average	3	3	3	2	1	1	1	1	1	1	1	2	3	2	2

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	MONITOR THE OPERATION OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS	12 Hours
Electrical power distribution board and electrical equipment - MSB, shore supply, ESB, shore supply, ESB and normal & emergency lights. Instrumentation, alarm and monitoring systems - Basic shipboard systems (Engine and Deck), Electrical drives, Technology of Electrical materials.-Troubleshooting of Electrical & Electronic control equipment & monitoring systems-Function test of control equipment and safety devices-Logical Six step trouble shooting procedure (Symptom identification, Symptom analysis, Listing of probable faulty function, Localising of faulty function, Localising trouble to circuit, Failure analysis) - Simulation testing of control equipment and safety devices-Differences and need for actual testing and simulation testing-Limitations.		
Competency Numbers	7,7.5,& 7.7	
UNIT-II	MONITOR THE OPERATION OF PROPULSION AND AUXILIARY MACHINERY	7 Hours
Explain control systems used for propulsion machine and auxiliary machines- Operational requirements in electrical domain.		
Competency Numbers	7 &7.5.3	
UNIT-III	OPERATION OF GENERATORS AND DISTRIBUTION SYSTEMS	10 Hours
Starting of generators, Paralleling, load sharing and changing over generators, Generator protection systems, Switch board protection systems.		
Competency Numbers	7 &7.5.3	
UNIT-IV	MARINE INTERNAL COMMUNICATION SYSTEMS	11 Hours
Operation of all internal communication systems on board including automatic phones, sound powered phone, walki talkie, VHF, etc. RADAR - Maintenance and brief theory, UMS operation - BNWAS, Dead Man's Alarm and Watch Keeper alarm systems.		
Competency Numbers	3.1 & 7	
UNIT-V	MAINTANANCE AND REPAIR OF DECK MACHINERY AND CARGO HANDLING EQUIPMENT	14 Hours
Maintenance and repair of electrical, electronic and control systems of deck machinery, Maintenance and repair of electrical, electronic and control systems of cargo handling equipment. Prevent, Control and Fight fire on- board Fire detection and alarm system, Type of fire sensors, Hazardous Zones and Areas. Maintenance and repair of control and safety systems of hotel equipment's Accommodation power system, Galley equipment, Laundry equipment, Electrical Fault Finding.		
Competency Numbers	7 &7.5.3	
Total hours: 54		
Text Books:		
1. A Textbook of Electrical Technology Vol-2, B L Theraja. 2. Marine Electrical Technology 11th Edition; By Elstan A. Fernandez; Publisher: Shroff Publishers and Distributors; Year: 2020; ISBN: 9789352139514.		

Reference Books:
1. Marine High Voltage Technology; By J. Majumder, Elstan A. Fernandez, Lakshman Singh Yadav; Publisher: Shroff Publishers and Distributors; Year: 2018; ISBN: 9788175981799.
2. Maintenance and troubleshooting of Marine Electrical Systems, Elstan Fernandez, Lakshman Singh Yadav; Publisher Zed Kuailz Publishers; Year: 2020; ISBN 9788194710608. 3. High Voltage Engineering by M.S. Naidu, V Kamaraju; Publisher Tata McGraw–Hill.

Program	**B.E. – Marine Engineering**					
Course code 241ME1A64TR	Course Name **Marine Auxiliary Machinery II**		L 2	T 1	P 0	C 3
Year / Semester	III Year / VI Semester		Contact hours/Week		3 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core ✓		Professional Elective	

Pre requisite		
Course objectives	1	Describe the design considerations and operation of evaporator. (K2)
	2	Explain the design and construction of steering gear systems. (K2)
	3	Demonstrate knowledge of shaft alignment methods and shafting components. (K3)
	4	Understand the process of types and operation of thrusters. (K3)
	5	Identify and explain the corrosion prevention and ventilation system (K2)
	6	Apply safety procedures and maintenance practices for steering gear, shafting, and propulsion systems. (K4)
Course outcomes	CO1	Apply principles of design and operation to effectively utilize evaporators. (K3)
	CO2	Demonstrate proficiency in operating and maintaining steering gear systems. (K2)
	CO3	Demonstrate proper shaft alignment and maintenance techniques. (K2)
	CO4	Conduct inspections of thrusters and propellers.(K3)
	CO5	Summarize corrosion prevention system and ventilation system.(K2)
	CO6	Analyze safety measures and maintenance protocols for steering gear, shafting, and propulsion systems. (K4)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	3	-	-	-	2	-	1	-
CO2	3	3	2	2	-	-	-	3	2	-	-	2	-	1	-
CO3	3	3	2	2	-	-	3	3	2	-	-	2	2	-	-
CO4	3	3	2	2	-	3	-	3	3	-	-	3	2	2	-
CO5	3	3	2	2	-	3	3	3	2	-	-	2	2	2	-
CO6	3	3	2	2	-	3	3	3	3	-	-	3	3	2	-
Average	3.00	3.00	1.83	1.83		3.00	3.00	3.00	2.40			2.33	2.25	1.60	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	EVAPORATORS	12 Hours
Principle of operation and construction of vacuum evaporator, flash evaporator, multiple effect evaporator and Reverse osmosis. Efficient operation and methods of improving efficiency. Layout of arrangement with use of cooling water from diesel engine. Automatic control of salinity. Care and maintenance. Distillers and conditioning arrangement of distilled water for drinking purpose.		
Competency Numbers	4.1.6	
UNIT-II	**STEERING GEAR**	**12 Hours**
Design consideration and construction of electro-hydraulic (rams and rotary vane types) steering gear. Function of telemotor system and hunting gear mechanism. Emergency steering arrangement. Care and maintenance of steering gear plants. Safety device. SOLAS requirements of steering gear system including single failure criteria		
Competency Numbers	4.1.7	
UNIT-III	**SHAFTING**	**10 Hours**
Methods of shaft alignment, constructional details and working of thrust blocks. Intermediate shaft bearing. Oil & water lubricated stern tubes. Air Sealing system. Stresses in tail end, intermediate and thrust shafts. Tail shaft and bearing condition monitoring (survey requirement).		
Competency Numbers	4.1.5	
UNIT-IV	**THRUSTERS & PROPELLERS**	**10Hours**
Different types of thrusters. Bow thrusters, Azimuth, side thrusters, retractable thrusters, controllable pitch propeller, Fixed pitch propeller and water jet propulsion.		
Competency Numbers	4.1.5	
UNIT-V	**CORROSION PREVENTION &VENTILLATION SYSTEM**	**10 Hours**
Basic principle of corrosion, Types of corrosion, Corrosion prevention system: Sacrificial Anode, MGPS, ICCP, Ferrous Ion generator. Types of pipeline coatings (rubber, epoxy) and laggings using onboard. Various paints used on hull. Principle of operation. Design consideration, construction & operational details of blowers. etc. Rotary blowers, turbo blowers.		
Competency Numbers	4.3.4	
		Total: 54Hours

Text Books:

1. Marine auxiliary machinery - H.D GEORGE, 7th edition, Butterworth Heinemann Ltd.
2. SOLAS 2009 consolidated edition, IMO Publication.

Reference Books:

1. MARPOL 2006, ISBN-10 8175980702, IMO Publication.
2. FSS Code, 2015 Edition, IMO Publication.
3. International Safety Guide for Oil Tanker and Terminals (ISGOTT), 6th edition, Witherby Seamanship International Ltd. ISBN-10 1856099180

Program	B.E. – Marine Engineering				
Course code 241ME1A64TS	Course Name **Marine Internal Combustion Engines - III**	L	T	P	C
		1	1	0	2
Year / Semester	III Year / VI Semester	Contact hours/Week	2 hrs.		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Pre requisite					
Course objectives	1	To explain the Benefits and Challenges of Dual Fuel Systems, Applications and Future Trends. (K2)			
	2	To explain Dual fuel diesel electric (DFDE) systems, in a clear and informative manner. (K2)			
	3	To explain the Construction and operation of MEGI and MEGA engines. (K2)			
	4	To explain scavenging, fuel and exhaust systems of dual fuel engines succinctly. (K2)			
	5	To explain Lubrication, Fuel and gas handling of gas engine. (K2)			
Course outcomes	CO1	Explain the Benefits and Challenges of Dual Fuel Systems. (K2)			
	CO2	Explain Dual fuel diesel electric (DFDE) systems. (K2)			
	CO3	Explain the Construction and operation of MEGI and MEGA engines. (K2)			
	CO4	Explain Scavenging, fuel and exhaust systems of dual fuel engines. (K2)			
	CO5	Explain Lubrication, Fuel and gas handling of gas engine. (K2)			
	CO6	Summarize the developments in the design of duel fuel engine. (K3)			

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO2	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO3	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO4	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO5	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO6	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
Average	3.00	3.00	3.00					2.00	2.00				3.00	2.00	2.00
Correlation level			1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)			

UNIT-I	Introduction to dual fuels	6 Hours
Definition and Types of Dual Fuels, Benefits and Challenges of Dual Fuel Systems, Applications and Future Trends.		
Competency Numbers	4.1.1	
UNIT-II	**Construction of Dual fuel diesel electric(DFDE) systems**	**8 Hours**
Introduction to DFDE Systems, Components of DFDE Systems, Construction and Integration Process, Case Studies and Examples, Future Directions and Innovation.		
Competency Numbers	**4.1.1**	
UNIT-III	**Construction and operation of MEGI and MEGA**	**8 Hours**
Introduction to MEGI and MEGA Engines, Key Components of MEGI and MEGA Engines, Construction Process for MEGI and MEGA Engines, Operation and Control Systems for MEGI and MEGA Engines, Advantages and Challenges of MEGI and MEGA Technology.		
Competency Numbers	4.1.1	
UNIT-IV	**Scavenging, fuel and exhaust systems of dual fuel engines**	**8 Hours**
Scavenging System in Dual Fuel Engines, Fuel Injection System in Dual Fuel Engines, Exhaust System in Dual Fuel Engines, Fuel Storage and Supply System, Integration and Control Systems.		
Competency Numbers	4.1.1	
UNIT-V	**Lubrication, Fuel and gas handling**	**6 Hours**
Lubrication System, Fuel Handling System, Gas Handling System, Combustion System, Emission Control system.		
Competency Numbers	4.1.1	
	TOTAL	**36 Hours**

Text Books:

1. Marine Auxiliary machinery - H.D. McGeorge.
2. The Running & Maintenance of Marine Machinery – J. Cowley.

Reference Books:

1. Basic Marine Engineering- J.K. Dhar.
2. Marine Engineering Practice - IMEI Publication.
3. General Engineering Knowledge for Marine Engineers - Reeds Volume: 8.
4. Marine Machineries- Operation & Maintenance – T.B. Srinivasan, IMEI Publication.
5. Gas and DUAL-FUEL Engines –Kees Kuiken, Target global energy training.

Program	B.E. – Marine Engineering				
Course code 241ME1A65TA	Course Name **Professional Elective-I(Marine Pollution Prevention And Safety)**	L	T	P	C
		3	0	0	3
Year / Semester	III Year / VI Semester	Contact hours/Week 03 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
				✓	
	Basic Science	Engineering Science	Open Elective	Mandatory	
Pre requisite					

Course objectives		
	1	To summarize the negative impacts of marine pollution on the environment, wildlife, and human health. (K3)
	2	To explain the procedures required to effectively implement the MARPOL conventions and ensure compliance with international regulations in a clear and informative manner (K2)
	3	To compile and present the safety characteristics and bunkering plan required for safe and efficient bunkering operations in a clear and informative manner. (K2)
	4	To summarize of the essential features of COW, IG systems, and safety devices, emphasizing their importance in ensuring safe and efficient operations. (K3)
	5	To explain the corrective actions necessary to control SOX and NOX emissions, as well as other air pollutants, and minimize their impact on the environment and human health in a clear and informative manner (K2)

Course outcomes		
	CO1	Summarize the ill effects of marine pollution (K3)
	CO2	Explain the procedures to implement the MARPOL conventions (K2)
	CO3	Compile the safety characteristics , bunkering plan for bunkering operations (K2)
	CO4	Summarize the important features of COW , IG SYSTEMS and safety devices (K3)
	CO5	Explain the corrective actions to control SOX and NOX pollutions and other air Pollution (K2)
	CO6	Analyze and take measures to control marine environmental protection (K4)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	3	3	3	-	-	-	3	3	1	-
CO2	2	1	1	-	-	-	-	3	-	-	-	-	3	-	-
CO3	3	3	2	2	-	3	1	2	-	-	-	-	3	2	-
CO4	2	2	1	1	-	2	3	1	-	-	-	2	3	1	-
CO5	2	2	-	-	-	2	3	3	-	-	-	3	3	1	-
CO6	3	3	2	1	-	3	3	3	1	2	-	3	3	2	-
Average	2.33	2.17	1.40	1.25		2.60	2.60	2.50	1.00	2.00		2.75	3.00	1.40	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	BILGE ,CARGO, BALLAST SYSTEM & OWS	10 Hours
Layout of Bilge system, Cargo oil system and Ballast system. Oil water separator – different types. Operation of OWS and its maintenance. 15 ppm alarm working and testing procedure.		
Competency Numbers	10.1	
UNIT-II	**SEWAGE TREATMENT PLANT**	**10 Hours**
Basics of Aerobic and Anaerobic bacteria. Different types of sewage treatment plant- construction and working. Vacuum toilet system working and pipeline diagram. Sewage discharge test and its procedure.		
Competency Numbers	10.1	
UNIT-III	**INCINERATOR**	**12 Hours**
Incinerator- construction and maintenance. Safeties and alarm testing procedure. Garbage compactor- Construction and Working. Garbage segregation, management and disposal.		
Competency Numbers	10.1	
UNIT-IV	**NOx & SOx REDUCTION METHODS**	**12 Hours**
NOx- Selective Catalytic Reactor and Exhaust Gas Recirculation: working and construction. Layout of SCR and EGR(High pressure and Low pressure EGR). SOx-Scrubber: construction and working. Layout of scrubber system for high Sulphur fuels. Handling and disposal of scrubber waste.		
Competency Numbers	10.1	
UNIT-V	**BUNKERING**	**10 Hours**
Bunkering-checklists preparations, pre-bunkering, During bunkering and After bunkering. Different bunker sample collection. Bunker calculation. SOPEP, Implications of bunker spill.		
Competency Numbers	10.1	
		Total: 54 Hours
Text Books:		
1. Revised MARPOL Annex VI 2009. 2nd illustrated, IMO Publication		

Program	B.E Marine Engineering, ECE and Mechanical Engineering					
Course Code 242CS1A63TI	Course Name Advanced Computing Science		L	T	P	C
			3	**0**	**0**	**3**
Year and Semester	I Year & II semester		Contact hours per week Hrs.3			
Prerequisite course	Nil					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course Objective	1	Address fundamental concepts and abstractions in computer architecture,
	2	Build an understanding of the fundamental concepts of computer networking and device.
	3	Gain a historical perspective of AI and its foundation.
	4	Study of Data Science and Machine Learning.
	5	Study of IoT and Information Security
	6	Applications of advance computing.
Course Outcome	CO1	Learning the basic structure of computer, operation and instructions
	CO2	Understanding of the fundamental concepts of computer networking.
	CO3	Study of the design of intelligent computational techniques
	CO4	Understanding of the Data Science and Machine Learning.
	CO5	Identify the Components that forms part of IoT Architecture and Information Security
	CO6	Application of IoT, Data Science and Machine Learning.

CO-PO ATTAINMENT

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	1	1
CO2	3	2	3	2	1	-	-	-	1	1	-	2	3	2	1
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	1	1	-	2	3	2	2
CO5	3	2	3	2	2	-	-	-	1	1	-	2	3	2	2
CO6	3	2	3	2	1	-	-	-	-	1	-	-	3	1	1
Average															

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT II BASICS OF COMPUTER NETWORK 9

Overview of Networking: An introduction to computer networking, Network types (LAN, WAN, MAN), Network topologies, introduction to internet and its uses. Define computer network, identifying basic networking elements and describing roles of Clients, Server,Peers, and Transmission Media . Network Connectivity devices, Modern repeaters, Hubs Bridges, Multiplexes and routers

UNIT III INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Concept of AI, history -current status – scope - agents – environments - Problem Formulations - Review of tree and graph structures - State space representation - Search graph and Search tree- Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems.

UNIT IV INTRODUCTION TO DATA SCIENCE AND MACHINE LEARNING 9

Concept of Data science - Application areas - Traits of Big data – Data Science tools - Overview of machine learning concepts – Types of Learning: Supervised, Unsupervised and Semi- Supervised Learning -ML tools.

UNIT V BASICS OF IOT AND INFORMATION SECURITY 9

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT- Application of IoT- IoT Tools- Core Information Security Principles, CIA (Confidentiality, Integrity, Availability), Information Security Management Governance, Security Policies

Text Book:

1. David A. Patterson, John L.Hennessy, "Computer Organization and Design", Fifth Edition, Morgan Kaufmann Publishers, 2014.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, safwat Zaky, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2011.
2. William Stallings**, "**Computer Organization and Architecture", Tenth Edition, Pearson Education, 2015**.**

Reference web site:

Total :45 Hours

PROGRAM	B.E. Marine Engineering					
Course Code 241ME1A64TP	Course Name: Power electronics and electrical Propulsion		L	T	P	C
			2	1	0	3
Year and Semester	III Year (VI Semester)		Contact hours per week 3 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
	Basic Science	Engineering Science	Open Elective	Mandatory		

Course Objective		
	1	To illustrate the basic operation of power semiconductor devices, including their types, characteristics, and applications, in a clear and informative manner (K2)
	2	To provide solutions to common problems associated with converters, inverters, and drives used on board ships, in a clear and informative manner. (K2)
	3	To categorize the topology of various electric propulsion systems used on board ships, including their components, functions, and applications, in a clear and informative manner. (K2)
	4	To explain the safety practices required when working with high voltage equipment on board ships, including precautions, procedures, and regulations, in a clear and informative manner. (K2)
	5	To design an optimal layout for DC and AC drives on board ships, including their placement, wiring, and cooling systems, in a clear and informative manner. (K4)

	6	To analyze the operation of drives used on board ships, including their functions, performance characteristics, and maintenance requirements, in a clear and informative manner. (K3)
Course Outcome	At the end of the course the student will be able to	
	CO1	Illustrate the basic operation of power semiconductor devices (K1)
	CO2	Solve the problems of converter, inverter and drives used on boards (K2)
	CO3	Categorize the topology of various electric propulsion systems used on boards (K2)
	CO4	Explain the safety practices on high voltage equipment's on boards (K2)
	CO5	Design the layout of dc and ac drives on boards. (K4)
	CO6	Analyze the operation of Drives (K3)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS
CO1	3	2	1	1	1	3	1	1	1	3	1	1	3	1	
CO2	3	3	2	2	1	1	1	2	3	3	1	1	3	2	
CO3	3	3	2	2	1	1	2	3	3	3	1	2	3	2	
CO4	2	2	1	1	1	3	2	3	-	3	1	2	3	2	
CO5	3	3	1	1	1	3	2	3	3	3	2	2	3	3	
CO6	3	3	2	2	1	1	1	3	3	3	3	-	3	2	
Average	2.83	2.67	1.50	1.50	1.00	2.00	1.50	2.50	2.16	3.00	1.16	1.30	3.00	2.00	1.
CORRELATION LEVELS				1. Slight (Low)				2. Moderate (Medium)				3. Substantial (High)			

Unit: 1	POWER SEMI-CONDUCTOR DEVICES	(12 Hours)
Structure, operation and characteristics of SCR, TRIAC, power transistor, MOSFET and IGBT. Driver and snubber circuits for MOSFET - Turn-on and turn-off characteristics and switching losses.- List the precautions when replacing MOSFETs and IGBTs in electronic circuits Determine methods to test a TRIAC in chart-table dimmer		
Competency Numbers	6.1.2.a	
Unit: 2	CONVERTORS, INVERTORS & DRIVES	(10 Hours)
Variable speed drive Hardware development, Direct current (DC) drives, Six thyristor full convertor. Duel-armature convertor, Thyristor DC drives, Alternating current devices. Slip energy recovery system. Load commutated inverter. Induction motor variable speed drives. Cycloconverter. Auto sequentially commutated current fed inverter.		
Competency Numbers	6.1.2.a	
Unit: 3	ELECTRIC PROPULSION - I	(10 Hours)
Electric Propulsion Scheme, Power supply network, Review of motor operation, Controlled Rectification and inversion, Convertor types, Propulsion system operation.-Automatic sequential starting of propulsion machinery after restoration of power after blackout		
Competency Numbers	6.1.1.e, 6.1.2.a	
Unit: 4	ELECTRIC PROPULSION – II	(10 Hours)

Harmonics, Use of Harmonic filters, AC drive with controllable pitch propeller, Salient feature of diesel electric Propulsion, Advantages and disadvantages of electrical Propulsion. Shaft generators, Synchronous condenser		
Competency Numbers	6.1.1.e, 6.1.2.a	
Unit: 5	HIGH VOLTAGE PRACTICE	(12 Hours)
Power system layout of a high voltage system on board the ship, Applications of high voltage systems on board for thrusters, Azipods and main propulsion. Earthing for HV Installation.		
Competency Numbers	6.1.1.d	
	Total: (54 Hours)	

Text Books:	
1	Elstan.A. Fernandez ,Marine Electrical Technology ,5th Edition.
2	Dr. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003
Reference Books:	
1	M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
2	Edmund G , Marine Electrical Installation & Diesel Electric Propulsion.

PROGRAM	BE-Marine Engineering					
Course Code 241ME1A61TL	Naval Architecture-II		L	T	P	C
			3	0	0	2
Year and Semester	III Year (semester VI)		Contact hours per week (3Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	✓					
Course Objective	1. To provide students with a comprehensive understanding of ship resistance and powering principles. (K1) 2. To equip students with the knowledge and skills necessary to analyze, evaluate, and optimize ship resistance and propulsion systems. (K1)					
Course Outcome	After completion of the course, the students will be able to: 1. Summarise the principles of ship resistance, including frictional and residuary resistance. (K2) 2. Analyze the factors affecting ship powering and evaluate effective power calculations. (K3)					

	3. Explain the concepts of ship bilging and its impact on stability and safety. (K2) 4. Apply Froude's and Reynolds's numbers in ship resistance analysis. (K3) 5. Evaluate different types of propellers and their selection criteria for optimal propulsion. (K4) 6. Demonstrate proficiency in assessing hull-propeller interaction and optimizing propulsion system efficiency. (K3)

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
CO6	3	2	2	-	-	-	-	-	-	-	-	2	3	3	3
AVERAGE	3	2.5	2.5	3	2.7	-	-	-	-	-	-	2	3	3	3
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL (HIGH)			

UNIT 1: INTRODUCTION TO SHIP RESISTANCE **10 Hrs.**

Froude's and Reynolds's number, components of ship resistance such as frictional resistance, wave making resistance, eddy making resistance and air & wind resistance, Laws of comparison.

UNIT 2: FRICTIONAL AND RESIDUARY RESISTANCE **12 Hrs.**

Understanding frictional resistance and its calculation methods, Concepts of residuary resistance and its significance in ship hydrodynamics, Effects of hull form and surface roughness on frictional and residuary resistance.

UNIT 3: POWERING OF SHIPS **10 Hrs.**

Effective power calculations, Admiralty coefficient, ships co-relation factor (SCF), measuring ships performance in terms of speed, fuel consumption and displacement, Model ship correlation, Determination of effective horsepower. Relation between power, speed, displacement and fuel consumption, specific fuel consumption, fuel consumption for the voyage.

UNIT 4: PROPULSION OF SHIPS **12 Hrs.**

Propeller action and calculations of propeller slip, Selection of suitable types of propellers (fixed pitch, variable pitch, ring propeller) Special types of propellers (Kort nozzles, VoithSchneider propeller) Geometrical properties of screw propeller thrust deduction and wake fraction, ship model correlation, ship trials. Law of similitude for propellers, efficiencies such as open water efficiencies, relative rotative efficiency, hull efficiency etc.

UNIT 5: HULL-PROPELLER INTERACTION **10 Hrs.**

Understanding the interaction between the hull and propeller, Effects of hull design, appendages, and propeller positioning on propulsive efficiency, Strategies for optimizing hull-propeller interaction to enhance overall propulsion system performance.

Total: 54 Hours
TEXTBOOKS: 1. **"Principles of Naval Architecture" by E.C. Tupper -** Comprehensive resource covering fundamental principles of resistance, propulsion, and hull design. 2. **"Marine Propellers and Propulsion" by John Carlton -** In-depth guide focusing on propeller selection, design, and performance analysis. **REFERENCES:** **1. "Ship Resistance and Propulsion" by Anthony F. Molland -** Detailed reference covering various aspects of ship resistance, including frictional and residuary resistance. 2. **"Introduction to Naval Architecture" by Bruce Johnson -** Provides foundational knowledge on ship design, including hull-propeller interaction and model ship correlation.

Program	**B.E. – Marine Engineering**					
Course Code	Course Name		L	T	P	C
241ME1A64TT	**Marine Safety Emergency Practices-I**		3	0	0	3
Year / Semester	III Year / V Semester		Contact hours/Week :		3 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
Pre requisite						
Course objectives	1	Explain main engine safeties and trouble shooting. (K3)				
	2	Explain safe / emergency temporary repairs. (K3)				
	3	Explain safety and emergency procedure for operation of plant machinery.(K2)				
	4	Explain Inspection, Survey and Monitoring of security activities. (K3)				
	5	Summarize misc. safe working practices. (K2)				
	6	Demonstrate auxiliary machinery troubleshooting. (K2)				
	On completion of the course the students will be able to					

Course outcomes	CO1	Apply main engine safeties and trouble shooting. (K3)
	CO2	Apply safe / emergency temporary repairs. (K3)
	CO3	Explain safety and emergency procedure for operation of plant machinery (K2)
	CO4	Apply Inspection, Survey and Monitoring of security activities. (K3)
	CO5	Apply misc. safe working practices(K4)
	CO6	Demonstrate auxiliary machinery troubleshooting. (K2)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2		2		3				3	3	3	
CO2	3	2	2	2		2		3				3	3	3	
CO3	3	2	2	2		2		3				3	3	3	
CO4	3	2	2	2		2		3				3	3	3	
CO5	3	2	2	2		2		3				3	3	3	
CO6	3	2	2	2		2		3				3	3	3	
Average	3.00	2.00	2.00	2.00		2.00		3.00				3.00	3.00	3.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	MAIN DIESEL ENGINE SAFETIES & TROUBLESHOOTING	10 Hours
Troubleshooting related to various types of marine propulsion diesel engines – causes, effects, remedies and prevention of knocking at TDC and BDC, Black smoke from funnel, Turbocharger surging, scavenge fire, Air starting line explosion, crankcase explosion, Exhaust uptake fire, OMD alarm.		
Competency Numbers	4.2,4.3,4.6,4.3.1,9.1	
UNIT-II	**SAFE EMERGENCY/ TEMPORARY REPAIRS**	**10 Hours**
Use of various types of adhesives, sealants, packing materials in carrying out temporary methods. Application: Sea water pipeline leak- Minor & Major, Centrifugal pump casing pump crack.		
Competency Numbers	**8.4,9.1**	
UNIT-III	**SAFETY AND EMERGENCY PROCEDURES FOR OPERATION OF PLANT MACHINERY INCLUDING CONTROL SYSTEM**	**14 Hours**
Protective/safety devices incorporated in each system in a ship's propulsion machinery stating that protective/safety devices isolated from their control systems. - Main engine shut down such as over speed, lubricating oil low pressure, etc. - prime mover of generator shut down - Boiler shut down such as low water, non-detect flame eye etc. - purifier shut down - testing functions/performances of protective/safety devices in the ship's statutory survey		
Competency Numbers	7.1,7.5.1,4.3.1,9.1	
UNIT-IV	**INSPECTION, SURVEYS AND MONITORING OF SECURITY ACTIVITIES**	**12 Hours**
Procedure for conducting inspections and surveys and monitoring of security activities specified in ship security plan; security related contingency plans Knowledge of security documentation; knowledge of enabling recognition of political security threats; knowledge of enabling recognition of weapons; dangerous substances and devices, and awareness damage they can cause; crowd management and control techniques; handling security information and security related communications; Knowledge of techniques for monitoring _restricted areas; knowledge of controlling access; and restrict the areas on board; methods of effective monitoring of deck and surrounding area Methods of controlling the embarkation; dis- embarkation and access while onboard crews & their effects; knowledge of various equipment and systems, including their limitations; need for testing calibrating security systems and equipment's.		
Competency Numbers	18.2,18.3,9.1	
UNIT-V	**MISC SAFE WORKING PRACTICES**	**8 Hours**
EXPLAIN THE FOLLOWING FROM SAFETY ASPECTS: LSA & FFA, Bunker operation safeties, BDN, ORB, Garbage record book, Handling of chemicals, Purpose of MSDS, Local control of ME, Telegraph & fuel control, C/O of ME controls, Immobilization certificate, Critical & hazardous operations, Critical activities check lists, Complete		

understanding of enclosed space, Local maneuvering, Working aloft, Black out condition. Explain with scenario, Dead ship condition explain with scenario, Causes of power failure, Difference hazard & harm, ISM safety measures, Bridge & ECR handing over controls, Explain SMS, Explain SOLAS, Explain IMO, Permits and check lists, Electrical isolation, ECB & MCB power change over, Explain locked out and tagged out, Explain tool box meeting, Emergency generator manual starting from B/out, E/R type of accidents and actions, Explain declaration of Security, Security levels, Drills and exercises related to ship security, Critical equipment's and its maintenance, PMS, ISPS, SSP, Near Miss, Accidents reporting, UMS ships and operation requirements.	
Competency Numbers	9.10
Total: 54 Hours	
Text Books:	

1. Taylor D. A., Introduction to Marine Engineering, revised second edition, Butterworth-Heinemann, 1999 ISBN 07506 25309.
2. McGeorge H. D., Marine Auxiliary Machinery, seventh edition, Butterworth-Heinemann, 1995 ISBN 0 7506 4398 6.
3. Shipboard Operations, H. I. Lavery, 2nd edition, Published February 15, 1990 by Routledge.
4. Original Equipment Manufacturers Manuals For On Board Equipments.

Program	B.E. – Marine Engineering					
Course code 241ME1A64PV	Course Name Marine High Voltage and Automation Laboratory		L	T	P	C
			0	0	2	1
Year / Semester	IV Year / VI Semester		Contact hours/Week: 2			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
			✓			
	Basic Science	Engineering Science	Open Elective		Mandatory	

Course objectives	1	Determine temperature using thermocouple and analyze its characteristics. (K2)
	2	Utilize RTD to measure temperature and understand its characteristics. (K2)
	3	Examine the characteristics of LVDT transducer and measure linear displacement. (K3)
	4	Examine the characteristics of strain gauge. (K3)
	5	Develop skills troubleshoot pressure switches effectively. (K2)
	6	Evaluate float switches, perform bilge alarm circuit, and troubleshoot (K3)
Course outcomes	On completion of the course the student will be able to	
	CO1	Evaluate temperature using thermocouples and analyze their characteristics. (K3)
	CO2	Analyze temperature using RTDs and understand their characteristics. (K3)
	CO3	Demonstrate proficiency in utilizing LVDT transducers to measure linear displacement. (K2)
	CO4	Understand and apply the characteristics of strain gauges in practical applications. (K2)
	CO5	Develop skills to troubleshoot pressure switches in various scenarios. (K2)
	CO6	Examine switches, perform bilge alarm circuits, and troubleshoot them appropriately. (K2)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	PSO2	PSO3
CO1	2	3	2	2	3	-	-	-	2	2	-	3	3	3	3

CO2	3	3	2	2	3	-	-	-	2	2	-	3	3	3	3
CO3	3	3	2	2	3	-	-	-	2	2	-	3	3	3	3
CO4	3	3	3	2	3	-	-	-	2	2	-	3	3	3	3
CO5	3	3	2	2	3	-	-	-	2	2	-	3	3	3	3
CO6	3	3	3	2	3	-	-	-	2	2	-	3	3	3	3
Average	2.8	3	2.3	2	3	-	-	-	2	2	-	3	3	3	3
Correlation Level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

List of Experiment: Total hours: 36 Hrs

1 a) To measure the temperature of given heat source using thermocouple.
b) To Exercise the characteristics of thermocouple.
2 a) To measure the temperature of given heat source using RTD
b) To Exercise the characteristics of RTD
3 a) Exercise the characteristics of LVDT transducer
b) To measure the linear displacement using LVDT.
4. To Exercise the characteristics of strain gauge.
5. To Exercise the operation & trouble shooting of pressure switch.
6. a) To Exercise the operation & trouble shooting of Float switch.
b) To perform Bilge alarm circuit.
7. To measure I to P & P to I converter.
8. Calibration & testing of Pressure gauges & Pressure switches using dead weight tester.
9. Calibration & testing of RTD and thermocouple.
10. To Exercise the operation of relays, contractors and timer.
a) To Exercise the level process station using manual mode control.
b) To Exercise the level process station using PID control by virtual instrumentation
11. To Exercise the pressure process station using analog PID mode controls.
12. Arithmetic operation, Timer, Counter operation using PLC
a) Interfacing of lamp and button with PLC for ON/OFF operation.
b) Perform Delayed Operation of Lamp By Using Push Button.
c) Combination of Counter and Timer for Lamp ON/OFF operation.

Competency Numbers	6.1.2B, 6.1.3A, 6.1.3B, 6.4

Text Books:

1. Marine Control Technology 4h Edition; By J. Majumder, Elstan A. Fernandez; Publisher: Shroff Publishers and Distributors; Year: 2020; ISBN: 9789352139682.
2. Applied Marine Control and Automation; By J. Majumder, Elstan A. Fernandez, Mahesh Patil; Publisher: Shroff Publishers and Distributors; Year: 2019; ISBN: 9789352139194.
3. Programmable Logic Controller Regh, JA Pearson

Reference Books:

4. Richard C. Dorf and Robert. H. Bishop, “Modern Control Systems”, Pearson Education, 12th Edition, 2011.
5. John J. D’Azzo, Constantine H. Houpis and Sttuart N. Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor and Francis Reprint, 6th Edition, 2014.

PROGRAM	BE -Marine Engineering				
Course Code	Course Name:	L	T	P	C
241ME1A65PP		0	0	2	1

	Power Electronics and Electrical Propulsion Laboratory				
Year and Semester	III Year (VI Semester)		Contact hours per week 2 Hrs		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course Objective	1	To learn about different kinds of power semiconductor devices used on board (K1)
	2	To learn about converters inverters and drives (K1)
	3	To understand about various electric propulsion systems (K1)
	4	To learn about high voltage practices on board (K1)
	5	To practice High voltage power system(K1)
Course Outcome	At the end of the course the student will be able to:	
	CO1	Explain the basic operation of power semiconductor devices (K2)
	CO2	Discuss the working principle of converter, inverter and drives used on boards. (K2)
	CO3	Explain the topology of various electric propulsion systems used on boards. (K2)
	CO4	Explain the safety practices on high voltage equipment's on boards. (K2)
	CO5	Design the layout of dc and ac drives on boards. (K3)
	CO6	Discuss, fabricate, Install and commission the electric panel boards. (K2)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	1	1	2	2	2	1	3	2	2	2
CO2	2	2	1	3	2	1	1	2	2	2	1	3	2	2	2
CO3	2	2	1	3	2	1	1	2	2	2	1	3	3	3	3
CO4	2	2	3	3	2	1	1	2	2	2	1	3	3	3	3
CO5	3	3	2	2	2	1	1	2	2	2	1	3	3	3	3
CO6	3	3	2	2	2	2	2	2	2	2	2	3	3	3	3
Average	2.3	2.3	1.7	2.7	2	1.2	1.2	2	2	2	1.2	3	2.7	2.7	2.7

Correlation Levels	1. Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

(36 Hours)

List of Experiments:

1. Characteristics of SCR and TRIAC
2. Characteristics of MOSFET and IGBT

3. AC to DC fully controlled converter 4. AC to DC half-controlled converter 5. Step down and step up MOSFET based choppers 6. IGBT based single-phase PWM inverter 7. IGBT based three-phase PWM inverter 8. Resonant DC-to-DC converter. 9. Study and obtain waveforms of three- phase half controlled bridge converter with R and RL loads. 10. Study and obtain waveforms of three-phase full controlled bridge converter with R and RL loads.
Text Books: 1 Dr. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003 **Reference Books**: 1 M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013. 2 Edmund G , Marine Electrical Installation & Diesel Electric Propulsion.

Program	**B.E. – Marine Engineering**					
Course code 241ME1A64PM	Course Name **Fire Fighting Laboratory**		L	T	P	C
			0	0	2	1
Year / Semester	III Year / VI Semester		Contact hours/Week – 2 hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
	Basic Science	Engineering Science	Open Elective	Mandatory		
Course objectives	1	To create a decision-making process for selecting the appropriate extinguishing media based on the type of fire. (K1)				
	2	To explain the emergency response procedures and actions to be taken in case of fire onboard a vessel. (K2)				
	3	To categorize the procedures for inspecting and maintaining fire-fighting equipment in aship, ensuring their optimal performance in emergency situations. (K2)				
	4	To acquire hands-on skills in the proper use of various firefighting equipment, tools, and techniques. (K2)				
	5	To categorize the different types and usage of emergency escape equipment for various emergency situations. (K3)				
Course outcomes	CO1	Select the extinguishing media based on type of fire. (K2)				
	CO2	Defend any Emergency situations on-board due to fire. (K3)				
	CO3	Classify the inspection and maintenance procedure for firefighting equipment. (K2)				
	CO4	Demonstrate the use of firefighting equipment. (K2)				

	CO5	Categorize the use of emergency escape equipment & the exit (K2)
	CO6	Demonstrate the skills in using firefighting and safety equipment. (K2)

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	2	3	2	2	-	3	3	3	-
CO2	3	3	3	3	-	3	2	3	2	2	2	3	3	3	-
CO3	3	3	3	3	-	3	2	3	2	2	2	3	3	3	-
CO4	3	2	-	-	-	3	2	3	2	2	-	3	3	-	-
CO5	3	3	3	3	-	3	2	3	2	2	-	3	3	3	-
CO6	3	2	2	-	-	3	2	3	2	2	3	3	3	3	-
Average	3.00	2.67	2.80	3.00		3.00	2.00	3.00	2.00	2.00	2.33	3.00	3.00	3.00	

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

LIST OF EXERCISES

BASIC FIRE FIGHTING LAB **Total Hours : 36**

1. Basic theory of fire, Fire triangle, Fire Prevention, Types of Fire, Different types of Extinguishers used, Extinguishing Small Fire by Sand and blanket

2. Starting Fire pump, Extinguishing Fire by Water, Boundary cooling, Using Fire hose, Dual nozzle, and dual nozzle after use in box.

3. Uses of Portable Foam Extinguisher, Extinguishing fire by Foam Extinguisher. Visual inspection of Foam Extinguisher.

4. Uses of Portable Dry powder Extinguisher, Extinguishing fire by Dry powder Extinguisher.

5. Uses of portable water extinguisher, extinguishing fire by water extinguisher & Internal test.

6. Uses of Portable Co2 Extinguisher, Extinguishing fire by Co2 Extinguisher. Visual inspection of Co2 Extinguisher.

7. Uses of Fire Man's outfit, Uses of SCBA, safety checks for SCBA, Using SCBA entry in the smoke filed area, Uses of EEBD and demonstration.

8. Study of Fire Plan, Locating Fire Fighting Equipment's as per Fire Plan.

9. Emergency Alarm Reporting to Muster Station, Forming Firefighting parties, Preparing Muster card.

10. Explaining about the muster list and assigning duties & following for all the drills. Internal test.

11. Rescuing injured Person (Dummy) Using Fire man's outfits and the Stretcher Rescuing the injured person.

12. Checking the Wheeled Foam, Dry powder Co2 Extinguishers.

13. Precaution and flooding ER with fixed Co2, High Expansion Foam, Emergency stop, Quick closing operation, stopping ventilator flaps,(Shipping Campus),Safe Entry after extinguishing fire.

14. Demonstrating High power Water Mist, Foam Applicator, Foam Monitor.

15. Practical, Written, and Oral Tests.

Competency Numbers	12.1 to 12.1.4

Program	B.E. – Marine Engineering					
Course code 241ME1A75TES	Course Name: Professional Elective-IV (Marine Control Engineering and Automation)		L	T	P	C
			2	1	0	3
Year / Semester	IV Year / VII Semester		Contact hours/Week: 3			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
				✓		
	Basic Science	Engineering Science	Open Elective	Mandatory		

Course objectives		
	1	Analyze the characteristics of open-loop and closed-loop control systems. (K3)
	2	Develop mathematical models for electrical, mechanical, and electro-mechanical systems. (K2)
	3	Apply block diagram reduction techniques and Mason's Gain Formula. (K3)
	4	Construct signal flow graphs and determine transfer functions. (K2)
	5	Summarize error analysis and understand the theory of controllers. (K2)
	6	Design various types of controllers, such as ON-OFF, PID, and pneumatic controllers (K4)

Course outcomes		
	On completion of the course the students will be able to	
	CO1	Evaluate the characteristics and differences between open-loop and closed-loop control systems. (K4)
	CO2	Create accurate mathematical models for electrical, mechanical, and electro-mechanical systems. (K4)
	CO3	Evaluate complex systems using block diagram reduction techniques and Mason's Gain Formula. (K4)
	CO4	Construct and interpret signal flow graphs to determine system transfer functions. (K2)
	CO5	Analyze errors and specify time domain characteristics for different control systems. (K3)
	CO6	Demonstrate the application of various types of controllers in practical scenarios, including ON-OFF, PID, and pneumatic controllers (K3)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	1	2	1	2	1	2	3	3	3
CO2	3	3	3	2	3	1	1	2	1	2	1	2	3	3	3
CO3	3	3	3	2	2	1	1	2	1	2	1	2	3	3	3
CO4	3	3	3	2	3	1	1	2	1	2	1	2	3	3	3
CO5	3	3	3	2	3	1	1	2	1	2	1	2	3	3	3
CO6	3	3	3	2	2	2	2	2	2	2	2	2	3	3	3
Average	3	3	3	2	2.6	1.2	1.2	2	1.2	2	1.2	2	3	3	3

Correlation level	1.Slight (Low)	2. Moderate (Medium)	3. Substantial (High)

UNIT-I	MODELLING OF LINEAR TIME INVARIANT SYSTEMS	10 Hours
Control systems – Characteristics of Control System - Open loop and Closed loop – Feedback control system characteristics - Mathematical modeling of Electrical, Mechanical and Electro-Mechanical Systems - Electrical Analogues Systems - Block Diagrams Reduction Techniques – Masan's Gain Formula - Signal flow graphs - Transfer functions.-Sequential Control circuits-preferential tripping-Digital sequential control devices.		
Competency Numbers	6.1.2B, 6.1.2C, 6.1.3	
UNIT-II	ERROR ANALYSIS AND THEORY OF CONTROLLERS	10 Hours
Standard test signals – Transient analysis of first and second order systems using step input - Time responses – Time domain specifications – Error Analysis – Classification of Controllers – ON-OFF Controllers, Multi Position Controllers, Stacked Type Controllers, Pulse Controllers, PID Controllers, Pneumatic and Hydraulic Controllers - Application on Ship using Controllers.		
Competency Numbers	6.1.3A, 6.1.3B, 6.3.2	
UNIT-III	INTRODUCTION TO AUTOMATION	12 Hours
Automation overview – Requirement of automation systems – Architecture of Industrial Automation System – Levels of Automation-Basic Elements of an Automated System- Flowcharts for automatic and control systems-UMS of engine room, Automation of Main propulsion machinery, Boilers, Auxiliary machinery using flowchart.-Functions and mechanisms of automatic control for main engine and auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system pumping and piping systems, steering gear system, cargo handling equipment and deck machinery.		
Competency Numbers	7.5	
UNIT-IV	PROGRAMMABLE LOGIC CONTROLLER & LADDER LOGIC PROGRAMMING	12 Hours
Introduction to PLC, Principles of Operation - Size and Application. Hardware Components: I/O Section, Discrete /Analog I/O Modules, Special I/O Modules, PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manual/Mechanical Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay /Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.		
Competency Numbers	7.5.2	
UNIT-V	SCADA FUNDAMENTALS AND INTRODUCTION TO IOT	10 Hours
Introduction, Open system: Need and advantages, Building blocks of SCADA systems, RTU-Evolution, Components, Communication, Logic, Termination and Testing and HMI subsystem - Power supplies, Advanced RTU functionalities, IEDs, Data Concentrators and Merging units. IoT fundamentals, IoT Architecture and protocols, Various Platforms, IoT components and Communication Technologies, Challenges in IoT.		
Competency Numbers	7.5.1	
Total hours: 54		
Text Books:		
1. Marine Control Technology 4h Edition; By J. Majumder, Elstan A. Fernandez; Publisher: Shroff Publishers and Distributors; Year: 2020; ISBN: 9789352139682.		
2. Applied Marine Control and Automation; By J. Majumder, Elstan A. Fernandez, Mahesh Patil; Publisher: Shroff Publishers and Distributors; Year: 2019; ISBN: 9789352139194.		
3. Programmable Logic Controller Regh, JA Pearson		
Reference Books:		
1. Richard C. Dorf and Robert. H. Bishop, "Modern Control Systems", Pearson Education, 12th Edition, 2011.		
2. John J. D'Azzo, Constantine H. Houpis and Sttuart N. Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor and Francis Reprint, 6th Edition, 2014.		

Program	B.E. – Marine Engineering					
Course Code 241ME1A74TW	Course Name **Marine Safety Emergency Practices-II**		L 3	T 0	P 0	C 2
Year / Semester	IV Year / VII Semester		Contact hours/Week		3 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
			✓			
Pre requisite						
Course objectives	1	Explain preparations for work on diesel engine. (K3)				
	2	Explain preparations for work on auxiliary machinery. (K3)				
	3	Explain standard task in dry dock. (K2)				
	4	Comply dry dock survey and maintenance. (K3)				
	5	Summarize process of taking ship to dry-dock. (K2)				
	6	Demonstrate knowledge of dry dock repairs. (K2)				
Course outcomes	On completion of the course the students will be able to					
	CO1	Apply preparations for work on diesel engine. (K3)				
	CO2	Apply preparations for work on auxiliary machinery. (K3)				
	CO3	Explain standard task in dry dock (K2)				
	CO4	Apply dry dock survey and maintenance. (K3)				
	CO5	Apply process of taking ship to drydock (K4)				
	CO6	Demonstrate knowledge of dry dock repairs. (K2)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2		2		3				3	3	3	
CO2	3	2	2	2		2		3				3	3	3	
CO3	3	2	2	2		2		3				3	3	3	
CO4	3	2	2	2		2		3				3	3	3	
CO5	3	2	2	2		2		3				3	3	3	
CO6	3	2	2	2		2		3				3	3	3	

Average	3.00	2.00	2.00	2.00		2.00		3.00				3.00	3.00	3.00	
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

UNIT-I	PREPARATION FOR WORK ON DIESEL ENGINES	10 Hours
Permits, isolations and procedure for carrying out maintenance on diesel engine, preparation for decarbonization report, dismantling and assembling of diesel engine bearings, turbocharger overhaul.		
Competency Numbers	9.1,9.3,9.4	
UNIT-II	**PREPARATION FOR WORK ON AUXILIARY MACHINERY**	**10 Hours**
Permits, isolations and procedure for carrying out maintenance on pumps, assembly and disassembly, air condition plant, vapor compressors, heat exchangers, cranes, windlass and mooring winches.		
Competency Numbers	9.1,9.3,9.9.4	
UNIT-III	**STANDARD TASKS IN DRY DOCK**	**10 Hours**
List the standard tasks to be undertaken as follows: (a) Clean the ship's bottom, which could include high-pressure water or grit blasting (b) Paint and recoat the underwater area and boot topping of the hull (c) Clean and paint the chain locker (d) Range and inspect the anchors and cables (e) Inspect and paint draught marks, plimsoll line and freeboard markings (f) Renew sacrificial anodes as and where appropriate (g) Conduct any general steel work repairs, i.e., flame cutting or welding (h) Carry out general repairs to deck and engine room		
Competency Numbers	4.2,4.1.6,9.1,9.8	
UNIT-IV	**DRY DOCK SURVEY AND MAINTENANCE**	**12 Hours**
Preparation by the ship's crew -Documentation for dock preparation -Communication between the ship company/crew and the dry dock personnel -Actions and precautions by the ship master before entering the dry dock Discuss the dry dock survey and maintenance requirements of the following based on harmonised survey system (a) Anti-Roll Stabilizer Units/Bilge Keels and Appendages (b) Bow thruster Units (c) Propeller including shipping and unshipping of keyless propellers and tail end shaft and stern tube (d) Rudder including shipping and unshipping (e) Machinery and equipment related to anchor chain		
Competency Numbers	9.8	
UNIT-V	**PERMITS TO WORK**	**12 Hours**
Explain requirements for various permits, Electrical isolation permit, High voltage permit, pressure vessel isolation permit, Enclosed space entry permit, Working aloft permit, Hot work permit, Elevator work permit, Lock and Tag system. Explain UMS requirements. Explain PMS,CMS		
Competency Numbers	9.1	
		Total: 54 Hours

1. **Text Books:** Taylor D. A., Introduction to Marine Engineering, revised second edition, Butterworth-Heinemann, 1999 ISBN 07506 25309.
2. McGeorge H. D., Marine Auxiliary Machinery, seventh edition, Butterworth-Heinemann, 1995 ISBN 0 7506 4398 6.
3. Shipboard Operations, H. I. Lavery, 2nd edition, Published February 15, 1990 by Routledge.

Original Equipment Manufacturers Manuals For On Board Equipments.

Program	B.E. – Marine Engineering					
Course code 241ME1A74PX	Course Name **Marine Hydraulics, Pneumatics and Electrical Control System Laboratory**		L	T	P	C
			0	0	1	1
Year / Semester	IV Year /VII Semester		Contact hours/Week: 1 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
Pre-requisite	Fluid mechanics fundamentals, Construction & Operating principles of positive displacement pumps, Thermodynamics of air compression, Construction & operation of air compressors and service/control air system.					

Course objectives	1	Identify hydraulic symbols and components in order to understand their functionality and application in hydraulic systems. (K1)
	2	Analyze and interpret hydraulic circuits to comprehend the flow of fluid and the interaction of various components. (K2)
	3	Apply appropriate techniques to set the pressure of a hydraulic power pack for optimal system performance. (K3)
	4	Operate a 4/2 hand lever operated double-acting cylinder to understand its functioning and control mechanisms. (K2)
	5	Evaluate the operation of a unidirectional flow control valve to regulate the flow rate in a hydraulic system. (K4)
Course outcomes	On completion of the course the student will be able to	
	CO1	Identify and interpret hydraulic symbols, components, and circuits in order to understand their role and functionality in hydraulic systems. (K2)
	CO2	Apply appropriate techniques to set the pressure of a hydraulic power pack for optimal system performance. (K3)
	CO3	Demonstrate proficiency in operating different types of hydraulic valves, such as double-acting cylinders, flow control valves, non-return valves, and sequence valves. (K2)
	CO4	Analyze and evaluate the speed control mechanisms of hydraulic cylinders using bidirectional flow control valves and flow control valves in different circuit configurations. (K3)
	CO5	Apply the principles of pneumatic systems to operate single and double-acting cylinders using various control valves. (K3)
	CO6	Understand and apply electro-pneumatic principles to operate cylinders using solenoid valves and design electro-pneumatic circuits for multiple cylinder sequencing. (K1)

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	2	-	3	2	3	-	-	3	2	-
CO2	3	3	2	-	-	2	-	3	2	3	-	-	3	2	-
CO3	3	3	3	-	-	2	-	3	2	3	-	-	3	2	-
CO4	3	3	-	-	-	2	-	3	2	3	-	-	2	2	-
CO5	3	3	3	-	-	2	-	3	2	3	-	-	2	2	-
CO6	3	3	3	-	-	2	-	3	2	3	-	-	3	2	-

Average	3	3	3	-	-	2	-	3	2	3	-	-	3	2	-	
Correlation level			1.Slight (Low)			2. Moderate (Medium)				3. Substantial (High)						

LIST OF EXPERIMENTS		18 Hours
CYCLE-I		
HYDRAULICS		
S.No	**Experiments**	
1	Study of hydraulic symbols & components	
2	Reading a Hydraulics circuits	
3	Setting pressure of the hydraulic power pack	
4	Study and operation of a 4/2 hand lever operated double acting cylinder	
5	Study and operation of unidirectional flow control valve	
6	Study and operation of speed control of cylinder with Bidirectional flow control valve	
7	Study and operation of non-return valve (check valve)	
8	Study and operation of sequence valve	
CYCLE-II		
PNEUMATICS		
9	Operation of a single acting cylinder using 3/2 spring return DCV	
10	Operation of a double acting cylinder using 3/2 hand lever operated DCV	
11	Operation of a double acting cylinder using memory valve	
12	Automatic Operation of a double acting cylinder using limit switches	
13	Operation of a double acting cylinder using pilot operated spring returned 4/2 DCV	
14	Speed control of the double acting cylinder using flow control valve (Meter in circuit)	
15	Speed control of the double acting cylinder using flow control valve (Meter out circuit)	
16	Multiple cylinders operation normal sequencing (Two cylinders –A+ B+ A- B-)	
CYCLE-III		
ELECTRO PNEUMATICS		
17	Operation of a single acting cylinder using single solenoid valve	
18	Operation of a double acting cylinder using single solenoid valve	
19	Operation of a double acting cylinder using double solenoid valve	
20	Multiple cylinders normal sequencing operation (Two cylinders –A+ B+ A- B-) using electro pneumatic circuit	
		Total Hours: 18 Hours

Competency Numbers	6- Operate electrical, electronic and control systems 6.3.2- Features of hydraulic and pneumatic control equipment 9- Maintenance and repair of ship board machinery and equipment 9.7- The interpretation of piping, hydraulic and pneumatic diagrams

Program	B.E. – Marine Engineering					
Course code 241ME1A77PD	Course Name **Ship In Campus - I**		L	T	SIC	C
			0	0	18	9
Year / Semester	IV Year / VII Semester		Contact hours/Week		18 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory/EEC/AC	
Pre requisite						
Course objectives	1	Analyze main propulsion engines to identify maintenance andrepair requirements. (K3)				
	2	Apply appropriate techniques to measure and adjust deflection and bearing clearances. (K3)				
	3	Evaluate the performance of Boilers and its auxiliaries, troubleshoot common issues. (K3)				
	4	Demonstrate proficiency in conducting maintenance and repair tasks on main propulsion engines. (K3)				
	5	Interpret technical manuals and documentation related to dry docking and deck maintenance. (K2)				
	6	Develop a comprehensive understanding of safety protocols and emergency procedures for main refrigeration systems (K2)				
Course outcomes	On completion of the course the student will be able to					
	CO1	Assess and identify maintenance and repair needs for main propulsion engines. (K2)				
	CO2	Develop skills in accurately measuring and adjusting deflection and bearing clearances. (K2)				
	CO3	Demonstrate the ability to diagnose and troubleshoot common issues Boilers and its auxiliaries. (K2)				
	CO4	Develop practical experience in performing maintenance and repair tasks on main Refrigeration systems. (K2)				
	CO5	Interpret technical manuals and documentation related to dry docking and deck maintenance. (K3)				
	CO6	Understand and apply safety protocols and emergency procedures when working with turbines and compressors (K1)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
CO2	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
CO3	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
CO4	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
CO5	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
CO6	3	3	3	3	-	3	3	3	-	-	-	3	3	3	-
Average	3.00	3.00	3.00	3.00		3.00	3.00	3.00				3.00	3.00	3.00	
Correlation level			1.Slight (Low)			2. Moderate (Medium)						3. Substantial (High)			

LIST OF TASKS **TOTAL HOURS: 324**

1. **Task 1** - Main Propulsion Engines, Maintenance and Repair & Deflection And Bearing Clearances.
2. **Task 2** - Main and Auxiliary Boiler and Economizer
3. **Task 3** - Air Compressors Maintenance and Over Hauling & Type of Compressors
4. **Task 4** - Fresh Water Generators
5. **Task 5** - Centrifuges
6. **Task 6** - Turbo Chargers, Maintenance and Repair & Safety And Emergency Procedures
7. **Task 7** - Refrigeration Principle of Working And Overhauling
8. **Task 8** - Shafting and Propellers
9. **Task 9** - Dry Docking
10. **Task 10** - Deck Machineries
11. **Task 11** - Marpol Pollution Equipment (Ows)

Competency Numbers	9.4 - Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment. 9.8 - Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications. 4.1.10 – Deck machineries. 5.3 - Oily-water separators(or-similar equipment) requirements and operation 9.9 - Detection of machinery malfunction

Program	B.E. – Marine Engineering					
Course code 241ME1A82TE	Course Name **International Maritime Organization and International Convention**		L	T	P	C
			2	0	0	2
Year / Semester	IV Year / VIII Semester		Contact hours/Week		2 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	✓					
	Basic Science	Engineering Science	Open Elective		Mandatory	
Pre requisite						
Course objectives	1	Identify the structure, functions, and activities of IMO, including conventions, codes, and recommendations. (K1)				
	2	Analyze the safety-related conventions, such as SOLAS and MARPOL, and their impact on ship construction and operation. (K3)				
	3	Understand the role and responsibilities of classification societies, international labor organizations, and other regulatory bodies in ensuring maritime safety and compliance. (K1)				
	4	Explore the key aspects of maritime safety regulations, including ISPS, port state control, and load line requirements. (K2)				
	5	Examine the importance of health and safety regulations, hours of work, rest, and manning in the shipping industry. (K2)				
Course outcomes	On completion of the course the students will able to					
	CO1	Identify and explain the structure, organization, and functions of IMO, including its conventions, codes, and recommendations. (K1)				
	CO2	Analyze and evaluate the compliance requirements and safety standards imposed by SOLAS, MARPOL, and other relevant conventions. (K3)				
	CO3	Understand the role of classification societies, flag states, and international labor organizations in ensuring maritime safety and enforcing regulations. (K1)				
	CO4	Apply the knowledge of ISPS, port state control, and load line regulations to assess and enhance maritime safety measures. (K3)				
	CO5	Evaluate the impact of health and safety regulations, hours of work, rest, and manning on the well-being of seafarers and the overall safety of maritime operations. (K3)				
	CO6	Demonstrate knowledge and understanding of international health regulations, medical guidelines, and drinking water quality standards as they relate to the maritime industry. (K2)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	2	-	-	2	3	-	-
CO2	-	-	-	-	-	3	3	3	2	-	-	3	3	-	-
CO3	-	-	-	-	-	3	3	3	2	-	-	3	3	-	-
CO4	-	-	-	-	-	3	3	3	2	-	-	3	3	-	-
CO5	-	-	-	-	-	3	3	3	2	-	-	3	3	-	-
CO6	-	-	-	-	-	3	3	3	2	-	-	3	3	-	-
Average						3.00	3.00	3.00	2.00			2.83	3.00		
Correlation level		1.Slight (Low)				2. Moderate (Medium)						3. Substantial (High)			

UNIT-I	**IMO STRUCTURE AND ITS ROLE**	10 **Hours**

IMCO, IMO introduction - History - Structure - Organization - Assembly - Council- Legal committee - Subcommittee - function - activities - conventions - codes - recommendations and guideline. Protocols, amendments, Acceptance, Approval, Tacit acceptance, Pilmsol act.

Competency Numbers	15.1(Pg No124)

UNIT-II	**SAFETY RELATED CONVENTIONS**	**12 hours**

Solas 1974, history, safety construction, LSA, Initial, Intermediate and Renewal of survey and certificates. Emergency Towing requirements, Safe Access, Water tight doors, Door alarm and closing time, Ro-Ro ship safety, Emergency bilge pump, Safety requirements in case of flooding, Water Ingress Alarm , Pumping requirements for Bulk carrier. UMS Ship and Safety Requirements. Steering Gear Alarm and Safety requirements, Ship Ventilation Requirements, Noise protection, Various communication devices, Emergency power requirements, Helipad, Survival craft, Maintenance of Falls, Abandon Ship Drill, HRU, Weather Routings, Various cargo codes, Certificates and Documents Required to carry on Board, Latest Regulations: FAL, Polar code, LL, SAR.

Competency Numbers	15.1 (Pg No 124)

UNIT-III	**MARPOL RELATED CONVENTIONS**	**10 hours**

Double hull. Various Amendments, Passenger ship safety, , MSC and its duties, Colreg 1972 , Oil pol 1954, Marpol 73/78, Various Amendments, Accidents, Incidents, intervention, Convention 69, Oil pollution preparedness, Response and Co-operation Convention 1990 (OPRC-199C))- OPRC -HNS act 2000, MEPC and its function, IMO member state audit scheme. Liability related conventions Civil liability convention 1969, fund 1971, maritime claims convention 1976, oil pollution compensation fund 1992(IOPC) LLMC 1996.
International convention, Law relating bill of lading (Hauge - Visby rules).

Competency Numbers	15.1 (Pg No 124)

UNIT-IV	**OTHER IMPORTANT INSTRUMENTS**	**10 hours**

IMDG codes, IBC Codes, IGC, INF, HSC (high speed craft) STCW 95-2010, VDR, AIS, EPIRP, SART, GMDSS, bulk carrier safety, enhanced survey, IMO grain regulation, member regulation, IGO, NGO, other codes etc.

Competency Numbers	15.2 (Pg.no 125)

UNIT-V	MARITIME SAFETY AND REGULATION	12 Hours
ISPS, CSO, SSO, Security levels, inspection, log entry, training, piracy, port state control, load line. International labour organization Role of International Labour Organization, its importance and relevance to shipping, merchant shipping (minimum standards convention) 1976 and its related conventions, Hours of work, rest, manning, health and safety, Document Prepared in Board of studies held on 24.4.2018 Document Approved in Academic Council held on 31.5.2018 Controlled Copy Rev 00/01.10.2012 accommodation, medical contract, leave' leave and other facility, ITF. CLASSIFICATION SOCIETY Various Classification society and Requirements for Ship, IACS, Flag state, Various Certificate, Documents required on board. WHO'S International Health Regulation 2005 (IHR 2005) International Medical Guide for Ship (IMGS), International Medical First Aid Guide (MFAG) WHO'S Guidance for Drinking water quality.		
Competency Numbers	15.3 & 15.4 (Pg.no 126 & 127)	
		Total: 54 Hours

Text Books:

1. Revised MARPOL Annex VI 2009
2. ISPS Code 2003 Edition

Reference Books:

1. SOLAS Consolidated Edition 2009, FSS Code 2007 Edition
2. ILO Maritime Labour Code 2006
3. FSS Code, 2015 Edition, IMO Publication.
4. International Safety Guide for Oil Tanker and Terminals (ISGOTT), 6th edition, Witherby Seamanship International Ltd. ISBN-10 1856099180
5. Marine auxiliary machinery - H.D GEORGE, 7th edition, Butterworth-Heinemann Ltd, ISBN-10 0750643986
6. Marine Engineering. D A Taylor, Revised Second edition, Butterworth Heinemann Ltd.
7. Inert Gas System - G.S.Heredia.
8. General Engineering Knowledge Reeds Volume VIII, Thomas Reed Publication.

Program	B.E. – Marine Engineering				
Course code 241ME1A84TY	Course Name **Marine Alternate fuel and Energy sources**	L	T	P	C
		2	0	0	2
Year / Semester	IV Year / VIII Semester	Contact hours/Week	2 hrs		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Pre requisite					
Course objectives	1	To explain the properties of Alternate fuel and energy sources, Applications and Future Trends. (K2)			
	2	To explain the properties of fuel cells, Applications and Future Trends. (K2)			
	3	To explain the Construction and operation of Wind and Solar energy sources. (K2)			
	4	To explain the Construction and operation of Autonomous ships. (K2)			
	5	To explain handling and storage of alternate fuels. (K2)			
Course outcomes	CO1	Explain the Benefits and Challenges of Alternate fuel and energy sources (K2)			
	CO2	Explain the properties of fuel cells. (K2)			
	CO3	Explain the Construction and operation of Wind and Solar energy sources (K2)			
	CO4	Explain the Construction and operation of Autonomous ships. (K2)			
	CO5	Explain the handling and storage of alternate fuels (K2)			
	CO6	Summarize the developments in alternate fuels and autonomous ships. (K3)			

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO2	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO3	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO4	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO5	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
CO6	3	3	3	-	-	-	-	2	2	-	-	-	3	2	2
Average	3.00	3.00	3.00					2.00	2.00				3.00	2.00	2.00
Correlation level			1.Slight (Low)			2. Moderate (Medium)					3. Substantial (High)				

UNIT-I	**FUEL PROPERTIES & PERFORMANCE IN ENGINES**	**6 Hours**
Properties of methane, ethylene, ammonia, hydrogen and biofuel blends. Combustion characteristics and emission characteristics.		
Competency Numbers	4.1.1 , 4.4 , 4.2	
UNIT-II	**Fuel Cells**	**6 Hours**
Introduction to Fuel Cell Systems, Components of Fuel Cell Systems, Construction Process of Fuel Cells, Case Studies and Examples, Future Directions and Innovation. Advantages and Challenges of Fuel Cells.		
Competency Numbers	4.1.1 , 4.4 , 4.2	
UNIT-III	**Wind and Solar energy Sources**	**6 Hours**
Introduction to Wind and Solar Energy sources, Key Components of Wind and Solar Energy Sources, Mountings for Wind and Solar Energy sources, Operation and Control Systems for Wind and Solar Energy sources, Advantages and Challenges of Wind and Solar Energy.		
Competency Numbers	4.1.1 , 4.4 , 4.2	
UNIT-IV	**Autonomous Ships and IOT**	**12 Hours**
Basics of IOT, Autonomous ships construction and operation, Remote operation of vessels through IOT, Advantages and challenges faced in Autonomous ships, IMO guideline for Autonomous ships.		
Competency Numbers	4.1.1 , 4.4 , 4.2	
UNIT-V	**Storage , bunkering and handling of Alternate Fuel Energy sources**	**6 Hours**
Fuel Handling System, procedures, precautions and preventions for handling of alternate fuels.		
Competency Numbers	4.1.1 , 4.4 , 4.2	
TOTAL		**36 Hours**

Reference Books:

1. Alternate Fuels and Advanced Combustion Technique as Sustainable Solutions for Internal Combustion Engines-Akhilendra Pratap Singh- Springer publication.
2. Smart Ship 1st Edition 2022 Soft bound.

Program	B.E. – Marine Engineering					
Course code 241ME1A87PG	Course Name **Ship In Campus - II**		L	T	SIC	C
			-	-	20	10
Year / Semester	IV Year / VIII Semester		Contact hours/Week		20 hrs	
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory/EEC	
Pre requisite	Ship In Campus – I					
Course objectives	1	Apply principles of auxiliary engine maintenance. (K1)				
	2	Analyze pump performance in pumping systems. (K3)				
	3	Evaluate piping components for system integration. (K2)				
	4	Examine different types of piping systems. (K3)				
	5	Demonstrate knowledge of heat exchanger operation. (K2)				
	6	Identify functions and types of steering gear. (K1)				
Course outcomes	On completion of the course the students will be able to					
	CO1	Plan maintenance tasks on auxiliary engines. (K2)				
	CO2	Compare pump performance in pumping systems. (K2)				
	CO3	Select appropriate piping components for system design. (K2)				
	CO4	Construct effective hydraulic and pneumatic piping systems. (K2)				
	CO5	Describe the operation of various heat exchanger types. (K3)				
	CO6	Explain the functions and distinguish between types of steering gear. (K2)				

POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		2		3				3	3	3	
CO2	3	3	3	3		2		3				3	3	3	
CO3	3	3	3	3		2		3				3	3	3	
CO4	3	3	3	3		2		3				3	3	3	
CO5	3	3	3	3		2		3				3	3	3	
CO6	3	3	3	3		2		3				3	3	3	
Average	3.00	3.00	3.00	3.00		2.00	0.00	3.00				3.00	3.00	3.00	
Correlation level			1.Slight (Low)				2. Moderate (Medium)					3. Substantial (High)			

LIST OF TASKS	TOTAL HOURS: 378

1. TASK 1 - Auxiliary Engines Prepare and Maintenance. 2. TASK 2 - Pumps and Pumping Systems. 3. TASK 3 - Piping Components (Valves, Filters, Piping Systems, Hydraulic, Pneumatic, Etc.) 4. TASK 4 - Heat Exchangers and Its Types. 5. TASK 5 - Steering Gear, Function of Steering Gear and Type of Steering Gear.	
Competency Numbers	9.4 - Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment. 9.8 - Manage safe and effective maintenance and repair procedures, Planning maintenance and repairs including statutory and class verifications. 5.4 - Operation and maintenance of machinery, including pumps and piping systems. 9.9 - Detection of machinery malfunction 8.4-Methods for carrying out safe temporary/emergency repairs